

Buenos Aires, August 20, 2020

Mrs. Ruth A. David, PhD
CAETS Secretary / Treasurer
USA

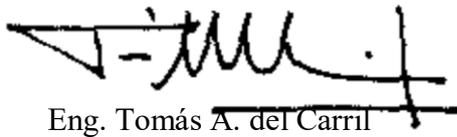
Dear Ruth,

As requested on your email of August 3, we are pleased to send to you, a report that summarizes the most significant activities carried out by the Academy during the year 2019.

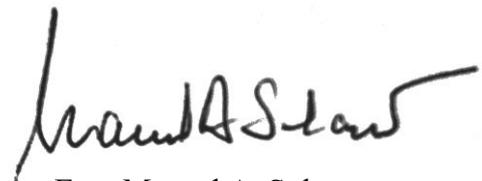
It also includes relevant activities fulfilled by ANI's Institutes, which are mainly focused on up to date issues of special concern for the Academy.

We'll appreciate your comments and kindly ask you to let us know anything else it could be required.

Kind regards,



Eng. Tomás A. del Carril
Academic Secretary



Eng. Manuel A. Solanet
President

Argentine National Academy of Engineering

Key Activities 2019

In 2019 we celebrated the first anniversary of the Academy Office relocation at the Palacio de las Aguas Corrientes. <https://turismo.buenosaires.gob.ar/es/atractivo/palacio-de-aguas-corrientes>

The Academy highlights the interest in holding meetings with National Authorities to share projects and ideas with the purpose of achieving fluid interaction, providing valuable contributions to improve the Institution's management.

Meeting with a Delegation from the Chinese Academy of Engineering

On September 19, a group of professionals from CAE visited the Academy. They accompanied Professor Manchao He, from China University of Mining & Technology in Beijing, on his trip to Argentina. On this occasion, they attended a public ceremony where Professor Manchao He received the honors as Corresponding Member of ANI. It was also a special opportunity that allowed us to continue strengthening cooperation bonds between both countries, particularly in the field of Engineering.

Plenary Sessions and Board of Directors Meetings

Eleven meetings of the Board of Directors, ten Ordinary Plenary Sessions and the Annual Assembly were held this year.

Public Ceremonies

Both the awards ceremonies and the public incorporations took place in sessions where the recipients made a dissertation on a topic regarding their areas of expertise. These ceremonies took place at the Palacio de las Aguas Corrientes and in the Aula Magna of the National Academy of Medicine according to the following schedule:

September “Latest Progress on Soft Rocks”, by Professor Manchao HE, on the occasion of his incorporation as Corresponding Member of ANI in China. https://www.youtube.com/watch?time_continue=31&v=H5Z9SnoeAbU&feature=emb_logo

December “Vaca Muerta. Its Impact in Argentina”, by the Titular Member Eng. Roberto S. Carnicer, at the public ceremony of his incorporation to ANI.

https://www.youtube.com/watch?v=xm8jm4hn1gc&feature=emb_logo

An Award Ceremony was held to bestow Eng. Isidoro Marín Awards to the Best Graduates of Engineering Careers from Argentine Universities.

https://www.youtube.com/watch?time_continue=2&v=1c6eh7avSRk&feature=emb_logo

Lectures were also delivered during Plenary Sessions:

August "Argentine Energy Context", by Titular Member Eng. Oscar U. Vignart. This presentation was made at the CAETS Meeting that took place in Sweden in June.

November "Use of probabilistic models for the retro-analysis of auscultation of tunnels - The case of the Riachuelo Emissary", by Dr. Eng. Rodolfo D. Aradas along with Dr. Nicolás Labanda.

ANI's Institutes

Institute of the Environment - IA http://www.acadning.org.ar/instituto_ambiente.htm

Its activities were developed throughout nine meetings, which were held from March through November 2019. During these meetings, the Members of the Institute analyzed different aspects related to news in the environmental sector in 2018 and issues to be addressed in 2019. The results of the presence of the Argentine delegation at the Annual Mining Convention held in Toronto- Canada in the first week of March 2019 were also commented on. The Public Hearing convened by the National Commission of Nuclear Energy, CNEA, that was held in January was mentioned as well. This hearing was held to consider the right treatment to be applied for restoring the environment at the site of the former Sierra Pintada uranium mine, which was operating in the province of Mendoza. It was remarked that at the hearing it was not proposed to put the mine back into operation, but only to address its environmental liability. Regarding the Management of Water Resources, it was informed that the Authority of the Matanza-Riachuelo Basin, ACUMAR, requested the collaboration of ANI for drafting the regulation of Resolution ACUMAR 46/2017, <http://servicios.infoleg.gob.ar/infolegInternet/verNorma.do;jsessionid=C1B49956E58A7F520C5D04638D727C9B?id=273042>, referred to the control system of liquid effluents in the basin, based on quality objectives of surface waters. Moreover, Members of ANI attended a meeting with the General Environmental Director of ACUMAR, where ACUMAR officials explained the essential concepts that this Resolution incorporates and the kind of collaboration that is requested from ANI. The first phase of this collaboration was the analysis of the documents provided by ACUMAR officials and the presentation of a preliminary opinion, with suggestions that could be extracted from that analysis. The Institute of the Environment's opinion in this regard was sent to ACUMAR on January 21.

The National Secretary of Environment and Sustainable Development, SAyDS, added to its website the Methodological Guides for the elaboration of Environmental Impact Studies (EIA) https://www.argentina.gob.ar/sites/default/files/guia_elaboracion_eia-2.pdf and Strategic Environmental Assessments (EAE) <https://www.argentina.gob.ar/ambiente/desarrollo-sostenible/evaluacion-ambiental/evaluacion-ambiental-estrategica>.

On the subject of Urban Waste Management, the document on “The Management of RRSSUU- Challenges for a Critical Environmental Situation- version 2 <http://www.acadning.org.ar/Institutos/IA%20ANI%20N2%20La%20gestion%20de%20los%20RRSSUU.pdf> was mentioned.

Regarding proposals for Action Plan 2019, it was decided to set the following topics as goal: 1. Natural resources and the national constitution. Environmental focus, especially on water resources, 2. Environmental liability from the exploitation of uranium in Sierra Pintada. Environmental perspective of the decision adopted from the public hearing held on 01-09-2019, 3. Strengthening the application of EIAs and SEAs. Weaknesses and strengths of its regulation and its use to date. Issues to be improved, 4. The management of mining environmental liabilities. Inventory, risk levels, conditions to reverse the situation, 5. The management of plastic waste. Global and local panorama, technological possibilities of substituting films derived from petrochemicals by others generated biochemically and alternatives for reuse and recycling.

Institute of Constructions and Structures - ICyE

http://www.acadning.org.ar/instituto_construcciones.htm

The Institute held seven monthly meetings during 2019. The main topics considered at these meetings referred to the conclusions from the International Seminar "Codes for geotechnical design" held in November 2019 at Buenos Aires. <http://saig.org.ar/noticias/resena-de-lo-sucedido-en-el-seminario-internacional-codigos-para-diseno-geotecnico/>

According to the conclusions of this Seminar, it was proposed that the ICyE would prepare a document with recommendations regarding the future regulations for foundations with no assistance in the production of a regulatory body or any of its parts. Another topic considered by the Institute was the collapse during the excavations in the city of Buenos Aires. Two years ago, the ICyE prepared a document with recommendations on safety in constructions. The idea is writing an article to reinforce these recommendations, to be published in a Newspaper. Different proposals will be prepared for this publication to gain attention in the review and control of projects and works. Also, the situation of the restructuring of the National Institute of Industrial Technology, INTI, and the continuity of the Research Center for National Security Regulations for Civil Works, CIRSOC, organization related to INTI, were discussed.

Institute of Energy – IE http://www.acadning.org.ar/instituto_energia.htm

The activities of the Institute of Energy were developed over 10 meetings. An update was made of the work carried out by the IE on energy matrix, unconventional gas, hydraulic energy, El Chihuido 1 Dam; and in the field of nuclear energy. All Members of the Institute agreed that they will provide support and collaboration in the preparation of the CAETS Meeting to be held in Buenos Aires in 2021, being the main topic The Future of Energy.

There were presentations on the current situation in the Wholesale Electricity Market and its connotations on the entire value chain of this industry; a synthesis was made of

ANI's participation in the CAETS Meeting held in Stockholm, Sweden. This presentation included a summary of the Argentine macroeconomic context and a brief of the information provided on Vaca Muerta and CAREN nuclear technology. The importance manifested at the Meeting by unconventional gas and advances in hydrogen technology to the detriment of nuclear energy was highlighted. Other topics discussed at the meeting in Sweden were climate engineering, medicine and engineering applications in this field, the Plastic Industry, etc. With regard to specific engineering topics, the relevance of digital penetration in all fields and the development of new skills were highlighted.

Mention was also made of the Next Generation Infrastructure Symposium (ISNG) <https://isngi.org/>, held in Buenos Aires, where ANI took part. Presentations were made on the Energy Market in general and in particular on the basis of the annual CeraWeek meeting, <https://ceraweek.com/index.html>, held in the United States. With a global approach, the dissertation covered a large number of topics and analyzed multiple issues. Furthermore, a detailed description of the current situation of the production of Renewable Energies in Argentina and its projection to 2025 was made as well as a description of the probable evolution of the Vaca Muerta deposit, unconventional Natural Gas and its importance in the so-called "transition towards renewable energies or towards the production of Energy without GHG emissions". A very complex and urgent issue was raised to address in the short term, which is prices for Electric Power public services. Then, a Seminar was held at Harvard University, organized by the National Academy of Engineering of the US. The agenda of this meeting was focused on "Climate change and its impact on world energy systems."

Having in mind the 2020 action plan, it was agreed that the momentum taken by the development and investments of different top-tier companies in the exploitation of the oil field should not be lost. With respect to Vaca Muerta, it is expected to prepare a document that would be made available to the authorities and regulators of the sector, which would deal with a large number of aspects aimed especially at facilitating the rapid increase in production and the essential export in the form of LNG.

Finally, preparations for a future paper on the electricity industry and its transition were made, which is undoubtedly being experienced in practically all nations due to the introduction of randomly interruptible renewable energies, towards a generation market with practically no net emissions, either by the elimination of thermal power plants, by remediation mechanisms or by a set of these two methodologies, to which an increase in energy efficiency with the subsequent reduction of energy intensity in each nation would be added.

Institute of Transport – IT http://www.acadning.org.ar/instituto_transporte.htm

Its activities were focused on the analysis of four main topics: 1. Paseo del Bajo Highway 2. Re-design of the Port of Buenos Aires 3. The AMBA Transportation System: Metropolitan Buses. 4. Road Safety.

The issue of the bidding for the Modernization and Expansion of the Port of the City of Buenos Aires was discussed. A presentation sent by the AGP (General Port Administration) was screened. The main characteristics of the bidding Project were

presented, among which the significant change in the physical configuration of the port, aspects related to the works (with a total investment of 1,910 Million Dollars) and the model proposed concession for the next 15 years. The use of the APP TP Application for Public Transport in the Metropolitan Area of Greater Mendoza was analyzed, within the framework of a contract with the Secretariat of Public Services of that Province. The application fed by information on the use of the RedBus card (similar to the SUBE) allows to obtain certain indicators of great interest in public transport planning, such as an origin-destination matrix and the generation of maps of heat.

Analysis of the bidding for Line F of the Buenos Aires Subway called by SBASE (Buenos Aires Subways SE) and the Córdoba - Bahía Blanca Waterway project (Arroyito - Catrilo).

There was a presentation on "The Continental Canal, a strategic axis of development for Argentina" and a first draft of the paper on the Reorganization of the AMBA bus system was presented.

ANI Awards 2019

Every year, the Academy awards prizes to distinguished specialists in the Engineering field, who have excelled in their career. In 2019, ANI recognized the outstanding accomplishments of the following professionals:

Ing. Enrique Butty Prize 2019 was awarded to Dr. Eng. Marcelo E. Zeballos for his outstanding activity in the field of Civil Engineering. http://www.acadning.org.ar/premio_butty.htm

Ing. Luis V. Migone Prize 2019, was awarded to Architect Justo J. Solsona, for his relevant performance in the professional and academic field, highlighting his contributions to society in the country and abroad, through the realization of architectural works particularly developed in the field of transport, housing and offices.

http://www.acadning.org.ar/premio_migone.htm

Ing. Antonio Marín Prize 2019, was awarded to Dr. Eng. Leandro Ramajo, for his important career of very high professional value.

http://www.acadning.org.ar/premio_marin.htm

Ing. Luis A. Huergo Prize 2017, was awarded to the paper "Modified Unsteady Vortex-Lattice Method to Study Flapping Wings in Hover Flight", whose authors are Bruno A. Roccia, Sergio Preidikman, Julio C. Massa and Dean T. Mook.

http://www.acadning.org.ar/premio_huergo.htm

For the twenty-seventh time the Ing. Isidoro Marín Prize To the Best Graduates of Engineering Careers of Argentine Universities, was awarded to Graduates of sixty Universities. http://www.acadning.org.ar/premio_egresados.htm

https://www.youtube.com/watch?v=1c6eh7avSRk&feature=emb_logo

International Council of Academies of Engineering and Technological Sciences, CAETS

The CAETS Annual Meeting 2019 was held from June 24 to 28 in Stockholm, Sweden, organized by the Royal Swedish Academy of Engineering Sciences, IVA, and on this occasion, it was focused on "The Next Hundred Years", in reference to the 100th Anniversary of the foundation of the Swedish Academy, being the first Engineering Academy created in the world. Four hundred participants from twenty-nine Engineering Academies attended this meeting. Eng. Manuel A. Solanet, along with Eng. Oscar U. Vignart attended this Meeting on behalf of ANI Argentina. During the various meetings held, the role that Engineering Academies should adopt to contribute to political decision-making was considered, as well as to seek to increase their collaboration with the industry, with special reference to climate change and sustainable technology. Responding to a request from the CAETS Energy Committee, ANI presented a paper on the energy situation in Argentina. In it, historical and present data on the energy matrix and its different components were shown. It was distributed to other CAETS Member Academies. Likewise, our Academy presented a promotional video of the CAETS Meeting that in 2021 will take place in Argentina. For this reason, Argentina will take over the Presidency of CAETS after the 2020 Annual Meeting in Seoul, Korea. To this end, ANI's Titular Member Eng. Manuel Solanet, has already been appointed President Elect. We extend our gratitude to IVA and CAETS for the warm reception given to our Representatives, to whom we also especially thank for having allowed the presence of the Academy at this international event.

VIII Inter Academic Meeting

On November 7, the Eighth Inter-academic Meeting took place on the topic of "Social Networks, Education and Values In the Vision of Engineering". Fifteen National Academies took part in this event, which reflected the impact of the vertiginous penetration of social networks on education, the development of science and values, particularly in young people. The use of social networks has expanded globally through cell phones, a circumstance that implies a rapid transformation in the ways that people used to communicate. In this way, although education has great possibilities, it faces several challenges, putting into play customs and forms of social relations that give rise to concern regarding moral values, without finding the adequate answers yet. All the presentations of this Meeting were collected in a publication: <http://www.acadning.org.ar/Libro%20Redes%20Sociales%20VIII%20Encuentro%202019%20Reducido.pdf>

Institutional Sponsorship granted by ANI

The National Academy of Engineering conceded its institutional sponsorship to the following events:

Conference on "Good Practices in Public Works" organized jointly by the Argentine Chamber of Engineering Consultants, CADECI, and the Pan American Federation of Consultants, which took place on 25 April; <http://www.cadeci.org.ar/index.php/servicios/congresos-eventos/item/2048-19-c-03>

Engineering Week 2019 "Connected with the Future", held at the Argentine Center of Engineers, CAI, June 3-6; <http://cai.org.ar/si2019/>

Conference "Engineering for a Day, Live your Future", carried out by the Facultad de Ingeniería del Ejército on October 23; <http://www.fie.undef.edu.ar/>

26th Argentine Conference on Structural Engineering, September 23-26, 2020, in the City of Rosario, organized by the Association of Structural Engineers, AIE; <http://jornadasaie.org.ar/>

The logo for the Australian Academy of Technology & Engineering (ATSE) is a white triangle with an orange border, containing the letters 'ATSE' in orange.

ATSE

Australian Academy of
Technology & Engineering



Overview

CAETS 2020

The Australian Academy of Technology and Engineering (ATSE) is one of Australia's four Learned Academies made up of almost 900 Fellows elected by their peers.

We bring together Australia's leading experts in applied science, technology and engineering to provide impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity and contribute to robust and practical thinking to global debates and challenges.

The Academy is an independent, non-government, not-for-profit organisation.

The following sections outline our work over the past year in five major areas: policy, international engagement, industry mentoring, our schools program and our response to COVID-19.

atse.org.au

1. Policy

ATSE's major policy activities in the last year have included the delivery of long-term research projects, rapid responses to emerging events and influential COVID-related advice to government.

A full list of our reports, policy statements and submissions, is available on [our website](#).

Rapid Research Information Forum, chaired by Australia's Chief Scientist Dr Alan Finkel

The Rapid Research Information Forum (RRIF) is a new mechanism to provide rapid expert information to government, drawing from the Australian research and innovation sector. ATSE led two RRIF reports to Government, responding to questions from Australia's national COVID Commission and the Minister for Industry, Science and Technology.

- **The effects of COVID-19 on Australia's research workforce, and capability to recover:** Australia's research workforce will be severely impacted by the pandemic and the effects are likely to be felt for an extended period. Income to universities, medical research institutes, publicly funded research agencies, CRCs, and the industrial sector is suffering from the loss of foreign students and a sharp decline in business research spending and philanthropy. There are concerns that women, early-career researchers and recent graduates will disproportionately experience negative impacts. Industry sectors may experience a reduced capacity to innovate given that universities perform approximately 43% of all applied research in Australia. A decline in innovation may limit economic growth by slowing the development of new technology, skills, and efficiency gains in service and production processes.
- **The effects of COVID-19 on women in the STEM workforce:** Based on disparities in the distribution of domestic workloads and reduced career opportunities compared to men, this pandemic is expected to disproportionately hinder women's STEM careers. High proportions of women employed in short-term contract and casual jobs are likely to be threatened by cuts to research and teaching jobs. Anticipated COVID-related funding cuts to equity programs would set back gains in STEM workforce diversity.

Post-COVID technology boom advice

Investing in a post COVID-19 tech boom: ATSE provided advice to the Australian Government on areas to invest to ensure a post-COVID technology supported economic recovery. Our advice was provided with the context that any investments must be made with greater economic sustainability and environmental sustainability at their core. It is equally vital that investments include mechanisms for retraining at a time of high unemployment, and unlock the full potential of our future workforce by deliberately including gender equity targets, as well as ensuring vulnerable people are not further marginalised.

By investing in responsible technological solutions for agile and responsive modern manufacturing and agribusiness, clean energy, integrated digital healthcare, and advanced data collection and analytics, technology can and will provide more reliable and better equity of access to goods, services and utilities. At the same time, it will create genuine and valuable opportunities for employment for people with disability, those living in rural and remote areas, and others who traditionally have found it difficult to train for and gain meaningful work.

Technology readiness assessments of Australia's health sector

ATSE's technology readiness report on Australia's healthcare sector recommends a rapid transition to meet future challenges. Australia's healthcare system must quickly incorporate technologies including remote consulting, wearable monitors and full digitisation if it is to meet the challenges of the coming decade. The investigation, **A New Prescription: preparing for a healthcare transformation**, includes four recommendations to help policymakers, businesses and researchers implement necessary changes, including:

- switching to electronic health records as soon as possible
- using telehealth and mobile technology to improve access
- supporting and empowering healthcare workers to retrain, adapt and develop skills to use new digital technologies
- targeted government support for translating medical research and preparing it to get where it's needed – to patients



MORE

READ

The full report is available on our website.

atse.org.au/healthech



ATSE-NAEK 'Hydrogen Futures' Workshop



Australia China Young Scientists Exchange Program

2. International Engagement

ATSE values its connection with CAETS academies around the world and recognises the importance of international collaboration in addressing global challenges in a fast-changing world.

Highlights from the past year include:

Australia-China Young Scientists Exchange Program

The Australia China Young Scientists Exchange Program is a flagship program funded through the Government's Australia China Strategic Research Fund. Sixteen outstanding early-to-mid career researchers in the STEM fields from each country undertake a two-week bespoke program of visits to develop and strengthen research relationships. Unfortunately, this program has been delayed until 2021 due to COVID-19.

Global Connections Fund

ATSE's Global Connections Fund (GCF) is part of the Australian Government's National and Innovation Science Agenda.

Established in 2016, the GCF promotes international connections between researchers and small-to-medium enterprises with a focus on research commercialisation. 34 Bridging Grants of up to AUD\$50,000 were awarded in 2019 and the awardees may be seen [here](#).

globalconnectionsfund.org.au

ATSE-Engineering Academy of Japan Transdisciplinary Symposium

The 2019 ATSE-Engineering Academy of Japan Transdisciplinary Symposium 'The Contribution of Engineering to Healthy Ageing and Sustainable Development Goals' was held in Sapporo December 2019. Alumni from the Academies' previous exchange programs, now increasingly senior research staff from both countries, met to discuss novel transdisciplinary approaches to the Sustainable Development Goals.

ATSE-National Academy of Engineering Korea 'Hydrogen Futures' Workshop

Held in Melbourne in early March 2020, the Australia Korea workshop brought together experts in hydrogen technologies from academia, business and government. The ensuing summary report *Bottling Australia Sunshine* may be seen [here](#).

CAS-AAS-ATSE Annual Symposium

ATSE's annual symposium with the Chinese Academy of Sciences and the Australian Academy of Science was held in Melbourne in November 2019, attended by senior Fellows from the three academies. The symposium was on precision medicine.

STS Forum

ATSE Fellow Professor Margaret Sheil attended the Science and Technology in Society Forum in Kyoto Japan, October 2019 and also represented ATSE at the Academy Presidents of Engineering Meeting.

International Delegations

ATSE hosted a number of visits by international delegations over the past year.

In late 2019 the Academy met with the President of the ASEAN Academy of Engineering and Technology, resulting in the development of a bilateral MOU to strengthen collaboration.

Also in late 2019, ATSE facilitated and participated in a fact-finding mission to Australia by the German National Academy of Science and Engineering (acatech) and the Federation of German Industries, culminating in a discussion paper on 'Energy research in Australia. Current trends and recommendations for German energy research policy'.



3. Mentoring for STEM Futures

The Industry Mentoring Network in STEM (IMNIS) is an award-winning industry engagement initiative of the Australian Academy of Technology and Engineering (ATSE), which pairs motivated PhD students and early-career researchers (mentees) in STEM with influential industry leaders (mentors) in a one-year mentoring program.

Through IMNIS, ATSE engages a high calibre network of esteemed Fellows and industry leaders who are investing in Australia's future workforce.

IMNIS prepares mentees to lead and excel in a range of careers. Motivated mentees have the opportunity to increase their understanding of industry, identify the skills needed to succeed, learn about different career opportunities, and extend their professional network. Mentors are experienced, well-networked industry professionals who generously volunteer their time and expertise.

IMNIS breaks down barriers to establish enduring connections between industry and academia, and researchers learn how to effectively engage with industry. Networking opportunities are provided through a series of state-based events over the course of the year with a focus on leadership, STEM careers in industry and engaging with industry. IMNIS also hosts a Mentoring & Sponsorship workshop for mentees and a Leaders Forum for mentors and invited guests.

IMNIS fosters a culture of innovation and collaboration, and provides a diverse range of industry professionals the opportunity to 'give back' to the STEM community and to invest in the professional development of Australia's future leaders in STEM.

In partnership with one of Australia's six industry growth centres, MTPConnect, ATSE's IMNIS initiative will drive workforce growth by engaging mentors and mentees in STEM fields of competitive strength and strategic priority, and expand its program to include international industry mentors.

Officially launched in 2015, IMNIS has become a highly regarded national engagement initiative with over 300 mentor-mentee pairs each year. One third of Australia's academic institutions participate. In 2016, IMNIS was recognised with a prestigious B/HERT Best Higher Education and Training Collaboration Award.

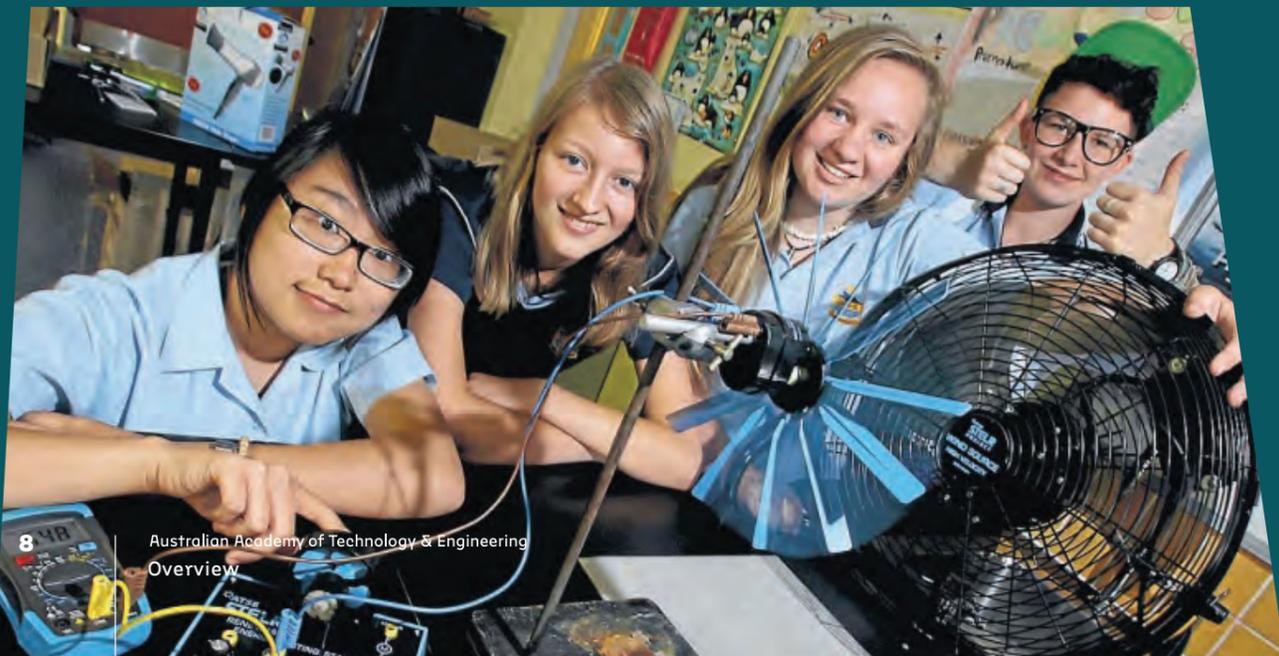
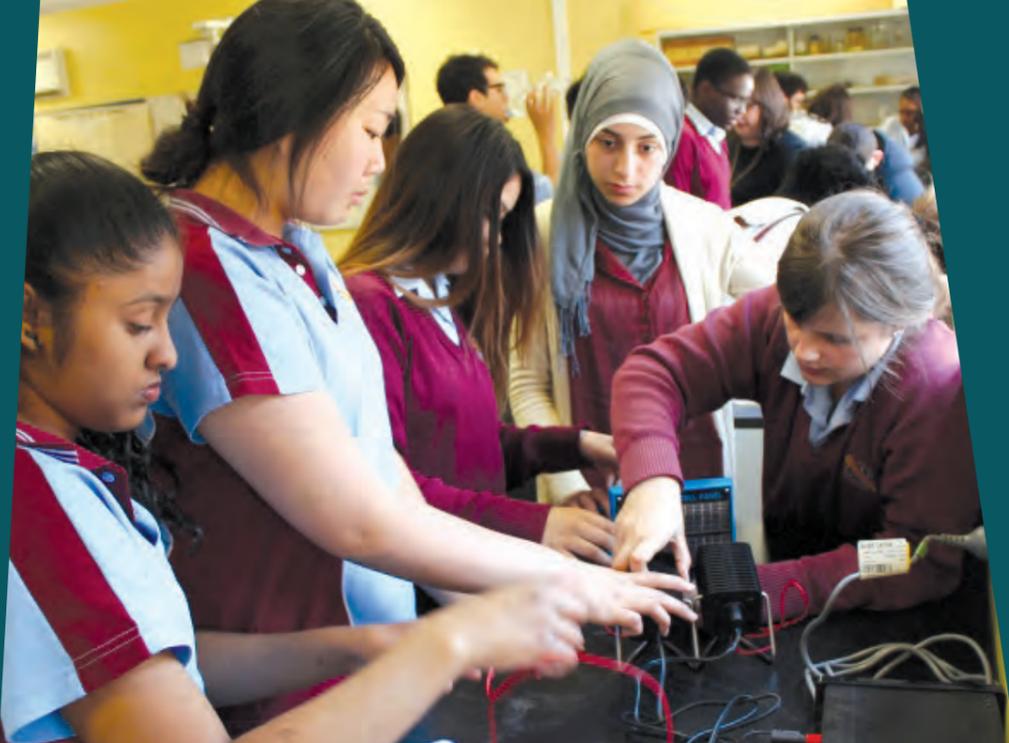
imnis.org.au

PARTNERS



FOUNDATION SUPPORTERS





4. Science, Technology & Engineering Education

Otherwise known as STELR — Science and Technology Education Leveraging Relevance — ATSE’s school education program is a national initiative which aims to boost participation and results in science, technology, engineering and mathematics in secondary schools.

STELR’s teaching modules relate these subjects to highly relevant social issues affecting all students. Modules are supported by classroom kits to facilitate inquiry-based, hands-on, minds-on, problem-based learning. There are now 753 schools currently in Australia and 31 internationally.

Highlights of the past year include:

International STEM training workshops

STELR held a workshop in Melbourne for 40 teachers from Saudi Arabia.

30 September-4 October 2019: Training on STELR STEM: ‘Climate Change, Sustainability and Water Education Workshop’

Hosted in Bandung Indonesia by the Southeast Asian Ministers of Education Organization (SEAMEO) Centre for Quality Improvement of Teachers and Education Personnel (QITEP) in Science and delivered by a team from ATSE, Monash, Southern Cross and Charles Darwin Universities and the Warrumbungle Environmental Education Centre. Thirty nine teachers and education personnel attended from Indonesia, Malaysia, Brunei, Cambodia, Myanmar, Thailand, Timor Leste and Vietnam. Topics included Energy, Renewable Energy Resources, Water in the 21st Century, Drones, Carbon Dioxide, Solar Cars, Hydraulic Technology, Towers, Sustainable Housing, Inquiry-Based Learning and Classroom applications. This event was supported by Orica. This program was supported by the Australian Government through the Australia-Indonesia Institute of the Department of Foreign Affairs and Trade.

Solar panel research

ATSE partnered with Australia’s scientific and industrial research agency (CSIRO) and Stanford University in a collaborative project *A case study of degradation of flexible photovoltaic modules*. 400 organic photovoltaic (OPV) modules were deployed in 100 schools selected from the STELR program.

Support for international schools

ATSE donated class sets of ATSE Wind Energy equipment to two schools in Peru. Curriculum materials were translated into Spanish with Spanish subtitling of STELR videos for broad dissemination.

Support for schools affected by Covid-19

ATSE produced a series of remote learning videos and student workbooks for schools closed due to COVID-19. The videos present three wind energy investigations and are designed for delivery with no specialist equipment. They are supported by a student workbook, available for download from the STELR website.

The student workbook is available for download from the STELR website: www.stelr.org.au

A Day in the Life of a Seven-Year-Old

The Day in the Life of a Seven-Year-Old program is a partnership between the Australian Power Institute and ATSE. It encourages curiosity for year 2 students in Australian schools by providing adaptable, practical and skills-based STEM related activities within their curriculum to raise awareness around future career pathways in STEM. Twenty-five schools nationally participated in the 2019 Pilot, with the program reaching 1060 students. The program will be made available to all Australian schools over the coming years.

API Solar Car Challenge

Class sets of 14 Solar Car kits were sent to ten schools. Students assemble the cars and engineer them for optimal performance applying the scientific knowledge they gained in their studies.

STELR
stelr.org.au

5. ATSE's Annual Awards

Each year, we recognise leading lights who are making extraordinary contributions to technological science and engineering in Australia.

The winners of our prestigious 2020 ATSE Awards were announced 30 July.

At a ceremony streamed out as an online event, the award winners came from a range of fields including biotech, agriculture and engineering – and from across small and large private, government and academic organisations. This year's awards celebrated innovations and practical solutions to a range of issues, including AI-guided pest and crop management, ultra-low gluten barley, and self-assembling polymers to deliver personalised precision medicine.



MORE

WATCH

A recording is available on our website.

atse.org.au/2020ATSE Awards

SUMMARY OF KEY EVENTS AND ACTIVITIES 2019-20

BACAS (BELGIAN ACADEMY COUNCIL OF APPLIED SCIENCES)

Since 1938 Belgium has an autonomous Dutch-speaking academy of sciences and arts (KVAB) and an equally autonomous French-speaking academy (ARB). Technical sciences (engineering) belong to the field of the “class of technical sciences” in KVAB and of the “class of technology and society” in ARB. BACAS is the common council through which these two classes are represented in international organisations such as CAETS. Some 50% of the members of the two classes work in industry, 50% in academia.

The main activities of BACAS consist of preparing position papers on actual societal issues for the government. In addition, thinkers’ programs are organised in order to benefit from the expertise of foreign researchers. Classes convene on a regular base to discuss progress of working groups preparing position papers or thinkers’ programs, and to attend lectures of experts in different scientific fields.

In 2019 KTW published four position papers:

- February 6, 2019: “**Research driven science**” (Dirk Van Dyck, Elisabeth Monard, Sylvia Wenmackers, e.a.). Researchers are key to preserve and to develop welfare and well-being of our society. They are an essential motor of innovation and are in the front line with regard to the tackling of global societal challenges and the education of academic graduates.
- April 29, 2019: “**Learning analytics in higher education**” (Tine De Laet e.a.). "Learning Analytics". The fast growth of online and blended learning produces lots of data regarding the quality of higher education. Expectations are big: better study performances, less drop-out, personalized feed-back and guidance. However, this promising development also creates new challenges regarding ethics and privacy.
- May 28, 2019: “**Corporate digital responsibility**” (Luc Bonte, Aimé Heene, Paul Verstraeten e.a.). An appeal to governments and companies to which the public can and should contribute. Due to the phenomenal increase of calculating capacity of computers, self-learning algorithms are capable of collecting and processing massive quantities of data (images, text, sound...). Artificial Intelligence (AI), after having been for a long time a purely academic field, currently experiences a breakthrough in many sectors. However, data mining also generates completely new ethical challenges.
- September 20, 2019: “**PhD’s: doctorate holders are shaping the future of Flanders**” (Liliane Schoofs). The number of doctorate holders in Flanders has more than doubled in the last decade. And yet there appears to be a shortage of such new “generalists” on the job market. What are the causes of this shortage and what are the consequences for the current and future strategy of Flemish universities and of the Flemish government?

Several working groups are in the process of preparing position papers due to be published in the course of 2020:

- Maintenance of infrastructure (highways, roads, tunnels bridges, railways) in Flanders (Luc Taerwe)
- Role of gas in the energy transition - Power-to-Gas (Reflection Group Energy, Joost Van Roost, Ivo van Vaerenbergh)
- Food expertise (Filip Arnaut, Jan Delcour)
- Quality of architecture today (Hilde Heynen and Bart Verschaffel)
- Multifunctional island at the Belgian coast (Ivo van Vaerenbergh).
- Use of English versus local language (Dutch) in higher education (co-operation between classes of human sciences, technical sciences and young)

The Reflection Group RRI (Responsible Research and Innovation) chaired by prof. Joos Vandewalle (Catholic Univ. of Leuven) launched a “Thinkers’ Program” about the preservation of public values in innovation processes.

Three thinkers studied the ethical aspects of RRI, governance and scientific aspects: Peter-Paul Verbeek professor in Philosophy at the Universiteit van Twente (Netherlands), Rinie van Est coordinator Smart Society at the Rathenau Instituut and Jan Rabaey who is professor Electrical Engineering at UC Berkeley.

In 2020, professor Willy Verstraete (Univ. of Ghent) has launched a new Thinkers’ Program: “Natural soil capital in the 21st century: challenges and opportunities”. This program will focus on three main subjects:

- Healthy soils for sustainable land management in the 21st century
- The importance of soils in a changing climate
- Appropriation of soils as a natural capital

International Thinkers are Richard Bardgett, British soil biologist, professor at Manchester University and member of the Royal Society, and Joke van Wensem, advisor at the Ministry of Environment in the Netherlands and vice-president of the Dutch soil science association.

Three reflection groups are chaired by members of KTW:

“**Energy**” (Ivo Van Vaerenbergh)

“**Responsible Research and Innovation (RRI) and ethics of science**” (professor Joos Vandewalle).

“**Art, Science and Technology**” (Elisabeth Monard).

The following lectures were held in the plenary meetings of KTW:

- “From electron tube to neuromorphic computer chips” (Hugo De Man)
- “Botanic garden Meise” (Steven Dessen)
- “Electrifying biotechnology” (Korneel Rabaey)
- “Optical chips for smart sensors and high band width optical communication” (Gunther Roelkens)
- “Roofing the Antwerp ring road: urban design as a social contract” (Alexander D’Hooghe, MIT)

At CTS the central theme for the years 2019-2020 is the transition to a desirable and sustainable future. The following topics have been presented at the monthly meetings:

- “Transition in agricultural and food-related systems”
- “Economic challenges in a limited world”
- “Digital revolution in the face of ethics and human rights”
- “Challenges for public governance: « steering of the school system »
- “Energy and economy: an impossible divorce? Role of businesses in the transition.”
- “Europe and the energy transition”
- “Fighting climate warming through carbon markets”

ARB organized also a series of lectures and symposia at its “Collège Belgique” about a broad range of topics, such as climate and politics with regard to the energy transition, juridical and ethical aspects of robotization, from bosons to the universe, ... Collège de Belgique received the colleagues of Collège de France and Québec.

BACAS is member of several international engineering associations:

CAETS the International Council of Academies of Engineering and Technological Sciences (Achiel Van Cauwenberghe and Paul Verstraeten represent BACAS in CAETS).

Euro-CASE is the European Council of Academies of Applied Sciences, Technologies and Engineering (Joos Vandewalle – KTW - and Luc Chefneux – CTS -)

EASAC (European Academies Science Advisory Council) published reports on ‘Decarbonization of transport: options and challenges’ and organized a symposium on “Decarbonisation of heating and cooling.” Other subjects: synthetic fuels, decarbonisation of air water and rail traffic, nuclear fission and fusion. (Jan Kretzschmar represents BACAS in EASAC).

ESAF (European Science Advisors’ Forum): prof. Joos Vandewalle respresented BACAS at ESF’s symposium in Dublin. The subject was the role of the scientific policy advisors and academies.

Paul Verstraeten
Past President of BACAS

Activities of Chinese Academy of Engineering (CAE-China)

(For Sharing in the CAETS 2020 Annual Meeting)

- **New members election**

In November 2019, CAE elected 75 new members, bringing the total number of members to 908. In addition, 28 new foreign members were elected, leading to 91 foreign members in total.

- **CAE's role as an engineering think-tank in advising the nation's policymaking by conducting strategic studies**

In 2019, CAE organized and conducted 360 strategic advisory studies to provide strategic advice for China's scientific and industrial development. These studies were intended to meet national strategic needs, highlight scientific and industrial development, and provide professional intellectual support, with focus on medium and long-term development strategies of engineering technology, cultivation and development of strategic emerging industries, industrial internet, artificial intelligence, disruptive technologies, new materials, energy production and consumption revolution, hydrogen energy and fuel cells, waste-free cities, ecological civilization, food safety, among other fields. Also, CAE expanded the third-party assessment services and increased the impact of advisory studies.

A total of 97 academic activities to highlight the advance of engineering technology and to enhance academic exchanges were also organized in 2019.

- **CAE's response to the Covid-19**

As an academic organization providing consultancy services for decision-making in engineering and technological sciences, CAE has actively responded to combating Covid-19 by organizing its members to provide ideas to decision-makers and communities. As a shining example, it was Dr. Chen Wang, Vice President of CAE who advised the government to converting large public venues such as exhibition centers and indoor stadiums into temporary hospitals (*Fangcang Shelter Hospitals*), to isolate large number of patients with mild to moderate COVID-19 from their families and communities, which was a proven way to cut off the infection chain and was recognized a key measure for

successfully mitigating the epidemic in Wuhan. Another example is a research for reusing masks as an effective solution during the severe shortage of personal protective equipment.

CAE has also been developing an online column named COVID-19 Prevention and Control through IKCEST, an online knowledge centre for engineering, sciences and technology operated by CAE. The knowledge center aims at collecting and sharing relevant information of Covid-19 and experience in its prevention and control from various countries.

Links about *Fangcang* Shelter Hospitals

A Lancet article:

[https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736\(20\)30744-3.pdf](https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(20)30744-3.pdf)

Construction and Operation Manual of *Fangcang* Shelter Hospitals for COVID-19:

https://gmcc.alibabadoctor.com/prevention-manual?content_id=2&locale=en-us

(English Version)

Links about Masks decontamination and Re-use

A video introduction: https://youtu.be/_BChl4gNYJg

PowerPoint slides:

https://www.euro-case.org/wp-content/uploads/2020/04/Eurocase/PDF/covid19/Reuse-of-Masks_Dan-Wang-Jian-Feng-Chen_BUCT.pdf

Links of IKCEST online column: COVID-19 Prevention and Control

http://ikcest.org/sdgs/sdgs_special_index.htm

● **Publications**

The Impact Factor of CAE's its flagship journal *Engineering* reached to 6.495 in July 2020, 5 years after it was launched in 2015. *Engineering* (www.engineering.org.cn) is the primary journal of CAE's "1+9+1" journal family (i.e. *Engineering*, 9 journals of frontiers based on CAE's 9 academic divisions, and the *Strategic Study of CAE*), which covers various fields of engineering, and reflects current engineering development trends and progress in order to promote the exchange and showcase achievements.

● **Supporting systems for consulting work**

- 1) CAE has been providing the local governments with consultative suggestions to support the regional economic development and social progress. So far, 17 strategic study institutes have been established jointly by CAE and provincial governments.

2) CAE has been working closely with leading enterprises, universities and research institutes by establishing strategic research consortia to support its consulting work. So far 13 consortia have been established focusing on innovation, aviation, aerospace, marine, IT and agriculture, etc.

- **International exchanges and cooperation**

CAE co-sponsored the 2019 Global Grand Challenges Summit with the engineering academies of the UK and the US, and the 22nd East-Asia Round Table Meeting of Engineering Academies (EA-RTM) in association with the engineering academies of Japan and Korea. CAE conducted a number of bilateral academic exchanges and joint studies with CAETS member academies and other related academic institutions in the areas such as frontiers of engineering, innovation, smart cities, smart manufacturing, industrial transformation and upgrading, energy system transformation, nuclear power, railway transportation, ecological civilization construction, standardization, tuberculosis prevention and control, integrative medicine, etc.

2019/2020 Key Activities of the Engineering Academy of the Czech Republic

The EA CR participated in video conferences on engineering challenges related to Covid-19 pandemic organized by the RAEng. Experts nominated by the EA CR reported on achievements made in the field of Personal Protective Equipment, Rapid Diagnostic Testing and Digital Contact Tracing in the Czech Republic.

The EA CR contributed with the data on the Czech Republic into the CAETS 2020 Energy Report.

The EA CR actively cooperated on the SAPEA project (Science Advice for Policy by European Academies) supporting European Commission's Scientific Advice Mechanism. It nominated its members into working groups of the project. IA CR members Prof. Josef Steidl and Prof. Lenka Lhotská participated in the work of working groups "Microplastics" and "Future of Ageing". SAPEA reports were made available by the EA CR to the professional community and the state administration.

The EA CR started to publish the EA CR Newsletter with current news on EA CR activities. An important item was nuclear engineering which should ensure the future self-sufficiency of energy in the Czech Republic. The electronic version of the Newsletter is sent to EA CR members, partner organizations and the state administration.

The EA CR award for 2019 was presented to a team of VUTS Liberec for the concept and creation of a unique DIFA jet weaving machine for the fully automated production of special 3D fabrics, so called distance fabrics, i.e. fabrics with large and varying distances.

Key activities 2019, ATV – The Danish Academy of Technical Sciences

Technological Summit

The subject of the 2019 Technological Summit treated the possibilities of Denmark becoming a laboratory for sustainable green solutions. The Academy launched the report "India - Land of Opportunities" on how Denmark and India can collaborate on India's green transformation and the SDG's.

New growth of STEM businesses

The Academy identifies well over 1,100 start-ups whose businesses are based on STEM skills (Science, Technology, Engineering and Math) in the report "The new growth of STEM businesses in Denmark". This type of business contributes more than other new companies to Denmark's future growth.

Applied AI Academy

Applied AI Academy allowed tech-leaders to explore the business implications of AI. On study trips to Silicon Valley the participants met AI practitioners from leading companies, venture capitalists, experts from world renowned innovation and research institutions, and startups working with new technologies.

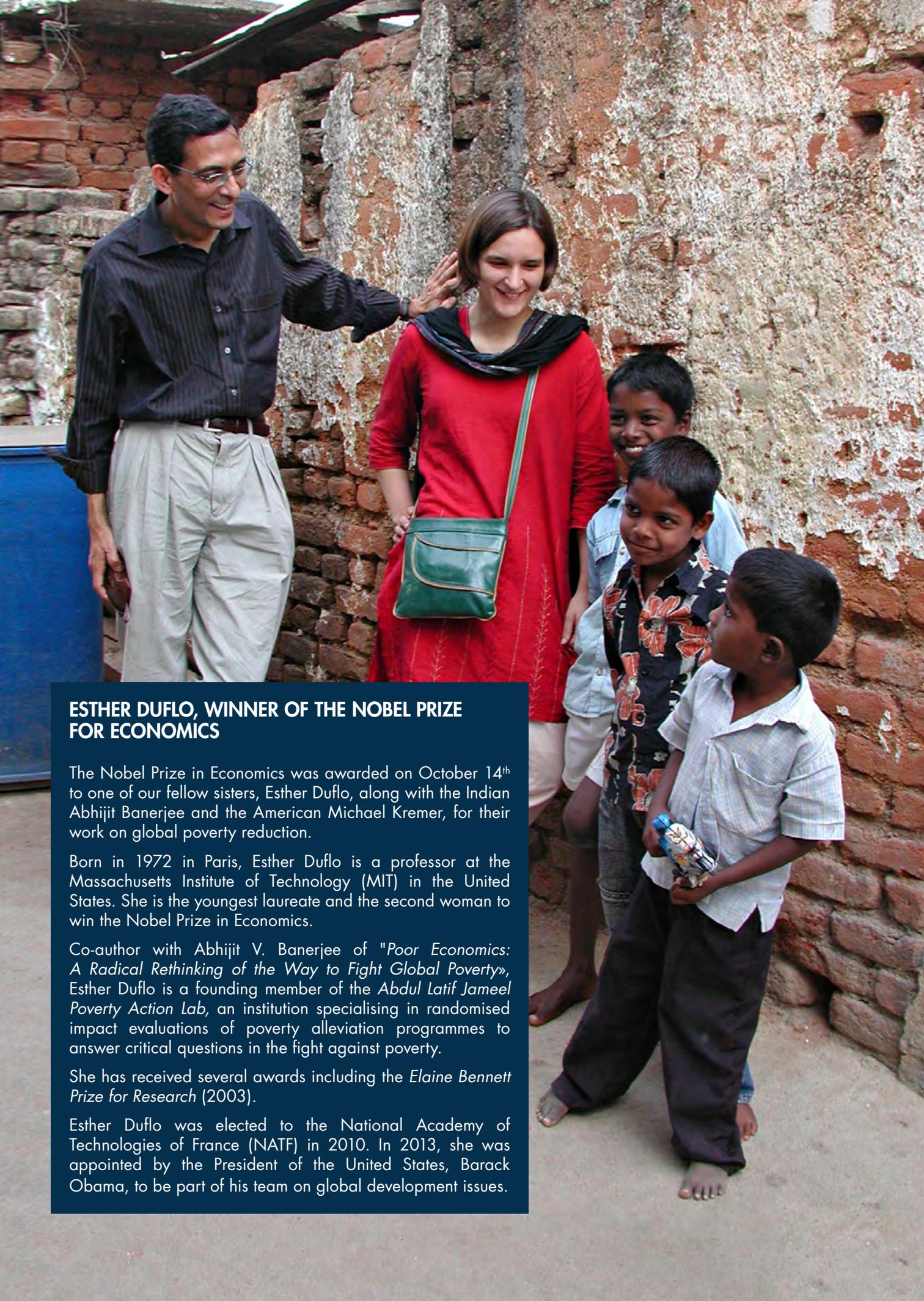
2019 ACTIVITY REPORT

The essentials



NATIONAL ACADEMY OF
TECHNOLOGIES OF FRANCE

SHARING REASONED, CHOSEN, PROGRESS



ESTHER DUFLO, WINNER OF THE NOBEL PRIZE FOR ECONOMICS

The Nobel Prize in Economics was awarded on October 14th to one of our fellow sisters, Esther Duflo, along with the Indian Abhijit Banerjee and the American Michael Kremer, for their work on global poverty reduction.

Born in 1972 in Paris, Esther Duflo is a professor at the Massachusetts Institute of Technology (MIT) in the United States. She is the youngest laureate and the second woman to win the Nobel Prize in Economics.

Co-author with Abhijit V. Banerjee of *"Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty"*, Esther Duflo is a founding member of the *Abdul Latif Jameel Poverty Action Lab*, an institution specialising in randomised impact evaluations of poverty alleviation programmes to answer critical questions in the fight against poverty.

She has received several awards including the *Elaine Bennett Prize for Research* (2003).

Esther Duflo was elected to the National Academy of Technologies of France (NATF) in 2010. In 2013, she was appointed by the President of the United States, Barack Obama, to be part of his team on global development issues.

SUMMARY

IDENTITY
& STRATEGY

p.6

PUBLICATIONS
AND NOTICES

p.8

EVENTS
PARTNERSHIPS

p.10
p.11

ORGANISATION
& GOVERNANCE p.14

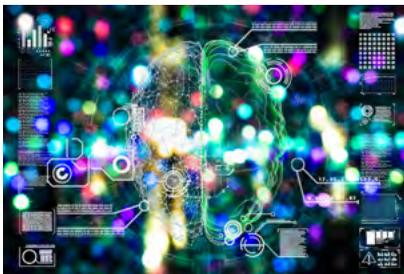
HIGHLIGHTS 2019

JANUARY

- **Scientific progress and industrial performance in material mechanics and structures:** seminar in partnership with the CNRS.
- **Facing the technical challenges of agriculture:** the contribution of technology. Joint report with the French Academy of Agriculture.

FEBRUARY

- **Brain-Machine Interface:** a day for the general public at the Cité des sciences et de l'industrie.



MARCH

- **Nuclear Energy and the Environment:** joint report with the French Academy of Sciences and the Chinese Academy of Engineering.
- Notice on the French Environment & Energy Management Agency study "**Trajectories for the evolution of the electricity mix 2020 – 2060**".

Director of publication: Pascal Viginier, President of the National Academy of Technologies of France

Publishing: Catherine Côme - National Academy of Technologies of France

Creation, execution: Benjamin de la Salle

Printing: Jouve

Photo Credits: © Istock - © Stéphanie Thine/ National Academy of Technologies of France © Euro-CASE

APRIL

- **The child, the teenager, the family and the screens and apps: a call for reasoned vigilance on digital technologies** of the Academy of Sciences, the National Academy of Medicine and NATF.



MAY

- **Fake news in the food industry.** Conference by Pierre Feillet.

JUNE

- Notice: **linky smart meters: a new technology in every household: issues and concerns.**
- NATF informs the Ministry of Higher Education, Research and Innovation of its proposals for the partnership research and innovation part of the multiannual research programming law.
- CAETS 2019: Engineering a better world - the next 100 years (Stockholm)
- **For a responsible and reasoned management of radioactive materials and waste:** stakeholder notebook in common with the French Academy of Sciences.

JULY

- Support for the **Manifesto for Artificial Intelligence** signed by eight major industrial groups.
- **Big Data: ethical issues** (Communication)

SEPTEMBER

- Colloquium **Marseille and the sea: yesterday, today, tomorrow** - organised in partnership with the Academy of Marseille.
- Frontiers of Engineering (Stockholm, Sweden)

OCTOBER

- **Mastering the hydrogen vector, a strategic challenge for the regions?** Seminar in partnership with the Graduate Institute for Science and Technology (Institut des hautes études pour la science et la technologie - IHEST).
- **Science and Technology in Society - Forum (Kyoto)**
- **Euro-CASE Annual Conference: The future of work - The content of jobs (Oslo)**

NOVEMBER

- 3rd NATF-Convention & Grand Prix: **Future Terrestrial Mobility.**
- **Agriculture facing its technical challenges: the contribution of technologies** - session organised in partnership with the Academy of Agriculture



DECEMBER

- Election of 14 new members.

FOR AN INCLUSIVE ACADEMY OF TECHNOLOGY

Our motto: *For reasoned, chosen and shared progress* encourages us to share, not only with decision-makers but with all our fellow citizens. We must both defend technologies, faced with all kinds of objections which very often have no real justification, and respond to citizens' questions, in particular by constantly integrating an ethical dimension into our work.

To help us adopt this inclusive approach, for the second year in a row we conducted a survey of the French to find out how they feel about technological advances. This study confirms the appeal, but also the concerns about new technologies, particularly on environmental issues. For about 50 % of French people, technological progress is one of the causes of climate change. However, the fight against global warming and the protection of the environment in general will not be possible without the contribution of technologies - for example, how to store intermittent renewable energy on a large scale or how to reduce greenhouse gas emissions for food production, health care, transport, housing, industrial production, etc. There is therefore a real mission for our academy to provide information on the consequences of the development of technologies, particularly those that are controversial, such as employment, with the destruction/creation/transformation of (new) professions, (new) companies or (new) sectors. Giving answers to these legitimate questions is a political challenge. The new European Commission has emphasised the concern about the environment with the rapid adoption of the Green Deal. It also defines a new balance between competition policy and industrial policy. We welcome the election of one of our members, Thierry Breton, as European Commissioner in one of the key posts.

If we look at the global context, we see an unprecedented technological acceleration, characterised by not only speed, but also, scale, particularly in physics, digital sciences and biology. In this context, France



Pascal Viginier, President of the NATF

has undeniable assets, thanks to the technological progress and breakthrough innovations it generates in many sectors and the many world-leading positions and companies it has in each of the Academy's divisions.

In order to be as close as possible to the challenges linked to technological and societal changes, the Academy has been reorganised into ten divisions, four of which are devoted to new themes: "Culture, Leisure;" "Industry and Services;" "Security and Defence;" "Technologies, Economy and Society". We have had a busy academic year: a total of eight reports, three quarterly Foundation reports, our contributions for the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST) and four contributions to the SAPEA (*Science Advice for Policy by European Academies*) reports for the European Commission.

Giving all citizens the benefit of progress also means promoting technological professions among young people. However, in France, unlike in other European countries, particularly Germany, very few young people go into these professions where there is a real lack of young talent and skills. Supporting technology is also a way to create jobs. Finally, we must also be attentive to the impact of current developments on skills, on gender inequalities - in this respect, we are pleased to have shifted our recruitment policy towards gender parity. We should also not neglect the impact on developing countries.

2020 will be the year of the transition to "adulthood" for our academy, which will celebrate its 20th anniversary. Our work is increasingly being viewed, and therefore potentially criticised and controversial. We must therefore systematically listen to the expression of ethical issues, contradictions by the various stakeholders and concerns by French people in all their diversity, and seek answers.

Created at the dawn of the 21st century, the National Academy of Technologies of France (NATF) is also heir to the Age of Enlightenment. Its motto, *For reasoned, chosen and shared progress*, calls for technological development at the service of mankind, the environment and sustainable growth.



> IDENTITY

Technological innovations are at the heart of most of the major challenges facing society: providing access to training and employment for the greatest number of people, building a healthcare and health system that can meet the needs of a growing population, making a successful energy transition and adapting to climate change...

On all these issues, NATF makes proposals and recommendations to public authorities and socio-economic actors.

Thanks to the diverse expertise of its members, the academy offers an original perspective on issues related to technologies and their interaction with society. It conducts its work in complete independence and places the societal and ethical dimension of technologies at the heart of its thinking. The following topics are examples of this approach:

- improvement of the health and diet of French people;
- the fight against unemployment, particularly youth unemployment, through educational transition, initial and lifelong technological education and training for the jobs of the future;
- the energy transition to combat climate change;
- the digital transformation of all sectors of activity;
- the technological upgrading of SMEs and their growth into mid-sized enterprises (MSEs);
- the mobility and transport of tomorrow;
- biotechnologies and their economic potential;

- development assistance to the least developed countries;
- regional economic development and job creation through technology.

> VALUES

PROGRESS

The Academy is committed to promoting technological progress in the interest of the public good. It takes its approach to progress to the Government and decision-making bodies in France as well as to European and international think tanks. In Europe, this is done notably via Euro-CASE and its new SAPEA programme for scientific advice to the European Union. Internationally, we use the framework of CAETS for Asia, the United States and Africa.

IMPARTIALITY

The documents produced by the Academy are validated by the plenary assembly following a process that guarantees their quality and impartiality. The publications also refer to points that the state of knowledge does not allow to be decided with sufficient certainty or that are controversial. Members of the National Academy of Technologies are elected by their peers on the basis of scientific and technical excellence, following rigorous recruitment procedures.

OPENING

The Academy contributes to the governance of technological issues, in particular through the involvement of its members in deliberative and decision-making bodies (law on multiannual research programming, the Parliamentary Office for the Evaluation

of Scientific and Technological Choices, the National Research Agency, etc.). The Academy involves outside personalities in its deliberations. The relevance of its analyses is also based on a good knowledge of best practices around the world. Its integration in European and international academic networks allows it to *benchmark* its work.

> STRATEGY

The National Academy of Technologies of France implemented its 2025 strategy in 2019:

1. ENHANCING ITS RELATIONS WITH THE ECONOMIC WORLD

The Academy has set itself the strategic goal of strengthening its link with the business world. A Senate of personalities, business leaders and representatives of the economic world, chaired by Jean Pierre Raffarin, former Prime Minister, was created in May 2019. The missions of this advisory body are to inspire the National Academy of Technologies when it needs guidance for its work; to extend the Academy's influence in all sectors of the economy; to help develop attractiveness of technological fields and to anticipate the needs for new technological skills.

Composed of an initial core group of about ten members appointed for three years, the new Senate will eventually bring together about fifty active business leaders.

2. DEVELOPING ITS ECOSYSTEM OF EXPERTS

Ten fields of action essential to the development of the country have been defined and constitute the new working structure of the Academy in 2019. One of the objectives of setting up this organisation into divisions and project groups is to develop the participation of external experts - academic or industrial.

3. STRENGTHENING ITS DIALOGUE WITH EDUCATION AND TRAINING STAKEHOLDERS

NATF promotes the teaching of technology in its different aspects in the education of young French people. The Academy is heavily involved in the National Education system. Our endeavours have contributed to introducing technology teaching in the second year of the general and technological track (introduction of "digital science and technology" training) and also to strengthening the place of environmental and climate-related technologies in education, starting in middle school. The Academy had also its fair share in the success of introducing more digital technologies in high school.

4. STRENGTHENING ITS COOPERATION IN EUROPE AND INTERNATIONALLY

The Academy has strengthened its activity within Euro-CASE. 2020 will see the activation of the Africa Club. Support for digital training is already underway with the National Polytechnic Institute Félix Houphouët-Boigny in the Ivory Coast and an organisation of the "Frontiers of Engineering" type is being set up for Africa, in liaison with the Quai d'Orsay, the French Development Agency (AFD) and NATF's Education and Training division. With China, our cooperation is continuing on three themes: *hydrogen, additive manufacturing and tuberculosis*. The Academy continues its active participation in the International "Council of Academies of Engineering and Technological Sciences" (CAETS) and takes responsibility for organising CAETS 2022 in Paris.

5. DIVERSIFYING RESOURCES

The NATF Foundation successfully continued to develop its activities, with management costs falling sharply and a higher proportion of project financing. In 2019, the Academy benefited from €0.5M of its own resources, coming from its foundation and the new Senate.

Texts adopted in 2019

- **Facing the technical challenges of agriculture. The contribution of technology.**

A joint report with the French Academy of agriculture, voted on January 9th

The French agricultural sector remains the leading one in Europe, but its share in terms of value in the European Union's agricultural production is declining. Similarly, France is no longer the leading European agricultural and food exporter. Economic precariousness is escalating and the evolution of agricultural practices raises both societal and environmental questions. Faced with these findings, the French Academies of Technologies and of Agriculture analysed how technological solutions such as genetics and plant improvement, crop protection and pest control, crop weed control, agricultural machinery, robotics and sensors, and digital technologies could meet these challenges.

- **Nuclear Energy and the Environment**

A joint report with the French Academy of Sciences and the Chinese Academy of Engineering, voted on March 13th

In a second joint study on nuclear energy issues, the three academies focused on the environmental impacts of nuclear energy in normal and accident situations, including waste management, providing a comprehensive analysis of these issues which are essentially similar in France and China. As the economics of energy production, which is also an important factor for the future, is determined by quite different local and regional conditions in the two countries, it was decided not to address this issue.

- **Notice on the ADEME study "Trajectories for the evolution of the electricity mix 2020 - 2060".**

Notice voted on 13th March

In its latest assessment of the evolution of the electricity mix up to 2060, the French Environment and Energy Management Agency (Agence de l'Environnement et de la Maîtrise de l'Énergie - ADEME) formulates recommendations that the Academy has assessed. The National Academy of Technologies is fully in line with the policy of development of renewable energies, but the success of this policy presupposes realistic assumptions. The conclusions of the ADEME study must therefore be taken with caution when it comes to public policy decisions.

- **The child, the teenager, the family and the screens and apps. Call for reasoned vigilance on digital technologies**

A joint report with the French Academy of Sciences and the National Academy of Medicine, voted on May 15th

The increasing use of computers and all screen-based tools by young children and adolescents is a cause for concern. Overexposure to these digital tools can affect brain development in younger people. It can lead to behavioural abnormalities, sleep disturbances or attention problems in teenagers. Families and teachers have a role to play in reducing the risks of uncontrolled screen and apps use.

- **The Linky communicating meters. New technology in every home: issues and concerns**

Notice voted on 12th June

The deployment of communicating electricity meters (Linky meters) is one of the recommendations of the Grenelle Environment Round Table. However, this meter gives rise to many misunderstandings, disputes and polemics within society.

In a Notice voted on 12 June, NATF considers that the deployment of Linky and the renewal of the ENEDIS information system carried out in parallel are an exemplary technical success, achieved in a very complex regulatory environment.



Linky smart meters are a positive step forward for a new shared and optimised use of electricity networks and contribute to the continuous improvement of their operation. The deployment of Linky meters will enable sophisticated management of the electricity distribution network at the level of territories and consumers (Smart grids). It is therefore essential for a successful energy transition.

- **For a responsible and reasoned management of radioactive materials and wastes**

Notice in the form of an actor's notebook, in common with the Academy of Sciences, voted on June 12th

Envid by many foreign countries, France benefits from a coherent set of laws on the management of radioactive materials and waste, setting the framework for studies and research on deep geological disposal of long-lived nuclear waste and specifying the procedures for creating a reversible deep geological disposal facility for high-level waste (HLW) and intermediate level long-lived waste (ILW-LL).

The 4th edition of the National Plan for the Management of Radioactive Materials and

Waste brought important new elements on three essential points: the operation of the Cigéo project for the deep geological disposal of HLW and ILW-LL ; the decision to suspend the development of the Astrid fast neutron reactor, which opens the essential question of whether the plutonium resulting from the processing of spent fuel can be valorised, or whether it should be qualified as waste; the limits of the current strategy for the disposal of very low-level waste (VLLW), highlighted by the first dismantling operations.

- **Big Data: ethical issues**

Communication approved on 3rd July

The Ethics, Society and Technology Committee selected sectors of human activity in which Big Data are, or will be, considerably changing practices and raise ethical questions: social networks, targeted advertising, e-commerce, health, agriculture and food, financial services, security, public policy... The study took approximately two years. The report brings together a set of contributions which, for each of the sectors considered, identify the pitfalls to be avoided and propose an approach geared towards meeting the needs of individuals and society as a whole.

Annual NATF-Convention and Grand Prix *Terrestrial mobility of the future*

On 18th November, the 3rd edition of this event brought together three hundred participants at the *Maison de la Chimie* in Paris around the topic of major transformations in the land-based mobility sector: electrification of vehicles, development of autonomous vehicles, digitalisation and evolution of services and uses.

The Grands Prix of the National Academy of Technologies were awarded to two young start-up:

- Mob-Energy, whose charging robots enable all car park operators to offer an electric car recharging service without installing a single terminal.
- Groupeer Technologies, whose ticketing solution for school transport meets both child safety and economic efficiency requirements.

Thematic sessions

The future of industrial SMEs. How do you get them to upgrade their skills? Focussing on the sectors or territories?

The child, the teenager, the family and the screens and apps. Call for reasoned vigilance on digital technologies

A revolution in units of measurement

Around logistics

New workers and new workplaces by 2030

Hydrogen (decarbonated): a key element in the ecological transition?

Transport, construction and urban planning: value conflicts

Agriculture facing its technical challenges: the contribution of technology

Panel discussions 2019

Gilles Brégant, Director General of the National Frequency Agency

Guillaume de Seynes, Managing Director, Upstream and Investments Division, Hermès International

Xavier Bertrand, President of the Hauts de France Regional Council.

Antoine Petit, President and Chief Executive Officer of CNRS

Martine Liautaud, Founding President of the Women Initiative Foundation

Bernard Duverneuil, President of Cigref

Annual seminar

Technologies for health: from innovation to its integration into the healthcare system

The annual seminar provided an opportunity to take stock of the societal, economic and organisational changes brought about by the introduction of new technologies in the health field. Issues such as cost/benefit to citizens, financing of innovation, access to data to benefit from the contributions of new computational approaches and ethical dimensions were addressed.

Conferences & Symposia

Piloting an object through brain activity, public session at the *Cité des Sciences et de l'Industrie* (Paris La Villette)

CAETS 2019: *Engineering a better world - the next 100 years*, à Stockholm (Sweden)

Science and Technology in Society Forum in Kyoto (Japan)

Euro-CASE Annual Conference: *The future of work - The content of jobs* in Oslo (Norway)

Frontiers of engineering symposium in Stockholm (Sweden)

PARTNERSHIPS

FRANCE

The National Academy of Technologies helps to inform public choices in innovation policy.

In particular, at the request of the Ministry of Economy and Finance and the Ministry of Higher Education, Research and Innovation, the Academy contributed together with the National Council of Industry to a benchmark for the ranking of France and its industrial sectors on a set of key technologies for the future.

At the request of the Ministry of Higher Education, Research and Innovation, the Academy has issued recommendations aiming at improving the measures taken by public authorities in order to better prepare France for the socio-economic changes brought about by technological innovations.

MESRI has also sought the Academy's advice in the context of the development of the new Law on Multi-Year Research Programming.

The Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST) regularly calls on the expertise of NATF to shed



further light on its studies, at hearings or in the form of written contributions. In 2019, the Academy gave its views on satellites and the services they provide; on new trends in energy research (renewable energies); on the contribution of science and technology to the restoration of Notre-Dame de Paris; and on energy production by the agricultural sector.

INTERNATIONAL

DELEGATE

Bruno Revellin-Falcoz

DEPUTY DELEGATE

G rard Creuzet

In 2019, the international outreach of the National Academy of Technologies has intensified, thanks to the development of relations with new countries and the intensification of work within CAETS and Euro-CASE.

Africa

By setting up an Africa Club, NATF is giving concrete evidence of its desire to strengthen its ties with this continent, in particular by organising an event of the type "Frontiers of Engineering", where a group of young French and African engineers is supervised and mentored by high-level experts. The objective is to promote the local creation of *start-ups*.

NATF also participates in the work of the Inter-Academy Development Group.

Germany

NATF and acatech maintain regular relations that cover the whole range of technological activities in both countries. Following a joint study on national public perceptions of technology, the two academies supported the *Manifesto on the Future of Industry in Europe* signed by the two governments.

CAETS

The Council of Academies of Engineering and Technical Sciences (CAETS) now brings together 30 countries around the world. Its annual conference was held in Stockholm (Sweden), dealing with four main themes:

- information and communication technologies,
- energy and climate,
- cities of the future,
- education.

CAETS has strengthened the activities of its permanent platforms, particularly the one dedicated to energy.

NATF has officially announced that in 2022 the annual CAETS conference will be held in France.

China

Work with the Chinese Academy of Engineering (CAE) has intensified and now focuses on five themes:

- nuclear energy and its environment, with the publication of a joint report;
- hydrogen;
- additive manufacturing;
- tuberculosis, with the organisation, in conjunction with the Chinese Academy of Medical Sciences and the French National Academy of Medicine, of a seminar on tuberculosis and the organisation of health systems in the two countries;
- the system for detecting dermatological pathologies.

Korea

NATF participated in Seoul in the CAETS Energy Committee activities organised by the National Academy of Engineering of Korea (NAEK) and is contributing to the preparation of CAETS 2020 to be held in Seoul on the theme of the *Smart Society*.

Euro-CASE

Euro-CASE is an association that brings together the academies of technology and engineering of twenty-three European countries and of which NATF is a founding member.

SECRETARY GENERAL

The Secretary General, Yves Caristan, has been reappointed for a new mandate.

EXECUTIVE BOARD

The Chairman of the Board, Reinhard Hüttl, was reappointed for a further term.

Representatives of NATF:

Bruno Revellin-Falcoz

G rard Creuzet

Euro-CASE Work platforms

Several members of the NATF contribute to the work of Euro-CASE work platforms:

Energy (*Energy Platform*)

With the participation of Jean-Fran ois Minster, Bernard Tardieu, G rard Grunblatt.

This group has published a report entitled *Energy Transitions in Europe - Common Goals but Different Paths*¹, available on the Euro-CASE website.

Engineering Education

With the participation of G rard Creuzet

This working group is finalising a report on *Challenges and Opportunities for Future Engineering Education in Europe*. It also initiates a reflection on *The future of work and young people*.

The future of work

This platform should be initiated in 2020 under the leadership of the Norwegian Academy of Technology.

Young people and engineering and technology academies

This platform should be initiated in 2020, under the guidance of the Royal Academy of Engineering of Great Britain.

Annual conference

The Euro-CASE Annual Conference 2019 was organised by the Norwegian Academy of Technological Sciences (NTVA) in Oslo on the theme: *The Future of Work and the Future of Jobs*. The conference was very interesting indeed and informed the theme of a future Euro-CASE platform.

On June 8th, the Croatian Academy of Engineering (HATZ) will host in Zagreb the 2020 edition of the Conference, dedicated to the *Challenges of European Energy Transition*.

SAPEA

Launched in 2017, the *Academic Consortium Science Advice for Policy by European Academies* (SAPEA) is part of the European Commission's Scientific Advice Mechanism, which is funding it with  6 million over five years. SAPEA is based on the collaboration of five European academic networks: Academia Europaea, the European Federation of Academies of Sciences and Humanities (ALLEA), the European Academies' Science Advisory Council (EASAC), the Federation of European Academies of Medicine (FEAM) and Euro-CASE.



Download
Euro-CASE position
papers

¹ Energy Transitions in Europe – common goals but different paths

SAPEA aims to bring together the independent scientific expertise of more than one hundred European academies from over forty countries. Several reports have been prepared with the collaboration of NATF in 2019: *Carbon Capture and Utilisation; Micro- and Nano-plastics; Transforming the Future of Aging*.

Within the framework of SAPEA, Euro-CASE and the European Commission are considering a study on energy in Europe.

United States of America

The National Academy of Engineering of the United States of America (NAE) presented the *Grand Challenges of Engineering Scholars Program*, a scholarship programme related to the sustainable development goals defined by the United Nations, organised with the Chinese Academy of Engineering and the UK Royal Academy of Engineering. The National Academy of Technologies of France will participate in this annual meeting in 2020.

India

The two academies of technologies - French and Indian - have decided to continue their cooperation by making an inventory of themes for potential future studies in order to set up joint working groups.

Japan

The sixth edition of the STS Forum in Kyoto (*Science and Technology in Society Forum*) was, as usual, chaired by Prime Minister Shinzo ABE.

NATF participated in this meeting which brought together more than 1200 participants.

On the programme of the forty sessions and associated events figured the following topics:

- energy and environment,
- ICT and smart cities,
- innovation,
- health,
- resources,
- education.

Poland

On the occasion of the 100th anniversary of scientific relations between France and Poland, the National Academy of Technologies of France and

the Ministry of Foreign Affairs, together with the Polish Academy of Sciences, organised a conference in Paris on the theme of mathematical modelling in bioinformatics.

United Kingdom

Exchanges with the UK Royal Academy of Engineering (RAEng) continued. RAEng presented its actions in relation to the sustainable development objectives defined by the UN. Cooperation with NATF is being explored on certain topics. The reorganisation of the two academies to better understand the major technological challenges of the future was also discussed, with the creation of the *National Engineering Policy Centre* under the direction of RAEng and the creation of divisions within the French Academy.

Switzerland

NATF and the Swiss Academy of Engineering Sciences (SATW) exchanged views on their respective work in the fields of artificial intelligence and energy transition, with the aim of a joint working session in 2020.

FRONTIERS OF ENGINEERING

The Europe-US exchange cycles organised by Euro-CASE and the US National Academy of Engineering (NAE) aim to bring together young engineers and scientists from Europe and the United States.

The latest symposium, organised by the Royal Swedish Academy of Engineering Sciences (IVA) and the NAE, was held in Stockholm on 18-20 November 2019. More than sixty engineers under the age of 45 discussed cutting-edge developments in the Internet of Things and 5G, systems approaches for a clean environment, production by *smart* industry and the evolution of materials engineering through advances in imaging technologies. The exchanges between participants were particularly constructive.



Plenary Assembly

As a political and deliberative body, the Assembly adopts notices and reports, approves the general guidelines and the work-programme. It is composed of full and emeritus members.

On 4th December 2019, the plenary assembly elected 14 new members, bringing the number of academics to 338.

Bureau

As an executive body, the Bureau is composed of the president, the vice-president, the general delegate and the outgoing president. The Chairman of the Planning Committee participates.

Academic Council

The Academic Council is an advisory body for decisions put to the vote of the assembly. It is composed of the 4 members of the bureau, 5 ex officio members and 7 elected members.

Divisions

Ten divisions have established working groups for analysing the major technological issues of our time. Systemic analysis is the preferred method, as is risk/opportunity analysis and social acceptability. Each report answers an ethical question.

- Food and Health
- Culture, leisure
- Education, Training, Employment and Labour
- Energy
- Environment and the impact of climate change
- Housing, mobility and cities
- Industry and services
- Digital
- Security and Defence
- Technologies, economies and societies

Inter-divisional project groups on topical technological issues may also be set up by the Bureau.

Studies carried out at the request of institutions, public authorities and partners may, where appropriate, be the subject of an emergency adoption procedure.



International contacts



Bruno Revellin-Falcoz

Honorary President
Delegate for International Relations
bruno.revellin-falcoz@academie-technologies.fr



Gérard Creuzet

Deputy Delegate for International Relations
gerard.creuzet@orange.fr



Yves Caristan

Secretary-General
Euro-CASE
yves.caristan@academie-technologies.fr



NATIONAL ACADEMY OF TECHNOLOGIES OF FRANCE

Grand Palais des Champs-Élysées - Porte C
Avenue Franklin D. Roosevelt - 75008 Paris

T.: +33 (0)1 53 85 44 44

www.academie-technologies.fr/en

M° : Champs-Élysées Clemenceau,
Franklin D. Roosevelt

11 August 2020

Key activities of acatech over the past year

Funded by the Federal Government and the Länder, acatech – National Academy of Science and Engineering is the voice of the technological sciences at home and abroad. We provide advice on strategic engineering and technology policy issues to policymakers and the public. We fulfil our mandate to provide independent, evidence-based advice that is in the public interest under the patronage of the Federal President.

Energy & Resources

acatech is developing options for our energy systems and for achieving a circular economy. Its experts are identifying research priorities and formulating policy options in a number of interdisciplinary projects. Jointly initiated by acatech, Leopoldina and the Union of the German Academies of Sciences and Humanities, the joint academy project **“Energy Systems of the Future” (ESYS) is contributing its expertise to make the European Union climate neutral by 2050.**

- Activities:
 - **In Advance of the meeting of the “climate cabinet” in September 2019, ESYS submitted its [guidelines for an efficient and effective market design](#)**; outlined how climate-friendly technologies can become established in the market
 - The Annual Meeting of ESYS was **held at Berlin’s Futurium on 19 November 2019.**
- Publications:
 - Joint publication: [Energy transition 2030: Europe’s path to carbon neutrality](#)
 - Joint publication: [Pathways into the energy future. The transformation of energy systems in an international perspective](#)
 - acatech research paper: [What is the Significance of Nuclear Energy to the Future of Global Power Generation?](#)

Digital & Self-learning

Digitalization marks the dawn of a fourth industrial age. The division Digital & Self-learning deals with the issues relating to artificial intelligence, industry 4.0 and human-machine interaction.

- Activities:
 - acatech coordinates the [Plattform Lernende Systeme](#). The AI map compiled by the platform featured around 700 applications throughout Germany by the end of 2019
 - acatech and the German Research Center for Artificial Intelligence (DFKI) launched the UPLINX project in order to develop targeted professional development and qualification programmes for businesses regarding machine learning skills
 - acatech coordinates the Research Council of the Plattform Industrie 4.0
 - acatech participated in the discussions concerning the development of a strategy to ensure **Europe’s digital sovereignty. As part of the [GAIA-X](#) initiative.**
- Publications:
 - acatech IMPULSE paper [“European Public Sphere. Towards Digital Sovereignty for Europe”](#)

- acatech DISCUSSION paper “[Revitalizing Human-Machine Interaction – Perspectives from Germany and Japan](#)” published in 2019, led by Henning Kagermann (Chairman of the acatech Board of Trustees) and Youichi Nonaka (Senior Chief Researcher at Hitachi)
- Joint publication “[Using the Industrie 4.0 Maturity Index in Industry. Current challenges, case studies and trends](#)“
- Joint publication “[Key themes of Industrie 4.0. Research and development needs for successful implementation of Industrie 4.0](#)“

Mobility

acatech aims to make an innovative, technology-neutral contribution to shaping the transport and traffic of the future. In doing so, its goal is to create a mobility system that is more intelligent, greener and above all user-friendlier.

- Activities:
 - The [National Platform Future of Mobility](#) (NPM) generates momentum on the topic of mobility and is the main advisor to the Federal Government on this issue.
 - Flagship projects such as “[New autoMobility](#)”, “[New autoMobility II](#)” and the “[German National Platform for Electric Mobility](#)”.
- Publications:
 - The acatech STUDY [Mobilität und Klimaschutz](#) (Mobility and Climate Protection) seeks to provide answers to questions of how people get about in Germany today and what they expect from **tomorrow’s mobility system**.
 - **In the acatech project “New autoMobility II”, an interdisciplinary project group outlines a systemic target scenario for automated and connected transport and traffic post-2030.** The [STUDY](#) was launched by acatech in September 2019 at the IAA International Motor Show in Frankfurt.
 - acatech paper “[On the Way to Intelligent Mobility](#)”

Technology & Society

acatech analyses social negotiation processes relating to technology, developing and testing dialogue formats based on its findings.

- Activities and publications:
 - **acatech’s HORIZONS publications in 2019 addressed two pressing topics:** [Cybersecurity](#) and [Sustainable Agriculture](#).
 - Joint publication of the [TechnikRadar](#) by acatech and the Körber foundation: explores what Germans think about technology and compares the result with European wide attitudes as well as some non-European countries

Circular Economy

The Circular Economy Initiative Deutschland (CEID) was launched in March 2019. A broad range of stakeholders from science, industry and civil society organisations help develop a vision for a circular economy in Germany. The individual measures and general conditions will be summarised **in the initiative’s** final report, the Circular Economy Roadmap for Germany, which is currently under preparation.

Biotechnology

Biotechnology was also the subject of an Innovation Dialogue with the German Chancellor that was organised by acatech. At the end of 2019, acatech published the DISCUSSION paper "[Materials Research: Inspired by Nature – Innovation Potential of Biologically Inspired Materials](#)". The paper describes the innovation potential of bio-inspired materials in everything from chemistry, energy and medicine to robotics and art and design.

Economy, Education & Work

Over the past year, **the Academy's activities in the field of Economy, Education & Work focused on** strengthening German industry and innovation at various levels.

- Activities and publications:
 - Growth finance: In a joint project with KfW and Deutsche Börse, acatech broke new ground by bringing together a range of actors from the financial sector with high-tech growth companies, academia and industry. **As a result, the STUDY "[Enhancing innovation in Germany by strengthening the growth finance ecosystem](#)" was published.**
 - Promoting STEM education: Publication of the 2019 Barometer of Young Talents in the STEM subjects by acatech and the Körber Foundation (annual publication since 2014)
 - acatech IMPULSE paper "[On the Way to Intelligent Mobility](#)"

Innovation

Organised by acatech, the Innovation Dialogue between the Federal Government, industry and science analyses new developments and discoveries in science and research and advises the Federal Government on all innovation policy matters. In 2019, the first steps were taken towards implementing the **recommendations of the Innovation Dialogue and acatech DISCUSSION paper on "[Impulse für Sprunginnovationen in Deutschland](#)" (Promoting Breakthrough Innovations in Germany).**

International Relations

acatech maintains strategic partnerships, is a member of the international umbrella organisation CAETS and the European umbrella association Euro-CASE. Moreover, acatech is coordinator of the EU project SAPEA – Science Advice for Policy by European Academies.

- Activities and publications:
 - acatech coordinates the EU project [SAPEA](#), which brings together outstanding expertise in engineering, humanities, medicine, natural and social sciences from over 100 academies, young academies and learned societies across Europe. A number of [publications](#) have been released over the past year.
 - acatech plays an active part in the international umbrella organisation CAETS and the European umbrella association Euro-CASE. The [CAETS Energy Committee Report 2018](#) published in July 2020 had been finalized by acatech.
 - acatech organized various bilateral events with partner academies and research institutions all over the world (e.g. UK-DE Energy Systems Symposium in 2020).

Coronavirus Pandemic

The coronavirus crisis is putting our healthcare and economic system under unprecedented pressure. acatech provides suggestions to overcome the coronavirus crisis.

- Activities and publications:
 - acatech has published a series of recommendations and proposals in response to the current coronavirus pandemic. A working group led by Christoph M. Schmidt and Reinhard F. Hüttl provides suggestions for how to address the challenge of implementing the necessary measures in practice.
 - acatech helps finding technical and scientific experts.
 - acatech IMPULSE paper "[The Coronavirus Crisis: Keeping the economy running, meeting basic necessities, maintaining innovation](#)" addressed three dimensions of the crisis management strategy needed to tackle the coronavirus pandemic: Intervention, Stabilisation and Stimulation.

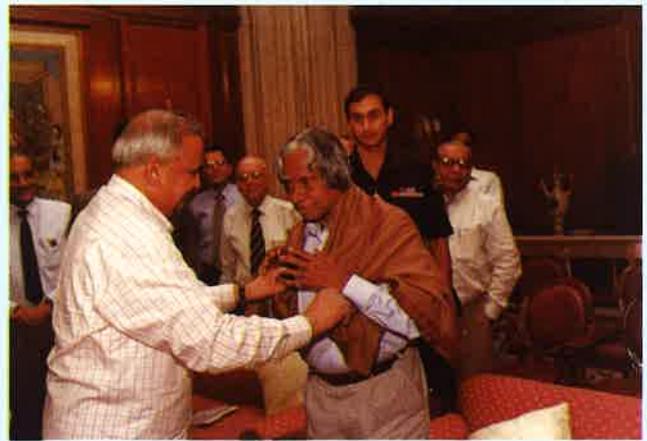


Indian National Academy of Engineering





Late Mr. Rajiv Gandhi, the then Hon'ble Prime Minister of India at the Foundation Function of INAE on 11th April, 1988.



Dr. P Rama Rao, President, INAE felicitating Late Dr. APJ Abdul Kalam, Past President of INAE at Rashtrapathi Bhavan on his assuming the Office of President of India.

INTRODUCTION

The Indian National Academy of Engineering (INAE), founded in 1987 is an autonomous institution partly supported by grant-in-aid from the Department of Science & Technology, Government of India. It comprises India's most distinguished engineers, engineer-scientists and technologists covering the entire spectrum of engineering disciplines. INAE functions as an apex body and promotes the practice of engineering & technology and the related sciences for their application to solving problems of national importance. The Academy provides a forum for futuristic planning for country's development requiring engineering and technological inputs and brings together specialists from such fields as may be necessary for comprehensive solutions to the needs of the country. As the only engineering Academy of the country, INAE represents India at the International Council of Academies of Engineering and Technological Sciences (CAETS); which is a premier non-governmental international organization comprising of Member Academies from 26 countries across the world, with the objective of contributing to the advancement of science and technology and promoting sustainable economic growth of all nations.

ELECTION TO FELLOWSHIP

The election to Fellowship of the Academy is by invitation only. At present, INAE has 835 Fellows from India and 82 Foreign Fellows on its rolls identified in ten Engineering Sections as under.

There are ten Sectional Committees of the Academy representing ten different Engineering Sections, viz., SC-I (Civil Engineering); SC-II (Computer Engineering and Information Technology); SC-III (Mechanical Engineering); SC-IV (Chemical Engineering); SC-V (Electrical Engineering); SC-VI (Electronics & Communication Engineering); SC-VII (Aerospace Engineering); SC-VIII (Mining, Metallurgical and Materials Engineering); SC-IX (Energy Engineering); and SC-X (Interdisciplinary Engineering and Special Fields).

ACTIVITIES OF THE ACADEMY

Symposia/Seminars/Workshops/Conferences

The Academy organizes Symposia/Seminars/Workshop/Conferences at national/international levels on topics of national importance. Based on the deliberations, INAE invariably brings out policy recommendations for suitable follow-up action by the concerned Ministry/Department/agency(ies).

Round Table: At the behest of DST, INAE conducted two Round Table meetings on "*Clean Coal Technologies in India: Current Status, Demands and Aspirations – Pathways to Achievements*" in 2016 at New Delhi. The objective of the round tables was to examine the various aspects of clean coal technologies and identify the technology gaps with respect to our national context and suggest thrust areas for future R&D efforts. Eleven Research areas were identified and accepted by DST for funding.

Engineers Conclave

INAE organizes an annual mega event of engineers as "Engineers Conclave" jointly with major engineering organizations/strategic departments of the Govt. of India on rotation basis. The objective of the Engineers Conclave is to provide a platform for engineers from allied fields to meet, deliberate and recommend right engineering solutions to some of the pertinent issues of national importance. The Engineers Conclave has two themes, one pertinent to the host organization and the other related to social problem requiring engineering interventions coordinated by INAE. The sixth Engineers Conclave 2018 (EC-2018) was organized jointly with Larsen & Toubro (L&T) on Oct 4-6, 2018 at L&T LDA, Lonavala. The two themes for EC-2018 were "Defence Manufacturing in Industry" and "Engineering Challenges in Urban Infrastructure". Mr. SN Subrahmanyan, CEO & MD, L&T was the Chair and Dr BN Suresh, President, INAE was the Co-Chair of EC-2018. Dr. Subhash Bhamre, Hon'ble Raksha Rajya Mantri was the Chief Guest and Dr. Ajay Kumar, Secretary Defence Production was the Guest of Honour of EC 2018. Actionable recommendations



Dr. Subhash Bhamre, Hon'ble Raksha Mantri delivering his Address in the Inaugural Session of EC-2018 on Oct 4, 2018 at L&T LDA Lonavala

based on the deliberations of the two themes are being progressed with the concerned Government Departments/Agencies.

International Seminar on Civil Aviation- Regional Air Connectivity

INAE in association with the Ministry of Defence Production and Ministry of Civil Aviation organized a one-day International Seminar on “Civil Aviation - Regional Air Connectivity” as a part of Aero India on 21st February, 2019 at Bangalore. This initiative was in line with the earlier efforts of INAE wherein the recommendations emanating from Engineers Conclave 2017 regarding “Development and Production of Regional Civil Aircraft in India” were submitted to Niti Aayog; who had taken up the case for instituting a Special Purpose Vehicle (SPV) as recommended by INAE for approval of the PMO; which has since been accorded and Ministry of Civil Aviation is processing the case to form a SPV to head the initiative. The international seminar was an opportunity wherein national and international speakers contributed to arrive at actionable recommendations to be progressed with the concerned agencies so as to take this initiative to its logical conclusion.



Left to Right: Mr. Jitendra Jadhav, Ms. Vandana Aggarwal, Dr. Shekhar C Mande, Dr. Sanak Mishra, Dr VK Saraswat, Dr. G Sathesh Reddy and Dr. BN Suresh

National Frontiers of Engineering Symposium

The National Frontiers of Engineering Symposium was launched by the INAE in 2006 as its annual flagship event. It brings together outstanding engineers between 30 and 45 years of age, from industry, Academia and R&D Labs to discuss leading-edge research and technical work across a range of engineering fields. Each year a few disciplines are chosen as focus areas. The Twelfth National Frontiers of Engineering (12NatFoE) Symposium was held from Sept 17-18, 2018 at IIT Guwahati. 40 to 50 young engineers participated and deliberated on the four themes viz. “Remote Sensing and Image Processing”; “Cyber Security”; “Additive Manufacturing” and “Medical Diagnostics and Therapeutics”.



Prof. Gautam Biswas, FNAE, Director IIT Guwahati delivering the Welcome Address during NatFoE-2018

Initiatives to encourage Frugal Innovation in the Country

Subsequent to the INAE Workshop on “Frugal Innovations in Rural Technologies” jointly organized with National Institute of Rural Development and Panchayati Raj (NIRDPR) and Vijnana

Bharathi in July 2017 at NIRDPR, Hyderabad, a Frugal Innovation Nurturing Programme (FINP) has since been launched with a view to promote the Frugal Innovation in the country. The objective of the FINP is to nurture prospective frugal innovations which have reached prototype stage to scale up and commercialize them for greater exploitation. An Innovation Promotion Committee has been constituted to progress this initiative and an MOU has been signed with National Innovation Foundation (NIF) Ahmedabad to provide inputs regarding Frugal Innovation projects to the Committee.

INAE-DST Joint Initiative on Disposal of Chemical Laboratory Waste

At the behest of DST, INAE organized a Round Table on “Laboratory Safe Practices and Waste Disposal in Academic and R&D Institutes” at University of Pune on July 28, 2018. The objective of the Round Table was to discuss the plan for establishing a pilot plant for disposal of chemical waste. Subsequently, it was decided that the pilot plants would be set up in College of Engineering, Pune and IISER, Kolkata in the first stage.

Engagement of Engineering Students in INAE Activities INAE Youth Forum and INAE Youth Conclave

An INAE Youth Forum for engineering students has been established in the year 2017 which was launched by Dr. K Kasturirangan, FNAE, Chairman, Karnataka Knowledge Commission at the first Youth Conclave held on Aug 11-12, 2017 at Birla Institute for Scientific Research, Jaipur, wherein around 250 engineering students participated. The objective of the Youth Forum is to engage the engineering students in activities of INAE thereby enhancing engineering excellence, promoting youth leadership and assisting in nation building. The second INAE Youth Conclave was organized at Indian Institute of Technology, Kharagpur on Aug 11-12, 2018. The Conclave was attended by more than 230 engineering students from all over the country, and about 40 INAE Fellows participated in the deliberations. The Conclave featured the award ceremony for the awardees of the Second Online National Essay Competition and other competitions held under the aegis of the Conclave.



Winners receiving Award during Second INAE Youth Conclave at IIT Kharagpur

Abdul Kalam Technology Innovation National Fellowship

INAE and Science and Engineering Research Board (SERB), Department of Science and Technology (DST) have instituted the **Abdul Kalam Technology Innovation National Fellowship** in the year 2017, with the view to recognize, encourage and support translational research by Indian Nationals working in various capacities of engineering profession, in public funded institutions in the country. All areas of engineering, innovation and technology are covered by this Fellowship. The Fellowship provides for a monthly honorarium of Rs 25,000/- and a Research

Grant of Rs.15.00 lakh per annum for engineering research and innovation activity. The Fellowship can be held for a maximum period of 5 years. The expected outcome of the research work carried out is to develop Commercialized or deployable technology; pilot scale or field trial worthy technology; patent (filed/ sold/ commercialized) working model or prototype for demonstration and trial.



Hon'ble President of India Shri Ram Nath Kovind, Dr Harsh Vardhan, Minister of Science and Technology and Prof Ashutosh Sharma, FNAE, Secretary, DST at Vigyan Bhawan, New Delhi with Abdul Kalam Fellowship Awardees & Other Awardees

Academia-Industry Interaction Schemes

INAE together with All India Council for Technical Education (AICTE) launched "AICTE-INAE Distinguished Visiting Professorship Scheme" during 1999. Under this scheme, Industry experts are encouraged to give series of lectures at an educational institution in their proximity for a specific time period. This scheme has become popular among industry experts as well as educational institutions. The retired INAE Fellows are also eligible for consideration as industry experts under this scheme.

Joint AICTE-INAE Schemes

AICTE- INAE Teachers Research Fellowship Scheme

A joint scheme – "AICTE- INAE Teachers Research Fellowship Scheme" for Engineering Teachers has been launched in 2013, in order to promote a research culture amongst the faculty in AICTE approved engineering institutions. Under this scheme, engineering teachers from AICTE approved engineering institutions are sponsored to pursue research in Council of Scientific and Industrial Research (CSIR)/ Defence Research and Development Organization (DRDO)/ Department of Space (DoS)/ Department of Atomic Energy (DAE) laboratories leading to the award of a Ph.D degree in the chosen field of study.

AICTE-INAE Travel Grant Scheme for Engineering Students

AICTE-INAE Travel Grant Scheme for Engineering Students has been launched in 2013 to provide financial support for engineering students to present papers abroad. The objective of the scheme is to provide partial travel assistance and registration fees to Bachelors and Masters Level engineering students for presenting a research paper in an international scientific event / conference/ seminar/ symposium/ workshop etc in order to provide them a platform for showcasing their work at international level.

INAE Chair Professorship Scheme

INAE Chair Professorship Scheme has been instituted in order to encourage engineers/technologists with outstanding research contributions, promote long-term participation in academic research and enhance the research standards in academic institutions. INAE Fellows between the ages of 45 and 65 years, working in well- recognized teaching/research institutions or industry in India are eligible for consideration.

INAE Distinguished Professors/Technologists Scheme

INAE Distinguished Professors/Technologists Scheme has been instituted in order to utilize the expertise of INAE Fellows after superannuation for research in engineering institutions/Universities/Research & Development establishments/industry in India. Superannuated Fellows below 70 years of age are eligible for consideration.

Mentoring of Engineering Teachers/Students by Fellows of INAE

INAE undertakes mentoring of Engineering Teachers and meritorious 3rd /4th year B.E./B.Tech students from recognized Engineering institutions, during the summer vacations, with a view to provide them guidance so as to excel further in their field of study.

Interaction with Government Agencies

With the objective of increasing the visibility of INAE in the policy domain, it was decided to align the activities of the Academy with the thrust areas of the Government of India and the Policy Makers; for which Consultative Committees have been constituted with DST, PSA and TIFAC and other agencies. These Committees meet quarterly to discuss and align the activities of INAE with the current thrust areas of national engineering interest.

INAE Expert Pool

A webpage has been created on the INAE Expert Pool to provide a platform to connect the experts from INAE with the various agencies to provide consultancy for solutions to technical problems. The Expert Pool website contains relevant details of expertise pertaining to INAE Fellows and Young Associates. The Expert Pool provides an easy to access and retrieve search engine to connect the experts registered in this web portal with the individuals or agencies seeking their services.

INAE Forums

One of the important objectives of the Academy is to assist the Government from time to time in formulating policies on critical technical issues. For this purpose, seven forums have been constituted – INAE Forum on Engineering Education, INAE Forum on Energy, INAE Forum on Technology, Foresight and Management, INAE Forum on Engineering Interventions for Disaster Mitigation, INAE Forum on Indian Landscape of Advanced Structural Materials, INAE Forum on Manufacturing and INAE Forum on Civil Infrastructure. These forums enable giving inputs to policy makers, institutes of higher learning & research, industries, etc. The INAE Forum on Engineering Interventions for Disaster Mitigation has recently brought out a Monograph on "Malpa Landslide Disasters". The Forum took suo moto cognizance of the challenges before the nation in Disaster Risk Reduction and drew a road map aiming at delivery of Actionable Recommendations which can make some difference on the ground. A Medium-Term Research Study was undertaken by the Forum to create a few pace-setting examples of scientific documentation of disasters to serve as a force multiplier. The Monograph, jointly published with National Institute of Science Communication and Information Resources (NISCAIR) is the culmination of the Study.

Engineering Excellence Awards

With an objective to promote Engineering Excellence, INAE has instituted the following awards.

Life Time Contribution Award in Engineering – the highest recognition from INAE – is given every year to two eminent Indian citizens who have made most distinguished contribution in the field of engineering/engineering research/engineering education/technology/engineering management which has brought prestige to the nation and are regarded as landmarks of technological development of the country. The award consists of Rs.5 lakhs in cash and a Citation.

Prof. Jai Krishna and Prof. SN Mitra Memorial Awards are given to an eminent engineer, engineer-scientist or a technologist for Academic and scholarly achievements in any discipline of technology/outstanding research in engineering and technology and application thereof/ outstanding contributions in the management of education and research in engineering/ outstanding achievements and contributions in the Indian industry, engineering services or engineering projects. The award consists of Rs.2 lakhs in cash and a Citation.

INAE Outstanding Teachers Award - the Academy has instituted the Outstanding Teachers Award in the year 2013 to honour INAE Fellows who have excelled in the field of teaching. There will be a maximum of two such awards per year and each awardee shall receive a scroll, a cash award of Rs.1.0 lakh and a book grant of Rs. 25,000/-.

Young Engineer Awards, instituted in 1996, are given for engineering research, excellence in engineering design, technology development and technology transfer. The Scheme has attracted nominations of bright young talent in the country and has become a prestigious National Award since then. So far, 228 young engineers have been conferred this Award and their early recognition has encouraged the best upcoming talent to make innovative engineering and technological contributions for our national development. The award consists of Rs.1 lakh in cash and a citation.

INAE Young Entrepreneur Award - INAE has instituted the Young Entrepreneur Award in the year 2017, with a view to encourage and recognize innovation and entrepreneurship among Young Engineers, below 45 years of age. The engineering innovations/inventions/concepts that have been actually realized and implemented in industry either in new processes or products are given weightage. The award carries a **cash prize of Rs 2 lakhs**.

Innovative Student Projects Awards, instituted in 1998, are given to identify innovative and creative projects/theses undertaken by engineering students at Doctoral, Master's and Bachelor levels. This Award recognizes innovative and creative projects and theses of students and research scholars in engineering institutions, since an early recognition of merit and talent can often mark the beginning of a brilliant career. The Award comprises a citation and prizes of Rs.25000/- for selected Ph.D. theses; Rs.15000/- for selected Master's theses; and Rs. 10,000/- to each team member of the selected project at Bachelor level subject to a maximum of four team members.

INAE Letters

INAE has launched a quarterly journal "INAE Letters" published by M/s Springer in the year 2016. The objective of the journal is to provide a medium for rapid publication of new research results and invited short review articles across different domains of engineering science and technology.

INAE on Social Media

INAE has created a Facebook and twitter Account to post the news of recent INAE activities in the Social Media.

INAE DIGITAL PLATFORM

A Digital Platform has been instituted with the objective of digitizing the functioning and operation of the activities of INAE. This Platform is being developed so as to facilitate online submission of applications/nominations for various schemes/awards/Fellowships implemented by INAE. INAE Digital Centre recently undertook the revamping of newly designed interactive INAE website which was launched during the Inaugural Session of the INAE Annual Convention held on December 14, 2018 at RCI, Hyderabad. The new INAE Digital Centre was inaugurated by Prof Ashutosh Sharma, FNAE, Secretary, DST on Feb 15, 2019. This Digital Centre is located at the 9th Floor in the same building viz. SPAZE IT Park, Tower A, Gurgaon wherein the current INAE Office is housed at the 6th Floor.



Prof Ashutosh Sharma, Secretary DST Inaugurating the New INAE Digital Centre with Dr Sanak Mishra President, INAE to his right

CAETS and International Affairs

INAE is a member-Academy of the International Council of Academies of Engineering and Technological Sciences (CAETS) and participates in its programmes/convocations of global concern for benefits at national/international levels. CAETS is committed to enhancing the contribution of science, technology and engineering in the world and its mission is to foster effective engineering and technological progress for the benefits of the societies of all countries. Having signed MoU's with a number of member academies of CAETS, INAE has initiated specific collaborative projects/programmes with engineering academies of UK, Australia, Korea, Canada, Germany, China, France and USA.

Joint Activities with Member Academies of CAETS INAE-ATSE Workshop on "Sustainable Urban Water Management"

The INAE- Australian Academy of Technological Sciences and Engineering (ATSE) joint Workshop on "Sustainable Urban Water Management" was held at Jodhpur in 2017. Eight delegates from Australia and 25 experts from various national organizations participated in the Workshop. The Workshop focused on discussion towards influencing a transformative change in the way urban water services are delivered and managed in cities.

INAE-NAEK Workshop on "High Temperature Materials"

The first joint Workshop between INAE and National Academy of Engineering of Korea (NAEK) on "High Temperature Materials" was held at Indian Institute of Science, Bangalore in 2017. 10 Korean experts and 20 Indian experts participated in the event. The programme covered the current and future directions in high temperature materials ranging from high temperature alloys and polymer matrix composites to ultra-high temperature composites. The Second INAE-NAEK Workshop on "High Temperature Materials" was held in May 2018 at Changwon, Korea in which INAE delegation participated.



Participants at Second INAE-NAEK Workshop on "High Temperature Materials" at Changwon, Korea

INAE GOVERNING COUNCIL

- | | | |
|--------------------------------------|--|---|
| 1 | President | : Dr. Sanak Mishra, Member of the Governing Board of the Steel Research & Technology Mission of India. Former Managing Director of Rourkela Steel Plant of Steel Authority of India Limited, and Vice-President of ArcelorMittal Group and CEO of its Projects in India |
| 2 | Immediate Past President | : Dr. BN Suresh, Chancellor, Indian Institute of Space Science & Technology (IIST) and Honorary Distinguished Professor, ISRO hqrs., Bangalore and Formerly Director, Vikram Sarabhai Space Centre, Trivandrum; and Formerly Member, Space Commission and Founder Director, Indian Institute of Space Science & Technology (IIST), Trivandrum |
| 3 | Vice-President (Fellowship, Awards & Corporate Communication) | : Prof. Indranil Manna, Professor, Department of Metallurgical and Materials Engineering, Indian Institute of Technology Kharagpur, Kharagpur and Former Director, IIT Kanpur |
| 4 | Vice-President (Finance & Establishment) | : Dr. Purnendu Ghosh, Executive Director, Birla Institute of Scientific Research, Jaipur |
| 5 | Vice-President (Academic, Professional & International Affairs) | : Dr. Pradip, Former Vice-President, TCS, Tata Research Development and Design Centre (TRDDC) (A Division of Tata Consultancy Services Ltd.), Pune |
| 6 | Chief Editor of Publications | : Prof. K Bhanu Sankara Rao, Pratt & Whitney Chair Professor, School of Engineering Sciences and Technology, University of Hyderabad; Formerly Associate Director, Materials Development and Characterization Group and Head, Mechanical Metallurgy Division, IGCAR, Kalpakkam; Formerly Professor and Dean School of Engineering Sciences and Technology, University of Hyderabad, Hyderabad |
| Members | | |
| 7 | Engg Section-I | : Ms Alpa Sheth, Managing Director, VMS Consultants Pvt Ltd, Mumbai |
| 8 | Engg Section-II | : Prof. Kamala Krithivasan, Formerly Professor and Head, Department of Computer Science and Engineering, IIT Madras, Chennai |
| 9 | Engg Section-III | : Dr. V Bhujanga Rao, ISRO Chair Professor, National Institute of Advanced Studies(NIAS), Bangalore and Former Distinguished Scientist & Director General (Naval Systems & Materials), DRDO,(Min of Defence),New Delhi; Former Director, NSTL Visakhapatnam |
| 10 | Engg Section-IV | : Mr. DP Misra, Director, Development Consultants Pvt Ltd & Adviser, Jindal Steel and Power Ltd., Mumbai |
| 11 | Engg Section-V | : Prof. Sivaji Chakravorti, Director, National Institute of Technology, Calicut. |
| 12 | Engg Section-VI | : Prof. UB Desai, Director, Indian Institute of Technology Hyderabad, Kandi,Telangana |
| 13 | Engg Section-VII | : Prof. S Gopalakrishnan, Department of Aerospace Engineering, Indian Institute of Science, Bangalore |
| 14 | Engg Section-VIII | : Dr. U Kamachi Mudali, Chairman & Chief Executive, Heavy Water Board, Department of Atomic Energy, Mumbai. |
| 15 | Engg Section-IX | : Mr. MV Kotwal, Former Member of the Board & President-Heavy Engineering, Heavy Engineering Division, Larsen & Toubro Ltd., Mumbai. |
| 16 | Engg Section-X | : Dr. V Jayaraman, Prof. Satish Dhawan Professor and Sr. Advisor (Space Applications), ISRO Headquarters, Bangalore. |
| Reps of various Organisations | | |
| 17 | Department of Science & Technology (DST), Ministry of Science & Technology | : Dr. BK Mishra, Director, Indian Institute of Technology Goa |
| 18 | Ministry of Human Resource Development (MHRD) | : |
| 19 | Department of Space (DOS) | : Dr. V Narayanan, Director, Liquid Propulsion Systems Centre, Indian Space Research Organisation, Department of Space, Govt. of India, Thiruvananthapuram |
| 20 | All India Council for Technical Education (AICTE) | : Prof. Manoj K Tiwari, Department of Industrial Engineering and Management, Indian Institute of Technology Kharagpur, Kharagpur |
| 21 | Indian National Science Academy (INSA) | : Prof. V Ramgopal Rao, Director, Indian Institute of Technology Delhi, New Delhi |
| 22 | Defence Research & Development Organisation (DRDO) | : Dr. SV Kamat, Director General, Naval Systems and Materials, DRDO, DG (NS&M) Office,Visakhapatnam |
| 23 | Department of Atomic Energy (DAE) | : Mr. RN Jayaraj, Formerly Chairman & Chief Executive, Nuclear Fuel Complex, Department of Atomic Energy, Hyderabad |
| 24 | Confederation of Indian Industry (CII) | : Mr. Soumitra Biswas, Adviser-Technology & Innovation, Confederation of Indian Industry (CII), Gurgaon. |
| 25 | Federation of Indian Chambers of Commerce & Industry (FICCI) | : Mr. Shyam Bang, Chairman, FICCI Taskforce on Manufacturing Excellence, FICCI, New Delhi |
| 26 | The National Association of Software and Services Companies (NASSCOM) | : Mr Gaurav Hazra, VP and member of the NASSCOM leadership team |

PRESIDENTS OF INAE

- Prof. Jai Krishna**, Former Vice-Chancellor, University of Roorkee, Roorkee and Founder President, INAE (1987-1991)
Dr. VS Arunachalam, Chairman, Centre for Study of Science, Technology and Policy (CSTEP), Bangalore (1991-1992)
Dr. S Varadarajan, Former Secretary, Dept. of Science & Technology and Dept. of Scientific & Industrial Research; Director-General, Council of Scientific & Industrial Research and Chief Consultant, Planning Commission. (1992-1995)
Dr. APJ Abdul Kalam, Former President of India (1995-1996)
Prof. PV Indiresan, Former Director, Indian Institute of Technology, Madras (1997-1998)
Dr. Anil Kakodkar, Former Chairman, Atomic Energy Commission and Secretary, Dept of Atomic Energy, Mumbai (1999-2000)
Dr. P Rama Rao, Chairman, Governing Council, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad (2001-2002)
Dr. A Ramakrishna, Former President & Deputy Managing Director, Larsen & Toubro Limited (2003-2004)
Dr. K Kasturirangan, Chairman, Karnataka Knowledge Commission, Distinguished Professor Emeritus, National Institute of Advanced Studies (NIAS), Bangalore (2005-2006)
Dr. PS Goel, Prof. M.G.K Menon DRDO Chair, Honorary Distinguished Professor, ISRO, Research Centre Imarat (RCI), Hyderabad; Former Secretary, Ministry of Earth Sciences & formerly Chairman, Recruitment & Assessment Centre, DRDO, Ministry of Defence, New Delhi (2007-2010)
Dr. Baldev Raj, Director, National Institute of Advanced Studies (NIAS), Bangalore (2011-2014)
Dr. BN Suresh, Chancellor, Indian Institute of Space Science & Technology (IIST) and Honorary Distinguished Professor, ISRO hqrs., Bangalore; Former Member, Space Commission, Former Director, Vikram Sarabhai Space Centre, ISRO and Founder Director, Indian Institute of Space Science and Technology, Thiruvananthapuram (2015-2018)
Dr. Sanak Mishra, Member of the Governing Board of the Steel Research & Technology Mission of India. Former Managing Director of Rourkela Steel Plant of Steel Authority of India Limited, and Vice-President of ArcelorMittal Group and CEO of its Projects in India (Jan 1, 2019-till date)

Indian National Academy of Engineering

Unit No. 604-609, 6th Floor, Tower A, SPAZE I-Tech Park, Sector 49, Sohna Road, Gurgaon – 122018 (India)
 Phone : (91) - 0124 - 4239480 Fax : (91) - 0124 - 4239481 Email : inaeq@inae.in

INDIAN NATIONAL ACADEMY OF ENGINEERING

SUMMARY OF ACTIVITIES

2019-20



Indian National Academy of Engineering

About the Academy

The Indian National Academy of Engineering (INAE), founded in 1987, comprises India's most distinguished engineers, engineer-scientists and technologists covering the entire spectrum of engineering disciplines. INAE functions as an apex body and promotes the practice of engineering and technology and the related sciences for their application to solving problems of national importance. The Academy provides a forum for futuristic planning for country's development requiring engineering and technological inputs and brings together specialists from related fields as may be necessary for providing comprehensive solutions to the needs of the country.

INAE is the only engineering Academy in India. INAE is a Member of the International Council of Academies of Engineering and Technological Sciences (CAETS). The aims and objects of the Academy are given below.

- (a) To promote and advance the practice of engineering and technology and the related sciences and disciplines (hereinafter referred to as 'Engineering') in India and their application to problems of national importance.
- (b) To disseminate among its members information on all matters pertaining to 'Engineering' and to encourage, assist and extend knowledge and information connected therewith by publishing such proceedings, journals, memoirs and other publications as may be desirable and hold meetings, lectures, seminars, symposia etc.
- (c) To interact, after due and detailed consideration, with professional bodies, engineering and scientific academies etc. already established or as may be established in future in India and abroad.
- (d) To promote and safeguard academic and professional interest of persons involved in 'Engineering' (hereinafter referred to as 'Engineer' in India by laying down a code of ethics which shall be an obligation to be signed by all Fellows of the Academy on admission thereto).
- (e) To provide an association of eminent 'Engineers' and to present at all academic forums research and developmental activities on 'Engineering' on mutually interactive and cooperative basis, both in India and abroad.
- (f) To promote the National Policy on Education of the Government of India as announced from time to time, in all matters of technical education where the Academy is concerned.
- (g) To assist the Government of India, the Local Governments, All India Council of Technical Education and others in analysing, forecasting for the purpose of planning and formulating the policies in respect of education in 'Engineering' and ensuring the appropriate standard thereof.
- (h) To offer the Government of India, the Local Governments and others, facilities for conferring with and ascertaining the views of 'Engineers' as regards matters directly or indirectly pertaining to 'Engineering' and to confer with the said Governments and others in cooperation with other fraternal professional bodies in regard to all matters pertaining

to 'Engineering'.

- (i) To encourage inventions, investigations and research and promote their applications for development of both organised and unorganised sectors of the national economy.
- (j) To encourage and promote the pursuit of excellence in the field of 'Engineering'.
- (k) To institute and establish Professorships, Fellowships, Studentships, Scholarships, Awards and other benefactions and to grant Certificates of Competency and Charter whether under any Act of Government of India or otherwise howsoever.
- (l) To do all such other acts and things as are incidental or conducive to the attainment of the above objects or any one of them.

New Initiatives during the Year

During the last one year, INAE, in addition to many of its well-defined activities, has been giving a major thrust to identify the issues of National importance where engineering interventions can provide the appropriate solutions and also to get associated with some of the vital policy matters. INAE has been making efforts to identify such problems of National importance in consultation with many of the Government Departments and is looking at the policy matters which are referred to the Academy by the concerned agencies for generating the right inputs. With this objective in mind, INAE has undertaken a number of new initiatives in terms of commencing new programmes and conduct of unique events during this year, which have enhanced the outreach and visibility of the Academy both in India and abroad. INAE has also initiated novel programmes and instituted an award to honour distinguished women engineers. A brief summary of these novel initiatives is highlighted below.

Institution of the INAE Woman Engineer of the Year Award

INAE has instituted a new award named “INAE Woman Engineer of the Year Award” from this year i.e. 2020 onwards, in order to recognize and promote meritorious contributions of women in engineering profession. Nominations have recently been invited for the INAE Woman Engineer of the Year Award 2020 during the month of March 2020. The purpose of the award is to recognize and honour deserving women engineers, every year, who have made outstanding contributions to any field of engineering and technology in India and may serve as role models to budding women engineering professionals in the future. The award aims to recognize meritorious and original contributions made by woman engineers in India from academia, research organizations or industry, whose individual efforts have made a significant difference in any branch of engineering and technology, by way of breakthrough innovation and disruptive change in different fields of engineering and have helped to advance the knowledge and competence to the benefit of the profession and people in India. The subject award is to be bestowed on an individual only and the nominations for the award should be nominated and seconded only by the Fellows of INAE. Woman engineers between the age of 40 to 60 years, who should be a citizen of India and working in India are eligible for nomination. In case the nominee is an INAE Fellow, she should not be a member of the INAE Governing Council during the year of the award. INAE will honour three women engineers between the age of 40 to 60 years, every year with this award – one from each of the three categories, (i) Academia, (ii) Industry and (iii) R&D. The award carries a cash award of Rs. 2 lakhs and a citation. The last date for the receipt of nominations for the subject award is May 15, 2020. The guidelines and nomination format for nomination can be downloaded from INAE website www.inae.in

INAE Foundation Day Celebrations on 11th April 2019

Indian National Academy of Engineering (INAE) was raised on 20th April 1987 having registered by the Registrar of Societies and was formally inaugurated on 11th April 1988 at New Delhi by the then Prime Minister, Mr. Rajiv Gandhi at a colourful Foundation Function in New Delhi. In order to commemorate this momentous occasion, INAE had decided to celebrate the FOUNDATION DAY of INAE on 11th April this year. Besides the INAE Office at Gurgaon, a number of Local Chapters had celebrated the Foundation Day and a brief report is given below.

INAE Foundation Day Celebrations at INAE Office, Gurgaon

The Foundation Day Celebrations at INAE Office, Gurgaon was organized on April 11, 2019 wherein Dr Sanak Mishra, President, INAE addressed the INAE staff headed by (Late) Brig Rajan

Minocha, Executive Director, INAE in an informal meeting in which Shri Pradeep Chaturvedi, FNAE, was also present. Dr Sanak Mishra welcomed all present and gave a brief overview of the history of INAE and the various locations in which the INAE office was housed. He also held interactions with the INAE staff about their experience in working at INAE office. Dr Sanak Mishra briefed all present on the recent activities and initiatives of the Academy that have increased its visibility in the engineering fora, as well as the policy domain. He also highlighted regarding the important forthcoming activities being planned in the near future. The meeting was an occasion for a lively interaction session of the INAE Staff wherein their suggestions and views regarding improved office functioning were sought by Dr Sanak Mishra, President, INAE which was followed by high tea.



Dr Sanak Mishra, President, INAE cutting the cake on Foundation Day Celebrations at INAE Office, Gurgaon



Group Photo of INAE Staff with Dr Sanak Mishra, President, INAE with Shri Pradeep Chaturvedi, FNAE to his right and (Late) Brig Rajan Minocha, Executive Director, INAE to his left

INAE Foundation Day Celebrations at Bangalore

INAE Foundation Day-2019 was celebrated by INAE - Bangalore Chapter (BC), at a function organized for the occasion on April 11, 2019 at Golden Jubilee Hall, ECE Dept, Indian

Institute of Science, Bangalore. Dr VK Aatre, Chairman, INAE BC personally guided the EC of INAE BC in organising the function. The two-hour Programme commenced with the Welcome Address by Dr AR Upadhya, Hon. Secretary, INAE BC wherein he briefly presented the milestones successfully achieved by INAE and its contributions since its founding in 1987. About 30 INAE Fellows/Young Associates participated in the function. The function was graced by the presence of Dr BN Suresh, Immediate Past President, INAE. Prof Anurag Kumar, Director, IISc though could not be present in person due to pressing engagements, conveyed his kind greetings for the success of the event. The following two talks were presented in the function:

1. "Employment Opportunities in Small Towns due to Digital Technologies", by Dr Sridhar Mitta, Founder & Managing Director, Next Wealth Entrepreneurs Pvt Ltd, Bangalore
2. " Elements of a Proposal for a Study on Status of Engineering in the Country", by Dr Rudra Pratap, Professor, CeNSE, IISc, Bangalore.



Dr VK Aatre, Chairman, INAE BC in front seat



Audience at IISc, Bangalore



Left to Right: Dr AR Upadhya and Dr BN Suresh, Immediate Past-President, INAE

Both the lectures were well received and generated good discussions. This was followed by brief addresses by Dr BN Suresh and Dr VK Aatre. The programme concluded with the Vote of Thanks by Prof G Jagadeesh, Jt. Secretary, INAE BC. Special thanks were given to Prof KJ Vinoy, Member EC, INAE-BC and his team for the excellent local arrangements for the function.

INAE Foundation Day Celebrations at Kolkata

INAE Foundation Day was celebrated by INAE Kolkata Chapter, on 11th April 2019, Thursday at the University of Calcutta, Salt Lake Campus (Board Room, Centre of Nanoscience and Nanotechnology, JD 2, Sector III, Salt Lake, Kolkata). All local INAE Fellows and Young Associates and their colleagues and students were invited to join the celebration.



Prof Sankar Pal, FNAE cutting the cake with Prof Sushmita Mitra, FNAE and Prof Debatosh Guha, FNAE to his left

INAE Foundation Day Celebrations by INAE Kharagpur Chapter

To commemorate the momentous occasion of the Foundation of the INAE on 11th April, 1987, a meeting of INAE Fellows at Kharagpur (primarily located at IIT Kharagpur) was organized in the Board Room of IIT Kharagpur on 11th April, 2019 at 5 pm. The meeting was convened by Prof Indranil Manna, Vice-President, INAE and was presided over by Prof PP Chakrabarti, FNAE, Director, IIT Kharagpur and was attended by 18 INAE Fellows and Young Associates. The meeting was essentially a brainstorming session and informal get-together to discuss several issues related to INAE and role of INAE in the national and state level wherein engineers and engineering could play a significant role. The Director emphasised the need to develop a better cohesion between school children and premier engineering institutions like IITs so that the former could clearly understand the career prospects, expectations and obligations of the engineering professionals and also, the engineering education system in IITs and other premier institutions so that the youth could fashion their educational as well as career objectives accordingly. He also stressed on the need to properly, if not aggressively, advertise the various achievements at both individual level and at the institute level at the IITs so that these achievements get their due attention and recognition from all corners. Some members also suggested that IITs should provide special incentives to carry out industrial projects at both UG and PG levels. The meeting ended by offering Vote of Thanks to the Director and to all the Fellows and Young Associates who attended the meeting.



Group Photo during INAE Foundation Day Celebrations at IIT Kharagpur



Prof PP Chakrabarti, Director, IIT Kharagpur (in the centre) presiding over the celebrations

INAE Expert Groups

The guidelines for INAE Expert Groups to prepare Engineering/Technology Roadmaps with Actionable Recommendations on selected engineering themes/ domains, to assist the policymakers on strategies and implementation for desired impact, had been circulated to the Fellowship on July 31, 2019. Subsequently, the proposals under the initiative were invited vide email dated October 7, 2019, which contained the break-up of the budget of maximum Rs 20 Lakhs (for up to a two-year duration) covering contingency, consumables, communication charges, secretarial help, technical support, library/laboratory charges, travel within India and permissible honorarium. The objective of the proposals to be considered under the INAE Expert Pool initiative, as given in the guidelines is

the development of a comprehensive engineering/technology roadmap with actionable recommendations on selected engineering themes or domains to help the country formulate a policy/strategy for implementation which will have the desired impact. It is expected that the specific topic chosen by the expert group is oriented towards or aligned with the Vision of INAE. INAE had been requested by DST, to submit its Vision for the next 5 years and the INAE Vision 2020-25 Document had been finalized and forwarded to DST, as per the requirement. These niche areas covered under the INAE Vision 2020-25 Document were given priority, while scrutinizing and recommending the five proposals received in the year.

The Steering Committee during its meeting on February 25, 2020 discussed five proposals and recommended the following for approval of the Governing Council. The objectives of the proposals are in consonance with the guidelines and the topics to be covered are also of importance in the national context.

- Proposal by Dr. Jayanta Bhattacharya, FNAE on “Infrastructure and Resource Requirements for Introduction of Automation and its Adoption in the Mineral Sector of India: A Stakeholder Engagement”.
- Proposal by Dr. Ashish Lele, FNAE on “Green Hydrogen in the Indian Economy – Technology Outlook for the Energy Transition”.
- Proposal by Prof. DN Singh, FNAE on “Industrial By-Products (IBPs) for Sustainable Infrastructure Development”.

The approval for these proposals by the Governing Council Members were subsequently taken by circulation in lieu of the Governing Council meeting scheduled on March 6, 2020 which was subsequently called off due to the travel advisory due to the COVID -19 Pandemic.

Academy Activities

Seminars/Workshops/Conferences –National

The Academy organizes Symposia/Seminars/Workshop/Conferences at national/international levels on topics of national importance. Based on the deliberations, INAE invariably brings out policy recommendations for suitable follow-up action by the concerned Ministry/Department/agency(ies).

The Thirteenth National Frontiers of Engineering (13NatFoE) Symposium

The Thirteenth National Frontiers of Engineering (13NatFoE) Symposium was organized by INAE jointly with IIT Bhubaneswar from May 31, 2019 to June 1, 2019 at IIT Bhubaneswar. The Inaugural Session of the two-day 13NatFoE Symposium was held on 31st May 2019 at IIT Bhubaneswar. Dr. Sanak Mishra, President, INAE was the Chief Guest and Prof. R.V. Raja Kumar, Director, IIT Bhubaneswar was the Guest of Honour. Prof. Indranil Manna, Vice -President, INAE and former Director, IIT Kanpur and Prof. K. Bhanu Sankara Rao, Chief Editor of INAE publications were also present at the Symposium. Prof Swarup Kumar Mahapatra, Dean- Continuing Education, Alumni Affairs and International Relations and Prof. S R Samantaray, Associate Professor, School of Electrical Sciences (SES) were the Coordinators of 13NatFoE Symposium.

The aim of the symposium was to bring together young and outstanding engineering professionals (aged~30-45 years) from the industry, universities, and research organizations to deliberate upon emerging and leading-edge research and development work in the domain of engineering and technology. Convening engineering professionals and technologists from various fields were provided a platform for brainstorming the contemporary and futuristic issues related to frontiers areas cross-disciplinary translational research and innovation. The overall purpose of the symposium was to interact and achieve synergy at distinctive scientific levels through presentations and discussions in the following four thematic areas: - Augmented Reality and Virtual Reality; Smart Grid; Advances in Materials and Manufacturing Technology and Next Generation Transportation Systems.

The speakers in their inaugural talks brought out very interesting points in their respective topics for meeting the pressing needs of the society. Prof. R.V. Rajakumar, Director, IIT Bhubaneswar during his Address emphasized the need for cross-disciplinary research and development to fulfil the needs of Industry. He touched upon the grand Science and Technology challenges facing the nation and the world at large and talked about the importance of the thematic areas of Augmented Reality (AR) and Virtual Reality (VR), Artificial Intelligence (AI), Smart Grid, Next-Gen Grid, Micro & Additive Manufacturing, IOT and 5G Communication for serving the needs of the modern society. He then gave a brief overview of the research activities taking place in IIT Bhubaneswar in these areas. He advised the young engineers to come up with energy efficient systems, which will help in reducing the carbon footprint and pave the way for environment restoration and energy saving. He also informed the audience about the initiative of IIT Bhubaneswar in accurately estimating the pressure and wind-speed in collaboration with IMD before the arrival of the extremely severe cyclone, “FANI”. He also thanked INAE for choosing IIT Bhubaneswar as the host of the 13thNatFoE Symposium. He complimented the Institute for hosting the event despite significant damage to the infrastructure caused by the cyclone, “FANI”.

Dr. Sanak Mishra, President, INAE then delivered an interesting speech with emphasis on Research & Development and the role of INAE in nation building; which was very well received by the

audience. He also ascertained that themes of the Symposium were well chosen, as they are in line with NITI Aayog’s current projection of areas of national interest.



Dignitaries at the Inaugural Session



Prof RV Raja Kumar, Director, IIT Bhubaneswar presenting a Memento to Dr Sanak Mishra, President, INAE

About 60 professionals from various institutes and R&D labs, industries & start-ups attended the event and shared their contributions. A large number of research scholars and faculty members of IIT Bhubaneswar also attended the symposium and contributed in the organization of the symposium. The cross-functional interactions and networking between the participants from various domains of engineering in the Symposium allowed a larger perspective to the participants and exposed them to some of the immediate needs of the society and also gave them an overview of research work happening in various parts of India.



Dr Sanak Mishra addressing the Audience



Prof Indranil Manna, Vice-President, INAE being presented a Bouquet in the Inaugural Session

The programme of the Symposium included 21 presentations by domain experts in the thematic areas and Plenary Talks by eminent speakers such as Prof. Ashok Jhunjhunwala, FNAE, Institute Professor, IIT Madras; Dr. Manish Gupta, FNAE, Co-founder and CEO, VideoKen; Shri. R.N, Nayak, FNAE, Former Chairman and Managing Director, Power Grid Corporation of India; Prof. Jayanta Mukhopadhyay, FNAE, IIT Kharagpur; Prof. S.A. Soman, FNAE, IIT Bombay; Prof. Rudra Pratap, FNAE, Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore and Prof. M. Parida, Dept. of Civil Engineering, IIT Roorkee. The Symposium provided an excellent opportunity for sharing of novel ideas and for catalysing the start of collaborative research

partnerships between brilliant young engineers and researchers from different sectors of the engineering profession.

Engineers Conclave-2019 (EC-2019)

The seventh Engineers Conclave 2019 (EC-2019) was organized jointly with Bharat Electronics Limited (BEL) on Sept 19-21, 2019 at BEL Academy of Excellence (Nalanda), Bangalore. The two themes of EC-2019 were “Defence Technology & Innovation” coordinated by BEL and “Transformation of Rural India Using Digital Technologies” coordinated by INAE. Shri MV Gowtama, CMD, BEL was the Chair and Dr Sanak Mishra, President, INAE was the Co-Chair of EC-2019. The programme commenced in the forenoon of Sept 19, 2019 with an enlightening Plenary Talk on “Dimensions of Digital Revolution” by Dr Gulshan Rai, Former National Cyber Security Coordinator of India. The talk gave an overview of the national perspectives and components pertaining to fostering a Digital Transformation and also highlighted the forecast in Cyber Technology in the country, over the next decade. The Plenary Talk was followed by the parallel Technical Sessions on the two themes of the Conclave.

The Inaugural Session of the Engineers Conclave 2019 was held on Sept 19, 2019 (afternoon) which was graced by the Chief Guest, Hon’ble Raksha Mantri Shri Rajnath Singh. The session featured an invocation by staff of BEL and the lighting of the lamp by the dignitaries on the dais viz the Chief Guest, Hon’ble Raksha Mantri Shri Rajnath Singh; Shri MV Gowtama, CMD BEL; Dr Sanak Mishra, President, INAE; Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO; Shri Mahesh V, Director (R&D) BEL and Chairman, Organizing Committee EC-2019 and Shri VVR. Sastry, FNAE, Former CMD BEL. The dignitaries on the dais addressed the gathering: Shri Mahesh V welcomed the delegates; Shri MV Gowtama highlighted the importance of the conclave; Dr Sanak Mishra presented a perspective of INAE and its activities and Dr G Satheesh Reddy briefed upon some latest developments in Defence R&D including the Light Combat Aircraft (LCA). He was delighted to apprise the august audience that the Hon’ble Raksha Mantri Shri Rajnath Singh on the forenoon of the same day, September 19, 2019 flew in the Tejas fighter aircraft from the HAL airport in Bangalore, becoming the first Defence Minister to fly in the indigenously-built Light Combat Aircraft (LCA).



Dignitaries on the Dais in the Inaugural Session (Left to Right) Shri Mahesh V, Shri MV Gowtama, Hon'ble Shri Rajnath Singh, Dr G Satheesh Reddy, Dr Sanak Mishra and Shri VVR Sastry

An interesting highlight of the Inaugural Session was the inauguration of the Product Development & Innovation Centre (PD&IC) of BEL by the Chief Guest, Hon'ble Raksha Mantri Shri Rajnath Singh through electronic mode. Shri MV Gowtama, CMD, BEL informed the gathering that the Centre will focus on IPR creation in strategic areas, reducing external dependence for critical subsystems, and standardisation of subsystems. The centre will also contribute to the 'Make in India' initiative of the government and is expected to provide a single window interface for DRDO and other R&D houses, and strengthen transfer of technology (ToT) processes and collaborative design efforts through involvement of start-ups and MSMEs.



*Inauguration of the Product Development & Innovation Centre, BEL
by Hon'ble Shri Rajnath Singh*

Hon'ble Raksha Mantri Shri Rajnath Singh also unveiled a high-power transmitter for Akash-NG RF seeker, designed by the Microwave Tube Research & Development Center (MTRDC), and concurrently developed along with BEL, based on a production order from the Research Centre Imarat (RCI). During his address he reiterated the government's commitment to reach out to remote villages through the Digital India initiative. He opined that the development of critical and cutting-edge technologies in defence would help save foreign exchange, which can be used for other development activities. He thanked INAE and BEL for inviting him to the Conclave and expressed that he keenly awaited the outcome of the Engineers Conclave 2019 in terms of the recommendations emanating from the deliberations and wished the event success. The Inaugural Session concluded with the proposing of the Vote of Thanks by Shri V.V.R. Sastry, FNAE, Former CMD BEL.



Unveiling of a high-power transmitter for Akash-NG RF seeker by Hon'ble Shri Rajnath Singh



Dr Sanak Mishra, President, INAE presenting a Memento to Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO

The parallel Technical Sessions on the two themes of the conclave were well attended by Fellows of INAE, invited dignitaries and delegates from Bharat Electronics Ltd. The Conclave was attended by about 120 INAE Fellows and Young Associates from across the country, who actively participated in the deliberations including as speakers and session chairs. Eminent experts and senior functionaries from Academia, R&D and Industry also participated in the conclave as delegates. The Technical Sessions on Theme - I on “Defence Technology and Innovation” comprised of Emerging Technologies & Trends for Defence, R&D in Defence, Policies, Growth Drivers and Skill Development, Strategic Partnerships/ Enabling International Cooperation and Success Stories & Way forward. Theme II on “Transformation of Rural India Using Digital Technologies” covered the sessions on the topics of Rural Digital Connectivity, e-Governance and Services, Enhancing Rural Livelihood Opportunities, Capacity Building Needs of Digital Rural India and Aspiring Rural India.

The Plenary talks held during the conclave both on technical and general topics captivated the audience. The second Plenary Talk by Art of Living Founder HH Sri Ravishankar was held through video conference and was coordinated by a devotee of his Ashram. The talk brought out the need for professionals with high pressure jobs such as engineers and technocrats to reduce tension in their lives in order to lead a healthy and meaningful life. The Third Plenary Talk on “Engineering Marvel” by Shri V. Gopinath, Chief Architect, EDRC, Project Director (SOU) L&T gave an enthralling pictorial representation of the various stages in the planning, designing and construction of the Statue of Unity (SOU) dedicated to the Iron Man of India, Sardar Vallabhbhai Patel. This towering piece of engineering is not only the tallest statue in the world but is a marvellous engineering feat by Indian engineers, artists and technologists as was brought out in the excellent presentation which was not only informative but a visual delight. The Fourth Plenary Talk on “Made in India – How to Make It Happen” was by Capt S. Prabhala (Retd), Former CMD BEL which covered strategies for achieving self-reliance in defence industry by development of indigenous technologies.

An entertaining cultural programme was also held in the evening of Sept 19, 2019 which featured a classical dance recital by a young artiste. An exhibition showcasing the products developed and manufactured indigenously by Bharat Electronics Limited was organized on the side-lines of Engineers Conclave. The delegates showed enthusiasm in their technical queries and appreciation of the products including Electronic Voting Machines, Radars, Electronic Warfare Systems, Akash Missile Systems, Opto-Electronic Equipment, Sonars and Akash Missile Systems.



Exhibition Showcasing Products Developed by Bharat Electronics Ltd on the side-lines of EC-2019

A Panel Discussion on the two Themes was held in the forenoon of September 21, 2019 wherein the panelists comprised of the respective Technical Session Chairs and the Moderators were the Coordinators of each concerned theme. The Panel Discussion focused on the points to be included in the recommendations to be compiled post conclave, based on the pertinent issues and suggestions emanating from the deliberations in the parallel technical sessions on both themes.

The Panel Discussion was followed by the Valedictory Session of EC-2019 which commenced with the Introductory Remarks and Welcome by Dr Sanak Mishra, President, INAE. Dr VK Saraswat, Member, Niti Aayog was the Chief Guest of the Valedictory Session. During the session, the summing up of the two themes was done by the respective Coordinators. The summing up of Theme I: Defence Technology & Innovation was done by Shri. Mahesh V, Dir (R&D) BEL, Coordinator, Theme-I, EC-2019 while that of Theme II: Transformation of Rural India Using Digital Technologies was presented by Dr. V. Jayaraman, Coordinator, Theme-II, EC-2019.



Chief Guest of Valedictory Session, Dr VK Saraswat, Member, Niti Aayog delivering Address



Presentation of Memento to Chief Guest, Dr VK Saraswat by Dr Sanak Mishra, President, INAE

Dr VK Saraswat, Member, Niti Aayog delivered a thought-provoking Valedictory Address wherein he emphasized that both themes of the conclave are apt and highly relevant in the present context. He expounded regarding a few initiatives and suggestions that would be desirable to enhance the innovativeness and productivity in the development of indigenous defence technologies in the country. He also emphasized the important parameters to be addressed in order to achieve the goal of transformation of Rural India using Digital Technologies and looked forward to the recommendations emanating as an outcome of the conclave. The Vote of Thanks on behalf of BEL was proposed by Smt. Padmini Balachandra, GM TP/CO, BEL. The Engineers Conclave 2019 was an astounding success and actionable recommendations emanating from the deliberations are under compilation for forwarding to the concerned stakeholders from the Government Departments/Agencies.

Seminars/Workshops/Conferences –International

3rd INAE-NAEK Workshop on "High Temperature Materials and System Engineering for Aerospace, Power Generation and Defense Industry" held on 15-17th July 2019 at Hyderabad. The above workshop was attended by 65 delegates (12 Korean and 53 Indian). All the participants for the workshop were invited delegates. The Indian delegates were composed of the scientists and technologies who steered the programmes earlier in Aerospace, Power Generation and Defence Industry, the people who are currently leading and associated young researchers and technologists. The total number of invited papers are 24 and were organized in five sessions. A separate session was organized to give an opportunity for interactions among the participants and to work out collaborative research projects between the institutions. Prof. K. Bhanu Sankara Rao FNAE, Chief Editor INAE Publications and Pratt and Whitney Chair at University of Hyderabad, and Dr. D.K. Likhi FNAE, Chairman and Managing Director, MIDHANI, Hyderabad coordinated this event.



Dignitaries on Dais in the Inaugural Session



Welcoming of Head of Korean Delegation



Lighting of the Lamp by Dignitaries



Group Photograph of Delegates

High temperature materials constitute a very important element of the current as well as emerging programmes of the Defence Research and Development Organization (DRDO) in India. Gas turbine and defence materials development is capital and technology intensive and takes a long gestation period to establish. In order to attain the maturity in the creation of multifunctional high temperature materials and their processing technologies and to develop further on that basis require continuity in production that should be guaranteed through multiple and concurrent aero engine and other defence programmes. An eco-system that supports R&D, iterative trails to test the fruits of R&D on production scale, and adoption for production if found viable are essential to complete indigenization of aero engine and other materials involved in defence systems along with the processing technologies in the long run. Dr. SV Kamat, Director General, Naval Systems and Materials, gave an overview on the DRDO Perceptive of High Temperature Materials. He described the usage of various materials in gas turbine engines and various other defence systems and pointed out the current challenges looming around the development of high temperature materials and the manufacturing technologies to be adopted. He brought out clearly the various factors to be considered in the development of high temperature materials depending on the systems and their operating conditions. He emphasized the role of advanced polycrystalline and single crystal superalloys, thermal barrier coatings on superalloys, the usage of Gamma TiAl in aero engine. He explained the

potential usage of Titanium Matrix-SiC fibre, Ceramic Matrix (SiC-SiC fibre), and refractory metal-intermetallic (Nb-silicides) composites in aero engine and defence systems. He also pointed out the exploration of additive manufacturing processes for the fabrication of rotating components in aero engine and defence systems. He has foreseen a greater role for the Materials Genome Initiative and enumerated the challenges associated with its implementation.



Presentation by a Korean Delegate



Presentation by Dr Dinesh Srivastava

Dr. Inho Kim of Agency for Defense Development has presented a brief overview on Defense Science & Technology Strategy and Priorities in Korea. It is the only government funded R&D organization which has been performing its mission as a core agency for ROK security in Korea. The strategy and priorities for defense S&T based on future weapon systems and technology requirement was discussed. The DMTD (Defense Materials Technology Directorate) in ADD has many S&T programs related to the materials for defense applications such as ceramics, metals, and composites including high temperature materials. The progress on an international cooperation project in defense material research area between ROK and INDIA launched on high hardness armor material between ADD and DMRL has been presented.

The Indian Space Research Organization (ISRO) is currently engaged in the development of Reusable Launch Vehicles (RLVs), Air Breathing Propulsion (ABP) technology and missions like Two Stage To Orbit (TSTO) and Single Stage To Orbit (SSTO). The design and realization of these advanced space missions are governed largely by operational limits of available high temperature materials. The material sensitive architecture of these missions is expected to fulfil a combination of conflicting requirements to meet severe environmental conditions during ascent, orbital and atmospheric re-entry phases. ISRO has undertaken technology development programme for a variety of high temperature materials which addresses to the requirements of various heat flux regions of these space vehicles. It includes thermal protection systems, ceramic matrix-based composites, ultra-high temperature ceramics, thermal barrier and high emissivity coatings, high temperature adhesives and engineering technologies to enable induction of these materials for intended applications. The presentation by Dr. S.C. Sharma from Vikram Sarabhai Space Centre, Trivandrum on “High Temperature Materials for Indian Space Programme” enumerated the entire gamut of activities taking place in ISRO in the materials development beginning from lab scale developments and scaling-up of the process-technologies till their qualification for practical use.

A Case Study on Application of the Systems Engineering in the Korea Space Launch Vehicle II Project has been presented by Junyouk Jang, Il Sang Yoo, Young Soon Jang of Korea Aerospace Research Institute (KARI). In South Korea, the KSLV-II (Korea Space Launch Vehicle II) project is in progress to develop the space launch vehicle capable of launching 1.5-ton satellite into a SSO (Sun Synchronous Orbit) and to acquire related technology. It is a large-scale and complex development project required a systematic approach. Space systems engineering is defined that the art and science of developing an operable system capable of meeting mission requirements within imposed constraints including (but not restricted to) mass, cost and schedule. A case study on application of the systems engineering in the KSLV-II project has been presented.

The aero propulsion R&D activities related to high temperature materials in Korea Aerospace Research Institute were presented by Dr. Inyoung Yang. He has presented briefly the component-level research that has been undertaken on gas turbine engines, high-speed air-breathing engines, and electric- or hybrid-powered propulsion systems. In case of the gas turbine engine, KARI is doing component-level design, analysis and test researches, as well as system-level controls design and engine performance test researches. Regarding the high-speed air-breathing engine, KARI has carried out research on the gas-fuelled and liquid-fuelled supersonic combustor and scramjet engine, as well as combined cycle engines such as air turbo ramjet and rocket-based combined cycle engine. Regarding the electric- or hybrid-powered systems, KARI succeeded to develop electric-powered systems, and currently evolving onto the hybrid propulsion system. He has described the supersonic test facilities available at KARI and about the thermal protection system for space plane.

Reduced activation ferritic–martensitic (RAFM) steels are potential candidate structural materials for first wall and test blanket modules (TBMs) of International Thermonuclear Experimental Reactor (ITER) which is under construction in France. India has developed INRAFM steel for the construction of its own TBM. The INRAFM steel was designed by altering the chemical composition of the conventional Mod.9Cr -1Mo ferritic-martensitic steel, with substitution of W and Ta for Mo and Nb respectively, in order to promote rapid decay of radioactivity after irradiation. Very low ductile-brittle transition temperature was achieved in this steel by adopting pure alloying elements, controlling residual and tramp elements to very low levels and by using vacuum induction melting and vacuum arc refining process. Fabrication of TBM by high heat input fusion welding processes such as shielded metal arc (SMA) and tungsten inert gas (TIG) welding processes develop a wider heat affected zone (HAZ) in ferritic-martensitic steels and generate an inhomogeneous microstructure in the HAZ, resulting in a marked variation in mechanical properties across the weld joint. Premature failures have been reported quite often in the ferritic-martensitic steel weld joints, due to the pronounced localization of creep deformation and cracking at the parent metal/HAZ interface; these are classified as Type IV cracking failures. In the light of these observations, electron beam welding (EBW) and friction stir welding (FSW) processes have been explored. The usage of FSW process in the fabrication of 12 mm thick INRAFM steel has been successfully demonstrated and optimized various parameters associated with FSW. The necessary post weld heat treatments for restoring the optimum microstructure for creep resistance and impact toughness have been described. The paper by M.Vijaya Lakshmi, K.V. Rajulapati, K. Bhanu Sankara Rao and G. M. Reddy gave important details of "New Joining Technology (FSW) for Creep Resistant Ferritic-Martensitic Steels for Conventional and Nuclear Energy Systems".

Prof. Dipankar Banerjee of Indian Institute of Science, Bangalore presented an illuminating lecture on Intermetallics and Related Alloys. He described that a combination of lightweight and heat tolerance has driven the development of intermetallic and related alloys. Nevertheless, their inherent brittle behaviour has limited successful alloy development to only a few examples. Against this

background he gave examples of the research work conducted in the past and being pursued currently which directed towards the development of intermetallics as well as alloys of Ni and Co that utilize the properties of intermetallics in precipitation hardening for applications at high temperatures. He touched upon the topics that include production of cast superalloys, and the role of micro segregation, incipient melting, origin of porosity, γ / γ' eutectic, blocky carbides and fine carbides. He has pointed out the need for modeling of fault energies, control of misfit, partitioning of various elements in γ / γ' in the design of Ni and Co-based superalloys.

Polycarbosilane (PCS), an organosilicon polymer has been of great interest as precursor for silicon carbide for different high-end applications such as structural material like SiC fibers, C/SiC and SiC/SiC composites in aerospace vehicles. "Indigenous Technologies for Synthesis of Polycarbosilane, PIP based C/SiC Composites and SiC Fibers" has been dealt in detail by Suresh Kumar et.al from Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur. This presentation summarized the research and development work conducted at DMSRDE to establish the synthesis and characterization of PCS, fabrication of C/SiC composite using the indigenous PCS precursor and SiC fibers. Indigenous PCS of select molecular weight was melt spun into PCS fibers and the fibers were cured under flowing air up to 200°C. The cured PCS fibers were pyrolyzed up to 1300°C under argon atmosphere. The SiC fibers were characterized using SEM, XRD, XPS, TEM, HRTEM and EPMA techniques for their microstructure, composition and crystalline phases. Details of the processes, results and micro-structure of the C/SiC composites and SiC fibers were presented. In addition, the feasibility of C/SiC composite components fabrication has also been highlighted.

Dr. LEE Yoonjoo of Korea Institute of Ceramic Engineering and Technology, Jinju, described "The sintering behavior of SiC-bulk derived from polycarbosilane with organic-inorganic conversion process". Polycarbosilane is a typical ceramic precursor of polymer derived ceramic (PDC) technique. It was originally developed for producing SiC fiber, but as a SiC precursor it has been used in various applications such as high surface area ceramics, catalyst supporter, ceramic thin film, fabrication of CMC, etc. In order to obtain a high-quality ceramic by PDC technique, it is important to control the crystal size and densification as well as the purity of the SiC with understanding of the overall organic-inorganic conversion mechanism. In the case of polycarbosilane, the polymer converted to SiC through curing – pyrolysis – crystallization process, and the nucleation of SiC is accompanied by additional reactions such as graphitization and secondary thermal decomposition. The process conditions at each step influences on the element content, and it affects the crystal growth and densification of SiC. A critical review of the characteristic phenomena at each step of process, and the effect of Si, C, and O elements on sintering of SiC has been presented.

Dr. Manyong LEE of Agency for Defence Development, Korea, presented a review on "High Temperature Ceramic Matrix Composites in Defence". Ceramic matrix composites (CMCs) have been widely used for structural materials in various fields. Especially, fibre reinforced CMCs (e.g. C/C, C/SiC, and SiC/SiC) have been world-widely researched and more advanced because of their unique characteristics which are the high strength and heat-resistance properties and have been naturally to be focused to the fields which are the aerospace, atomic energy, other industries needed for heat protection as well as the defence. Out of these representative CMCs, the life time of C/SiC composite in high temperature circumstance up to about 2000°C is longer than that of C/C composite and the service temperature is higher than that of SiC/SiC composite. In view of this, the C/SiC composite has a host of possibility and applicability for military and has a potential to be

more fabricated. Dr. Lee briefly introduced the C/SiC composite and its manufacturing processes, and Korean research work in the development of C/SiC composites.

MIDHANI, Hyderabad produces various grades of special steels, superalloys and Titanium alloys suitable for the high temperature applications especially in the areas of aerospace, power and defence. Some of the important superalloys developed in Midhani include SuperNi 742, Superni 115, Superni 750 MW, Superni 617CC, Superni 718 (IN 718), Superco 605 (IN 605) etc. In addition to Superalloys having high temperature applications. MIDHANI has also developed various grades of titanium and steels such as Titan 26 (IMI 685), Titan 44 (Beta 21 S) and 17-4 PH, 347 MN, 9Cr1Mo, 10-1-1 respectively. All these materials were manufactured by surmounting the major challenges comprising of narrow range of chemical composition, reduction in presence of trace elements, casting the sound ingot, hot working without flow instability, optimization of thermo mechanical processing parameters, achieving the required microstructure and specified mechanical properties. Dr. S.K. Jha presented the "Advances in Processing of High Temperature Materials in MIDHANI".

Dr. G. Padmanabham, D.Srinivasa Rao, R. Vijay and Ravi N. Bathe of International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, presented an overview on "Advanced Materials and Manufacturing Process for High Temperature Applications" with special reference to the activities on-going at their Centre. Research results on Oxide Dispersion Strengthened steels of different types and their application in fast reactors and AUSC plants have been presented. The recent advances in the development of ODS- Iron Aluminides have been highlighted. The efforts of ARCI on the development of thermal spray, electrolytic and vapor deposition coatings were described. The progress on Laser Arc Hybrid Welding and Laser Cladding and fabrication of components by Metal Additive Manufacturing were described. The repair and refurbication of aerospace components, extension of life of power plant systems, the development of Ceramics such as spinel and silicon carbide conducted at ARCI have been presented.

Prof Indranil Manna, Vice-President, INAE; Professor, IIT Kharagpur and former Director, IIT Kanpur gave an excellent overview on Laser Surface Engineering (LSE). In addition to covering the fundamental aspects associated with LSE, he explained in detail the LSE of Ti-Alloys with Si/Al, pulsed laser deposition of ceramic coatings, Graded microstructure development in IN-718 Superalloy and application of LSE for hardening, melting, alloying and cladding. He emphasized that LSE offers advantages of obtaining meta stable phases, stable microstructure and attaining of attractive combination of properties which were not possible by conventional equilibrium processing. He has touched upon ceramic to metal graded surface composite that may allow designing tailored properties.

Dr. Seyoung Kim (Korea Institute of Energy Research) presented an overview of the current status of Korea's ceramic composite research projects. A combustor for regenerative cooling type scramjet engine using fiber reinforced ceramic composite material was developed by Korea. A flow path was formed inside the CMC combustor and the performance was tested by exposing it to actual combustion environment. In addition, the efforts made for developing a sealant for air tightness maintenance of a fitting part for injecting fuel into the CMC regeneration cooling channel and a study conducted for micropore interception of the CMC material were presented. The pressure of the fuel injected for regeneration cooling was set to about 40 bar, and the design structural analysis of the CMC flow path and the actual pressure resistance test were performed together.

Functional requirements of speed, range, lethality, flexibility and survivability of defense systems depend heavily on numerous materials and material systems that are closely integrated to make up the structure of the vehicle and its propulsion system. In addition to functionality, choice of materials influence the life-cycle cost of vehicles and is therefore a key factor in deciding its affordability. Realization of very high speed aerospace vehicles, such as supersonic and hypersonic vehicles, is possible only if materials having sufficient strength and oxidation resistance at very high temperatures, coupled with resistance to thermal shocks are developed. Dr. V.V. Satya Prasad explained briefly the advances made at DMRL in the development of ultra-high temperature materials for futuristic high speed aero-space vehicles. He informed that the DMRL has developed technology to prepare Carbon fibre reinforced silicon carbide (C_f -SiC) composites using CVI-CVD process in the form of panels and a few selected shapes by optimizing process parameters such as fibre volume fraction and fibre interface coating. These composites have been characterized for various mechanical and thermal properties like tensile and flexural strength (both at room temperature and high temperature), fracture toughness, thermal conductivity etc. In addition, DMRL has also developed technology for synthesizing ZrB_2 powder up to 5 kg scale and for preparing ZrB_2 -SiC (UHTC) composites in the form of discs up to 150mm diameter. These composites exhibited consistency in room temperature flexural strength, oxidation resistance and strength retention after exposure to 1500C. The niobium based Cb 752 (Nb-10W-2.5 Zr) alloy is particularly suitable for very high temperature applications as it exhibits adequate strength even at 1400°C. Preparation of this alloy is a very challenging task in view of the differences in the densities and melting temperatures of Nb, W and Zr. The feasibility of preparing this alloy in the form of ingots up to 100 mm diameter and thermo-mechanical processing of the ingots to produce sheets of 5 mm thickness has been established at DMRL.

"Fabrication and testing of ultra-high temperature ceramic (UHTC) materials for TPS application" was narrated by Dr. Sea-Hoon Lee of Korea Institute of Materials Science, Changwon. In order to fabricate ablation resistant UHTC matrix composites, the investigations conducted on powder synthesis, dispersion, shaping, densification, coating process and ablation testing have been explained. The methods to synthesize nano-UHTC powders and liquid precursors having controlled size, shape, size distribution, chemical composition and purity were developed. Nano powder synthesis of ZrC , ZrB_2 , HfB_2 was conducted by innovative processes. Highly concentrated UHTC slurries up to 57vol% were successfully fabricated. Ultra-fine (200 – 300 nm) and homogeneously distributed UHTC-SiC nano composites were successfully fabricated. The UHTC material showed excellent ablation resistance on ablation testing at 2000-2800°C using oxy-acetylene torch, arc-jet plasma wind tunnel and hybrid rocket. The maximum bending strength of the C_f/HfC -SiC UHTC-CMC was 280MPa. The material did not lose its strength after the thermal shock test at 1500°C. The thermal shock resistance of the UHTC was clearly improved by the fabrication of the CMC. Oxy-acetylene Torch Test, Arc-Jet Plasma Wind Tunnel Test and Rocket Motor Tests were successfully conducted.

Dr. A. K. Maiti of BHEL R&D Hyderabad dealt on "Thermal Barrier Coatings (TBC) for Gas Turbine Components". Thermal barrier coatings (TBCs) perform an important function as heat resistant layer for component, such as gas turbine parts operating at elevated temperature. Typical examples are turbine blades, combustion liners, transition pieces and nozzles. TBCs have made possible the increase in operating temperature of gas turbines by protecting the underlying metallic body from damage by surrounding heat. TBC is normally a two-layer structure of bond coat and top coat. Bond coat is usually made of alloy (Ni/CoCrAlY) whereas the standard top coat is made of yttria stabilized zirconia (YSZ). YSZ is preferred because of its high melting point and thermal expansion coefficient. Incidentally YSZ top coats are not suitable as TBC beyond 1000⁰ C.

Advanced ceramic material like lanthanum/gadolinium zirconate are preferred and used as top coat for high temperature gas turbines. Bond coat and top coat material is deposited by plasma spray process (atmospheric/vacuum). Plasma spray process is normally used for depositing ceramic powder. EBPVD (Electron beam physical vapour deposition) is also used for depositing ceramic layer (YSZ). EBPVD process produces columnar grain whereas plasma spray gives lamellar grain structure. Columnar grains are better than lamellar grains due to high shock resistance but the process of EBPVD are not preferred commercially due to its high operating cost. Plasma spray is more popular due to its low cost and simplicity. The efforts of BHEL in developing TBC coatings and their characterization have been presented in detail.

Dr. D. Srivastava, presented the role of Nuclear fuel Complex, Hyderabad in "Manufacturing of Materials and Structural Components for various types of Reactors". NFC has mandate to develop and manufacture structural components and fuel assemblies required for all the operating Nuclear Power Reactors as well as future advanced reactors in India. The Complex is engaged in the manufacture of various Zirconium alloy reactor core structurals like Pressure Tubes, Calandria Tubes, Garter Springs, Reactivity Mechanism Assemblies for the Pressurized Heavy Water Reactors (PHWRs) and Square Channels for the Boiling Water Reactors (BWRs). The type of structural elements varies with different types of reactors i.e., PHWR, BWR and the Breeders etc. The expertise gained in manufacturing Fast Breeder Test Reactor (FBTR) sub-assemblies was successfully translated to develop technologies required for manufacturing core sub-assemblies and components required for the forthcoming 500 MWe Prototype Fast Breeder Reactor (PFBR) at Kalpakkam. NFC had also manufactured a variety of seamless tubes for strategic applications to meet the requirements of DAE, Space and Defence. Various high temperature materials developed and their processing for application in experimental High Temperature Reactor have been mentioned.

"Current status of high temperature nuclear materials development for future nuclear reactor system applications" has been explained by Dr. Tae Kyu Kim of Korea Atomic Energy Research Institute, Daejeon. As a long-term national research project, high temperature nuclear materials are being developed at the Korea Atomic Energy Research Institute (KAERI) to improve the safety of nuclear reactor systems in the future. In case of the pressurized water reactor (PWR), the R&D activities are focused on the accident tolerant fuel (ATF) and 3D printing technology. Different grades of SA508 are used for pressure vessels, main stream line material and secondary piping. The R&D activities on the high-temperature nuclear materials for future nuclear reactor systems have been summarized as ferritic-martensitic (FM) steels such as Gr91/Gr92 steels for steam generators, T92 for cladding, HT9 for fuel sub-assembly and oxide dispersion strengthened (ODS) alloys for core applications in fast reactors. HT 9 duct was processed by VIM+ESR and fabricated by hot piercing. The VHTR which operates between 700-950°C will have ceramic coated pebbles, graphite core, and Alloy 800H and Inconel 617 for heat exchanger piping. SiC/SiC composites will be used for some internal structures.

The efficiency of conventional fossil-fired thermal power plants is a strong function of temperature and pressure. The need to reduce CO₂ emissions has provided an additional incentive to increase efficiency. More recently the interest has been evinced in the development of Advanced Ultra Super Critical (AUSC) Power Plants in India. Three major institutions (IGCAR, Kalpakkam, BHEL and NTPC) are involved in development of materials and AUSC Power Plant System Engineering. Several Indian Educational institutions and reputed research laboratories are also participating in the characterization of mechanical properties and development of welding technologies. Dr. K. Laha of AUSC Mission Directorate, Noida has made a detailed presentation on identifying, evaluating, and

qualifying the materials needed for the fabrication of various components to be used in the construction of 800 MW AUSC power plant, the design of which is nearing completion. The Indian AUSC power plant is envisaged to operate with maximum steam temperature of 710 °C at 310 bar with plant efficiency more than 46 %. High temperature and pressure steam in AUSC plant needs better creep resistance material than ferritic-martensitic steels (T91 and T92) used in USC power plant. Austenitic stainless steel (Sanicro 25) and nickel base superalloy (Inconel 740) are considered for super heater and reheater tubes. Selection of the material among the different alternatives (Super 304H and Inconel 617) are based on the detailed creep strength and economic consideration. Inconel 617 and 740 both are qualified for headers and main pipes. Inconel 740 is preferred over Inconel 617 because of its higher creep rupture strength coupled with higher fatigue strength. Induction bending process for fabrication of the Inconel 740 pipes is being addressed. Key components of turbine are: Casing to contain and regulate steam flow; Bolts to integrate both halves of casings; and Rotor and Blade to extract the steam energy and convert into mechanical energy. In Indian AUSC, both the casing and rotor of HP and IP turbine will be welded ones. Complicated structure of the casing is produced by casting. In inner casing of AUSC, welded Inconel 625 / G911 steel will be used against G911 ferritic steel in USC. Establishment of welding technology for the dissimilar weld joint between alloy 625 and G911 is being persuaded. Bolts for integrity of both halves of casing will be Inconel 718 against alloy X9 in USC for higher stress relaxation resistance. The rotor is of welded Inconel alloy 617 / E911 ferritic steel in AUSC against E911 steel in USC. Large diameter (\approx 1 meter) rotor will produced by forging process, bringing grain size inhomogeneity and hence mechanical properties. Welding process development of the dissimilar (625/E911) rotor is a key technology and is in the process of development. For LP turbine, an ultra-super clean NiCrMoV steel (control on P, Sn, Mn) will be used for both rotor and casing to minimize temper embrittlement at high temperatures. The materials selected for stationary and rotatory blades and valves have also been highlighted.

Dr. R. Sankarasubramanian and Dr. A. Venugopal Rao of DMRL Hyderabad dealt on "Role of Artificial Intelligence / Machine Learning and Integrated Computational Materials Engineering (ICME) in Materials Discovery". Materials discovery is a rate controlling step in the design of new engineering structures. It is essential that materials design be incorporated as part of engineering design of structures and systems so that maximum benefit is realised. However, this seems to be extremely difficult task because the physical behaviour of engineering materials is extremely complex; features at several length scales and various phenomena occurring over several time scales control their properties and performance. Traditional materials development relies on trial-and-error based experimentation. This approach is laborious and time taking. Availability of affordable computing systems combined with advances in modelling and simulation in terms of reliable software and efficient algorithms, have started changing this scenario. Using the above ecosystem, ICME has recently emerged as a new discipline as a means to accelerate materials discovery. Further, the availability of extensive data accumulated over decades of research combined with the emergence of Artificial Intelligence (AI) has opened up extensive scope for accelerating discovery of newer materials. In this presentation, efforts of DMRL in making use of ICME-based approach for designing newer nickel-based superalloys have been elaborated. The prospect of incorporating AI-based approach in the design and processing of superalloys and in the aero engine turbine disc manufacturing by powder metallurgy were discussed.

"Application of digital and artificial intelligence technology to improve the energy efficiency and availability of existing thermal power plants" has been presented by Dr. Seog Hyeon Ryu, Advisor of Doosan Heavy Industries & Construction, Korea. In-service, power generation facilities maintain normal functions through periodic overhaul and maintenance, but it is difficult to avoid decreasing

the thermal efficiency and availability to some extent as the operation time increases. This presentation highlighted an early warning solution for power plant, boiler combustion optimization solution and boiler tube management system (BTMS) based on digital and artificial intelligence technology. It has been mentioned that, PreVision developed by Korea for early warning has two big features: detecting fault signs via prediction technology using sensor data and diagnosing the same for root cause analysis. These can help avoid unplanned plant outages by using prediction and diagnosis solutions. Optimizing the boiler furnace's combustion is effective at improving its thermal efficiency and reducing the fossil power plant's emissions. The artificial neural networks (ANN)-generated combustion model is applied to the particle swarm optimization (PSO) algorithm to explore the boiler's input values to optimize the combustion. The BTMS provides functions for predicting and managing the temperature distribution and lifetime of the tubes based on applying the boiler's design information, real-time operation information, and fuel information.

Prof. Hyochoong BANG of Korea Advanced Institute of Science and Technology, presented A Case Study on Space Education Initiatives by Cubesat. In this talk, recent university space activities in Korea are introduced in particular Cubesat program. The Cubesat is being considered as a new game changer in space education and innovative technology. KAIST) launched a 2kg size Cubesat into space with some success story in 2017. The program has significant impact on young generation by providing new opportunities. Korean government strongly supported university Cubesat initiatives. This talk generated attention with possibility of collaboration in Cubesat between India and Korea in the near future.

Prof. Vinay K Dadhwal, Indian Institute of Space Science and Technology, Trivandrum, gave a detailed presentation of Space Education Initiatives in India. Space education in India covers a very large canvas of science, technology and applications. The areas that address space education include astronomy and astrophysics, heliophysics, planetary science, astrobiology, to a number of engineering branches such as aerospace and avionics with inclusion of material science and technology, communication and optical engineering and earth science, geomatics and geodesy, positioning and navigation. Education opportunities in India for above disciplines were presented especially the leading institutions. Major centres focusing on PhD research and training in relevant areas of space are Physical Research Laboratory, Ahmadabad (estd. 1944), Indian Institute of Remote Sensing, Dehradun (estd.1966 as Indian Photointerpretation Institute), Space Physics Laboratory (1968, under VSSC), National Atmospheric Research Laboratory, Gadanki (estd 1992 as National Mesosphere-Stratosphere-Troposphere Radar Facility NMRF). These organizations independently and through programs such as establishment of Space Technology Cells in IITs by ISRO, RESPOND program and a number of recent initiatives have been significant in spreading the space education through research and training. Most significant initiative of ISRO in the field of education has been establishment of Indian Institute of Space Science and Technology (IIST) in 2007. IIST is a deemed-to-be university under the Indian education system and offers undergraduate, post-graduate and doctoral degrees in relevant disciplines.

The research focus at IIST is both on (a) space relevant discipline-wise areas with particular emphasis on gap areas identified by ISRO and (b) conceptualize and realize space projects to provide system engineering experience to students, researchers and faculty. Recent such project on an ARIS (Advanced Retarding Potential Analyses for Ionospheric Studies) launched on PS4-OP on 1 april 2019 on PSLV C45 and would also fly shortly again PS4-OP on PSLC-C48. It has proven successful and its variants have been accepted to fly on upcoming ISRO missions to Mars (MON-2) and Venus. IIST has established a Small Spacecraft and Payload Centre (SSPACE) which currently is working on one in-house cubesat (AHAN) and two international collaborative small spacecraft

projects, namely InspireSat-1 (with University of Colorado) and AAReST (with Caltech USA and University of Surrey, UK). IIST has designed various subsystems, including OBC, cold gas thrusters, EPS, flight software and all will be flown on ISRO vehicles in next 1-2 years. Ongoing international collaborations were presented.

A letter of appreciation has since been received from President, NAEK.

Other Activities/Affairs of INAE

Frugal Innovation (National Innovation Council, DST)

Besides the core activities of INAE, one of the objectives of the Academy is to pursue academic activities to addressing 'Engineering challenges' that the country is facing. The first focus is to undertake specific studies to address some urgent problems. Many of these have fructified in concrete action plans, in particular the reprocessing of automobile waste. The second major step was the organization of Engineers Conclave and this has led to very specific implementable recommendations. As a third focus, INAE Forums are providing very useful inputs to policy makers in key areas like Urban Transportation, Housing, Disaster Mitigation etc... In line with these initiatives took by INAE, one of the major initiatives was the institution of the Frugal Innovation Nurturing Programme (FINP) by INAE which is a follow up action of the two-day Workshop organized jointly with National Institute of Rural Development and Panchayat Raj (NIRDPR) on Frugal Innovation on July 7-8, 2017 at NIRDPR, Hyderabad.

Frugal Innovation Nurturing Programme (FINP) was instituted in August 2018 with an objective to nurture prospective frugal innovations which have reached prototype stage to scale up and commercialize them for greater exploitation. For this purpose, Innovation Promotion Committee (IPC) was constituted for implementation of the Programme under the Chairmanship of Dr. V Bhujanga Rao, FNAE. Frugal Innovation Nurturing Programme (FINP) has also joined hands with National Innovation Foundation (NIF) to identify some innovations that have reached prototype stage and have been successfully tried in the field, but were limited in out-reach in terms of infrastructure/means available with the inventor. Frugal Innovation Nurturing Programme (FINP) has since identified four such innovations during 2018-19 and one of them was scaled up from TRL-4 to TRL-9. After gaining experience in 2018-19, 13 such innovations have been identified for further exploitation and commercialization under this Programme.

Welcome Meeting for Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE

A Welcome Meeting for Lt Col Shobhit Rai (Retd) who joined INAE Office as Deputy Executive Director was held on January 6, 2020 at INAE Office, Gurgaon. The meeting was presided over by Dr Sanak Mishra, President, INAE and was attended by the staff of INAE. Dr Sanak Mishra, President, INAE welcomed Lt Col Shobhit Rai (Retd) and felicitated him with the presentation of the Academy tie and a Memento and wished him a fruitful tenure at INAE.



Dr. Sanak Mishra, President INAE welcoming Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE

Group Photograph with INAE Staff at Welcome Meeting

Participation of INAE in 107th Indian Science Congress

During the meeting of DST – INAE Consultative Committee held on November 28, 2019 in the Office of Secretary, Department of Science and Technology (DST), Prof. Ashutosh Sharma, FNAE, Secretary, DST had suggested that INAE should participate during the 107th Indian Science Congress Expo from January 3-7, 2020 being held at University of Agricultural Sciences, Bangalore, to increase the outreach of the Academy, within the scientific and engineering fraternity. Accordingly, Ms Pratigya Laur, Research Officer, INAE was deputed as a representative from INAE, to set up a stall pertaining to INAE, during the exhibition at the DST Pavilion at Pride of India Expo – Mega Science Exhibition in the 107th Indian Science Congress Expo held at Bangalore. Two posters containing information on ‘About INAE’ and the ‘INAE-SERB, DST Abdul Kalam Technology Innovation National Fellowship’ were showcased in the stall. This Expo was attended by persons from a very broad scientific and engineering community ranging from students to the highest professional levels. The visitors at the Congress appreciated the INAE stall and the information showcased about INAE was well received.



INAE Stall at Indian Science Congress at Bangalore

Meeting of INAE Delegation with Hon'ble Minister of Civil Aviation

INAE Delegation comprising of Dr Sanak Mishra, President, INAE; Dr BN Suresh, Immediate Past -President, INAE; Dr Kota Harinarayana, Former DG, ADA; Dr PS Goel, Former President, INAE and Lt Col Shobhit Rai (Retd), Deputy Executive Director, INAE met with Hon'ble Minister of Civil Aviation, Shri Hardeep Singh Puri on January 14, 2020 at New Delhi to present the recommendations on the “Development of Regional Transport Aircraft in the country”, which had emanated from the deliberations of various high level meetings including the Engineers Conclave 2017, held at Bangalore. The issue is relevant in the context of India having the largest market in the world for the class of Regional Transport Aircraft, with 90-seater capacity.



Left to Right: Dr Kota Harinarayana, Dr BN Suresh, Dr Sanak Mishra and Dr PS Goel at the Meeting in Office of Hon'ble Minister of Civil Aviation, New Delhi

INAE Youth Activities

INAE Youth Forum

INAE had created a Youth Forum in the year 2017 with the objective of facilitating the engagement of Indian youth in engineering activities at national level. Through the institution of the Youth Forum, INAE extends Student Membership to winners of various competitions conducted for engineering students such as National Online Essay Competition, Innovative Student Project Awards and also other competitions under the aegis of the Youth Forum, thereby endorsing their talent and advocating their ability to contribute meaningfully to the development of the country. The Youth Forum provides a platform for the engineering students to voice their concerns on engineering aspects and also interact with INAE Fellows and Young Associates on issues of national interest that shall help shape their future careers in the engineering profession. The INAE Youth Forum was launched during the first INAE Youth Conclave held at Birla Institute of Scientific Research Jaipur on Aug 11-12, 2017.

The third INAE Youth Conclave 2019

The third INAE Youth Conclave was organized at Indian Institute of Technology (IIT), Delhi on Aug 9-10, 2019. Prof. V Ramgopal Rao, Director IIT, Delhi had kindly hosted the event. Dr. Purnendu Ghosh, Vice President INAE and Chairman INAE Youth Committee along with Prof Shaikh Ziauddin Ahammad, IIT Delhi and Prof. BK Panigrahi, FNAE IIT Delhi organised the event. The Conclave was organized for engineering students in Graduate, Post Graduate and Doctoral level. The event included interactive sessions of students with INAE Fellows and other Subject Experts and presentations by students based on engineering models or engineering ideas. The engineering model and idea presentations were based on five topics of national importance namely (a) Health is Wealth (b) Digital Revolution (c) Environment Protection (d) Lab to Market and (e) Waste to Wealth. The Conclave was attended by more than 200 engineering students from all over the country, and about 30 INAE Fellows participated in the deliberations. The Conclave was inaugurated by the Chief Guest, Prof. Anil D Sahasrabudhe, Chairman AICTE and Guest of Honour was Prof K VijayRaghavan, Principal Scientific Adviser to the Government of India.



Dr. Sanak Mishra, President INAE addressing the audience in the Inaugural Session of INAE Youth Conclave 2019



Chief Guest, Prof Anil D Sahasrabudhe, Chairman AICTE delivering Address during INAE Youth Conclave 2019



Guest of Honour, Prof. K VijayRaghavan, Principal Scientific Adviser to Govt. of India, delivering Address in INAE Youth Conclave 2019

The Inaugural Session was followed by individual/team presentations by students on the five chosen theme areas. Each participating student/student team was judged by a panel of judges consisting of experts from academia and industry. The Top three from each group were awarded prize money of Rs. 25,000 for the winner, Rs. 15,000 for the first runner-up and Rs. 10,000 for the second runner-up. The presentation session was followed by technical sessions on “Engineering Education: Demand and Supply”, “Technical Innovation in India: Frugal and Conventional”, “Societal Reinvention through Technology” and “Young Entrepreneur: Prospect and Challenges”.



Presentation of engineering ideas by student on Waste to Wealth during INAE Youth Conclave 2019



Panel Discussion Sessions by INAE Fellows (left to right): Prof. Amit Agrawal, IIT Bombay, Prof. Anurag Sharma, IIT Delhi and Prof Prem Krishna: Prof. Manoj Tiwari, IIT Kharagpur, Prof. KL Chopra, Dr. Purnendu Ghosh and Prof BK Panigrahi

The conclave concluded with the award ceremony for the awardees. The students who attended the conclave were held interactions with INAE Fellows from Academia, R&D and Industry during the sessions. Dr. Purnendu Ghosh, Vice President, INAE and Chairman INAE Youth Committee congratulated all the awardees. He informed that all the awardees would be inducted as INAE Student Members for a period of 5 years and encouraged their involvement in INAE activities.



Presentation of Awards to Winners in Award Ceremony of INAE Youth Conclave 2019



Group Photograph of Participants and Delegates at INAE Youth Conclave 2019 at IIT Delhi

INAE Study Group on Indian Engineering Heritage- Metallurgy

INAE Engineering Heritage – Metallurgy Study Group was reconstituted during 2020 with Dr. U. Kamachi Mudali continuing as its Chairman with the following Fellows of INAE as members: Dr. E.S. Dwarakadasa, Bangalore, Dr. S. Venugopal, NIT Dimapur, Dr. N.K. Mukhopadhyay, IIT BHU, Dr. Soumitro Tarafder, NML, Jamshedpur, and also those who are involved in the metallurgical heritage filed as invitees for the Study Group meetings. The Study Group was given the following mandate by INAE:

- a) Organizing workshops, seminars & symposia on metallurgical heritage
- b) Commissioning research monographs on specific aspects of Indian heritage in metallurgy
- c) Promoting discourses, lectures and study projects on the Indian heritage in metallurgy for students at institutes and universities
- d) Enabling studentship and research in archaeometallurgy of the Indian sub-continent and enabling research fund for eminent projects
- e) Inspiring young leaders to work in the area of archaeometallurgy through promotion of mentoring by peers
- f) Inspiring new individuals and groups to work in the domains of priority
- g) Facilitating connectivity of Indian initiatives on archaeometallurgy with similar programmes of fraternal learned societies in India and abroad.

Keeping in view the mandate of the Group, a meeting of the Engineering Heritage – Metallurgy Study Group and a Workshop on “Advanced Characterisation of Ancient Metallic Objects” was discussed and proposed at Institute of Rajasthan Studies, Janardan Rai Nagar Rajasthan Vidyapeeth (Deemed -to -be) University, Udaipur. Dr. U. Kamachi Mudali, Chairman, IEH-Metallurgy, Prof. Lalit Pandey, Former Professor and Director, Institute of Rajasthan Studies, JRN Rajasthan Vidyapeeth, Udaipur and Dr. Pravin P. Deshpande, College of Engineering, Pune prepared a proposal to conduct the meeting and event during April 03-04, 2020. The objective of the workshop was to bring out the recent techniques available for characterization of ancient metallic objects along with review of existing techniques and the characterization carried out so far. IEH-Metallurgy Committee members and experts working on advanced characterisation techniques from all over India will be invited for the event. Further utilizing the huge data of characterization already available in the country for digitization will be discussed in a panel discussion at the end of Workshop. However, in view of Covid-19 pandemic the event was postponed till further announcement.

Abdul Kalam Technology Innovation National Fellowship

Indian National Academy of Engineering (INAE) and Science and Engineering Research Board (SERB), Department of Science and Technology (DST) launched the INAE-SERB, DST Abdul Kalam Technology Innovation National Fellowship in the year 2017, to recognize, encourage and support translational research by Indian Nationals working in various capacities of engineering profession, in public funded institutions in the country.

The nominees for the subject Fellowship should have a minimum of 5 years' service left in the parent organization. The Fellowship amount is Rs 25,000/- per month in addition to salary being drawn and a Research Grant of Rs.15.00 lakh per annum will also be provided. An Overhead of Rs.1.00 lakh per annum will also be provided to the host institute. A Maximum of 10 Fellowships will be awarded per year. The duration of the Fellowship will be initially for three years, extendable by up to two more years depending on the performance and the Fellowship can be held for a maximum of 5 years.

The scheme has received a good response and has gained visibility in the engineering community across the country. A maximum of 10 Fellowships are awarded in a year and six Fellowships were conferred in the Financial Year 2017-18 and eight in the Financial Year 2018-19. The INAE Governing Council during its meeting on December 12, 2019 at Birla Institute of Scientific Research (BISR), Jaipur, approved the names of seven nominees selected during the Financial Year 2019-20, as per details given below.

- i) Prof Rohit Srivastava, IIT Bombay
- ii) Prof Pushpak Bhattacharyya, IIT Patna
- iii) Prof V Kamakoti, IIT Madras
- iv) Prof Sujatha Srinivasan, IIT Madras
- v) Prof Subhananda Chakrabarti, IIT Bombay
- vi) Prof Bikramjit Basu, Indian Institute of Science, Bangalore
- vii) Prof Debatosh Guha, University of Calcutta, Kolkata

This would now make a total of twenty-one nominees who have been selected for conferment of the subject Fellowship since its inception.

Reaching out to Policy Makers: Interaction with Govt. Agencies

Indian National Academy of Engineering (INAE), during the recent past, in addition to its well-defined activities, has been giving a major thrust in carrying out activities on issues of National importance, where engineering interventions can provide the needed solutions. In order to facilitate identification of topics on thrust areas for conduct of activities, INAE has in place consultative/joint Committees with DST, Office of Principal Scientific Adviser (PSA) to Government of India, TIFAC, AICTE etc. The actionable recommendations emanated from the activities have been forwarded as inputs for policy formulation, to the concerned agencies, which have been well received and, in many cases, implemented. The progress made by INAE on some of these activities are summarized below.

DST-INAE Consultative Committee

Study on “Pilot Project on Safe Laboratory Practices and Laboratory Waste Disposal”

During one of the DST-INAE Consultative Committee Meetings, Prof. Ashutosh Sharma, Secretary, DST entrusted the task to INAE for creating a plan of action to enhance the awareness of health and safety issues and safe disposal of chemicals and solvents in chemical and biological laboratories in Indian universities, research institutes and colleges. Accordingly, a project entitled, “Pilot Project on Safe Laboratory Practices and Laboratory Waste Disposal” was undertaken and report prepared.

The Study was carried out by Dr. S Sivaram, FNAE as the Principal Engineering Investigator (PI) and Dr. G.S. Grover, Chief Scientist (Retd), CSIR-National Chemical laboratory, Pune; as Team Member and Consultant and Mr. Shankar B. Kausley, TCS Pune as Team member. As a pilot project, three institutes were identified to create an implementable action plan as well as establish best practices for the disposal of chemical and hazardous wastes in the chemical and biological laboratories. The three institutes identified for undertaking of the study are:

1. Savitribai Phule Pune University (SPPU), Pune
2. Institute of Chemical Technology (ICT), Mumbai
3. Indian Institute of Science Education and Research (IISER), Kolkata

Other than the above mentioned three institutes, the inputs were also obtained from other institutes who are doing a remarkable work in this area viz IIT Delhi which has developed a zero-waste campus wherein the entire waste is being used to generate bio fuel to run the vehicles within the campus and carry out other activities. A report on the proposed pilot project on Safe Laboratory Practices and Laboratory Waste Disposal, along with the project proposal, after duly incorporating all suggestions has since been prepared and submitted to Prof Ashutosh Sharma, Secretary, DST on February 5, 2020 for consideration and allotting a time slot for making a presentation on the subject.

Research Study on “Housing”

DST had desired INAE to undertake a Research Study for providing optimal engineering solutions for Housing under Jan Awas Yojna announced by the Hon’ble Prime Minister of India. Accordingly, INAE Forum on Civil Infrastructure, chaired by Prof. Prem Krishna, Former Vice-President, INAE during its Forum meeting on November 6, 2019, had deliberated and submitted a proposal on ‘Housing’ to INAE with an objective to create a “White Paper” to provide a set of needed actions related to Policy Initiatives, Engineering R&D and Extension. Subsequently, during the meeting of the DST-INAE Consultative Committee held on Nov 28, 2019, Prof. Prem Krishna, Chairman, INAE Forum in Civil Infrastructure presented the proposal on ‘Housing’ to be

undertaken by the Forum. He briefed the Committee that the proposed study will entail assessment of category-wise and region-wise shortage of housing units. It will involve a critical review of technologies for affordable housing, tried in recent years and currently shortlisted for consideration. The project will also focus on Industrialised Mass Housing, which will encourage industry to come forward to support the mission. The time frame for completing the Study will be about 12 months and once completed a detailed Project Proposal on “Housing” will be submitted to DST.

PSA-INAE Consultative Committee Role of Hydrogen in India's Energy Strategy

Prof. K VijayRaghavan, Principal Scientific Advisor (PSA) to Govt. of India on the side-lines of the R&D Conclave held on 17 December 2019 in Delhi expressed his willingness that INAE should prepare a concept paper on Hydrogen based approach for India's Energy Strategy. For this a Round Table Interaction of domain experts on "Role of Hydrogen in India's Energy Strategy" was organized by INAE Pune Local Chapter on February 15, 2020 at Pune, which was attended by domain experts from INAE Fellowship and other expert invitees from Academia, R&D organizations and Industry. The invited experts shared insights on the current and future global situation about use of Hydrogen as an energy source; discussed the overall situation in India with respect to technologies, capabilities and affordability for Generation, Storage, Transportation and Usage of Hydrogen and concluded on the approach to be followed by INAE in forwarding recommendations to the Government. Subsequent to the deliberations, the recommendations in the form of a White Paper containing all the pertinent issues related to Role of Hydrogen in India's Energy Strategy are being finalized and shall be submitted to Prof. K VijayRaghavan, Principal Scientific Advisor (PSA) to Govt. of India.

Research Schemes

INAE Chair Professorship

INAE Chair Professorship was instituted in order to encourage engineers/technologists with outstanding research contributions, promote long-term participation in academic research and enhance the research standards in academic institutions. INAE Fellows between the ages of 45 and 65 years, working in well- recognized teaching/research institutions in India are eligible for consideration.

The nominations were not invited during the year since it was decided to review the methodology for inviting and processing the nominations and other details of the INAE Chair Professorship scheme with a view to enhance its impact.

INAE Distinguished Professors/Technologists

INAE Distinguished Professors/Technologists Scheme has been instituted in order to utilize the expertise of INAE Fellows after superannuation for research in engineering institutions/Universities/Research & Development establishments/industry in India. Superannuated Fellows below 70 years of age are eligible for consideration.

The nominations were not invited during the year since it was decided to review the methodology for inviting and processing the nominations and other details of the INAE Distinguished Professors/Technologists schemes with a view to enhance impact.

Mentoring of Engineering Teachers by INAE Fellows

INAE undertakes mentoring of Engineering Teachers from recognized Engineering institutions, during the summer vacations, with a view to enhance the quality of Engineering education being imparted in the country.

A total of twenty one Engineering Teachers were selected under scheme on “Mentoring of Engineering Teachers by INAE Fellows” this year, as per details given below.

S No	Name of Mentor	Organization of the Mentor	Name of Engineering Teacher	Institution of Teacher
1	Prof. Suman Chakraborty	Indian Institute of Technology Kharagpur	Dr. Naresh Kumar Mani	Manipal Institute of Technology, Manipal
2			Dr. Debashis Pal	Indian Institute of Engineering Science and Technology, Shibpur
3	Prof. Bijnan Bandyopadhyay	Indian Institute of Technology Bombay	Dr. Prasiddh Trivedi	Ramrao Adik Institute of Technology, Navi Mumbai
4	Prof. K. Bhanu Sankara Rao	University of Hyderabad	Dr. Raffi Mohammed	National Institute of Technology, Andhra Pradesh

5	Prof. S.V. Kulkarni	Indian Institute of Technology Bombay	Mr. Vishal Shantaram Dake	Sardar Patel College of Engineering, Mumbai
6	Prof. Radhakant Padhi	Indian Institute of Science, Bangalore	Dr. I. Thirunavukkarasu	Manipal Institute of Technology, Manipal
7	Dr. Soumitra Tarafder	CSIR- National Metallurgical Laboratory Jamshedpur	Dr. Md. Basiruddin Sk.	Jadavpur University, Kolkata
8	Dr. Surendra Kumar Biswal	CSIR - Institute of Minerals and Materials Technology, Orissa	Mr. Kashinath Barik	Indira Gandhi Institute of Technology, Sarang, Odisha
9	Dr Archana Sharma	Bhabha Atomic Research Centre, Mumbai	Dr Somesh Vinayak Tewari	SRM University, Andhra Pradesh
10	Dr. J. Krishnan	Retired L&T Chair, MS University, Baroda	Dr. Visvesh Badheka	Pandit Deendayal Petroleum University Gandhinagar Gujarat
11			Mr. Sachin Ganeshrao Solanke	Saraswati college of Engineering, Maharashtra
12	Dr. G. Madhusudhan Reddy	Defence Metallurgical Research Laboratory, Hyderabad	Dr. K. Guruvidyathri	University of Hyderabad
13	Prof. Ashok Kumar Pradhan	Indian Institute of Technology Kharagpur	Dr. Nabin Kumar Sahu	Dhirubhai Ambani Institute of Information and Communication Technology, Gandhinagar
14	Dr. Sukumar Mishra	Indian Institute of Technology Delhi	Mr. Saumendra Sarangi	MNNIT Allahabad
15			Ms. Stuti Shukla Datta	Amity School of Engineering and Technology, Lucknow
16	Prof. S.K. Koul	Indian Institute of Technology Delhi	Mr. Kushmanda Saurav	Indian Institute of Technology Jammu

17	Prof. J C Misra	Indian Institute of Technology Kharagpur	Dr. Satya Rajan Mishra	Institute of Technical Education & Research (ITER), Bhubaneswar
18			Dr. Priya Mathur	Poornima Institute of Engineering & Technology, Jaipur
19	Prof. Bidyadhar Subudhi	Indian Institute of Technology Goa	Dr. Bikramaditya Das	Veer Surendra Sai University of Technology, Sambalpur
20	Dr. Parag R Gagote	Institute of Chemical Technology Mumbai	Mr. Nandana Chakinala	Manipal University Jaipur
21	Prof. Anil Kottantharayil	Indian Institute of Technology Bombay	Dr. Lintu Rajan	National Institute of Technology, Calicut

Mentoring of Engineering Students by INAE Fellows

INAE undertakes mentoring of meritorious 3rd /4th year B.E./B.Tech students from recognized Engineering institutions, during the summer vacations, with a view to provide them guidance so as to excel further in their field of study and improve the quality of engineering education.

A total of thirty seven Engineering Students were selected under the scheme “Mentoring of Engineering Students by INAE Fellows” this year, as per details given below.

S No	Name of Mentor	Organization of the Mentor	Name of Engineering Student	Institution of Student
1	Prof. K. T. Jacob	Indian Institute of Science, Bangalore	Ms. Priyal Parihar	Maulana Azad National Institute of Technology, Bhopal
2	Dr. Parag R. Gogate	Institute of Chemical Technology, Mumbai	Mr. Atindra Kumar Kushwaha	Madan Mohan Malviya University of Technology, Gorakhpur, Uttar Pradesh
3	Prof. K Bhanu Sankara Rao	University of Hyderabad	Ms. Anjuri Sai Mounika	National Institute of Technology, Andhra Pradesh
4			Ms. Tirumala Eswara Siri Vara Prasad	RGUKT - IIIT Nuzvid
5	Prof D.P. Kothari	VNIT, Nagpur	Mr. Anshuman Pathak	UPES, Dehradun

6	Prof. Shibam Koul	Indian Institute of Technology Delhi	Ms. Goutha Reddy Shalini	University College of Engineering, Osmania University, Hyderabad
7	Prof. Satyam Suwas	Indian Institute of Science, Bangalore	Ms. Namballa Baby Raga Malikasri	RGUKT - IIIT Nuzvid
8			Mr. Y Kaarrthikeyan	Mahatma Gandhi Institute of Technology, Hyderabad
9	Dr. R. Gopalan	ARCI, Chennai	Mr. ShemShetty Saicharan	Rajiv Gandhi University of Knowledge Technologies, Basar
10			Ms. KVS Aishwarya	Mahatma Gandhi Institute of Technology, Hyderabad
11	Dr. Neelesh B Mehta	Indian Institute of Science, Bangalore	Mr. Suman Roy Ghatak	Jadavpur University, Kolkata
12			Mr. Arunabh Srivastava	Indian Institute of Technology, Madras
13	Prof B S Murty	Indian Institute of Technology Hyderabad	Mr. Jajjara Sampath Kumar	RGUKT-IIIT NUZVID, Andhra Pradesh
14	Prof. Amol Gokhale	Indian Institute of Technology Bombay	Mr. S N Suprabhat	Mahatma Gandhi Institute of Technology, Hyderabad
15	Prof. SV Kulkarni	Indian Institute of Technology Bombay	Ms. Navyashree Shetty	VJTI, Mumbai
16			Mr. Pushkar NA	Indian Institute of Technology Kharagpur
17	Prof. Tammana Jayakumar	Defence Metallurgical Research Laboratory, Hyderabad	Mr. Murali Krishna Yenneti	National Institute of Technology, Karnataka
18			Mr. Naga Durga Sairam Veditreswarapu	SRKR Engineering College, Bhimavaram
19	Prof. Pradip Dutta	Indian Institute of Science, Bangalore	Mr. Raghvendra Dheeraj Peddinti	Indian Institute of Technology, Bhubaneswar

20	Prof. Suman Chakraborty	Indian Institute of Technology Kharagpur	Mr. Abhranil Guha Thakurta	Jadavpur University, Kolkata
21			Mr. Souvik Ghosh	Indian Institute of Engineering Science and Technology Shibpur
22	Prof. Vinay Gupta	Indian Institute of Technology Kanpur	Ms. Amrita Bhattacharjee	Jadavpur University, Kolkata
23	Dr. Vikas Kumar	Ex-Defence Metallurgical Research Laboratory, Hyderabad	Ms. Tailam Sasi Kala	RGUKT-IIIT NUZVID, Andhra Pradesh
24			Ms. E. Anjali Priya	Rajiv Gandhi University of Knowledge Technologies, Basar
25	Dr. G. Madhusudan Reddy	Defence Metallurgical Research Laboratory, Hyderabad	Mr. Gudavalli Revanth Sai Krishna	National Institute of Technology Andhra Pradesh
26			Ms. Amrutha PH S LR	Mahatma Gandhi Institute of Technology, Hyderabad
27	Prof. K. J. Vinoy	Indian Institute of Science, Bangalore	Ms. Akurati Meghana	University College of Engineering, Osmania University, Hyderabad
28	Dr. Sukumar Mishra	Indian Institute of Technology Delhi	Mr. Sudhansh Shekhar Singh	National Institute of Technology, Surathkal
29	Prof. Santosh Kumar Gupta	UPES, Dehradun	Ms. Gauri A Panday	Shiv Nadar University, Noida
30	Dr. Samir V Kamat	Defence Metallurgical Research Laboratory, Hyderabad	Ms. Cholleti Prathyusha	Rajiv Gandhi University of Knowledge Technologies, Basar
31			Mr. N Sai Sri	Mahatma Gandhi Institute of Technology, Hyderabad

32	Prof. Rahul Mitra	Indian Institute of Technology Kharagpur	Mr. Abhishek Jakhota	Mahatma Gandhi Institute of Technology, Hyderabad
33			Mr. Tanmay Garg	Indian Institute of Technology Bhubaneswar
34	Prof P K Dash	Siksha O Anusandhan University, Bhubaneswar	Mr. Abhishek Kumar Pandey	GIET University, Gunupur
35			Mr. Debasis Tripathy	Parala Maharaja Engineering College, Behrampur
36	Prof. R. Sarathi	Indian Institute of Technology Madras	Ms. Thirumagal V	SSN College of Engineering, Tamil Nadu
37	Prof. Saptarshi Basu	Indian Institute of Science, Bangalore	Mr. Aneek Chakraborty	Jadavpur University, Kolkata

INAE Forums

One of the important objectives of the Academy is to assist the Government from time to time in formulating policies on critical technical issues. For this purpose, five forums have been constituted – INAE Forum on Energy, INAE Forum on Technology, Foresight and Management, INAE Forum on Engineering Interventions for Disaster Mitigation, INAE Forum on Indian Landscape of Advanced Structural Materials and INAE Forum on Civil Infrastructure. These forums enable giving inputs to policy makers, institutes of higher learning & research, industries, etc.

INAE Forum on “Indian Landscape of Advanced Structural Materials”

Workshop on Future Landscape of Structural Materials in India (FLSMI)

The Workshop on Future Landscape of Structural Materials in India (FLSMI) was organized under the aegis of the INAE Forum on Indian Landscape of Advanced Structural Materials at Kolkata on December 7, 2019. A brief background on the subject is as follows: While manufacturing is a key component for sustainable economic growth of a nation, the success of manufacturing of structural goods or components heavily depend on designing, developing and exploiting the appropriate material. Materials for structural applications that offer a diverse range of mechanical properties are mostly a combination of several materials and are produced by multi-step manufacturing process. Moreover, the urge for improvement never ceases as both stringency of service condition and need for technological advancement continuously rise.

The seed was sown to initiate this initiative in April 2016, at an INAE Meeting, when it was decided that an authentic compendium will be published on Structural Materials in India under the aegis of the INAE Forum on “Indian Landscape of Advanced Structural Materials”. It took another year and a half to work out the strategy and design a structure for the proposed book, with the chapter headlines and the relevant experts earmarked. The objective was to review the existing capability and readiness of the country to synthesise, develop and utilise advanced structural materials for the country’s need.

The main structural materials identified for the study are advanced high strength steels, new generation aluminium alloys, Ti and Mg-based structural alloys, FRP composites and advanced ceramics. The concerned beneficiary sectors would be Defence, Aerospace, Railways, Power Generation and Automotive, all with a target of high strength, higher properties, longer service life and reliability. The stakeholder coverage however would include industry in each materials sector, industrial R&D, Government research laboratories, R&D laboratories of OEMs and academic institutes.

The genesis of the Forum is that INAE initiated a Technology Forum on "Indian Landscape of Advanced Structural Materials" in 2016 with Dr Debashish Bhattacharjee, VP, Tata Steel as the Convener of the Forum. The first meeting was held in Ahmedabad in Dec 2016, followed by two more in Kanpur in Jun 2017 and Kolkata in Nov 2018. Based on the deliberations in different fora at various levels and occasions spanning over the last three years, it is now planned to create an authentic report on the current status and future needs and trends in designing and developing advanced structural materials for various important industrial and strategic sectors of India. The collated review articles may be published as a peer reviewed compendium by a reputed publishing house. In this connection, INAE organized a one-day National Workshop in Kolkata on 7th Dec 2019 (Saturday) on "Future Landscape of Structural Materials in India (FLSMI)" in Hotel Pride

Plaza, New Town, Kolkata. The workshop was inaugurated by Dr Sanak Mishra, President, INAE. Day long deliberations comprised 12 oral presentations followed by extensive interaction for 20-30 min each (including 3 by skype) by experts who would eventually submit chapters devoted to specific themes and help INAE create a comprehensive technology forecast and policy roadmap document for the nation.

The areas under focus are structural materials and components for Railways, Aviation, Space technology, Automobiles, Defence, Thermal power and atomic energy power plants, Refractories, Structural glass, Bio-medical prosthesis / implants, Carbon/graphene-based structures and design, Light metals (aluminium / titanium / magnesium based structural alloys), FRP composites and advanced ceramics.



Dr Sanak Mishra, President, INAE delivering his address as the Chief Guest



Prof Indranil Manna, Vice- President, INAE delivering talk on high temperature materials

The outcome of the study will be a report that will clearly highlight the following:

- (i) Current Indian scenario on development of advanced structural materials
- (ii) Gap with the rest of the world both in terms of volume and in terms of research and development
- (iii) Suggested actions that can be taken in terms of encouragement in research in certain areas through focused funding calls, or encouragement of start-ups and SMEs through intellectual and Government R&D support.

The workshop featured very interesting talks by eminent speakers and was a grand success.

INAE Forum on “Civil Infrastructure”

Workshop on the Report entitled, “Urban Transportation: Challenges and Way Forward”

A Workshop on the Report entitled, “Urban Transportation: Challenges and Way Forward”, Prepared by the INAE Forum on Civil Infrastructure was held on 10 July 2019 at Metro Bhawan, New Delhi. The genesis of the event is highlighted as follows. The INAE Forum on Civil Infrastructure, set up in January, 2018, had planned to study three areas of great National concern – Traffic & Transportation, Housing, Water. A study was first taken up to assess the National status of Urban Transportation – the challenges being faced, and, the possible way forward to tackle these. A report on the study has been prepared by Prof. Mahesh Tandon, FNAE; Dr. Mangu Singh, FNAE; Prof. N. Raghavan, FNAE; Prof. P.K. Sikdar, FNAE; Prof. Prem Krishna, FNAE and, Dr. Satish Chandra, all of whom have experience of working in the subject area. The workshop was held to discuss the report with, as wide a representation as possible from amongst the stakeholders, in order

to get their views/suggestions, before finalising the same. A copy of the Executive Summary was made available to the participants prior to the workshop.

Dr. Mangu Singh, FNAE, MD DMRC, kindly provided the support base for organising the workshop, and, it was held at the Metro Bhawan on July 10, 2019. Dr. V.K. Saraswat, FNAE, Member, Niti Aayog, kindly graced the inaugural session as the Chief Guest, and, Dr. Sanak Mishra, President INAE spared his valuable time to preside over it. Prof Prem Krishna, Chairman of the Forum, made a presentation on the Background and Salient Aspects of the Report. The session was well attended.



*L to R: Prof Prem Krishna, Dr VK Saraswat
Dr Sanak Mishra and Dr Pradip*



Dr VK Saraswat being felicitated by Dr Mangu Singh

There were two Technical sessions, at which features of the report were presented and discussed. In the first session, chaired by Prof. S.S. Chakraborty, a presentation on *Organisational and Policy Issues* was made by Dr. Mangu Singh, and, Prof. Tandon, FNAE, presented his views on *'Infrastructure - Engineering Issues'*. The post lunch technical session, was chaired by Mr. Rakesh Chopra, former Member Engineering of the Indian Railways. Presentations were made by Dr. Satish Chandra, Director, Central Road Research Institute (CRRI), on *Multi-Modal Transport*, and, by Dr. Sikdar, FNAE on *ITS (Intelligent Transportation System)*. Both sessions had very meaningful discussions. Valuable comments were made by the President INAE at the closing session. The purpose of the Workshop was well served and the inputs received will help to finalise the Report and take it forward.



*Dr Sanak Mishra, President, INAE being
felicitated by Dr Mangu Singh*



Audience at the workshop

INAE Forum on Civil Infrastructure

Progress of Work

The forum was formed to address the subject area of Infrastructure, to cover specifically the issues of Traffic & Transportation, Housing and Water. The main objective of the forum is to create reports from its study to recommend needed actions, related to, Policy Initiatives, Engineering Development/Research, Education, and suggesting the Way Forward. To begin with the area of Traffic & Transportation was addressed. A draft report entitled, “Urban Transportation: Challenges and Way Forward” based on the study, authored by Profs. Prem Krishna, Mahesh C. Tandon, P. K. Sikdar, Dr. Mangu Singh, Prof N. Raghavan, and, Prof Satish Chandra, Director CRRI, was presented for Brainstorming at a workshop held in July 2019. A brief on the deliberations of the workshop is given below:

As wide a representation as possible from amongst the stakeholders, was invited to the Workshop, in order to get their views/ suggestions, before finalising the same. A copy of the Executive Summary was made available to near about 40 participants prior to the workshop. Dr. Mangu Singh, FNAE, MD DMRC, kindly provided the support base for organising the workshop, and, it was held at the Metro Bhawan New Delhi. Dr. V. K. Saraswat, FNAE, member Niti Aayog, kindly graced the inaugural session as the Chief Guest, and Dr. Sanak Mishra, President INAE spared his valuable time to preside over it. Also present was Dr. Pradip, Vice President INAE. Dr. Prem Krishna, Chairman of the INAE Forum on Civil Infrastructure, made a presentation on the Background and Salient Aspects of the Report. The session was well attended. There were two technical sessions at which features of the report were presented and discussed. In the first session, chaired by Prof. S.S. Chakraborty, FNAE, a presentation on Organisational and Policy Issues was made by Dr. Mangu Singh, and, Prof. Tandon, FNAE, presented his views on ‘Infrastructure Engineering Issues’. The post lunch technical session, was chaired by Mr. Rakesh Chopra, former Member Engineering of the Indian Railways. Presentations were made by Dr. Satish Chandra, Director, Central Road Research Institute (CRRI), on Multi-Modal Transport, and, by Dr. Sikdar, FNAE on ITS (Intelligent Transportation System). Both sessions had very meaningful discussions. Valuable comments were made by the President INAE at the closing session. The purpose of the Workshop was well served and the inputs received helped to finalise the Report and take it forward.

Taking into account the ideas emerging from the workshop, the report was finalised and a hardbound printed version was released at the Annual Convention of the INAE at Jaipur in December, 2019. The recommendations for future action made in the report were grouped into four broad heads, namely, Organisational issues, Policy issues, Intelligent Transportation Systems, and, Engineering issues for Infrastructure.

The way forward as given in the report is as under.

1. An all-India cadre should be set up consisting of Traffic & Transportation personnel, including ITS experts in various fields (planning, IT, utilities, mechanical systems, etc.) for faster and more efficient delivery.
2. Considering the vital importance of metro rail development for easing out the urban traffic problems, it is imperative that this is provided with greater independence rather than being encumbered by the norms, practices and controls of the conventional railway systems.
3. National-level policies, to drive the multi – modal transport environment, will have to be framed for, promoting and implementing expeditiously in a planned manner, integrated

Public transportation systems such as metros and BRT, with special provisions for NMT (bicycles and pedestrians etc.) for various urban centres.

4. A policy be framed to enable the setting up of a National database of all motorised vehicles covering smart number plates and all driving licenses adopting smart card driving licenses, etc., and, real time traffic accident data capture and management.
5. Automation to be introduced into Toll Collection, Traffic Control Systems including detection of traffic offences and issue of challans, besides the development of a City Traffic App for multi-modal transport system in a city, giving map-based information for transit from point A to point B across all available systems.
6. IRC codes should permit necessary deviations in geometrics and loading standards to be applied judiciously for urban situations, which call for it.
7. In order to facilitate appropriate planning of infrastructure for Urban Transportation, it is imperative that the space in cities, both above and below ground, is surveyed and accurately mapped in the digital mode, to be available to planners and the engineering organisations.
8. Implementation and functioning of Unified Metropolitan Transport Authority (UMTA) and Urban Transport Fund (UTF) and integration in urban transport development. Furthermore, it is imperative that the Government of India consider for legislation in the form of the Urban Transport Act to strengthen UMTA and its implementation in the states.
9. A nationwide drive to improve safety on the road has to be taken up in a comprehensive manner, involving all the stakeholders, through appropriate media campaigns, etc as the safety statistics are very alarming and getting worse day by day.

The report is under distribution by the INAE, and, effort is on such that the study can reach those concerned with the subject area within the Government as well as outside.

Further, as per the mandate of the Forum a study has been undertaken to address the subject of Housing. For this purpose, the membership of the Forum was reorganised such that it is more sharply focussed on the subject area of Housing. Members added are, Dr. S. K. Bhattacharyya, FNAE, Dr. S. K. Agarwal, Executive Director, BMTPC, Mr. K. Senou, Head Precast Initiatives, L&T, and, Mr. Sanjay Pant, Director Civil Engineering, Bureau of Indian Standards. The Forum has so far had four meetings, and, there is good understanding of issues and their dimensions. Depending upon how the situation due to the COVID – 19 shapes up, the report should be completed by June/July 2020.

INAE Forum on Engineering Interventions for Disaster Mitigation

The Forum is in its seventh year of action, since its establishment by INAE on August 8, 2013 during which it has delivered a number of Actionable Recommendations from time to time, for nation-wide implementation. The follow-up of the recommendations has therefore been an integral part of every annual report. During the period under report, substantial progress has been achieved over three other major agenda items: (1) Apropos its reconstitution-Revamp and bolster Forum's ongoing programme in tune with the emerging areas of national concern (2) Pro-actively, take a major initiative in one of the top priority emerging areas aimed at actionable recommendations and

(3) Continue to pro-actively engage with the government and private sector institutions to respond to emerging national concerns with science and technology and innovation based engineering interventions.

Of the many actionable recommendations¹ made by the Forum, the good news is that the Government of India, Ministry of Mines Committee on Establishment of Expenditure, has recently issued a Memo on Establishment of an autonomous “Centre for Landslide Research Studies and Management (CLRSM)” at Dehradun, in the state of Uttarakhand. It is a matter of great satisfaction because, but for the intensive INAE follow-up, direct interaction with NDMA, related completed Medium Term Research Study and Roundtable meetings conducted during the preceding years, the national level consensus would not have been possible. The Forum had recommended an empowered, autonomous Centre to “serve as a premier geo-hazard centre with state-of-the-art facilities, which would eventually grow into a national centre of excellence”. The other good news is that, as suggested by INAE, “the CLRSM will be fully autonomous in its functioning, similar to that of a national laboratory of the Council of Scientific and Industrial Research with full operational freedom and an independent budget”.

Ever since its establishment, the Forum had emphasized- both the importance and urgency of - scientific documentation of disasters aiming at a game plan to plough back the very same lessons in reshaping future engineering interventions. Keeping that end in view, the Forum had created a pace setting example by scientific study, documentation and publication of the Monograph on Malpa Landslide tragedies. It was done with fullest involvement of Member NDMA, Executive Director NIDM and other national level institutions and experts. The satisfaction came when the recommendation appeared as point 9 of the 10-point agenda presented by the Prime Minister of India at the inaugural of the 7th Asian Ministerial Conference, stating that “No opportunity to learn from disasters should be wasted.” Encouraged by this call, the Forum may consider delivering yet another monograph of scientific documentation based on its completed research study on Malingaon landslide disaster.

Establishment of Disaster Mitigation Fund (DMF) has been on the active national agenda since 2005. Because of its urgency and importance, the Forum participated intensively in the ensuing national debate. The resulting paper with advocacy on DMF was formally presented by the Chairman of the Forum at the meeting of the National Advisory Committee of the NDMA. The good news on this front is that, as per the latest news report, the XV Finance Commission (2020-2025) has already taken many significant decisions in this regard.

The recent reconstitution of the Forum has opened up a fresh set of opportunities for the Forum to think beyond the ideas projected in the earlier backgrounder. The discussion on new possibilities, held at the first two meetings of the newly constituted Forum, has so far helped in picking one newly emerging area of topmost Priority; namely; Valorization of Industrial Waste for Hazard Mitigation. Based on nation-wide consultations -the Forum’s proposal for hosting a Round Table Meeting is currently in the stage of implementation. Coordinated by Dr D.N. Singh, the details of the RTM were finalized and the event was scheduled for Friday the 20th March 2020. It had to be rescheduled because of the Covid-19 lock down.

The Forum is well on its way to pick two or more areas out of the shortlist prepared through discussions held so far. It also proposes to continue discussion on multi-hazard disaster resilience

¹ (Ref: INAE Proceedings Volume 1 and Current Science, Volume 109, No5 of 10 September 2015).

driven by the head winds of challenges in dealing with cascading and concatenation of disasters such as landslides, earthquakes and floods.

INAE Forum on Energy

Engineering Focus for Future Development in India

India-Future Growth

In India today, the prime need is a higher and more sophisticated technology to meet the needs of the poorest sections of our society. In moving towards that goal, the Academy must keep in mind the basic aim of poverty alleviation as a fundamental objective and act as a forum of consolidating all indigenous engineering efforts. The major task of the Academy is to chalk out the future course of Indian engineering using interdisciplinary advantages and the vast and diverse experience that its Fellows have in India and abroad. The country expects from Fellows of the Academy to demonstrate that India can be innovative, that India can show imagination, and can orient science and technology to the three basic directions – of indigenous development of imported technologies, of indigenous generation of new technologies and of moving to the frontiers to put Indian science and technology at forefront in the world. The Academy's duty will be to become an instrument for attaining technological and scientific self-reliance and try to bridge the gap between what is achievable and what India must achieve.

In keeping with this background, the Energy Forum has initiated an Academy-wide discussion on what the Academy considers to be the 'future of engineering', and what would be the 'corresponding engineering education' to meet the development challenges of the country. In doing so, we recall the national and government commitment to sustainable development, and consequently on the need for the Academy to focus on national and global actions to attain sustainable development.

It is necessary to first identify areas of development that are crucial for socio-economic growth of the country. While considering the future focus areas and subsequently the engineering education to match those requirements, it is also necessary to consider whether we have proposed engineering education in keeping with the technological changes. One example can be considered that whereas most of the control systems have now moved from pneumatic and mechanical to electronic based systems, the engineering curriculum and text books are still carrying details of pneumatic control systems.

As a starting point, the Forum suggested the following focus areas of development in the country:

1. High speed freight movement
2. Connectivity through highways and other transportation systems
3. Development of cities – impact of smart cities
4. Integration of Automation and Artificial Intelligence (including control systems) in industry and in infrastructure.
5. Robotics in manufacturing and service sectors
6. Decarbonization in major sectors like cement, steel, and civil aviation.

The Energy Forum requested other Fora of the Academy for their inputs and consideration for joining the study. In this regard, the 'Forum on Technology Foresight and Management' took up the idea, and after detailed discussion has approved joining in this Study.

Next Steps

The Energy Forum and the Technology Foresight and Management Forum are now approaching the Academy Steering Committee to initiate this as an Academy-wide study, under the Energy Forum, focusing on these sub-sectors and identifying the development requirements by the year 2030, and the requirement of matching engineering ecosystem, including educational systems and processes. In the area of engineering education, there is a need to identify and develop an approach to support knowledge creation and dissemination through engineering education at all levels; and at the same time, skills development at all levels. Knowledge and skill sets have to be developed for ensuring achievement of national goals.

The Academy may wish to initiate a national discussion on the impact of connectivity, globalization, digitization, and artificial intelligence on work, skills, incomes, and prosperity. Whereas on one hand wealth creation at the top will be the first priority for the business and industry, India will still have to consider as to how poor people can be pushed into what is normally termed as a middle class. The idea here is to eradicate poverty and pull as large a number of persons from the poverty areas into the next stage of middle income group.

It will also be extremely necessary to focus on industry so as to see if and how manufacturing companies could operate like tech companies, such as the creation of cross-functional platform teams in order to stay ahead of digital disruption. This would need action to create new work culture and bring around operational changes.

Start-ups, micro and small industry sector, in India as in the rest of the world, will also play an important role in global economic development. Can the engineering education and skills development programmes be so oriented that sufficient space in terms of knowledge and skill is created for upgrading them from start-up level to the major industries?

The Proposal for the Study to be conducted under the Energy Forum will now be submitted to the Steering Committee for their support.

INAE Forum on “Technology Foresight and Management for Addressing National Challenges”

INAE Forum on Technology Foresight and Management for addressing National Challenges was constituted in 2012 under the Chairmanship of Mr. V.K. Agarwal, Formerly Chairman Railway Board & Ex-officio Principal Secretary to Govt. of India & Formerly Director Steel Authority of India and Indian Oil Corporation with Dr. Y.P. Anand, Formerly Chairman Railway Board & Ex-Officio Principal Secretary, Govt. of India; Prof. Prem Vrat, Vice-Chancellor and Professor of Eminence, ITM University, Gurgaon & Formerly Vice-Chancellor UP Technical University; Dr. C.R. Prasad, CMD, Everest Power Pvt. Ltd., New Delhi & Formerly CMD, GAIL; Mr. Anil Kumar Anand, Director Technical, Microtrol Sterilisation Services, Mumbai & Formerly Director (Reactor Projects Group), BARC; Mr. Pradeep Chaturvedi, Vice President, World Environment Foundation & Formerly Regional Representative, Centre for Application of Solar Energy, UNIDO (joined later); Mr. Kishore Pal Singh, Formerly Managing Director RITES and Managing Director, Tata Projects Ltd.; Mr. Suresh Chandra Gupta, Formerly Member Electrical, Railway Board & Ex-officio Secretary to Govt of India; Mr. Vinoo Narain Mathur, Formerly Member Traffic Railway Board & Ex-Officio Secretary to Govt. of India; and Mr. Arun Kumar Gupta, Formerly Director Oil India Ltd. and Editor, RITES Journal as the Members of the Forum.

The mandate of the Forum is to evolve solutions keeping in view the issues of sustainable development, poverty reduction, and climate change in focus and suggest appropriate technologies accordingly. Further, suitable Engineering Management techniques will be employed to find cost effective and optimal solutions. Domain of National Challenges is very wide and also keeps on changing from time to time. This Forum would selectively address the following mentioned domains as a broad guide (a) Food Production and Utilisation and Conservation of Water (b) Energy Generation and Utilities (c) Manufacturing Technologies (d) Mass Transit Systems and (e) Building and Construction Technologies.

The First Report of the Forum was published in 2014 which covered the areas pertaining to Waste Management, Water – Meeting the Future Challenges, and Transport – Making it Greener. The Second Report of the Forum was published during 2016 which covered the aspects of Agriculture – Waste Reduction and its use; Energy – Major Thrust on Solar; and Mass Transit Systems. The Third Report of the Forum was published in 2018 which addressed pertinent issues and concerns regarding Rural Urban Continuum and development of High-Speed Rail in the country.

After the release of three reports, the Forum decided to bring out the Fourth Report covering three broad areas viz. (a) Issues of Environment / Climate Change / Sustainability (b) Rail-based Infrastructure Urgently Needs Four Major Interventions at the Level of Government of India (c) Improving the Operating Ratio of Indian Railways – A Way Forward. In order to cover the wide spectrum of the pertinent issues, Shri Keshav Chandra, Former Member Mechanical Railway Board & Ex-Officio Secretary to the Govt. of India and Shri A. P. Mishra, Former Member Engineering Railway Board and Ex-Officio Secretary to the Govt. of India were included as Members of the Forum especially with a view to cover the emerging challenges and to strengthen the Forum for handling the current issue of ‘Boost to Rail in MSME Sector’. The Fourth Report of the Forum has been prepared and is under publishing which will be shortly available as INAE Publications on INAE website.

The Forum is currently examining the following:

1. “Logistics”
2. “Municipal Solid Waste Management”
3. “Energy Sector with special reference to Solar and Coal Power”
4. “Engineering Focus for Future Development in India”
5. “Boost to Rail in MSME Sector”

INAE “Satish Dhawan Chair(s) of Engineering Eminence”

INAE Satish Dhawan Chair of Engineering Eminence was instituted with the objective of enhancing the visibility of the Academy in the policy domain and establishing social connect. Eminent engineers who have contributed to some aspect of nation building are chosen for this esteemed position. The objective of the Chair is to utilize their competence to facilitate future growth of the nation in the engineering domain. The Satish Dhawan Chairs were conferred earlier on Dr. K Kasturirangan, FNAE, (Formerly Chairman, Space Commission and Secretary, Department of Space, Bangalore; Formerly Director, National Institute of Advanced Studies, Bangalore and Formerly Member (Science), Planning Commission, New Delhi) and Dr. Anil Kakodkar, FNAE, (Formerly Director, BARC, Mumbai; Formerly Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy, Mumbai).

In the year 2017, INAE Satish Dhawan Chair of Engineering Eminence was conferred on Dr Kota Harinarayana, FNAE, formerly Programme Director, Aeronautical Development Agency (ADA) Bangalore who was associated with NAL, Bangalore for necessary institutional support. The task undertaken under the aegis of the Chair was on preparing the policy document on “Aircraft for Regional Connectivity”. Based on his contributions and progress, Dr Kota Harinarayana was granted extension of the tenure of his association as Satish Dhawan Chair at NAL Bangalore; for a period of one more year upto end December 2018, in order to facilitate the completion of the task currently under progress and finalize the report.

In the year 2019, the INAE Satish Dhawan Chair of Engineering Eminence was conferred on Dr PS Goel, Honorary Distinguished Professor, ISRO Hqrs. and Raja Ramanna Chair Visiting Professor and Formerly Secretary, Ministry of Earth Sciences and Chairman, Earth Commission; and Director, ISRO Satellite Centre, Bangalore; Formerly Chairman, Recruitment and Assessment Centre, DRDO, Ministry of Defence, Govt. of India Delhi and Formerly Prof. M.G.K Menon DRDO Chair. Dr PS Goel was conferred the Satish Dhawan Chair in recognition of his outstanding contributions to the Indian Space Programme as well as leadership role in the growth of the engineering profession in the country. He was associated with National institute of Advanced studies (NIAS), Bangalore for institutional support to carry out work under the aegis of the subject chair. Dr PS Goel has undertaken multi focused activities under the aegis of the subject chair which include:

- Editing a book “Climate Change and the White World”, to be published by Springer. Editors: Dr. P.S. Goel, Dr. Rasiok Ravindra and Dr. Sulagna Chattopadhyay.
- Writing of a book “Making of a Satellite Centre” which will bring the history of development of Satellite Technology and Evolution of Satellite Centre (Earlier ISRO Satellite Centre (ISAC) and now UR Rao Satellite Centre (URSC)).
- Keeping Track of Advanced Technologies for the common man, for which he has been closely coordinating with labs of CSIR, DST, MoES and NIF. Keeping Track of Advances in Advance Technologies particularly in Aerospace and alerting respective labs of CSIR (NAL for example) and ISRO.

Dr PS Goel has since been granted one year extension of tenure w.e.f January 1, 2020 as INAE Satish Dhawan Chair in order to complete the task undertaken under the aegis of the subject chair.

Engineering Excellence Awards

Life Time Contribution Award in Engineering 2019

This award is given to an eminent Indian citizen who has made most distinguished contributions in the field of Engineering / Engineering Research / Technology, which have brought prestige to the nation and regarded as landmarks of technological development of the country.

During the year 2019, the Life Time Contribution Award in Engineering was conferred on:

Prof. ES Subba Rao, Formerly Professor, IIT Kanpur; Director and then Chief Consulting Advisor, Tata Research Development & Design Center, Pune

Prof. ES Subba Rao was conferred the award in recognition of his pioneering contributions to ferroelectrics and zirconia ceramics and leadership in nurturing two world class institutions – IIT Kanpur (higher education) and TRDDC (industrial research).

Mr. AS Kiran Kumar, Formerly Director, Space Application Centre (SAC), Ahmedabad (Gujarat); Former Chairman, Space Commission, Chairman, ISRO and Secretary, Dept of Space, Govt. of India. Mr. AS Kiran Kumar was conferred the award in recognition of his pioneering contributions to the development and application of space science and technology for national development, space science research and planetary exploration.

Prof. Jai Krishna and Prof. SN Mitra Memorial Award 2019

These awards are given to an eminent engineer, engineer-scientist or a technologist for one or more of the following:

- (a) Academic and scholarly achievements in any discipline of technology
- (b) Outstanding research in engineering and technology and application thereof.
- (c) Outstanding contributions in the management of education and research in engineering
- (d) Outstanding achievements and contributions in the Indian industry, engineering services or engineering projects

Prof Jai Krishna Memorial Award is given from among the disciplines of Engineering Section I (Civil Engineering), Engineering Section III (Mechanical Engineering), Engineering Section IV (Chemical Engineering), Engineering Section VII (Aerospace Engineering) and Engineering Section VIII (Mining, Metallurgical and Materials Engineering).

Prof S N Mitra Memorial Award is given from among the disciplines of Engineering Section II (Computer Engineering and Information Technology), Engineering Section V (Electrical Engineering), Engineering Section VI (Electronics & Communication Engineering), Engineering Section IX (Energy Engineering) and Engineering Section X (Interdisciplinary and Special Engineering Fields and Leadership in Academia, R&D and Industry)

During the year 2019, Prof Jai Krishna and Professor SN Mitral Memorial Awards were conferred on:

Prof Jai Krishna Memorial Awardee

Prof. KT Jacob, Emeritus Professor, Department of Materials Engineering, Indian Institute of Science, Bangalore was conferred the Prof Jai Krishna Memorial Award 2019 in recognition of his outstanding contributions to pathbreaking research and promotion of education and in the fields of Metallurgy and Materials Science in the country.

Professor SN Mitra Memorial Awardee

Prof. RK Shevgaonkar, Vice Chancellor and Professor of Eminence in School of Engineering and Applied Sciences, Bennett University, Greater Noida was conferred the Prof SN Mitra Memorial Award 2019 in recognition of his outstanding contributions for providing dynamic leadership to Engineering Education in the country and outstanding research contributions in the areas of Radio Astronomy, Fibre Optic Communication and Antennas.

INAE Outstanding Teachers Award 2019

The Academy has instituted the “Outstanding Engineering Teachers Award” in the year 2013 to honour INAE Fellows who have excelled in the field of teaching in Indian colleges, universities, and institutions, and have provided guidance and inspired students to take up careers in Engineering and Technology. Two such awards are given per year with one award in each group as under.

Group-1 - covering Engineering Section I (Civil Engineering), Engineering Section III (Mechanical Engineering), Engineering Section IV (Chemical Engineering), Engineering Section VII (Aerospace Engineering) and Engineering Section VIII (Mining, Metallurgical and Materials Engineering).

Group-2 - covering Engineering Section II (Computer Engineering and Information Technology), Engineering Section V (Electrical Engineering), Engineering Section VI (Electronics & Communication Engineering), Engineering Section IX (Energy Engineering) and Engineering Section X (Interdisciplinary and Special Engineering Fields and Leadership in Academia, R&D and Industry).

During the year 2019, INAE Outstanding Teachers Award was conferred on :

Prof. BS Murty, Director, IIT Hyderabad & Institute Professor and Girija & R. Muralidharan Chair Professor IIT Madras, JC Bose National Fellow was conferred the Outstanding Teachers Award in recognition of his outstanding teaching; motivating research scholars to carry out high quality of research and his research interests in high entropy alloys, nanocrystalline materials, bulk metallic glasses and in-situ composites.

INAE Young Engineer Awards 2019

The Academy instituted INAE Young Engineer Awards in 1996, to recognize excellence in design and technology transfer, innovative development and engineering research. The scheme has attracted nominations of bright young talent in the country and has become a prestigious national award since then. So far, 243 young engineers have been conferred this award and their early recognition has encouraged the best upcoming talent to make innovative engineering and technological contributions for our national development. The nominations for INAE Young Engineer Award for the year 2019 were sought from INAE Fellowship, Engineering institutions, R&D Labs. Out of 137 nominations, 50 were shortlisted by the Sectional Committees. The shortlisted candidates gave presentation of their work before the Selection Committee on August 26, 2019 at New Delhi.

The following fifteen candidates were selected and conferred INAE Young Engineer Award 2019.

- 1 Dr. Sandip Chakraborty, Indian Institute of Technology Kharagpur
(Computer Systems and Ubiquitous Computing)
- 2 Dr. Ravishankar Krishnaswamy, Microsoft Research India, Bangalore
(Design and analysis of algorithms for fundamental optimization problems)
- 3 Dr. Venugopal Arumuru, Indian Institute of Technology Bhubaneswar
(Fluid and Thermal Science)
- 4 Dr. Shyamprasad Karagadde, Indian Institute of Technology Bombay
(Solidification, Computational methods)
- 5 Dr. Bhushan Jayant Toley, Indian Institute of Science, Bangalore
(Microfluidics and Point-of-Care Diagnostics)
- 6 Dr. Rakesh Gupta, Tata Research Development & Design Centre, Pune
(Chemical Engineering, Multiscale Modelling and Nanotechnology)
- 7 Dr. R Sudharshan Kaarthik, Indian Institute of Space Science and Technology,
Thiruvananthapuram
(Electrical Power Systems for satellite, Electronic Systems, Renewable Energy)
- 8 Dr. Shyam Kamal, Indian Institute of Technology (Banaras Hindu University),
Varanasi
(Control Systems)
- 9 Dr. Ketan Rajawat, Indian Institute of Technology Kanpur
(Signal Processing in Networks)
- 10 Dr. VR Supradeepa, Indian Institute of Science, Bangalore
(Photonics and Lasers, Optical Communications and RF Photonics)
- 11 Mr. S Narendar, Defence Research and Development Laboratory, Hyderabad
(Thermo-Structural Testing and Wave Propagation in Nanostructures)
- 12 Mr. Sourabh Karmarkar, Liquid Propulsion Systems Centre, Thiruvanthapuram

(Design, development & analysis of liquid propulsion Stage Systems)

- 13 Dr. Uttam Kumar Ghorai, Ramakrishna Mission Vidyamandira, Howrah
(Materials Science & Engineering, Nanoscience & Nanotechnology)
- 14 Dr. Poulami Chakraborty, Bhabha Atomic Research Centre, Mumbai
(Liquid Metal Corrosion, Materials for Fusion & Advanced Nuclear Reactors)
- 15 Dr. Javed Nabibaksha Sheikh, Indian Institute of Technology Delhi
(Fibres & Textile Processing Technology)

INAE Young Entrepreneur Award 2019

The INAE Young Entrepreneur Award was instituted in the year 2017 to encourage and recognize innovation and entrepreneurship among Young Engineers. The engineering innovations/inventions/concepts that have been actually realized and implemented in industry either in new processes or products are given weightage.

The recipients of the award for the year 2019 are:

- 1 Mr. Suteerth Tripathi and Ms Shivani Gupta
Inochi Care Private Limited, New Delhi.
(Mechatronics Biotechnology and Biotechnology)
2. Mr. Prakhar Jain and Mr. Usama Ahmed Abbasi
MicroX Labs, Bangalore
(Chemical Engineering and Biomedical Engineering)

Innovative Student Projects Awards, 2019

The Academy has instituted Innovative Students Projects Award since 1998 to identify innovative and creative projects undertaken by the students at three levels B.E./ B. Tech, M.E/ M.Tech and PhD in engineering colleges. This Award recognizes innovative and creative projects and theses of students and research scholars in engineering institutions, since an early recognition of merit and talent can often mark the beginning of a brilliant career.

A total 136 nominations received (37 at Doctoral level; 37 at Master's level and 62 at Bachelor level) were examined by the Selection Committee. Out of these, 47 nominations (18 at Doctoral level; 10 at Master's level and 19 at Bachelor level) were shortlisted for presentations of their work before the Selection Committee. Ten candidates at Doctoral level, five at Master's level and ten at Bachelor level were selected by the Selection Committee for conferment of Innovative Student Projects Awards 2019 as given below.

Doctoral Level

- 1 Dr. Abir De, Indian Institute of Technology Kharagpur
(Modelling and Learning Influence in Social Networks)

- 2 Dr. Gaurav Goswami, Indraprastha Institute of Information Technology, Delhi
(Unravelling Representations for Face Recognition: from Handcrafted to Deep Learning)
- 3 Dr. Subham Swaroop Sahoo, Indian Institute of Technology Delhi
(Coordinated Control of DC Microgrids)
- 4 Dr. Shambhu Sau, Indian Institute of Technology Bombay
(Modular Converter Topologies with Reduced Transformer Rating and Capacitor Size for High-Power Regenerative Drives)
- 5 Dr. Surender Singh, Indian Institute of Technology Roorkee
(Utilization of RAP for Sustainable Concrete Pavements)
- 6 Dr. P Mastanaiah, Indian Institute of Technology Hyderabad
(Electron Beam Welding and Friction Stir Welding of Dissimilar Aluminium Alloys (AA2219 and AA5083))
- 7 Dr. Raosaheb Ananda Farakte, Institute of Chemical Technology, Mumbai
(Transport Phenomena in Multiphase Processes)
- 8 Dr. Lokamanya Chikmath, Jain University, Bangalore
(Non-linear Prognostic Analysis of Fastener Joints for Structural Health Monitoring Applications)
- 9 Dr. Atasi Dan, Indian Institute of Science, Bangalore
(Spectrally Selective Tandem Absorbers for Photothermal Conversion in High Temperature Solar Thermal Systems)
- 10 Dr. Nithin Chandran, Indian Institute of Technology Kharagpur
(Sequence and Structural Analysis of RNAs and their Interactions with Proteins)

Master's Level

- 1 Mr. Shivam Harshadkumar Ribadiya, Chandubhai S Patel Institute of Technology, CHARUSAT University, Gujarat
(Time Synchronization Protocol using NavIC)
- 2 Mr. Rishab Anand, Indian Institute of Technology Bombay
(Simplified Control Strategy for Inhomogeneous Series-Connected Battery Strings)
- 3 Mr. Vikram Kishore Bharti, Indian Institute of Technology Hyderabad
(Carbon-Sulfur Composites as High-Performance Cathode Materials for Lithium-Sulfur Batteries)
- 4 Ms. Neethu M, Indian Institute of Space Science and Technology, Thiruvananthapuram

(Actuator Interface Board Design for Momentum-biased Cubesat ADCS)

- 5 Ms. Ruchika Zalpouri, College of Agricultural Engineering and Technology, Punjab Agricultural University, Ludhiana
(Development and Evaluation of Refraction Based System for Dehydration of Potato)

Bachelor Level

- 1 Mr. Rohit Gandikota, Indian Institute of Space Science and Technology, Thiruvananthapuram
(Harnessing Deep Generative Models for Multimedia Data Hiding)
- 2 Ms. Sharmila Reddy Nangi, Indian Institute of Technology Kharagpur
(A Deep Generative Model for Code-Switched Text)
- 3 Ms. Archana CM, Indian Institute of Space Science and Technology, Thiruvananthapuram
(Dodecagonal Voltage Space Vector Based Direct Torque Control Scheme for Open-End Winding Induction Motor with a Single DC Source)
- 4 Ms. Sneha Gem Mathew, Indian Institute of Space Science and Technology, Thiruvananthapuram
(Low Complexity Cyclostationary Feature Detection using Sub-Nyquist Samples)
- 5 Mr. Bala Suraj Pedasingu, Indian Institute of Technology Tirupati
(ALTO: Adversarial Learning for Tracking Objects)
- 6 Mr. Suraj R, Indian Institute of Space Science and Technology, Thiruvananthapuram
(PS4Net: An Opportunistic Software Defined Networking Framework Over PSLV Stage 4)
- 7 Mr. V Charan, Mr. G Raja Vallabh and Ms. Y. Aishwarya Reddy
Mahatma Gandhi Institute of Technology, Hyderabad
(Path Correcting Multi-Purpose Agricultural Robot)
- 8 Mr. K Lakshman Vedavyas and Ms. L Pooja
Mahatma Gandhi Institute of Technology, Hyderabad
(Effect of Milling Time and Optimization of Poling Conditions on Piezoelectric Properties of BCZT Ceramics)
- 9 Mr. Gracio Joyal Lobo, Ms. Amrutha K, Mr. Dumpeti Vineeth and Mr. Mediseti Swami Charan
International Institute for Aerospace Engineering and Management, Jain University, Bangalore.
(Tubercles Effect on a Wing Performance for NACA 634-421 Aerofoil)
- 10 Mr. J Chandra Bose, Mr. G Mohankumar, Mr. A Muthushivashankar and Mr. CB Raambalagi
National Engineering College, Kovilpatti

(Experimental Study on Bio-Concrete by Partial Replacement of Fine Aggregate Using Medical Vial Waste)

Joint Schemes with AICTE

AICTE-INAE Distinguished Visiting Professorship Scheme

Industry-academia interactions have become essential as with the world over technological changes in recent times these can impart relevant knowledge to the students in the engineering institutions, that is sustainable in the changing conditions. While industries could gain by using the Academia's knowledge base to improve the industry's cost, quality and global competitive dimensions; thereby reducing dependence on foreign know-how and expenditure on internal R&D, academicians benefit by seeing their knowledge and expertise being fruitfully utilized practically and also by strengthening of curricula of educational programs being offered at engineering colleges/institutions. INAE together with All India Council for Technical Education (AICTE) launched "AICTE-INAE Distinguished Visiting Professorship Scheme" in 1999. Under this scheme, Industry experts are encouraged to give a few lectures in engineering institutions. This scheme has become popular among industry experts as well as engineering colleges.

Due to irregular disbursement of fund from AICTE the scheme was temporarily put on hold. To review the performance of the existing Distinguished Visiting Professors (DVPs) under the scheme and to deliberate on the fund required to continue with the scheme, the annual meeting of AICTE-INAE Distinguished Visiting Professorship Scheme Committee was scheduled on March 16, 2020.

As there was a sudden & rapid outbreak of Coronavirus (COVID-19), the meeting was postponed and approval on important points of the agenda was taken by circulation through email. Based on the regularity of lectures given by the Distinguished Visiting Professors in their respective associated AICTE approved engineering college(s), forty DVPs were given extension of tenure. Selection of new DVPs was withheld due to delay in release of AICTE fund. Subsequent to AICTE releasing the remaining projected funds for financial year 2019-20, a meeting of AICTE-INAE DVP Scheme Committee will be held to select new DVPs.

AICTE-INAE Teachers Research Fellowship

Indian National Academy of Engineering (INAE) launched AICTE-INAE Teachers Research Fellowship Scheme jointly with AICTE during 2013, for Engineering Teachers to pursue Doctoral Research in Central Laboratories under Council of Scientific and Industrial Research (CSIR)/ Defence Research and Development Organization (DRDO)/ Department of Space (DOS)/ Department of Atomic Energy (DAE). The Ph.D degree is awarded by AcSIR for CSIR, IIST for DoS, DIAT for DRDO and corresponding institution of concerned DAE lab.

To implement the scheme effectively, the AICTE-INAE Teachers Research Fellowship (TRF) Scheme Committee has been constituted with members from INAE Fellowship and reps from AICTE, INAE, CII, CSIR, DRDO, DOS and DAE.

The scheme this year, was promoted by AICTE through advertisement in print media and by sending mails to Principals of engineering colleges. Only two applications from eligible engineering teachers were received under the scheme during the current year. As the number of applications was only two, no meeting for shortlisting the candidates was held during February, 2020.

Lab Name	Number of candidates selected for academic year 2019-20
CSIR	1
DIAT	1
DOS	1
DAE	none

The labs have been contacted to get the vacancies available with them for Academic year 2020-21.

AICTE-INAE Travel Grant Scheme for Engineering Students

Indian National Academy of Engineering (INAE) launched AICTE-INAE Travel Grant Scheme for Engineering Students jointly with AICTE during 2013 to provide financial support to pre-final and final year Bachelors and Masters Level engineering students for presenting a research paper in an international scientific event (conference/seminar/symposium/workshop/exhibition etc.) in order to encourage engineering students to engage in research.

The scheme facilitates a student to travel abroad and take part in presenting his/her research work in International Platform by providing of 100% Registration Fee, 100% Visa fee, 50% of the actual Airfare for discounted /concessional air ticket, and local travel from the Engineering College/ Institution to the nearest airport and back. Maximum financial support per student towards registration, concessional travel expenditure and visa fees, is limited to Rs. 1 lakh.

AICTE-INAE Travel Grant (TG) Scheme Committee comprising of INAE Fellows from different Engineering Sections has been constituted to review the operation of the scheme regularly and select deserving candidates as per defined criteria.

The Scheme was promoted by AICTE through print media and by sending mails to Principals of AICTE approved Engineering colleges. There was an increase in number of valid applications received this year. Due to irregular release of fund, the scheme was temporarily on hold from October 2019 till December 2019. The scheme was resumed in January, 2020. Out of 108 applications received under the scheme during 2019-20, 65 students were selected.

The MoU of AICTE-INAE Travel Grant Scheme was renewed on November 22, 2019 for next three years with effect from June 21, 2019.

INAE Travel Grant Scheme for Engineering Students

Indian National Academy of Engineering (INAE) launched the INAE Travel Grant Scheme for Engineering Students during 2014 with the objective to facilitate engineering students to present papers abroad with the purpose of enhancing the quality of engineering education in the country. The objective of the scheme is to provide partial travel assistance and registration fees to third/fourth year B.E./B.Tech; first/second year M.E./M.Tech; or fourth/fifth year Integrated M.Tech Level engineering students from Institutions/Colleges other than AICTE approved Engineering Colleges such as IITs, IISc, NITs, IIITs and other engineering colleges/institutes/universities in order to encourage engineering students to engage in research.

The applicant should have an invitation for presenting a research paper which has been accepted in a conference /seminar /symposium /workshop abroad. Reimbursement of 100% Registration Fee, Visa Fee, 50% of the actual Airfare for discounted/concessional air tickets and actual fare not exceeding AC II Class train fare will be admissible for travel from the Technical Institution to the nearest airport and back. Maximum financial support per student towards registration, concessional travel expenditure and visa fees, is limited to Rs. 1 lakh.

A new Selection Committee comprising of INAE Fellows from different engineering sections has been constituted to review the operation of the scheme regularly, select deserving candidates, and revisit eligibility criteria for selection so that more students can avail of the scheme.

The Committee considered new courses in engineering which are being introduced by IITs, NITs and other autonomous Universities. The Committee decided that the applications from students of any degree with 4 years or 5 years of engineering studies will be accepted besides regular BTech/ MTech and Integrated MTech as per eligibility criteria.

During the year, 15 applications were received under the scheme and 8 students were selected.

Events organized by Local Chapters

INAE Kolkata Local Chapter

National Engineers Day Celebrations

INAE Kolkata Chapter celebrated National Engineers Day on September 18, 2019 at the Gurukul Campus of the Institute of Engineering and Management, Salt Lake Electronics Complex, Kolkata. On this occasion, Prof. Indranil Manna, Vice-President, INAE and Professor, Department of Metallurgical and Materials Engineering, Indian Institute of Technology Kharagpur delivered the “Engineers Day Lecture” on “Towards Academic Excellence and Technology Development”. In his thought-provoking talk, Prof. Manna addressed the ancient gurukul system of pursuing knowledge and several transformations with time and change of our society. He described the national initiative of Government of India called IMPacting Research INnovation and Technology (IMPRINT) and its goal of translational research through collaboration between academia and industry. At the end, he highlighted the various programs and initiatives taken by INAE. This motivational talk was well received by the audience and raised enthusiastic discussions among the participants.

Prof. Sankar K. Pal, FNAE, Distinguished Scientist and former Director, Indian Statistical Institute, Kolkata, addressed the audience and encouraged the young group of engineers to elevate their career with INAE. He also highlighted the vast opportunities and immense scope that INAE provides to every engineer. Prof. Bimalendu Bhusan Bhattacharya, FNAE, S.N. Bose National Centre for Basic Sciences, Kolkata also participated in the celebrations. Prof. A.K. Nayak, Principal, IEM formally welcomed the gathering and Prof. Debatosh Guha, FNAE, Secretary, INAE Kolkata Chapter conducted the proceedings of the meeting. The event was attended by more than 50 participants including INAE Fellows, researchers, graduate students, and young faculty members from various departments of several universities, institutes, and industries located in and around Kolkata.



Prof. Indranil Manna delivering the lecture



Prof. S K Pal addressing the audience



Audience present at the program



Prof. Debatosh Guha conducting the proceedings

INAE Kolkata Local Chapter Organizes Science Day Lecture 2020

Indian National Academy of Engineering (INAE) Kolkata Chapter celebrated National Science Day on 1st March 2020 at the National Institute of Technology Sikkim, Ravangla, Sikkim. Prof. Mahesh Chandra Govil, Director, NIT Sikkim delivered the Science Day Lecture at 4:30 PM in the Institute auditorium. He addressed the challenges and advances in the wide application of Internet of Things. That lecture was enthusiastically attended by of about 80 young scientists, students, and INAE Fellows. The talk triggered several questions among the students. Prof. Bhargab B. Bhattacharya, President, INAE Kolkata Chapter, presided over the function. Padma Shri Prof. Sankar K. Pal, INSA Distinguished Professor, DST-SERB National Science Chair, and former Director of Indian Statistical Institute graced the occasion and concluded the event by offering a memento to the speaker.



Prof. Mahesh Chandra Govil, Director, NIT Sikkim delivering INAE Science Day Lecture at NIT Sikkim, Ravangla



Prof. MC Govil (right) receiving the memento from Prof. Sankar K. Pal (middle) in presence of Prof. Bhargab B. Bhattacharyya (left).

INAE Workshop on “Recent Advances in Engineering Science and Technology” Organized by INAE Kolkata Local Chapter in association with NIT Sikkim

A one-week workshop on “Recent Advances in Engineering Science and Technology” was held at the National Institute of Technology (NIT) Sikkim, Ravangla, Sikkim during 1-5 March 2020. This event was jointly organized by INAE Kolkata Chapter and NIT Sikkim. The inaugural session in the morning of the first day of the workshop indicated a huge interest among the participants gathered from different engineering institutes such as North Eastern Regional Institute of Science and Technology, Sikkim Institute of Science and Technology, Sikkim Manipal Institute of Technology, along with the host institute- NIT Sikkim. About 90 participants attended the event. Prof. Mahesh

Chandra Govil, Director, NIT Sikkim extended maximum support for the workshop, within the limited facilities available in the purely hilly terrain of Sikkim and made this event possible. He presided over the inaugural function and heartily welcomed all the participants. Prof. Sankar K. Pal, INSA Distinguished Professor, DST-SERB National Science Chair, and former Director of Indian Statistical Institute delivered the inaugural address. Prof. Bhargab B. Bhattacharya represented INAE Kolkata Chapter as its present President and addressed the audience. Prof. Debatosh Guha, Secretary INAE Kolkata Chapter discussed the background of this workshop and read out the welcome message of the INAE President, Dr. Sanak Mishra. Dr. Surajit Kundu proposed the formal vote of thanks on behalf of the host institute.

Several state-of-the-art topics have been covered by several eminent speakers and educators which include: Prof. Sankar K. Pal, (*Granular Mining and Data Analytics*), Prof. Bhargab B. Bhattacharya (*Automating Biochemical Protocols with Microfluidic lab-on-chip*), Prof. Mahesh Chandra Govil (*Internet of Things*), Prof. Debatosh Guha (*New Generation Wireless Techniques*), Prof. Virendra Singh (*Computer Architecture in 21st Century*), Prof. Pragati Kumar (*Analog Signal Processing Circuits*), Prof. Mrinal Kanti Mandal (*Microwave Circuits and Systems*), Prof. S. K. Parui (*SIW Technology*), Dr. Ramesh Babu Battula (*Next Generation Communications*), Dr. Anindya Bose (*GNSS*) and Dr. Surajit Kundu (*Printed Antennas*). Along with the technical talks and tutorials, some specific hands-on-training were also arranged for the participants.

Participation certificates were given to all attendees in the valedictory session. The local organizers had gratefully acknowledged their collaboration with INAE Kolkata Chapter and also the technical cum financial support from the INAE, for organizing the workshop in a North-Eastern state of the country. The workshop was a great success and the participants re-iterated in their feedback that more such workshops be held in the future.



Inauguration of the Workshop



Participants at the Inaugural Session



Prof. Sankar K. Pal delivering his talk



Delegates felicitated by the organizers



*Prof. Bhargab B. Bhattacharya
Delivering his talk*



Group Photograph of Participants with the Delegates

INAE Pune Local Chapter and Pune Engineering Forum

With the objective of bringing together the Core engineering with Computer Science, INAE Pune Chapter organized an event on November 7, 2019 at College of Engineering, (COEP), Bhau Institute Auditorium. Theme of this event was: "Engineering Complex Adaptive systems with Digital Twins". The program comprised invited talks by eminent experts from industry. At the outset, Mr MV Kotwal, Chairman INAE Pune Chapter and Pune Engineering Forum, delivered the Welcome Address. Dr Pradip, Vice President INAE, gave a brief introduction to INAE to the august audience, while Mr Vinay Kulkarni, Secretary INAE Pune Chapter, introduced the theme along with the invited speakers. The invited talks were followed by interaction with the workshop participants which are highlighted as follows. Mr Vijay Talele, CEO Bhau Institute, provided a brief overview of Bhau Institute. Mr Ram Kulkarni, Secretary Pune Engineering Forum, proposed the Vote of Thanks. The interactions between the delegated continued post event over tea. The details of the invited talks are given below.

Talk #1: Experience sharing from automotive industry on Model based Systems Engineering by Shri Puran Parekh, iASys



Abstract: Automotive Industry involves very complex multi-domain engineering and a high level of innovation. Right from fundamental material science to advanced AI technology - everything has to work in harmony. Automotive industry has come a long way from pure mechanical engineering to sophisticated complex mechatronics. This necessitates the need for model-based systems-engineering (Digital Twin) approach to speed up the development process. The task gets more complex due to its multi-disciplinary nature. Need for a structured data management approach from different domains is key for creating Digital Twins of the physical world. A few examples in the vehicle powertrain area were used to explain the complexity and possible solutions.

Talk #2: Supporting dynamic adaptation of enterprise in the face of partial information and uncertainty by Dr Souvik Barat, TCS Research and Innovation



Abstract: Modern enterprises are large complex “system of systems” operating in a dynamic and uncertain environment to achieve their goals. To stay ahead of the competition and achieve moving business targets, these enterprises require continuous analysis, adaptation, transformation, and also design to operate in a new way. The state-of-the-practice to decide appropriate changes and design are primarily intuition based, which is significantly lacking the rigour and often results into ineffective solutions. Pure historical data-centric AI-driven approaches also fail to demonstrate expected precision as the existing data of most of the enterprise is often inadequate and frequently it becomes irrelevant in this dynamic world. The talk covered a model-based simulation-aided, evidence-backed approach to make enterprises adaptive. The approach hinges on the concept of Digital Twin – a set of relevant models that are amenable to analysis and simulation. The efficacy of this approach was clearly brought out using some real-life case studies.

Talk #3: Skin Digital Twin: A Computational Approach Towards Mimicking Nature by Dr Beena Rai, TCS Research and Innovation



Abstract: Human skin is one of the complex and versatile organs, responsible for various functions like preventing the body from excessive loss of water and attack of foreign pathogens. Besides these physiological functions, the importance of the skin aesthetics has been the focus of humankind since ages. Skin is one of the largest organs of human body (~1.5 – 2 sqm of surface area) anatomically being composed of three layers. The top-most layer, called epidermis, is responsible for skin’s health apart from providing it glow, youthfulness and texture. Epidermis is further divided into 5 sub-layers of which stratum corneum (SC) – the most external one, is responsible for skin’s barrier function. Dermis, located beneath epidermis is primarily made up of collagen and elastin and provides structural support and elasticity. The deepest layer named as hypodermis is composed of adipose tissues and provides the heat resistance. Both pharma and cosmetics industry have been leveraging skin for various businesses like transdermal delivery of drugs or skin care products. However, traditional route of design and development of these products has been laborious and time-consuming experimentations involving in-vitro and in-vivo methods. Needless to add, the process not only remains expensive but also presents a threat to the environment where millions of animals are sacrificed every year. Irony of the situation is that, in spite of these costly and unethical efforts, the success rate for viable products remains very low (10-30% only). Therefore, it is hardly a surprise that both these industries are looking for digital interventions which could substitute or eliminate animal testing. At TCS, we have developed a first principle based computational model of human skin which mimics physiological properties of skin. A multiscale modelling framework linking atomistic-molecular-mesoscale-

macroscale is employed to study molecular transport across the skin. The model thus developed has provided a base to develop an IT enabled platform (TCS Digital Skin Twin Platform) for the simulation-based design and development of pharma/cosmetics products. The concept of a skin digital twin was described and its utility in product design & testing was vividly illustrated using examples from the pharma and cosmetics industries.

Talk #4: A platform for integrated engineering of materials, products and manufacturing processes by Shri Sreedhar Reddy, TCS Research and Innovation



Abstract: Industry 4.0 and smart manufacturing are about taking advantage of digital technologies to achieve higher efficiencies in the manufacturing industry. At the heart of manufacturing lies product engineering and doing this right requires taking an integrated view on the design of materials, products and manufacturing processes. At the moment this is largely done in a “silo-ed” manner with a high degree of dependence on human expertise, leading to suboptimal outcomes. Integrated computational material engineering (ICME) is an emerging approach for integrated engineering of products, materials and manufacturing processes. It advocates a knowledge guided, data supported, simulation driven approach for “in-silico” exploration of the design space, thereby significantly reducing the dependence on human expertise and trial-and-error based experimentation cycles. However, this requires a technology platform that enables seamless integration of product design with process and materials design so that all three can be investigated, analyzed and optimized simultaneously to be able to obtain the right material for the right product to be manufactured in the right way. The platform should provide for seamless integration of multiple kinds of simulation models, tools, data sources and decision support systems. It should be capable of extracting and integrating knowledge from various sources and reasoning with it so as to be able to provide context-appropriate guidance to the designers during the design process. In this talk a platform called TCS-PREMAP being developed at TCS was described.

Indian National Academy of Engineering (INAE) Pune Local Chapter organised a Round Table interaction on “Role of Hydrogen in India’s Energy Strategy” on 15th February 2020 at Tata Consultancy Services (TCS), Pune

A Round Table Interaction of domain experts on "Role of Hydrogen in India's Energy Strategy" was organized by INAE Pune Local Chapter on February 15, 2020 at Pune. The meeting was attended by Dr Sanak Mishra, President, INAE; Dr PS Goel, Former President, INAE; Dr BN Suresh, Immediate Past - President, INAE and domain experts from INAE Fellowship and other expert invitees from Academia, R&D organizations and Industry. The meeting was organized with active support from Mr MV Kotwal, Chairman Pune Local Chapter and Dr Pradip, Vice-President, INAE. The invited experts shared insights on the current and future global situation about use of Hydrogen as an energy source; discussed the overall situation in India with respect to technologies, capabilities and affordability for Generation, Storage, Transportation and Usage of Hydrogen and concluded on the approach to be followed by INAE in forwarding recommendations to the Government.

A brief Background note on the pertinent issues related to Role of Hydrogen in India’s Energy Strategy which were addressed in the presentations and deliberations during the subject Round table interaction are summarized below:

Energy Strategy – Crucial in India’s growth

India's growth & sustainability are rooted in selecting the right strategic path, integrating renewable energy – Solar, Geo-thermal, Tidal, Biomass & Wind, with existing sources involving Hydro, Coal, Oil, Gas & Nuclear. Towards this, India will have to carve out its own strategy while considering the rapid developments taking place globally. This strategy will have to be necessarily transformative, to satisfy aspirations of millions of young Indians and for the country to play its rightful role in a sustainable global community.

The Direction: India's energy security by and large will have to depend on its own resources both renewable as well as non-renewable. This implies that energy sources like solar, wind, biomass will have to be seamlessly integrated with conventional, well-established sources. Simultaneously, the imperatives of reduction in GHGs and the carbon footprint must be factored in. Linkages need to be established also keeping in mind the necessary energy storage requirements. The current electricity transmission & distribution infrastructure will not be able to support the above needs. It is obvious that a clean and well-planned distributed energy system will always remain a vital component of India's energy strategy.

Demand side implications: Keeping in mind the demand side scenario for industrial, residential, commercial, rural & transport sectors, multiple options have been considered by several agencies and working groups. Apart from technological feasibility, the most important questions of financial viability and affordability have also been covered to some extent. As an example, the proposed switch from fossil-fueled vehicles to EVs, while bringing in significant benefits, poses challenges in terms of availability of suitable charging networks and strategically important access to basic raw materials if Lithium-based batteries are the primary mode for energy storage.

The moot question to be answered whether Hydrogen can play an important role in this energy strategy for India covers the above issues. In the interaction meeting the speakers shared insights on the current and future global situation about use of Hydrogen as an energy source and discussed the overall situation in India with respect to technologies, capabilities and affordability for Generation, Storage, Transportation & Usage of Hydrogen.

A draft report summarizing the deliberations has been prepared which is under finalization with suggestions from all participants. It is envisaged that subsequently, the recommendations will be summarized in the form of a White Paper containing all the pertinent issues related to Role of Hydrogen in India's Energy Strategy for submission to Prof. K VijayRaghavan, Principal Scientific Advisor (PSA) to the Govt. of India, as suggested.



Ongoing Deliberations during the meeting



Group Photograph of Delegates in the Round Table Interaction

INAE Bangalore Local Chapter

India-USA Lecture Series on Aging Aircraft Organized by Indian Institute of Science, Bangalore; INAE Bangalore Local Chapter and CSIR-NAL, Bangalore.

The India-USA Lecture Series on Aging Aircraft organized by Indian Institute of Science, Bangalore; INAE Bangalore Local Chapter and CSIR-National Aerospace Laboratories (CSIR-NAL), Bangalore was held on November 27-29, 2019 a Department of Aerospace Engineering, Indian Institute of Science, Bangalore. The events' Main Sponsors were India---USA Science and Technology Forum (ISSTF) and Office of Naval Research (ONR), USA. The event also received

gracious partial support from Institute of Mechanical Engineers (IMEchE), UK and Defence Research and Development Organization (DRDO). Prof. S. Gopalakrishnan from Department of Aerospace Engineering was the Coordinator from Indian Side and Prof. Lalita Udpa from The Michigan State University as its Coordinator from US Side. Dr S. G Sampath and Dr AR Upadhy were the course Directors from the US and Indian side respectively

The event featured six speakers from USA, nine from India and two from Canada and one from Italy. The list of speakers who delivered lectures in this Lecture Series are as follows. Speakers From USA: Dr Bill Nickerson, Office of Naval Research, USA; Dr S G Sampath, Former Scientist, FAA, USA and US Army; Prof. Lalita Udpa, Michigan State University, USA; Prof. Sankaran Mahadevan, Vanderbilt University, USA; Prof. Colin Drury, University of Buffalo, USA and Dr. Jayanth Kudva, NextGen Aeronautics, California, USA. The speakers from Canada and Europe were: Prof. Afzal Sulaiman, University of Victoria, Canada; Dr Prakash Patnaik, National Research Council, Canada and Mr Mariani Ugo, Leonardo Helicopters, Italy. Air Marshal Vibhas Panday, Indian Air Force and Dr R Sundar, Biss Research, Bangalore; Prof. Krishnan Balasubramaniam, IIT, Madras; Dr P D Mangalgi, Visiting Professor, IIT Kanpur; Dr K Vijayaraju, Aeronautical Development Agency, Bangalore; Mr Yogesh Kumar, Former Executive Director, HAL, Bangalore; Mr HRS Prasad, Center of Excellence in Aerospace, VTU, Bangalore; Dr Ramakanth Singh, DGCA, New Delhi and Mr Siddhartha Ghosh, Spice Jet, Gurgaon were the speakers from India

The Lecture series inauguration took place on November 27th 2019 at 9.0 am. The Inaugural Function included speeches by Dr Tessy Thomas, Distinguished Scientist and Director General of Aeronautics, DRDO, Mr G. Rajashekar, Additional Director General, Department of Civil Aviation, Government of India, Dr. S. G Sampath, Course Director of Lecture Series from USA, Prof. Lalita Udpa, Course Coordinator from USA, and Dr A R Upadhy, Course Director of Lecture Series from India. Prof. S. Gopalakrishnan, Course Coordinator from India proposed the Vote of Thanks.



IULSAA Inauguration: L---R; Dr Tessy Thomas, Mr Rajashekar, Prof. Lalita Udpa, Dr Sampath and Prof. S. Gopalakrishnan



Dr Tessy Thomas, FNAE addressing the gathering in the Inaugural function

The Inaugural Function was followed by two plenary talks, the first talk by Air Marshal Vibhas Pande, Director General (Aircrafts), Air Headquarters, New Delhi and the second by Dr Bill Nickerson, Office of Naval research---Global, USA. The talk by Air Marshal concentrated on Aging Issues in Air Fleet management, while the plenary talk by Dr Nickerson concentrated on the environmental issues such as corrosion on the aircraft aging.



Air Marshal Vibhas Pande, VSM, Director General (Aircraft), IAF delivering Plenary Talk *Dr Bill Nickerson from Office of Naval research, USA delivering Plenary talk*

The talks by various speakers spread over eight sessions. Each talk was of 45 minutes duration with 15 minutes allocated for discussion. The Lecture Session began by Dr S G Sampath giving an overview of the aging aircraft issues based on his own experience on FAA, USA. In all, there were 18 lectures, covering a wide spectrum of areas that included Fatigue behaviour, Corrosion behaviour, Aging Aircraft Engines, Aging Helicopters, Aging Wiring, Aging Avionics, New Material system insertion and Human factor issues and policy guidelines. The Lecture series also featured a lecture from regulator Directorate of Civil Aviation and also a lecture from a private airline Spice jet official. These two lectures in particular, addressed the aging issues faced by aircraft certification agencies and the commercial airlines, respectively.



Prof. Krishnan Balasubramaniam from IIT Madras delivering Lecture



Dr S G Sampath from FAA, USA delivering Lecture



Dr. Mariani Ugo from Leonardo Helicopters, Italy delivering Lecture



Dr Jayant Kudva from NextGen Aeronautics, USA delivering Lecture

At the end of the first day, a Cultural Program was held during which a Carnatic music concert was rendered by Prof. Sankaran Mahadevan, who also happened to be an expert in Uncertainty Quantification and was also a speaker in the Lecture Series.



Cultural Evening: Carnatic Music Concert given by Prof. Sankaran Mahadevan from Vanderbilt University USA

The response to this Lecture Series was tremendous. In all over 160 delegates from both Government and Private agencies registered for this lecture series out of which there were 25 student registrations. Students who attended the Lecture series were primarily from IISc, IIT Madras, IIT Kharagpur, NIT Calicut, and JNU, Hyderabad. There was substantial participation from Indian Airforce, who were also one of the stakeholders of this Lecture Series.



Air Marshal Vibhas Pande and his IAF team interacting with Dr AR Upadhyaya, the Course Director IULSAA



Delegates attending Lecture Series Inauguration Program

Delegates from both Government and private aerospace agencies attended this Lecture Series and the list gives the organizations that participated in this event are given below.

Government Organizations: (a) Aeronautical Development Agency (b) Center for Airborne Systems (c) CEMILAC (d) Hindustan Aeronautics Limited (e) National Aerospace Laboratories (f)

Department of Civil Aviation (g) R & D E (Engrs) and (g) Indian Air Force –Maintenance Command and Air Headquarters.

Private Aerospace and other Agencies: (a) Boeing Aircraft Company (b) Textron (c) Airbus Industries (d) Axis Cadets (e) Several NDT companies in Bangalore (f) GE Aviation (h) Rolls Royce.

Private Airline Companies: (a) Spice Jet (b) Air India and (c) Blue Dart Aviation

Several leading Aerospace Scientists and Engineers participated in this Lecture series, which included Dr Kota Harinarayana, Dr A R Upadhya, Mr Ashok Baweja, Prof. Dattaguru, Cmde C D Balaji to name a few.



Dr Kota Harinarayana, Former Program Director, ADA Chairing a Session



Mr Ashok Baweja, Former CMD, HAL and Chairman, IMechE India chairing a Session

On the evening of November 28, the Banquet dinner was arranged at Bangalore Golf Club which was attended by over 150 delegates. The Lecture Series ended on November 29, 2019 with a feedback session. The event was greatly appreciated by the delegates and there was a general agreement that India should have a separate Center for Aviation Safety Research and a draft proposal prepared by Dr Ramchand Former Director of CABS and Dr S.G Sampath was circulated to all the delegates. It was decided that a committee will be setup to finalize the details of this center and then talk to the Government for the funding details. At the end of the event, Prof. Gopalakrishnan summarized the critical aspects of different lectures delivered in this event and thanked all the volunteers who made the organization of this Lecture Series possible.

Meeting with the Hon'ble Deputy Chief Minister & Minister for IT, BT and S&T, Higher Education and Skill Development

As informed by Dr AR Upadhya, Hon. Secretary, INAE Bangalore Chapter, the initiative by Dr VK Aatre, Chairman, INAE Bangalore Chapter to engage with the State Govt of Karnataka led to a meeting of a small group of INAE Fellows led by Dr Aatre with the Hon'ble Deputy Chief Minister & Minister for IT, BT and S&T, Higher Education and Skill Development, Shri CN Ashwathnarayana on 14th February 2020. The DCM was briefed about INAE, the rich and diverse Technology & Engineering expertise and experience available with the FNAES, and how it could be utilised gainfully for finding solutions for some of the problems faced by the state. Subsequently a write up on INAE including a list of technical studies that the Academy has carried out so far , the

recommendations of which have been sent to the GoI, was sent to the DCM for favour of information.

Following this, the DCM's Office had asked INAE BC to nominate a Fellow each as a member of the following State Govt Bodies under the Dept of S&T:

- (i) Karnataka Knowledge Commission, chaired by Dr K Kasturirangan.
- (ii) Karnataka State Council for Science and Technology (KSCST), President: Hon'ble Chief Minister, Government of Karnataka; Vice Presidents: Minister for Finance, Director, IISc and Minister for S&T
- (iii) Executive Committee of KSCST, Chairman: Director, IISc, Co-Chairman: Chief Secretary, Government of Karnataka

Based on a discussion in the Executive Committee of the Bangalore Chapter, the following INAE Fellows have been nominated by the BC to the above bodies:

- Dr KG Narayanan, Former Director, DRDO- ADE, Bangalore and former Advisor to DG, DRDO, Member, Karnataka Knowledge Commission
- Dr G Jagadeesh, Professor, Dept. of Aerospace Engineering, IISc, Member, KSCST
- Dr V Bhujanga Rao, Former DS & Former DG(NS&M), DRDO and presently, ISRO Chair Professor at NIAS, Bangalore, Member, Executive Committee, KSCST

INAE Mumbai Local Chapter

Talk by Prof JM Vasi, FNAE on the topic "Assessing the Performance of Solar Photovoltaics in India: Need for a Multi-disciplinary Approach" at IIT Bombay, Mumbai on May 3, 2019

INAE Mumbai Local Chapter organized a talk by Prof JM Vasi, FNAE on the topic "Assessing the Performance of Solar Photovoltaics in India: Need for a Multi-disciplinary Approach" at IIT Bombay, Mumbai on May 3, 2019. The key highlights of the program was a welcome address by Prof DN Singh, Hon. Secy, INAE Mumbai Chapter, followed by introduction to the Chapter and the speaker by Prof Grover, Hon. Co-Chair, INAE Mumbai Chapter. Following this, a talk by Prof Vasi on "Assessing the Performance of Solar Photovoltaics in India: Need for a Multi-disciplinary Approach" followed by discussions was the major highlight. A brief meeting of Executive Committee members on programs followed the talk.



Prof AK Suresh, Co-Chair, INAE Mumbai Local Chapter presenting a Bouquet to Prof JM Vasi



Group Photo of Participants at INAE Mumbai Local Chapter Event at IIT Bombay

The event was attended by about 50 INAE Fellows and other experts and was a great success.

One-Day National Workshop entitled: “Urban and Rural Challenges in Management of Solid Waste in India: A Circular Economy Approach to Building Smart Habitats”.

INAE Mumbai Local Chapter, IIT Bombay, Indian Institute of Chemical Engineers (IChE) and Indian Environmental Association (IEA), Mumbai, jointly organized a One-Day National Workshop entitled: “Urban and Rural Challenges in Management of Solid Waste in India: *A Circular Economy Approach to Building Smart Habitats*”. This Workshop was held in IIT Bombay, Mumbai on Tuesday, 24th September, 2019 during 9:00 AM and 6:00 PM.

The One-Day Workshop was attended by the delegates from Municipal Corporation of Greater Mumbai, plastic manufacturers and users, housing societies, ALMs, real estate developers, corporate organisations engaged in providing processes and products, waste management companies and

academic institutions. About 155 delegates participated in the Workshop. A brief background about the significance of the topic of the workshop is given below.

India has had satisfactory track record of contributing in the international initiatives, *namely; Millennium Development Goals (MDGs)* during 2001 and 2015 as well as *Sustainable Development Goals (SDGs)* since 2016 – wherein each nation has its own targets to be fulfilled and each reports the respective progress to the steering committee at the United Nations Organization (UNO). In the same period, the Government of India has had several targeted programmes to upgrade sanitation and other municipal services across the nation through several initiatives including *Jawaharlal Nehru National Urban Renewal Mission (JNNURM)* and *Smart Cities* programme managed by the Ministry of Urban Development. The *Swachh Bharat Abhiyan* steered by the Prime Minister has recently inspired all the citizens to participate actively in the nation-wide campaign to clean-up our habitats and work places.



Photographs of the Audience



Dr Anil Kakodkar, FNAE delivering Address Memento



Dr Pradip, Vice-President, INAE presenting



Interaction of Senior Delegates at the Workshop

Group Photograph of Participants

The Experts during their presentations appealed to the participants in the Workshop to formally adopt the “8-R concept” (Regulate, Rethink, Repair, Reduce, Reuse, Recover, Recycle and Re-manufacture) to conserve energy, minimize wastes, and promote waste recycling. This would be possible in reality only when the development planning agencies make targeted efforts to create the markets and engage the local community to make this strategy financially viable and socially sustainable.

Dr. Pradip, Vice President, INAE delivered the Welcome Address and Prof. A. K. Suresh, FNAE, Deputy Director, IIT Bombay during his briefing elaborated the focus and content of the Workshop. The Workshop was graced by Dr. Anil Kakodkar, FNAE as the Chief Guest and he delivered the Keynote Address. Mr. D. P. Misra, FNAE proposed the Vote of Thanks on behalf of INAE, IIT Bombay, IChE and IEA at the end of the Inaugural Session.

Speaker Meeting Featuring talk by Dr. Lawrence L. Kazmerski, FNAE on “Photovoltaics History, Technology, Innovation, and Progress: The Future is Now...”

A Speaker Meeting of INAE Mumbai Local Chapter was held on 16th October 2019 at IIT Bombay, Mumbai featuring a talk by Dr. Lawrence L. Kazmerski, FNAE. The technical details of the special talk are given below.

Talk on “Photovoltaics History, Technology, Innovation, and Progress: The Future is Now . . .” Delivered by Dr. Lawrence L. Kazmerski, FNAE

Member Research Staff (Emeritus), National Renewable Energy Laboratory, Golden, CO
Research Professor, University of Colorado Boulder, Boulder, CO, Visiting Professor, IIT Bombay,
India At Room No 23, VMCC, IIT Bombay, 16th October 2019

Dr. Lawrence L. (‘Kaz’) Kazmerski is one of the global experts and pioneers in solar photovoltaics (PV). With his ongoing association at NREL, University of Colorado Boulder and IIT Bombay, he continues to remain active in R&D activities. His talk at IIT Bombay, which had an audience of about 40 persons including Fellows of INAE, focused on the current state-of-the-art as well as the historical background of solar PV.

Dr. Kazmerski mentioned that the idea of using the sun as a source of energy was proposed by several engineers in the first couple of decades of this century, including giants such as Edison,

Tesla and Steinmetz. However, the first practical solar cell (with an efficiency of 5%) was developed only in the mid 1950's by Bell Telephone Laboratories to be used in their rural 'repeater' stations. The Vanguard-1 satellite launched in 1958 was the first to use solar cells as the power source. Subsequently, all satellites have relied on solar power. Modern satellites use very complex multijunction solar cells with high efficiencies approaching 40%.

Today, solar PV is being driven mainly by terrestrial deployment. This started in the 1970's, but took off rapidly in the 2000's due to falling prices. Solar power is now becoming cheaper (computed on LCOE basis) than any other energy source, driven mainly by China's manufacturing prowess. The total world-wide deployed solar power is approaching 500 GW, and is likely to cross 1 TW in the next few years. India is one of the three largest deployers of solar power today. Besides being cheap and easy to set up, solar power also has a much smaller carbon footprint, said Dr. Kazmerski.

Most of the solar panels in production today are based on silicon. Though this is the oldest technology, continuous developments have made the Si cells more efficient, and today the record efficiency is 26%, which is quite close to the theoretical. However, Dr. Kazmerski explained that there are several exciting alternatives to silicon, one of which is perovskites, which emerged only a few years ago, but whose efficiencies have rapidly increased from a few percent to 25% today. Perovskite-on-silicon tandem cells have recently shown record efficiencies, and a roadmap exists to take this to greater than 30% for terrestrial applications. The long-term stability and reliability remain to be explored, though, before these can replace silicon. Another alternative to silicon is organic solar cells, which have the advantage of being made on flexible substrates. Dr. Kazmerski passed around a flexible organic solar cell.

Dr. Kazmerski ended his talk by describing how far we have come since the early days when he started his career and expressed his conviction that many new developments will carry solar PV even further in the future. Dr. Kazmerski also designs colourful ties and scarves with a solar motif in his spare time, and he distributed several of these to members of the audience.

INAE Hyderabad Local Chapter

It is well known that Hyderabad has a prominent place in the Engineering map of India especially because it houses a large number of globally renowned R&D centres, Academic Institutions and a large cluster of Industries and Information Technology companies that are directly connected with the Engineering and Technology. Defence labs, BHEL, NFC, MIDHANI, IITH, UOH, TCS, CYIENT are among a few to name, along with many small-scale industries and several other academic institutions encompassing and demonstrating voluminous and diversified engineering activities by many engineering professionals associated with these organizations.

Yet another significant highlight of Hyderabad has been the number of resident INAE Fellows crossing a significant number viz., more than 50 indicates the valuable contribution of the engineers, engineer-scientists and technologists from Hyderabad who have contributed to the overall development of the Nation.

One of the major objectives of INAE has been "*To encourage and promote the pursuit of excellence in the field of Engineering*". In order to realize such an objective and to provide a knowledge-based platform for all the stakeholders, INAE has been instituting Local Chapters for easy dissemination and recognition of local talent on a national scale. In this connection, Dr Dasharath Ram, FNAE, DS

and Director, DRDL, Hyderabad was requested by INAE in the recent past, to initiate the process of starting a INAE Local Chapter at Hyderabad which was accordingly instituted.

Based on the suggestions by Dr Dasharath Ram, the following members had met at University of Hyderabad on 28th October 2019 to discuss the formation of INAE Hyderabad Local Chapter:

1. Prof. K. Bhanu Sankara Rao, FNAE,
Pratt & Whitney Chair Professor, University of Hyderabad
2. Dr G. Madhusudhan Reddy, FNAE,
Outstanding Scientist and Associate Director, DMRL, Hyderabad.
3. Dr Jaiteerth R. Joshi, Scientist 'G', DRDL, Hyderabad
4. Dr L. Rama Krishna, Scientist 'F', ARCI, Hyderabad
5. Dr.-Ing. V.V.S.S. Srikanth, Associate Professor, SEST, University of Hyderabad
6. Dr. Koteswararao V. Rajulapati, Associate Professor, SEST, University of Hyderabad
7. Dr Sushmee Badhulika, Associate Professor, Department of Electrical Engineering, IIT Hyderabad

After due deliberations, it was decided to formulate the Managing Committee comprising of Fellows of INAE and active members of various other professional bodies. Accordingly, the composition of the Managing Committee of INAE Hyderabad Local Chapter is as under:

Chairman	-	Dr Dasharath Ram, FNAE DS and Director, DRDL, Hyderabad
Secretary	-	Dr G. Madhusudhan Reddy, FNAE OS and Associate Director, DMRL, Hyderabad
Joint Secretary-		Dr-Ing. V.V.S.S. Srikanth Associate Professor, SEST, University of Hyderabad
Treasurer	-	Dr Jaiteerth R. Joshi, Scientist 'G', DRDL, Hyderabad
Advisors	-	Mr B.V.R. Mohan Reddy, FNAE Founder and Executive Chairman, CYIENT Ltd. Hyderabad
		Prof. K. Bhanu Sankara Rao, FNAE, Pratt & Whitney Chair Professor, University of Hyderabad
		Dr Dinesh Kumar Likhi, FNAE Chairman and Managing Director MIDHANI, Hyderabad
Members	-	Dr Venkata Mohan Srinivasulu Reddy, FNAE Tata Innovation Fellow and Principal Scientist CSIR-IICT, Hyderabad
		Dr L. Rama Krishna,

Scientist 'F', ARCI, Hyderabad

Dr P. Venkata Ramana,
Professor, MGIT, Hyderabad

Dr Koteswararao V. Rajulapati,
Associate Professor, SEST, University of Hyderabad

Dr Sushmee Badhulika,
Associate Professor, IIT Hyderabad

Dr Seshagiri Rao Ambati
Associate Professor, NIT Warangal

Dr M. Phani Surya Kiran
Scientist 'E', DMRL, Hyderabad

Dr Swati Ghosh Acharyya
Assistant Professor, SEST, University of Hyderabad

The members present also discussed in detail about the activities to be taken up by the INAE Hyderabad Local Chapter and the following activities were decided to be undertaken by the Chapter:

- a) To conduct several Professional Conferences in different organizations located in and around Hyderabad.
- b) To organize the first meeting of INAE Hyderabad Chapter at DRDL, Hyderabad sometime in the month of November, 2019 by inviting the Fellows and INAE Young Associates located at Hyderabad. Dr Dasharath Ram, FNAE, Chairman, INAE Hyderabad Local Chapter would deliver a talk on the Manufacturing Aspects of Advanced Materials during the meeting.
- c) To organize the second meeting of INAE Hyderabad Chapter at University of Hyderabad in the month of December, 2019.
- d) To organize a lecture on Recent Developments in High Temperature Materials at IIT Hyderabad in the month of December, 2019.
- e) To organize monthly lectures on various advanced disciplines of Engineering such as Machine Learning, Artificial Intelligence, Data Science etc.

INAE Hyderabad Chapter and the Department of Metallurgical and Materials Engineering, Mahatma Gandhi Institute of Technology, Hyderabad has organized a one-day National Conference on "Advances in Metallurgical Engineering" on March 4th, 2020 at MGIT Hyderabad for educating the undergraduate and post graduate students. Dr. G.D. Janaki Ram, Professor, Department of MSME, IIT Hyderabad has graced the occasion as a chief Guest. In his keynote address, Prof. G.D. Janaki Ram dealt the emerging aspects in Additive Manufacturing and its growing application in the fabrication of various components. More than 200 delegates participated in the conference. Prof. K. Bhanu Sankara Rao FNAE provided the necessary guidance in the selection of speakers and the successful organization of the conference.

INAE Kharagpur Local Chapter

One-day Workshop on Steel Technology at IIT Kharagpur

The Department of Metallurgical and Materials Engineering, Indian Institute of Technology Kharagpur, the Kharagpur Chapter of Indian Institute of Metals and the Kharagpur Chapter of Indian National Academy of Engineering had jointly organizing one-day ‘Workshop on Steel Technology’ on 24th October 2019. The workshop was organized at Prof. S.N. Bose Auditorium in IIT Kharagpur. Prof. Sriman Kumar Bhattacharjee, Officiating Director of IIT Kharagpur inaugurated the workshop. Prof. Rahul Mitra, Head of the Department of Metallurgical and Materials Engineering delivered the welcome address and shared the activities of the department. Prof. Suman Chakraborty, Dean of SRIC, IIT Kharagpur and INAE Chair Professor, Prof. Surjya Kanta Pal, Chairman of Steel Technology Center and DHI Center of Excellence in Advanced Manufacturing also addressed the gathering informing about the various initiatives and activities taken by IIT Kharagpur to support the manufacturing sector. The workshop covered various important areas of steel metallurgy through the following theme-based sessions, conducted by eminent academicians of IIT Kharagpur as session chairpersons:

- Progress in iron and steel making, (Chaired by Prof. P.K. Sen),
- Advanced physical metallurgy and processing of steel, (Chaired by Prof. S.B. Singh),
- Innovative coating, joining and modelling studies on steel, (Chaired by Prof. K. Das and Prof. G.G. Roy).

Besides the faculty members and research students of IIT Kharagpur, several faculty members and scientists from IEST Shibpur, Jadavpur University, NIT Durgapur and Rourkela, National Metallurgical Laboratory and Tata Steel in Jamshedpur, and RDCIS-SAIL Ranchi participated in the workshop and presented their research activities related to steel. The presence of eminent experts like Dr. Soumitra Tarafder from NML Jamshedpur, Prof. Pravash Chandra Chakraborti from Jadavpur University and Prof. Santanu Ray, former scientist of RDCIS-SAIL and present JSPL and JSL Chair-professor and Editor of Metal News, during the workshop, is worth mentioning.

The following two distinguished international doyens attended the workshop and delivered Institute Lectures: 1) Dr Debashish Bhattacharjee, Vice President, Technology and New Materials, Tata Steel and Former Group Director of Global Research, Development and Technology, Tata Steel and 2) Prof Dr H J Fecht, Chair Professor and Director “Institute of Micro and Nanomaterials” at Ulm University, Eureka Cluster Office Director Metallurgy Europe, Member of European Academy of Sciences and Arts. The Workshop was coordinated by Prof. Debalay Chakrabarti with the help, support and advice from Prof. Rahul Mitra, Head of the Department of Metallurgical and Materials Engineering, IIT Kharagpur, Prof. Tapas Laha and Prof. G.G. Roy from the Indian Institute of Metals Kharagpur Chapter, Prof. Sumantra Mandal and Prof. Indranil Manna, Vice-President, INAE from INAE Kharagpur Local Chapter.



Prof SK Bhattacharyya, FNAE, Officiating Director, and Prof Indranil Manna, Vice-President, INAE Lighting the Lamp



Lighting of Lamp by Prof Suman Chakraborty Prof Rahul Mitra Delivering the Welcome Address



Prof SK Bhattacharyya Addressing the Audience Prof Indranil Manna, Vice-President, INAE Felicitating Prof Dr H J Fecht



Audience in the event



Prof Suman Chakraborty delivering talk



Prof Indranil Manna addressing the audience



Dr Debashish Bhattacharjee giving presentation



*Prof Indranil Manna and Prof Dr H J Fecht
INAE Kanpur Local Chapter*



Dr Debashish Bhattacharjee delivering lecture

Learning Through Virtual Laboratories at IIT Kanpur

A full day Virtual Laboratory workshop was organised by Indian Institute of Technology (IIT) Kanpur and INAE Kanpur Local Chapter on September 14, 2019. Prof. K. Muralidhar, President, INAE Kanpur Local Chapter, and Prof. Kantesh Balani, Coordinator, Virtual Lab IIT Kanpur, lighted the lamp and inaugurated the workshop. Prof. Muralidhar, in his introductory remarks, highlighted the grand challenges that engineers need to focus on as per global needs. He also emphasised the need of tools, from hammer to virtual laboratories that enhance the value of engineers in today's world. The Virtual Laboratory workshop witnessed the enthusiastic participation of 184 delegates from 13 colleges and 5 schools (from Indore, Sultanpur, Kannauj, Banda, Moradabad, Motihari, and Kanpur). Such large participation highlights that the domain of virtual laboratories is gaining popularity and momentum in the recent times. The technical program

started with an introduction to ‘*Virtual Laboratories*’ by Prof. Kantesh Balani, who highlighted the need of building confidence via gaining knowledge through virtual lab platform. This Virtual Laboratory initiative is being supported by Ministry of Human Resource and Development (MHRD) under the National Mission on Education through Information and Communication Technology (NMEICT). The lead coordinator of this Virtual Lab initiative is IIT Delhi with 23 participating institutes across the country.



Prof K Muralidhar Lighting the lamp



Audience in the event

Prof. D. Goswami highlighted ‘Ultrafast Laser Spectroscopy’, and later Ms. Sonal Dixit, Mr. Boda Pool Singh, Mr. Narendra Dhar, and Mr. Arun Kumar Sharma together introduced ‘Transducers and Instrumentation’ virtual laboratory developed by Prof. Nishchal Verma. Then, Prof. Kantesh Balani demonstrated virtual laboratory on, ‘Material Response to Microstructural-, Mechanical-, Thermal- and Biological-Stimuli’, followed by showcasing of ‘Production Shop Simulation Laboratory’, by Prof. Deepu Philip. The lunch break allowed participants to engage in discussions with the eminent speakers. Following lunch, Prof. Pankaj Jain enticed students with ‘Virtual Astrophysics Laboratory’ talking about fascinations of watching stars from earth. Prof. K.V. Srivastava showcased ‘RF and Microwave Characterization Laboratory’, which is jointly developed with Prof. M.J. Akhtar. Prof. S. Banerjee elicited conceptual notes on ‘Waves and Phenomena’ and highlighted that oscillations are inherently present in our daily lives. The last talk by Prof. S. Kamle on ‘Aerospace Virtual Laboratory’ served as icing on the cake and emphasized on learning new concepts by conducting experiments.

The participants from various schools and colleges highly appreciated this opportunity of engaging with IIT Kanpur faculty through this Virtual Laboratories platform. The energy and enthusiasm in the workshop was never ending, and encouragement by participating faculty and students was without boundaries. The ignited curiosity of students and invigorating participation from faculty was highly satisfying. Involvement of participants percolated to requests of hosting such workshops specifically at their schools and colleges. The program was successfully concluded with distribution of certificates by Prof. S. Kamle, and presentation of vote-of-thanks by Dr. Aparna Dixit. The workshop was hosted by Prof. Kantesh Balani, and the organisational aspects were assisted by Mr. Dhananjay Umrao, Ms. Sheetal Singh, Mr. Shivam Shukla, Mr. Raj Babu, Mr. Dinesh Diwakar, and volunteers from Pranveer Singh Institute of Technology, and IIT Kanpur.

Women in Sciences and Engineering (WiSE) 2019 Conference Organized by IIT Kanpur in association with INAE Kanpur Local Chapter

As a part of Diamond Jubilee Celebrations at IIT Kanpur, Women in Sciences and Engineering (WiSE) Conference 2019 was organised with support from Indian National Academy of Engineering (INAE) Kanpur Chapter. WiSE 2019 was inaugurated by Dr. Abhay Karandikar, Director, IIT Kanpur, Chief Guest Dr. Asha Agarwal (retired from GSVM), guest of honour Dr. Mamta Vyas (Chief Medical Officer, IIT Kanpur), Dr. S.C. Srivastava (on behalf of Dr. K. Muralidhar, President, INAE Kanpur Chapter), and conference organisers (Dr. Bushra Ateeq and Dr. Kantesh Balani). All expressed a desire to enhance the participation of women in sciences and engineering and sensitizing the policy makers towards creating sustainable opportunities for women to be able to pursue these as career options.



Inauguration Ceremony and Address by Prof. Abhay Karandikar during Women in Sciences and Engineering 2019 Conference at IIT Kanpur on October 19, 2019

The WiSE 2019 conference is a very different and unique concept which witnessed eminent women speakers discuss their research. This conference addressed multi-thematic areas and served as a platform for thought stimulating interactions. The open discussion time for the group of speakers addressing an erudite audience not directly from their domain encouraged cross-discipline and engaging dialogue to force open new areas of collaborative research.

WiSE 2019 conference witnessed two plenary talks, and 20 technical talks including the impact of these technologies on society and need of linguistic diversity. In addition, concept of virtual laboratories and an activity-based leadership talk also fascinated the participants. Over 64 participants and occasional footfall raised the participants to over 80. Further, two panel discussions, i.e. “*Opportunities & Challenges for Women in Sciences and Engineering*” and “*Innovation and Entrepreneurship*” were also highly informative and useful for both women and men in sciences and engineering domains.

Video message by Dr. Rohini Godbole (IISc Bangalore), Dr. Madhu Loomba (Madhuraj Hospitals, Kanpur), Dr. Debrupa Lahiri (IIT Roorkee), and Dr. S.T. Aruna (NAL Bangalore), also emphasised that women need to embrace womanhood beyond her home and be able to pursue their career ...free of any gender-discrimination. A total of 24 talks (two plenary talks, and other thematic talks) along with two panel discussions are planned for the conference during Oct. 19-20, 2019 at IIT Kanpur.

Dr. Asha Agarwal delivered plenary talk highlighting need of early cancer detection, which was followed by 10 invited talks on themes of materials, electronics, and energy/environment.



Participants listening to video message by eminent supporters of WiSE 2019.



Collage of talks from various speakers during Women in Sciences and Engineering Conference at IIT Kanpur on October 19, 2019

Later, the panel discussion on “*Opportunities & Challenges for Women in Sciences and Engineering*” was received with very active engagement of audience in sensitizing the gender equality that is demanded in work setting. The session was moderated by Dr. Neetu Singh from IIT Delhi, and panel member included Dr. Emila Panda from IIT Gandhinagar, Dr. Prita Pant from IIT Bombay, Ms. Arpita Gupta (counsellor at IIT Kanpur), Dr. Pratibha Sharma from IIT Kanpur & Ms. Apoorva (student at IIT Kanpur). The gender biases need to be eradicated from the society and a natural flow must ensue towards sharing equal responsibility. The panel members expressed the need of sharing these recommendations to higher bodies for sensitizing these issues for consideration when making policy-decisions.



Panellists of “Opportunities & Challenges for Women in Sciences and Engineering” during Women in Sciences and Engineering Conference at IIT Kanpur on October 19, 2019.

The second day started with plenary talk by Dr. Anuradha Godavarty, Florida International University, FL, USA. She highlighted the aspects and importance of transition from a researcher to an innovator and to an entrepreneur. This talk set the mood for the panel discussion later in the day.



Plenary talk by Dr. Anuradha Godavarty via Skype on October 20, 2019

The next talk was on leadership and women-empowerment that involved the participants in engaging activity and highlighted team building. The enthusiasm persisted on the second day of WiSE 2019 conference with thematic talks hovering on biomedical materials and agricultural sciences. The day ended with an involving panel discussion on “Innovation and Entrepreneurship”, which was moderated by Dr. Mini Chandran (IIT Kanpur) and the panellists included Dr. Arpita Amarnani (GIM, Goa), Dr. Neetu Singh (IIT Delhi), Dr. Kousudi Patil (IIT Kanpur), Dr. Renu (Principal Scientist, ICAR-NBAIM, Maunath Bhanjan, U.P.



*Collage of various speakers giving talk during
Women in Sciences and Engineering
Conference at IIT Kanpur on October 20, 2019.*

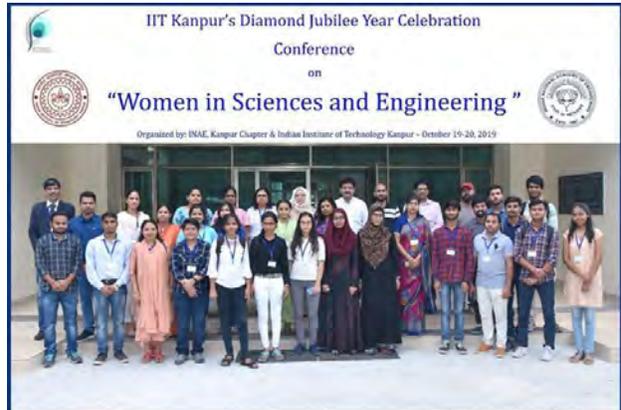


Panellists of “Innovation and Entrepreneurship” interacting with audience during Women in Sciences and Engineering Conference at IIT Kanpur on Oct. 20, 2019.

In summary, WiSE 2019 conference was very well received by the community and all the participants recommended that such an event should become a regular event. All the participants extended their full-hearted support for organisation of next WiSE at much bigger scale in near future.



Day 1: October 19, 2019



Day 2: October 20, 2019

INAE Delhi Local Chapter

Indian National Academy of Engineering (INAE) Delhi Local Chapter in association with Bharti School of Telecom and Technology Management (IIT Delhi) and IEEE Delhi Local Chapter organized a Lecture by Prof. Arumugam Nallanathan from Queen Mary University, London, UK

The Indian National Academy of Engineering (INAE) Delhi Local Chapter in association with Bharti School of Telecom and Technology Management (IIT Delhi) and IEEE Delhi Local Chapter organized a lecture on Communication Technologies and Requirements for Industry 4.0 on Feb 3, 2020 at 4.30 P.M. at Bharti School of Telecom and Technology Management, IIT Delhi.

Abstract of the Lecture: The Fourth Industrial Revolution (Industry 4.0) is coming, and this revolution will fundamentally enhance the way the factories manufacture products. The modern manufacturing industry will upgrade to a new era of productivity with the confidence to reinvent their business. To realize this ambitious goal, the industry needs a solution that could support to access real-time information, eliminate downtime, production automation, empower employees with the freedom to work anywhere, anytime, etc. Therefore, the conventional wired lines connecting central controller to robots or actuators will be replaced by wireless communication networks due to its low cost of maintenance and high deployment flexibility, which becomes an evitable trend. However, mission-critical industrial applications require ultra-high reliability and low latency communication (URLLC) that is not supported by our current wireless communication systems and is one of the primary cornerstones of the fifth generation (5G). Thus, there is an urgent need for rethinking the design of communication system. This lecture highlighted the communication requirements and technologies for the revolution towards Industrial 4.0, and the recent advances in information theory for the transmission of short packets, which provide the theoretical principles that govern the practical design of system parameters, followed by proposed framework and methodologies to solve the key issues in the context of URLLC that indispensably needed by Industry 4.0. The talk concluded with directions for future research.

Speaker Profile: Dr Arumugam Nallanathan is Professor of Wireless Communications and Head of the Communication Systems Research (CSR) group in the School of Electronic Engineering and Computer Science at Queen Mary University of London since September 2017. His research interests include Artificial Intelligence for Wireless Systems, 5G and beyond Wireless Networks, Internet of Things (IoT) and Molecular Communications. He published nearly 500 technical papers (including more than 200 top IEEE journal papers) in scientific journals and international conferences.

INAE Delhi Local Chapter organized a lecture by Prof. Sukumar Mishra the topic “Reliable and Secure DC Microgrids” on February 4, 2020 at Bharti School of Telecommunications Technology & Management, IIT Delhi.

INAE Delhi Local Chapter organized a lecture by Prof. Sukumar Mishra, an INAE Chair Professor, in the Department of Electrical Engineering at IIT Delhi on the topic “Reliable and Secure DC Microgrids” on February 4, 2020 at Bharti School of Telecommunications Technology & Management at IIT Delhi Campus, New Delhi. In his talk he first defined what is microgrid, and contrasted with conventional regional and national grids as well as with respect to nanogrid (individual household level) and picogrid (human body level power control, on the order of milliwatts). He then explained the power grid connectivity requirements, and subsequently the aspect of generator based grid connectivity versus current-day solar/wind power based grid connectivity. The issue of lack of any inertia in solar DC grid in grid network stability was

addressed. Besides, though there are newer DC-based electrical products coming to the market that can fit with the new DC energy type, the conventional AC-based electrical product manufacturers have concerns on their product lines. Yet, there are efforts on DC microgrid-operated electrical appliances.

Prof. Mishra then discussed some of his efforts on DC-microgrid operated home appliance experiments, including DC-power operated home and EV charging park. To account for the electrical connection/disconnection related surge and instability issue, he introduced the discussion on AI-based intelligent control of microgrid control, where his concept of “de-rating” of photovoltaic source was presented. The concept of local battery usage instead of “de-rating” was discussed from cost-efficiency tradeoff perspective. Finally, the tradeoff between microgrid performance optimality and easy/fast controllability in the face of communication link uncertainties through decentralized (instead of fully-centralized) controllability was discussed. The talk was attended by about 20 research students and industry practitioners as well as a few IIT Delhi faculty members. Following the talk, a brief informal discussion was held on the industry-academia collaboration and technology-oriented research.

Indian National Academy of Engineering (INAE) Delhi Local Chapter organized an interaction event with Telecommunications Standards Development Society, India on February 14, 2020 at Indian Institute of Technology Delhi

An interaction event was organized by Indian National Academy of Engineering (INAE) Delhi Local Chapter with Telecommunications Standards Development Society, India at Indian Institute of Technology (IIT) Delhi on February 14, 2020. The event was organised with the objective of developing a better understanding on Telecommunications Standards Development Society, India activities on technology standardization to find a synergy towards the Indian academic researchers' technology-oriented research. Telecommunications Standards Development Society, India (TSDSI) officials gave presentations on how the society could assist the academic researchers in the standardization efforts, and explained the other details of TSDSI membership benefits and travel support.

Commitment of INAE to the Efforts of Government of India towards Containment and Eradication of COVID-19 Pandemic

Dr Sanak Mishra, President INAE has written a letter to Dr Pramod Kumar Mishra, Principal Secretary to the Prime Minister conveying utmost admiration in the exemplary manner in which measures have been taken by the Government of India under the inspired leadership of the Hon'ble Prime Minister, towards the containment and eradication of the COVID-19 pandemic. He lauded the Government initiatives encompassing provision of medical services and facilities; promotion of indigenous medical testing facilities; development of cost-effective medical equipment; excellent governance; economic relief measures; repatriating Indian citizens from affected countries; appropriate education of citizens; timely lock-down of the country and ensuring essential supplies and facilities across the country. Dr Sanak Mishra highlighted that INAE commits itself to extend all and any support required by the Government for the furtherance of its initiatives and measures for the containment and eradication of the COVID-19 pandemic and he looked forward to the Academy contributing to the ongoing and novel measures and innovative strategies of the Government of India.

In this regard, Dr Sanak Mishra, President INAE had initiated a letter to the INAE Fellowship and INAE Young Associates requesting for relevant expertise in the engineering fields from Fellows who can come forward to offer their expertise to mitigate any dimension of the COVID 19 Pandemic from engineering perspective. Once inputs were received, these were to be communicated to Department of Science and Technology with the objective of making meaningful contributions to the various measures and initiatives of the Government by providing the pertinent technical inputs to synergize the efforts, with innovative engineering interventions and providing consultancy in concerned fields. Subsequently, the names of INAE Fellows and Young Associates willing to contribute to the pertinent activities and measures initiated by DST in the containment and eradication of the COVID was forwarded by Dr Sanak Mishra, President INAE to Prof Ashutosh Sharma, Secretary, DST.

International Affairs

CAETS 2019 Convocation and Annual Meetings in Stockholm, Sweden

CAETS and International Conference on Engineering a Better World – Next 100 Years.

Global challenges were on the agenda when engineers and scientists from all over the world met at the CAETS Conference (Council of Academies of Engineering and Technological Sciences), organized by the Swedish Academy of Engineering Sciences (IVA). The meetings of CAETS Executive Board and the Conference were held during 24 – 28 June 2019 at Stockholm, Sweden. Dr. Sanak Mishra, President INAE and Member of the Executive Board of CAETS, Dr. Pradip, Vice President INAE and Mr. Pradeep Chaturvedi, Fellow INAE attended as official delegates.

Together with Ruth A. David, Secretary General of International Council of Engineering Science and Technological Sciences, CAETS, Prof. Tuula Teeri, Chair of CAETS and President of IVA, opened the annual CAETS conference at the City Conference Centre in Stockholm.

The fact that IVA hosted the event this year was no coincidence, as IVA– the world’s first engineering sciences academy – turns 100 years old in 2019.

Welcoming the participants in the Conference, Prof. Tuula Teeri remarked: “My elder colleagues may disagree with me, but I think we have never before faced such great challenges in the world. However, we have probably said so for 100, 1,000 or 2,000 years, and we have always managed to solve the problems”.

Mr. Ibrahim Baylan, Minister for Business, Industry and Innovation, Swedish Government, in his thought-provoking inaugural address emphasized the need to keep peoples’ needs in mind. “All technology shifts have killed jobs, but they have also always created new jobs. We, therefore, need a society that helps people to go from old to new jobs, through vocational training, investments in research and development, education, and so forth.” Interestingly, he illustrated the need to conceive of a world free of fossil fuels, with the example of steel and electric vehicles. He emphasized the need to develop fossil-fuel free steel.

The conference brought together 400 participants from all over the world, including delegates from 26 CAETS academies of engineering and 3 from Nigeria, New Zealand and Serbia that were elected as new members of CAETS.

Topics of Different Presentations

A number of international thinkers and experts in areas of great significance for the immediate future were invited to address the Conference.

For three days, the role of science, technology and engineering in meeting global societal challenges was in focus. To shed light on some of the most acute challenges facing the society and explore possible solutions, the Swedish Academy put together a cross-disciplinary program. That was really a unique way of conducting the conference. The conference turned out to be a meeting place for everyone working within or interested in science, technology, engineering and societal issues.

‘Engineering a Better World: The Next 100 Years’ was a Conference within the framework of the CAETS international network of academies of engineering sciences.

The Conference consisted of a series of sessions, each devoted to a specific topic of immediate concern. The first session reflecting ‘Progress’ included the opening presentation on ‘The first 100 Years’ which provided an overview of developments since the inception of the Swedish Academy. This session also included presentations on ‘Internet – Engineering for Society’; and ‘LIGO – Engineering for Science’.

The second session was entitled, ‘Challenges’ and it included presentations on ‘Energy System of the Future – Evolution or Revolution’; ‘Unequal Cities’; ‘Antibiotic Resistance – a Multiple Systems Failure’; and ‘Water as Leverage – from Risk to Reward’.

The third session was on ‘Creative Chaos’ which included presentations on ‘Engineering the Climate’; ‘Sustainable Transition Pathways for Plastics’ and a Panel Discussion on: ‘Future Health – Are New Business Models Required?’

The fourth session was on ‘Digital Dawn’, which included a presentation on ‘Productivity and Performance in a Digital Age’. It covered the impact of technologies like AI and Machine Learning.

The fifth session on ‘Effective Education’ had presentations on: ‘The Changing Face of Global Engineering Education and Logic’, and ‘Landscape of the ‘Knowledge System – Implications for the Educational System’.

The session on ‘Inclusive Infrastructure’ included presentations on: ‘The All-Embracing Transportation System’; ‘Design and Engineering for Sustainability Transitions’, and ‘Society 5.0 – a Human-Centric Strategy’.

The Conference concluded with the panel discussions on ‘Policy Advice for the Future’ and ‘Industry – Academy Collaboration for the Future’.

The Major Takeaways from the Conference

The major takeaways from the Conference are summarized below:

- (i) When considering the global challenges that we are facing today, it feels that they are graver than ever before. Then again, historical records from 100, 500 or 2000 years ago suggest that people have always felt that their current problems are the worst ever. And yet, humankind has always been able to put things right and the world has become progressively a better place, than before.
- (ii) New, powerful technological solutions are the key to solving many of our current challenges but at the same time, the technology is perceived as a threat by many people in the turbulent labour markets. Many fears for the loss of their jobs and for losing control over their lives by technological advances like automation, robotics and artificial intelligence, have to be innovatively addressed.

Engineers like us will have to make efforts in convincing people that new technology will help us lead a better life. Otherwise they will be very vulnerable to demagogues declaring new technology is “wrong and dangerous”.

- (iii) One clear message from the speakers at the conference was that we will need to put people at the centre of all our efforts, engaging them in discussions and involve them in the decision-making process, concerning the effects and implementation of different emerging technologies.

The focus of our national development should not just be technology-driven but human-centred and based on the core values of openness, open to criticism, sustainability and inclusion.

Inequalities between regions, countries and citizens is a huge obstacle for reaching our climate goals. The fundamental issue will be to find a balance between the environmental and the social agendas.

- (iv) The world is becoming more complex, globalized and very difficult to grasp in its entirety. Our current economic models predicting future trends tend to fail to account for e.g. intangible assets important in the digital world. There are also long implementation and restructuring lags with the introduction of new technology before people experience long-lasting positive impacts, in their lives.

Inclusive innovation, collaboration and prosperity shared by all will be needed to overcome the obstacles of increasing fear about technology.

- (v) Due to the complexity and the scale of our challenges, what is needed in the world is perhaps first and foremost cooperation and sharing between scientists, engineers and the policy-makers – between scientists and engineers from different fields, and between scientists, engineers, the political decision-makers and the general public.

To solve our problems, we must learn to manage complex collaborations.

- (vi) We need to reach a common understanding of the problems we face and the ways in which they can be solved. The longer we argue, the more likely it will be that we reach unforeseen tipping points, which can't be reversed. The high speed of our development gives us genuine hope but only as long as our institutions are capable of changing, in response to the call of the times.

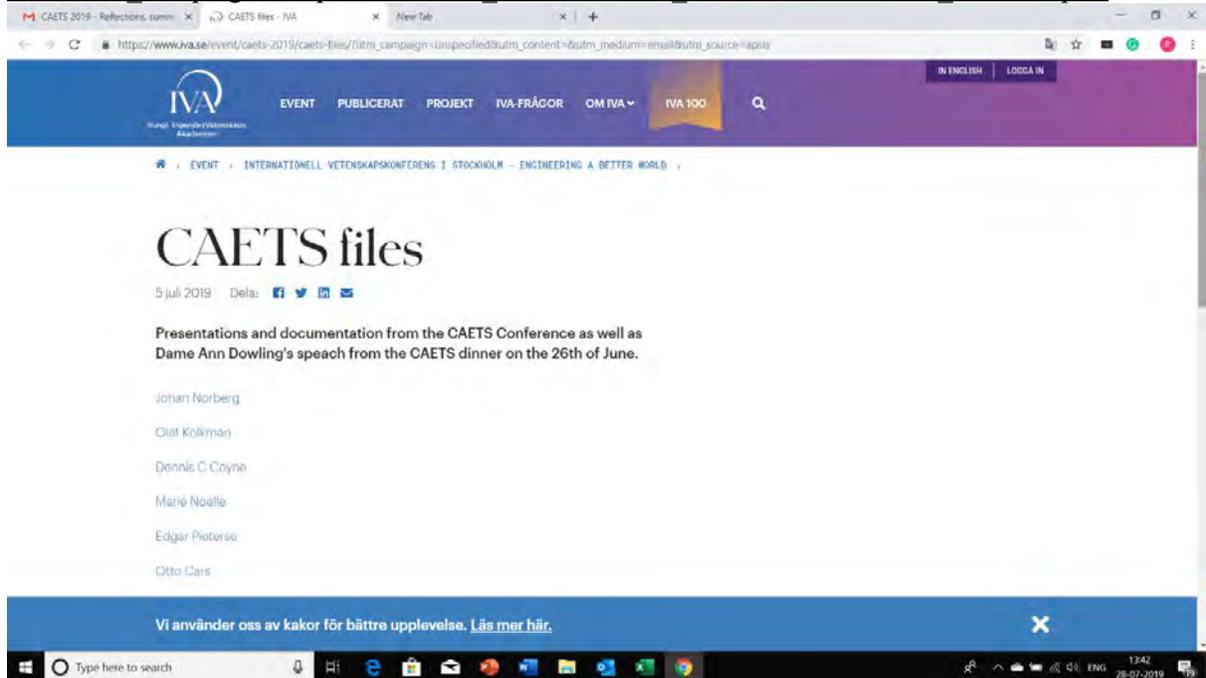
Tomorrow's leaders need to have a multidisciplinary, integrated approach, clarity of vision and a big focus on equality. Mentoring the future leaders who are inclusive and trained in necessary engineering skill sets that is, dealing with complexity, uncertainty and decision-making even in the face of a lack of complete scientific understanding of real-life problems, should be on our immediate agenda.

- (vii) The engineering academies must play a pro-active role and find ways and means to create appropriate linkages (and partnership, if possible) with the policymakers to be able to facilitate technology transitions – for example, today to renewable energy, electrification, digital transformation and a fossil-fuel free, people-centric public transportation. Another role the engineering academies must play is to inspire our next generation of emerging leaders to take up engineering as a profession and solve challenging problems facing us. Need for appropriate changes in our engineering education system including internships, increasing exposure to industry and

enhancing academia-industry collaboration were also discussed as one of the key responsibilities of engineering academies.

IVA has made the copies of all the power-point presentations on the above-mentioned topics, available on their website. The readers are requested to download them directly from the link provided below:

https://www.iva.se/event/caets-2019/caets-files/?utm_campaign=unspecified&utm_content=&utm_medium=email&utm_source=apsis



Sideline Meetings with Member Academies

Indian (INAE) delegation held bilateral meetings with engineering academies of UK, France, Australia, Korea and Sweden. Possibilities of cooperation and collaboration with various academies were discussed. A review of past activities was undertaken and the possibilities of future strengthening of cooperation were discussed. The President, INAE emphasized in all meetings that programs that can proactively provide inputs to the government need to be emphasized. The President also emphasized that mechanism for mutual exchange programs need to be developed on a reciprocal basis, to which all academies agreed.



Dr. Sanak Mishra, Dr. Pradip and Mr. Pradeep Chaturvedi with the Korean Delegation at CAETS Conference, June 2019, Stockholm, Sweden

Discussion with RAEng UK focused on cooperation in the areas of smart city, artificial intelligence, climate change and sustainable development.

Discussion with NATF, France focused on the need to identify a few thrust areas where funding possibilities could be geared up. Some of the areas identified included energy, smart grids, artificial intelligence (especially applied to agriculture and health) and urban sewage treatment.

Discussion with Korean Academy included a review of the forthcoming INAE – NAEK Workshop on “High Temperature Material and System Engineering for Aerospace, Power Generation and Defence Industry” being organized at Hyderabad during July 15-17, 2019. The areas for cooperation for future cooperation discussed were artificial intelligence, robotics, IOT and automotive manufacturing including electric vehicles.

Discussion with ATSE, Australia, emphasized on identifying areas of mutual interest. Delegation of ATSE explained that the framework of Indo-Australian Inter-Governmental Fund has indicated health technologies, biotechnologies and medical device technologies as some of the preferred programs.

Discussion with the President of the Swedish Academy indicated a strong desire and an opportunity to collaborate with IVA, especially in the areas of knowledge, entrepreneurship, business development and motivation for young engineers. Swedish Academy also showed keen interest in having an agreement with INAE.

CAETS Meetings

The CAETS Executive Board met on 24 June 2019 and was attended by Dr. Sanak Mishra, President, INAE. Subsequently CAETS Council meeting was organized on June 27, 2019 and was attended by Dr. Sanak Mishra, President, INAE and Dr. Pradip, Vice President, INAE. Highlights of the meeting was that three more engineering academies, namely from New Zealand, Serbia and Nigeria were inducted into CAETS. The next CAETS meeting, that is, CAETS 2020, will be held in Seoul, South Korea during June 22-25, 2020, hosted by NAEK. The theme of CAETS 2020 is “Engineering A Better World – Smart Society”. The Engineering Academy of Argentina will host the CAETS 2021 during Dec 21-25, 2021 and the theme of the conference will be “The Future of Energy” with special emphasis on training of human resources to lead the transition to a Renewable Energy Future. The venue of CAETS 2022 has also been decided and it will be Paris, hosted by the French Academy of Engineering in March 2022. The meeting also included formal presentations by the CAETS working committees on various themes – namely on Energy, Engineering Education, Communicating with Public (particularly the next generation), and on Diversity and Inclusion.

The Fellowship

The selection process for election to the Fellowship was reviewed a few years back and modified wherein two stage selection process had been introduced. The comments from the Fellowship on the nominations received are also obtained prior to the first meeting of the Sectional Committees. In the first stage, the nominations are initially shortlisted to seek peer review reports from the recommended Fellows/domain experts. In the second stage, the peer review reports received are considered by the Sectional Committees to recommend nominations for election to the Fellowship for approval of the Governing Council. The following were elected as Fellows of the Academy w.e.f. Nov 1, 2019.

Newly elected Fellows

Engineering Section-I (Civil Engineering)

- 1 Dr. V Sundar, Professor Emeritus, Department of Ocean Engineering, Indian Institute of Technology Madras, Chennai.
- 2 Mr. Alok Bhowmick, Managing Director, B&S Engineering Consultants Pvt. Ltd., Noida.

Engineering Section-II (Computer Engineering & Information Technology)

- 1 Prof. Vijay Natarajan, Professor, Department of Computer Science & Automation, Indian Institute of Science, Bangalore
- 2 Dr. Manik Varma, Senior Principal Researcher, Microsoft Research India, New Delhi.
- 3 Prof. Supratik Chakraborty, Bajaj Group Chair Professor, Department of Computer Science & Engineering, Indian Institute of Technology Bombay, Mumbai.

Engineering Section-III (Mechanical Engineering)

- 1 Dr. NC Murmu, Senior Principal Scientist/Scientist-F and Head, Surface Engineering and Tribology, CSIR-Central Mechanical Engineering Research Institute, Durgapur.
- 2 Prof. SG Deshmukh, Professor, Mechanical Engineering Department, Indian Institute of Technology Delhi, New Delhi.
- 3 Prof. Sameer Khandekar, Sir M Visvesvaraya Chair Professor, Room SL-109, Department of Mechanical Engineering, Indian Institute of Technology Kanpur, Kanpur.

Engineering Section-IV (Chemical Engineering)

- 1 Prof. Sachin C Patwardhan, Professor, Department of Chemical Engineering, Indian Institute of Technology Bombay, Powai, Mumbai-400 076
- 2 Dr. Parag R Gogate, Professor, Chemical Engineering Department, Institute of Chemical Technology (ICT), Mumbai.
- 3 Dr. Guruswamy Kumaraswamy, Professor, Department of Chemical Engineering, Indian Institute of Technology Bombay, Mumbai.

Engineering Section-V (Electrical Engineering)

- 1 Prof. Bidyadhar Subudhi, Professor, School of Electrical Sciences, Indian Institute of Technology Goa.
- 2 Prof. SA Khaparde, former Professor, Department of Electrical Engineering, Indian Institute of Technology Bombay, Mumbai.

Engineering Section-VI (Electronics & Communication Engineering)

- 1 Prof. Nandita Dasgupta, Professor, Department of Electrical Engineering, Indian Institute of Technology Madras, Chennai.
- 2 Prof. AG Ramakrishnan, Professor, MILE Laboratory, Department of Electrical Engineering, Indian Institute of Science, Bangalore.
- 3 Prof. D Manjunath, Professor, Department of Electrical Engineering, Indian Institute of Technology Bombay, Mumbai.

Engineering Section-VII (Aerospace Engineering)

- 1 Dr. D Roy Mahapatra, Associate Professor and DRDO Chair, Department of Aerospace Engineering, Indian Institute of Science, Bangalore.
- 2 Prof. Radhakant Padhi, Professor, Department of Aerospace Engineering, Indian Institute of Science, Bangalore.
- 3 Dr. L Venkatakrishnan, Chief Scientist & Head, Experimental Aerodynamics Division, National Aerospace Laboratories, Bangalore.

Engineering Section-VIII (Mining, Metallurgical and Materials Engineering)

- 1 Prof. Satyam Suwas, Professor, Department of Materials Engineering, Indian Institute of Science, Bangalore.
- 2 Prof. N Ravishankar, Professor, Materials Research Centre, Indian Institute of Science, Bangalore.
- 3 Dr. Vikas Kumar, former Distinguished Scientist and Director, Defence Metallurgical Research Laboratory, Hyderabad.

Engineering Section-IX (Energy Engineering)

- 1 Prof. K Srinivasa Reddy, Professor, HT&TP Laboratory, Department of Mechanical Engineering, Indian Institute of Technology Madras, Chennai.
- 2 Mr. MS Unnikrishnan, Managing Director & CEO, Thermax Limited, Pune.
- 3 Dr. Bibek Bandyopadhyay, Senior Advisor, Transaction Advisory Services, Ernst & Young LLP, New Delhi; Senior Advisor, International Institute of Energy Conservation, New Delhi.

Engineering Section-X (Interdisciplinary and Special Engineering Fields and Leadership in Academia, R&D and Industry)

- 1 Dr. Sanjay Bajpai, Scientist G and Head (Technology Mission Division: Energy Water and all others), Department of Science & Technology, Technology Bhawan, New Mehrauli Road, New Delhi
- 2 Mr. Ranajit Kumar, Outstanding Scientist & Head, Nuclear Controls and Planning Wing (NCPW), Department of Atomic Energy, Mumbai.
- 3 Prof. Pramod Kumar Jain, Director, Indian Institute of Technology (BHU), Varanasi.

Newly elected Foreign Fellows

- 1 Prof. M. Packirisamy, Professor & Concordia Research Chair, Director Micro Nano Bio Integration Centre, Department of Mechanical, Industrial and Aerospace Engineering, Gina Cody School of Engineering and Computer Science, Concordia University, Canada.
- 2 Prof. Liang-Shih Fan, Distinguished University Professor, C. John Easton Professor in Engineering and Professor of Chemical and Biomolecular Engineering, The Ohio State University, USA.
- 3 Prof. Timothy Charles Lieuwen, Regents Professor and David S. Lewis, Jr. Chair, Department of Aerospace Engineering & Department of Mechanical Engineering and Executive Director, Strategic Energy Institute, Georgia Institute of Technology, USA.

Fellows elected under Rule 37(g)

During the AGM of Fellows in the year 2015, it was brought out that many eminent experts from the Industry who have excelled in their respective spheres are not Fellows of the Academy since they are not nominated for election to the Fellowship through the normal process. Therefore, the percentage of elected Fellowship on the rolls of the Academy from the category of “Industry” was only 19%. With a view to enhance the visibility of INAE in Industry domain and also to increase industry representation in the Fellowship, it was decided during the year 2015 to increase the intake of eminent experts from thirty to forty at any point of time to be elected as Fellows under Rule 37(g) effective from the year 2016 onwards. Since then, upto five exceptional eminent persons from the Industry category are being elected as Fellows under the Rule 37(g) in a year.

This year, three eminent engineering luminaries elected from Industry category under Rule37(g) were.

- 1 Mr. MV Gowtama, Chairman & Managing Director, Bharat Electronics Ltd., Bangalore.
- 2 Mr. SS Mohanty, Vice-Chairman cum Managing Director, Nelloch Ispat Nigam Ltd., Bhubaneswar.
- 3 Dr. Ramachandra Naidu Galla, Founder & Chairman, Amara Raja Group, Karakambadi, Chittoor Dist. (A.P.).

Honours and Awards

Republic Day Award

The following INAE Fellows have been conferred with the prestigious award of Padma Bhushan Award and Padma Shri Award on the occasion of the Republic Day on January 26, 2020.

Padma Bhushan Award

- Mr Venu Srinivasan, Chairman, TVS Motors Company Ltd., Chennai

Padma Shri Award

- Prof. Sujoy K. Guha, Professor, School of Medical Science and Technology, Indian Institute of Technology Kharagpur
- Prof. Sudhir K Jain, Director, Indian Institute of Technology Gandhinagar
- Prof. T Pradeep, Professor, Department of Chemistry, Indian Institute of Technology Madras

Other Awards

The details of awards received by INAE Fellows during the year are given below.

1	<p>Prof. Roddam Narasimha, FNAE, Chairman, Engineering Mechanics Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore was one of the two scientists from India who received the 2019 Nature Awards for Mentoring in Science. Both the scientists earned praise from former trainees for prioritizing the success of their laboratory members over competition or a publish-or-perish mentality, and for the joy they find in science. Nature's mentoring award programme, which in 2019 marked its 15th year, annual confers two prizes: one for a mid-career mentor, and other for a lifetime of achievement in mentoring. The 2019 awards sought nominations from India, a country that produced 24,300 PhD graduates in 2014, the fourth -highest number in the world after the United States, the United Kingdom and Germany. The nominations were judged by a panel that included Indians scientists working in the nation and abroad and each award had a prize of Rs 7 lakhs. Prof Roddam Narsimha, a fluid dynamicist received the Lifetime Achievement award.</p>
2	<p>Dr G Satheesh Reddy, FNAE, Secretary to Government of India, Dept of Defence R&D, Chairman, Defence Research and Development Organisation (DRDO), Scientific Adviser to Raksha Mantri and Director General, Aeronautical Development Agency (ADA), has been conferred with the prestigious AIAA Missile Systems Award 2019 by American Institute of Aeronautics and Astronautics (AIAA), one of the world's largest and reputed aerospace technical societies. The award recognizes excellence in developing and implementing missile systems technology and for inspired leadership of missile systems programmes. Dr G. Satheesh Reddy was selected for his over three decades of significant national contributions toward indigenous design, development, and deployment of diversified strategic and tactical missile systems, guided weapons, advanced avionics, and navigation technologies in India. He is the first Indian to be conferred with this Award.</p> <p>The news clippings regarding the same may be viewed at the links given below</p> <p>https://www.thehindu.com/todays-paper/tp-national/drdo-chairman-wins-missile-systems-award/article26422423.ece</p>

	https://timesofindia.indiatimes.com/city/hyderabad/international-award-for-satheesh-reddy/articleshow/68237684.cms
3	Prof Bikramjit Basu, FNAE, Honorary Professor, University of Manchester, UK; Guest Professor, Wuhan University of Technology, China and Professor, Materials Research Centre, Indian Institute of Science, Bangalore has been selected to be elevated to the grade of Fellow of The American Ceramic Society, founded in 1899. Recognition of this achievement will be given at the ACerS Honours and Awards Banquet at the 121st Annual Meeting of the American Ceramic Society on, September 30, 2019 in Portland Oregon, USA.
4	Dr. Prahlada Ramarao, FNAE, Pro Chancellor S-VYASA, Director, Centre for Energy Research and Adjunct Faculty, Dept of Management IISc and NIAS, Bengaluru has been nominated by the President of India, in his capacity as the Visitor of Indian Institute of Science (IISc), Bangalore as his nominee on the Court of the Institute as per Clause 8.1 (a) of the Scheme, Regulations and Bye-Laws of IISc Bangalore.
5	Prof Bhargab B. Bhattacharya, FNAE Professor of Computer Science & Engineering (Retd.) Indian Statistical Institute, Kolkata & Distinguished Visiting Professor Department of Computer Science & Engineering IIT Kharagpur and his research group at ISI Kolkata has recently received a recognition from the Institution of Engineers-India (IEI) and IEEE. Prof Bhargab B. Bhattacharya was conferred with the IEI-IEEE Joint Award for Engineering Excellence - 2018 for contributions to VLSI and microfluidic biochips and their bio-medical applications. Some of the relevant work was supported by INAE Chair Professorship (2016-2018). Further details may be viewed at the link https://www.ieee.org/about/awards/joint-awards-est.html#india
6	Prof R.P. Mohanty, FNAE Chief Consultant, SOA (Deemed to be University), Bhubaneswar, Formerly Vice-President, The Associated Cement Companies Ltd., Mumbai, Formerly Chair Professor, Dean and Advisor, ITM Group of Institutions, Navi Mumbai; Vice-Chancellor, Siksha 'O' Anusandhan University, Bhubaneswar; Former Senior Advisor, ICFAI Group, IFHE University, Hyderabad has been nominated by the National Council of Indian Institution of Industrial Engineering (IIIE), (NHQ Mumbai) as the National President for a period of 2 years (2019-2021).
7	Prof Ganti Prasada Rao, FNAE Member UNESCO-EOLSS Joint Committee, Abu Dhabi, UAE has been honoured as Distinguished Alumnus of Indian Institute of Technology Kharagpur; Notable Alumni of Jawaharlal Nehru Technological University (JNTU), Kakainada and also a Notable Alumni of Maharajah's College, Vizianagaram, all three institutions of higher learning that he attended after his schooling.
8	Dr Ravindra Gettu, FNAE, Dean, Industrial Consultancy & Sponsored Research and Prof. V.S. Raju Chair Professor, Department of Civil Engineering, Indian Institute of Technology Madras, Chennai has been elected as a Foreign Member of the Russian Academy of Engineering.
9	Prof BV Rao, FNAE Adjunct Faculty, NIAS, Bangalore; National President, IPE and formerly Professor IIT Madras and former Pro-Chancellor & Advisor VIT University, Vellore has been conferred with Lifetime achievement Award at the Indian Technology Congress

	(ITC)-2019, held on September 4-5, 2019 at Bangalore. This Award was presented at the Inaugural Ceremony of the Congress on 4th Sep with a Citation.
10	Prof. Manoj Kumar Tiwari, FNAE, Department of Industrial and Systems Engineering, IIT Kharagpur has been elected as fellow of NASI Prayagraj. His NASI Fellowship will be effective from 23rd December 2019.
11	<p>Dr. J.C. Misra, Ph.D., D.Sc., FNASc., FNAE, FIMA (UK), FITHP, FRSM (London), FIET (UK); Adjunct Professor, Indian Institute of Engineering Science and Technology, Shibpur, Howrah; Formerly, Pro Vice-Chancellor, SOA University, Bhubaneswar; Former Professor and Head, Department of Mathematics, IIT Kharagpur; Ex- President, Mathematical Sciences Section, Indian Science Congress and Recipient of INAE Outstanding Teachers Award and Ram Mohan Puraskar has been elected a Fellow of the Institution of Engineering and Technology (IET), London - a highly prestigious world-famous multidisciplinary professional engineering institution.</p> <p>Dr. J.C. Misra, has also been elected as a of Fellow the Royal Society of Biology (London) on 1 April 2020 in recognition of his research contributions in Physiological Fluid Dynamics. He has been elected a Fellow of the Royal Society of Public Health in recognition of research contributions in Bioengineering/Physiological Fluid Dynamics that have promising impact on Public Health.</p>

News of Fellows

1.	<p>Dr Sanak Mishra, President, INAE and Formerly Managing Director, Rourkela Steel Plant and Director, Steel Authority of India Ltd.(SAIL); Vice-President, ArcelorMittal and CEO India Projects; Secretary General, Indian Steel Association was the Guest of Honour and Chief Speaker at the Engineers Day Celebrations organized by Rourkela Steel Plant, in association with Institution of Engineers on September 15, 2019 at Civic Centre, Rourkela Steel Township.</p> <p>Dr Sanak Mishra was also the distinguished speaker and delivered the Dr Dara P Antia Memorial Lecture: A Discourse on the Art of Leadership Practice organized by the Indian Institute of Metals Pune Chapter and Dr Dara P Antia Memorial Lecture Committee on September 17, 2019 at College of Engineering, Pune. Dr. Dara Antia, was a recipient of the INAE "Lifetime Contribution in Engineering" Award. He was the Founding Member of the Indian Institute of Metals and a Distinguished Alumnus of Banaras Hindu University. He also had the unique distinction of being the very first Indian to receive his Sc.D. in Metallurgical Engineering from MIT USA (1943).</p>
2.	<p>Dr Purnendu Ghosh, Vice-President, INAE and Executive Director, Birla Institute of Scientific Research, Jaipur has authored a book titled “FLOATING IMAGES” published by Pothi Publishers. Some of his other books are: The rising sun, Neural suitcase, Ethics of the chair, Looking into the mirror, Magic of the morning sun, Biotechnology in India and Engineering of life and life technologies. A brief description of the book titled “FLOATING IMAGES” is as follows. During his journey, the author met various people. Some people/events made a mark on him. In this collection of poems, the author has interpreted his experiences about the intricacies of human nature. This book is about knowing the self, more than anything else.</p>
3.	<p>Dr RK Bhandari, FNAE, Formerly Director, Central Building Research Institute, Roorkee & Programme Director, UN-HABITAT, Nairobi and Formerly Chairman, Centre for Disaster Mitigation and Management, VIT, Vellore delivered the 4th Arvind Verma Memorial Lecture on August 21, 2019 at New Delhi. The topic of the lecture was “ The Urgency for Resurgence of the Culture of Geotechnical Engineering Practice in India”.</p>
4.	<p>Prof BS Murty, FNAE Professor, Department of Metallurgical & Materials Engineering, IIT Madras has taken over as Director of IIT Hyderabad from August 26, 2019.</p>
5.	<p>Mr RN Jayaraj, FNAE, Formerly Chairman & Chief Executive, Nuclear Fuel Complex, Department of Atomic Energy, Hyderabad has been chosen by Ministry of Electronics and Information Technology, Government of India for the Honorary Position of Chairman of “Research and Technology Committee” for development of Technologies for e-waste Management in the country. The Centre of Excellence for this task is being created at Hyderabad in the Campus of Centre for Materials for Electronics Technology (C-MET), Cherlapalli.</p>
6.	<p>Prof DN Singh, FNAE, Institute Chair Professor, Geotechnical Engineering Division, Department of Civil Engineering, Indian Institute of Technology Bombay, Mumbai was Principal Investigator of a study led by IIT Bombay which was featured in an article titled “Mineral Contents of Buldhana’s Lonar Lake Similar to Moon Rocks: IIT-Bombay Study” published in Hindustan Times, Mumbai on March 25, 2019. Prof DN Singh has requested for suggestions and comments on the article which may be viewed at the link given below</p>

	<p>https://www.hindustantimes.com/mumbai-news/mineral-contents-of-buldhana-s-lonar-lake-similar-to-moon-rocks-iit-bombay-study/story-sl9v4p3gBvp2oIorYDY77H.html</p>
7.	<p>Dr Debabrata Das, FNAE, Visiting Professor, Former Head and Renewable Energy Chair Professor, Department of Biotechnology and Former Professor-in-Charge P K Sinha Center for Bioenergy, Indian Institute of Technology, Kharagpur has jointly authored a book with Dr Jhansi L. Varanasi titled "Fundamentals of Biofuel Production Processes" published by CRC Press, USA in 2019. Focusing on fundamentals of biofuel production from renewable energy sources and biohydrogen production, this book offers a complete understanding of the bioconversion processes. Dr. Das also authored a book entitled "Biochemical Engineering: An Introductory Text Book" published by Jenny Stanford Publishing Pte. Ltd., Singapore. The book provides students the knowledge that will enable them to contribute in various professional fields, including bioprocess development, modelling and simulation and environmental engineering.</p>
8.	<p>Prof R.N. Iyengar, FNAE, Distinguished Professor, Centre for Ancient History & Culture, Jain University, Bangalore has recently authored a book on “Nārada Śilpaśāstra” published by Jain University Press.</p>
9.	<p>Dr. Debabrata Das, FNAE, Visiting Professor, Former Head and Renewable Energy Chair Professor, Department of Biotechnology and Former Professor-in-Charge, P K Sinha Center for Bioenergy, Indian Institute of Technology, Kharagpur and his research group have recently signed a Technology License Agreement on their Biohydrogen Production process with M/s. Dhampur Sugar Mills Ltd.</p>
10.	<p>Prof. Sankar K. Pal, FNAE, Distinguished Scientist and Former Director, Indian Statistical Institute, Kolkata has assumed the office of Distinguished Professor Chair of Indian National Science Academy (INSA) at the Indian Statistical Institute, Kolkata on Oct 1, 2018. This Chair position is one of the highest scientific honours that INSA confers.</p> <p>Prof Sankar Pal delivered the following prestigious Keynote/Named Lectures in India and abroad in the last one year.</p> <p>Abroad:</p> <ul style="list-style-type: none"> • Series of Invited talk(s) at 5th International School on Big Data (BigDat 2019), University of Cambridge, U.K., January 7-11, 2019. • Keynote talk at the International Conference on Information, System and Convergence Applications (ICISCA), Bangkok, Thailand, January 23-25, 2019. • Keynote speech at the Int. Conf. on Smart Grid Technology and Data Processing: Smart Urban and its Breakthrough in Technology and Management, Suzhou, China, Feb 28 - March 1, 2019. • Invited talk in the Department of Electrical and Computer Engineering, University of Illinois, Urbana-Champaign (UIUC), IL, USA on May 7, 2019. • Invited talk at 3rd Qingdao International Academicians Conference, Qingdao, China,

	<p>May 28 to 31, 2019.</p> <p>India:</p> <ul style="list-style-type: none"> • Prof. Meghnad Saha Memorial Lecture of the National Academy of Sciences, India, Jharkhand Chapter, to commemorate the 125th Birth anniversary of its founder, CSIR-NML Auditorium, Jamshedpur, October 5, 2018. • Prof. M. N. Saha Memorial Lecture of the National Academy of Sciences, India, Varanasi Chapter, to commemorate the 125th Birth anniversary of its founder, Banaras Hindu University, Banaras (BHU), March 29, 2019. • CSIR Foundation Day Lecture at the Vigyan Auditorium, CSIR Madras Complex and CSIR-Structural Engineering Research Centre, Chennai, September 27, 2019
11.	<p>Dr P.A. Lakshminarayanan, FNAE, Technical Advisor, Simpson Chennai and Former Head, Engine R&D, Ashok Leyland; Former Chief Technical Officer, Sampson & Co. Ltd has edited his third book to be released in November 2019 at the ISEES Conference at NEERI, CSIR, Nagpur. The details of the book are given below.</p> <p>Design and Development of Heavy Duty Diesel Engines · A Handbook Editors: Lakshminarayanan, P. A., Agarwal, Avinash Kumar (Eds.)</p> <p>Further details of the book are available at the link given below.</p> <p>https://www.springer.com/gp/book/9789811509698</p>
12.	<p>Prof. Manoj Kumar Tiwari, FNAE, Department of Industrial and Systems Engineering, IIT Kharagpur has been appointed as Director of NITIE (National Institute of Industrial Engineering Mumbai) by MHRD Govt of India for the period of five years. He took over the charge w.e.f. 5th November 2019.</p>
13.	<p>Mr Ajay N Deshpande, FNAE and Ex CMD/D(T) of EIL was invited to speak in Leadership Panel titled “Excellence Strategies & Leadership Insights” at the India Operational Excellence Conference (IOPEX) organised by The Energy & Climate Initiatives Society at New Delhi on November 18, 2019. Mr Deshpande in his talk covered the operational excellence benchmarks to be improved upon in both the project implementation as well as post-operational stages of Oil & Gas projects. While process intensification, modularisation, smart 3D modelling, construction mechanisation and overall digitalisation of activities are the bench marks to be met in project implementation stage, capacity utilisation energy numbers, operational availability, volumetric expansion in production with GHG footprint are the bench marks in plant operations. The talk was met with an enthusiastic response in Q&A session by the audience.</p>
14.	<p>Prof Bikramjit Basu, FNAE, Professor, Materials Research Centre, Indian Institute of Science, Bangalore has been informed by the International Union of Societies for Biomaterials Science and Engineering (IUSBSE) that his nomination to receive the accolade of Fellow Biomaterials Science and Engineering (FBSE) has been approved. The presentation of the Fellowship which will occur in 2020 at the 12th World Biomaterials Congress to be held in Glasgow, United Kingdom.</p>

	Prof Bikramjit Basu has also been elected as Fellow of the Indian Academy of Sciences, Bangalore during 2019 (effective 2020).
15.	Prof SN Mukhopadhyay, FNAE Ex-Adjunct Professor, Birla Institute of Technology & Science, Pilani has authored a book on “Fundamentals of Waste and Environmental Engineering” published by TERI Press, New Delhi.
16.	Mr Ajay N Deshpande, FNAE, ex CMD/Director (Technical) of EIL, was invited to Manipal University-Jaipur to deliver a talk on the National Science Day by the School of Chemical & Civil Engineering. In his talk titled “Technology / Engineering / Manufacturing Challenges in Hydrocarbon Sector”, Mr Deshpande covered the opportunities available for graduating students within the state of Rajasthan due to investments in upstream oil and gas exploration/production activity, as also in downstream refining and petrochemicals segment. Choice of a career whether in a Technology driven EPC or an Operation company, offers ample challenges for technology innovation, design indigenisation, localised manufacturing and providing value add-services, which he emphasised citing examples in each area. The talk was followed with an engaged discussion on utilizing of these opportunities.
17.	Mr AN Desphande, FNAE, ex CMD/Director (Technical) of EIL, was invited to chair a session and also speak as member of a panel discussion at a workshop titled - “Changing Energy Paradigm” organised by the Lovraj Kumar Memorial Trust (LKMT) at the India International Centre, New Delhi. While the session he chaired was about the importance of Biofuels and technologies available for their commercialisation to target the Government of India sponsored JIVAN scheme, during the panel discussion he spoke on the imperatives and options for Petroleum Refining industry to integrate Petrochemicals production for enhancing the value generation per barrel crude processed and also to combat the challenge posed to transport fuels by EVs and the expanding gas market. The sessions were vibrant with audience’s active participation in Q&A session.

News of INAE Young Associates

1	Dr Koteswararao V. Rajulapati, Associate Professor, School of Engineering Sciences and Technology, University of Hyderabad, Hyderabad was elected in March 2019 as "Fellow of Telangana Academy of Sciences (FTAS)" in recognition of his contributions to Science & Technology. He is currently in the grade of Professor at University of Hyderabad.
---	--

Fellows Deceased in Last one Year

During the year 2019-20, it was learnt about the sad demise of the following INAE Fellows. Deepest condolences have been expressed to the families of the deceased Fellows on behalf of INAE and prayers were offered for their souls to rest in peace. Brief Obituaries as a mark of respect for the departed INAE Fellows are given below.

Obituaries

Dr Tuhin Kumar Roy

Dr Tuhin Kumar Roy, FNAE born on August 1, 1923 passed away on August 4, 2019.

Dr Tuhin Kumar Roy, FNAE Chairman, CMDC Design Pvt. Co. Ltd., New Delhi and Formerly Professor and Head, Chemical Engineering Department, Jadavpur University, Kolkata had made outstanding research contributions in the field of Chemical Engineering, covering the areas of Hydrometallurgy and Fluidization. His proactive efforts in the transfer of indigenously developed technologies to commercial scale, for utilization in Chemical Manufacturing Plants in India, are well recognized. As an inventor, he developed novel technologies and processes for recovery of nickel and cobalt from ore leach solutions for commercialization. He held several patents in India and USA in the fields of hydrometallurgy and chemical processes and published many research papers on reactions in fluidized bed, selective precipitation of metal powders and metallic sulphides and oxidative leaching of minerals. He had guided project work on coal processing plants including low temperature carbonization, formed coke and coal beneficiation. He had served as President of the Indian Institute of Chemical Engineers and the National Association of Consulting Engineers. In 2007, he was conferred with the Indian Institute of Chemical Engineers Diamond Award. Dr TK Roy had also contributed significantly to the activities and programmes of INAE and served as Honorary Treasurer from 1993 to 1995.

May God Bless his soul to Rest in Peace

Col BK Rai (Retd)

Col BK Rai, FNAE born on November 21, 1926 passed away on August 19, 2019.

Col BK Rai, FNAE, Formerly Chairman, UPTRON Group, HCL Ltd had made outstanding contributions in the growth of the Electronics Industry. His role in building up UPTRON from scratch into a highly diversified and profitable venture is well recognized. The major areas of activity of UPTRON are: Computer and microprocessor-based systems; Computer communications; Radio and line communication systems; Office Automation; Mining control and communications; Process control and instrumentation; ground water electronic data logging; online computerised seat reservation systems for Air India and Indian Airlines; electrolytic capacitors; energy optimization systems and Black & White and colour picture tubes and low-cost Television and radios. Previously, he had held important positions in Air Headquarters and later joined the private sector. He also contributed towards identification of technologies for development of high technology products, of national importance, in industrially backward areas. He has trained senior personnel in technology and industrial management and helped nurture entrepreneurship in the Electronics field in remote areas.

May God Bless his soul to Rest in Peace

Prof AS Arya

Prof AS Arya, FNAE born on June 16, 1931 passed away on September 1, 2019.

Prof AS Arya, FNAE, Member, State Disaster Management Authority, Govt. of India and Formerly Seismic Capacity Building Advisor, Ministry of Home Affairs, Govt. of India-UNDP DRM Programme and Professor Emeritus, IIT Roorkee has made significant contributions in the field of Earthquake Engineering including formulation of the Codes of Practice and guidelines for earthquake resistant design and construction of buildings. He played a key role in developing indigenous expertise relating to earthquake disaster prevention and mitigation for structures ranging from multi-storeyed buildings, dams, nuclear power plants and petrochemical plants etc. He was instrumental in developing several courses in structural and earthquake engineering based on state-of-art in the subjects covering frontier areas of research. His innovative approach in developing laboratories for research were acclaimed and contributed significantly to conduct of experimental studies related to dynamic behaviour of masonry buildings and structures. All his life, he worked with zeal on implementation of seismic safety measures and was responsible for preparation of Vulnerability Atlas of India and Techno-legal Regime for Natural Disaster Reduction by Chairing of an Expert Group and helped create national awareness of disaster risk and safety practices and policies. Prof AS Arya was conferred with the Padma Shri Award by President of India and received the INAE Lifetime Contribution Award in Engineering in 2002.

May God Bless his soul to Rest in Peace

Prof Tarun K Ghose

Prof Tarun K Ghose, FNAE born on September 1, 1924 passed away on September 24, 2019.

Prof Tarun K Ghose, Founding Chair, Biochemical Engineering and Biotechnology, IIT Delhi was a pioneer in introducing biochemical engineering education and research in the country. He had made outstanding research contributions in the areas of Biotechnology and Biochemical Engineering including elucidation of the mode of formation of cellulase enzyme complex. He was recognized worldwide for his research work in the nineteen sixties on elucidation of the mode of formation and action of cellulase enzyme complex and its action on rapid saccharification of cellulose. This led to the development of what is known as “membrane reactor” for simultaneous reaction and separation of products of cellulose saccharification. His significant research contributions also covered areas of modelling, analysis and development of several optimal systems including strategy on dynamic control on rapid release of enzyme; analysis of immobilized cell bioreactor- a pioneering concept; rapid conversion of cellulose to ethanol and its separation by a non-distillative route and development of a biphasic biomethanation process. Prof TK Ghose initiated the Department of food technology and biochemical engineering at Jadavpur University, H.B. Technological Institute, Kanpur, and Biochemical Engineering Research Centre at IIT Delhi. He was conferred with the INAE Life Time Contribution Award in Engineering in the year 2017.

May God Bless his soul to Rest in Peace

Dr. VR Kanetkar

Dr VR Kanetkar, FNAE born on March 7, 1954 passed away on September 30, 2019.

Dr VR Kanetkar, Consultant- Technical Services, Autometers Alliance Ltd, Noida and formerly Assistant Vice -President, Corporate R&D, ABB Limited, Vadodara and Vice -President, Autometers Alliance Ltd had made significant research contributions in the areas of Power Electronics. He has several power electronic products and systems to his credit as a designer and most of these are from concept to commissioning including thyristorized DC drives, series parallel slip power recovery system, thyristorized reactive power compensators, semiconductor fuse-less design for thyristor converters, medium voltage thyristor converters, Elevator drive and insulated - gate bipolar transistor (IGBT) converter based Dynamic reactive power compensators. At ABB, Dr Kanetkar's responsibilities included development of electronic and power electronics products and systems necessary for Indian environment and customers. He provided support to the business areas on drives, traction, networks, automation, communication and relays in terms of analysis, simulation, guidelines for specific requirements, site problem solving, technical evaluations and studies and negotiations for orders. He contributed in major power electronics R&D work and implemented international standards for the functioning units of ABB. Dr VR Kanetkar translated his vast experience to Indian industries, Universities and Professional organizations.

May God Bless his soul to Rest in Peace

Technical Contributions by INAE Fellows

1. Summary of book authored by Prof R.N. Iyengar, FNAE on “Nārada Śilpaśāstra”

Prof R.N. Iyengar, FNAE, Distinguished Professor, Centre for Ancient History & Culture, Jain University, Bangalore has recently authored a book on “Nārada Śilpaśāstra” published by Jain University Press. A brief summary of the book is given below.

Nārada Śilpaśāstra

[Sanskrit Text on Architectural Civil Engineering]

R.N. Iyengar, (helped by K.S.Kannan & S.Y.Wakankar)

Jain University Press, 2018, Rs.300/- (ISBN 978-93-85327-58-2)

India has a rich and ancient tradition of building cities, monuments, towers, dams, bridges, reservoirs, step-wells and other civic infrastructure besides beautiful temples and palaces. Some of the present-day highways are aligned on ancient tracts that were first laid several centuries ago. There are several ancient Sanskrit texts known as either *Vāstuśāstra* or *Śilpaśāstra* that describe some aspects of residential buildings, temples and other structures. The present text, attributed to the authorship of Nārada, the legendary sage and polymath, is a *Vāstuśāstra* text, although traditionally the manuscripts are titled *Nārada Śilpaśāstra*. This text, in terse technical Sanskrit prose describes site selection, planning of villages and cities, construction of roads, dams, lakes, foundation, basement, building typology, importance rating, super structure of private and public buildings including marriage halls, art galleries, theatres and temples. Internal evidences point out that in its present form, this text originated at a time when weekdays were not in vogue, but acquired additional material at a later period and fixed in South India around 6th century CE. Prof. R.N. Iyengar, himself a renowned Civil Engineer, helped by two Sanskrit scholars, has for the first time brought out this unique Sanskrit text on the theory and practice of Architectural Civil Engineering in ancient India with Introduction, translation, notes and figures.

Excerpts from the Foreword of Prof. Michel Danino (*Member, ICHR*)

“.....*The efforts... bound to elicit much scholarly interest in India and abroad. This critical edition, based on three manuscripts, comes with a careful editorial apparatus, which includes ... Prof. Iyengar’s meticulous discussion of the date and provenance of the text, which he attributes to the sixth century CE at the latest and to south India respectively, is in my view conclusive; it also shows the breadth of his scholarship in the technical literature in Sanskrit...it is certain that from the angle of sustainability at least, if not also aesthetics, our “modern” concepts or urbanism and architecture would benefit from an open-minded scrutiny of texts... such as the one Prof. Iyengar and his collaborators have now put in our hands....*”

ju.publications@jainuniversity.ac.in

2. Summary of Technology License Agreement on Biohydrogen Production Process signed by Dr. Debabrata Das, FNAE & his research group at IIT Kharagpur with M/s. Dhampur Sugar Mills Ltd.

Technology License Agreement on Biohydrogen Production Process

Indian Institute of Technology (IIT) Kharagpur has pioneered the promising Research and Development of biohydrogen production process by applying fermentation technology and actively involved in this research work for a period of last more than twenty years. The

commendable contributions towards development of a commercially competitive and environmentally benign bioprocess began with the isolation and characterization of high-yielding hydrogen producing bacterial strain *Enterobacter cloacae* IIT-BT 08, which is known to be the highest producer of hydrogen by fermentation. They successfully demonstrated **10 m³** Pilot Plant studies for the commercial exploitation of the process using cane molasses, rice mill wastes, distillery effluent, sewage sludge, etc. sponsored by MNRE, Government of India. The aim was to synchronize the bioremediation of wastewater with clean energy generation. IIT Kharagpur and M/s. Dhampur Sugar Mills. Ltd., Dhampur, UP signed a Technology License Agreement on 3rd May, 2019 on the development of Biohydrogen Production Process in the commercial scale. They have published 6 books and more than 150 publication in the peer reviewed journals on the different bioenergy generation processes. International Association of Hydrogen Energy conferred Akira Mitsui award to Prof. Debabrata Das, FNAE, Group leader for his contribution in hydrogen research at WHEC 2008 at Brisbane.



10 m³ Biohydrogen Pilot Plant at IIT Kharagpur



Mr. Vijay Goel, President, M/s. Ms. Dhampur Sugar Mills Ltd., India, Prof. Debabrata Das, Inventor and Prof. Pallab Dasgupta, Dean, SRIC, IIT Kharagpur at the Technology Licence Agreement Ceremony on “Biohydrogen production from the distillery effluent” at IIT Kharagpur.

INAE Annual Convention

The INAE Annual Convention 2019, hosted by Birla Institute of Scientific Research (BISR), Jaipur, from December 12 -14, 2019 and coordinated by Dr Purnendu Ghosh, Vice – President, INAE and Executive Director, BISR, Jaipur was held at BISR, Jaipur. All INAE Fellows and Young Associates had been invited to participate in the Annual Convention 2019. The Convention commenced with the INAE Governing Council Meeting on December 12, 2019 followed by the Award Lectures by the winners of Life Time Contribution Award in Engineering 2019 viz Prof EC Subbarao and Mr AS Kiran Kumar; Prof Jai Krishna Memorial Awardee - Prof KT Jacob; Prof SN Mitra Memorial Awardee- Prof RK Shevgaonkar and the INAE Outstanding Teacher Awardee- Prof BS Murty. After the Award Lectures, the INAE Fellows Dinner was held which provided an excellent opportunity for networking of Fellows.

The Inaugural Session of the INAE Annual Convention 2019 was held on December 13, 2019, which commenced with the lighting of the lamp by the dignitaries on the dais, followed by wonderful rendition of a melodious invocation by the BISR team. The Welcome Address was delivered by Dr Purnendu Ghosh, Vice – President, INAE and Executive Director, Birla Institute of Scientific Research, Jaipur. Dr Sanak Mishra, President, Indian National Academy of Engineering (INAE) in his Presidential Address, gave an overview of the Academy and the major activities of the last one year. The highlight of the event was the inspiring talk delivered by the Chief Guest – Mr SK Roongta, Chairman, BALCO to the august audience. The book “Mind of an Engineer Volume II” edited by Dr Purnendu Ghosh released during the Inaugural Session is the second volume of a series of books featuring articles by INAE Fellows about the reminiscences, inspirations, challenges and opportunities in their professional journeys. The next feature of the Inaugural Session was the release of the Report on “Urban Transportation: Challenges and Way Forward” edited by Prof Prem Krishna, former Vice-President, INAE and Chairman, INAE Forum on Civil Infrastructure. The report comprises of an analysis of the challenges faced in the modernization of Urban Transportation and suggests solutions to overcome the same. This was followed by the Special Induction Ceremony of INAE Fellows from Industry wherein two stalwarts of industry viz. Mr SS Mohanty, Vice-Chairman cum Managing Director, Neelachal Ispat Nigam Limited and Dr Ramachandra Naidu Galla, Founder & Chairman, Amara Raja Group were inducted as Fellows of INAE. The Inaugural Session concluded with the proposing of the vote of thanks by Prof Indranil Manna, Vice-President, INAE.



Release of book “Mind of an Engineer Volume II”



Release of Report on “Urban Transportation: Challenges and Way Forward”

Three Plenary Talks were delivered during the Annual Convention by eminent personalities as per details below.

- First Plenary Talk on “Hydraulic Design of Water Resources Structures- Role of Model Studies” by Dr. (Ms.) Varsha V. Bhosekar, Director, Central Water and Power Research Station, Pune on December 13, 2019

- Second Plenary Talk on “Disruptive Innovations in Iron & Steel Industry” by Mr. Manoranjan Ram, Associate Vice-President, SMS Group, Paul Wurth India Pvt Ltd., Gurgaon on December 13, 2019.
- Third Plenary Talk on ‘Ecologically Yours: Tagore's Empathy with Environment’ by Ms Pramita Mallick, renowned vocalist and exponent of “Rabindra Sangeet” (the music of Tagore) on December 14, 2019

Technical Sessions were held on December 13, 2019 in which newly elected Fellows (whose Fellowship is effective from November 1, 2019) and INAE Young Engineer Awardees 2019 made presentations relating to their own significant engineering contributions.

The Grand Award Function was held on the evening of December 13, 2019, wherein Prof EC Subbarao and Mr AS Kiran Kumar were conferred the Life Time Contribution Award in Engineering 2019. Prof KT Jacob and Prof RK Shevgaonkar were conferred the Prof Jai Krishna Memorial Award and Prof SN Mitra Memorial Award 2019 respectively and Prof BS Murty was conferred the INAE Outstanding Teacher Award 2019. The awardees for INAE Young Entrepreneur Award 2019 were Mr. Suteerth Tripathi and Ms. Shivani Gupta, Inochi Care Private Limited, New Delhi and Mr. Prakhar Jain and Mr. Usama Ahmed Abbasi, MicroX Labs Pvt Ltd. Fifteen Young Engineer Awards 2019 were conferred to brilliant engineers below 35 year of age. The Innovative Student Project Awardees 2019 comprised of ten awards at Doctoral level; five at Master’s Level and ten at Bachelors Level who were presented for innovation in their project/thesis work. The Innovative Student Project Awardees 2019 and the team leaders of the INAE Youth Conclave 2019 competition award winning teams were also inducted as INAE Student Members during the Grand Award function. After the vote of thanks proposed by Dr Pradip, Vice- President, INAE a Cultural Programme was organized prior to the Dinner. The artists enthralled the audience with their entertaining performance.



Prof EC Subbarao being conferred with the Life Time Contribution Award in Engineering 2019



Mr AS Kiran Kumar being conferred with the Life Time Contribution Award in Engineering 2019



Prof KT Jacob being conferred the Prof Jai Krishna Memorial Award 2019



Prof RK Shevgaonkar being conferred the Prof SN Mitra Memorial Award 2019



Prof BS Murty being conferred the INAE Outstanding Teachers Award 2019



Dr Poulami Chakraborty being conferred the INAE Young Engineer Award 2019



Mr Suteerth Tripathi & Ms Shivani Gupta being conferred the INAE Young Entrepreneur Award 2019



Dr Gaurav Goswami being conferred the Innovative Student Project Award 2019

The session on lectures by the INAE Young Entrepreneur Awardees 2019 was held in the morning of December 14, 2019 wherein Mr Sutherth Tripathi delivered a lecture on “High performance multi-functional wound healing technology” and Mr Usama Ahmed Abbasi delivered a lecture on “Portable, efficient and affordable blood cell counter”.

The Annual General Meeting of Fellows was held on December 14, 2019 wherein during the Induction Ceremony, the newly elected Fellows and Young Associates were formally admitted into the Academy by the President, INAE. The was followed by the Special General Meeting of Fellows and the event concluded with lunch. A scenic tour of historical places, in and around Jaipur, was organized for the interested Fellows and Young Associates on December 15, 2019.



Group Photo with Newly Elected Fellows



Group Photo with INAE Young Associates

Publications of the Academy

Mind of an Engineer Volume II

The book – The Mind of an Engineer Volume 1, an initiative of the INAE published in the year 2016 is a reflection of the experiences of some of the Fellows of the INAE in the field of science, technology and engineering. The book is about the reminiscences, eureka moments, inspirations, challenges and opportunities in the journey the professionals took toward self-realization and the goals they achieved. “The Mind of an Engineer: Volume 2” has been brought out by Indian National Academy of Engineering (INAE) recently, which is the second book of the series of a unique initiative undertaken by the Academy, to publish somewhat autobiographical articles by INAE Fellows on the subtle nuances in their personal and professional experiences that have helped shape their minds as eminent engineering professionals. Dr Purnendu Ghosh, Vice-President, INAE is the editor of “The Mind of an Engineer: Volume 2” which was released during the INAE Annual Convention held at Jaipur in December 2019.

INAE Journal - Transactions of Indian National Academy of Engineering- An International Journal of Engineering and Technology

The title of the INAE Letters Journal has been changed to “Transactions of Indian National Academy of Engineering- An International Journal of Engineering and Technology” to make it a full- fledged journal to include full Research Papers and Review Articles, besides short communications w.e.f January 2020. Prof. K. Bhanu Sankara Rao FNAE, is the Editor-in-Chief and being published in co-operation with Springer Nature. The Editorial Board of Transactions of Indian National Academy of Engineering” has also since been re-constituted to include one Fellow from each of the Engineering Sections as an Editor, and few Young Associates as Associate Editors. Necessary changes have been made on the website of M/s Springer, which also contains the revised guidelines for submission of papers by authors. A link has also been provided on INAE website in the publication section, to access the website of M/s Springer for submission of papers by authors online. Provision for free online access of research papers published in the Transactions of Indian National Academy of Engineering has also been made through the login facility of INAE Fellows.

Overview of Activities of the International Committee of the Engineering Academy of Japan (2019/2020)

The Engineering Academy of Japan (EAJ) is a key member of the International Council of Academies of Engineering and Technological Sciences (CAETS) and uses their network to conduct international activities that contribute to the development of engineering and scientific technology in Japan and throughout the world.

<Inter-Academy Alliances>

(1) International Council of Academies of Engineering and Technological Sciences: CAETS Steering Committee

The 2019 CAETS Conference was held in Stockholm from June 24 to 28, 2019 in commemoration of the 100th anniversary of the Royal Swedish Academy of Engineering Sciences (IVA). We worked on exchanging information with the representatives of each country's engineering academies, and held meetings to promote cooperative activity with representatives from Korea, host country for 2020, and Australia, with whom we are cooperating with.

(2) East Asia Round Table Meeting of Academies of Engineering: EA-RTM Steering Committee

The EA-RTM Steering Committee hosted the 22nd round-table meeting at Osaka University in December in cooperation with the Kansai Branch and Osaka University. At the joint symposium to deepen "medical engineering collaboration," high-quality presentations and discussions served as the impetus for future cooperation among the three academies in Japan, China and Korea.

(3) Japan-Europe Cooperation Steering Committee

The Japan-Europe Cooperation Steering Committee exchanged experiences with the National Academy of Science and Engineering (acatech, Germany), the Royal Academy of Engineering (RAEng, UK), the Royal Swedish Academy of Engineering Sciences (IVA), and the National Academy of Technologies of France (NATF), and mutually examined the development of collaboration.

<Next-Generation Training Exchange Programs>

(4) Japan America Frontiers of Engineering Symposium: JAFOE Steering Committee

The steering committee worked while communicating closely with the National Academy of Engineering (NAE) and the Japan Science and Technology Agency (JST) to advance preparations for the symposium to be held in the US in 2020 (which has been postponed to 2021 due to the novel coronavirus).

(5) Australia Japan Emerging Research Leaders Exchange Program Trans-disciplinary Symposium: ERLEP Steering Committee

This is a cooperative project with the Australian Academy of Technological Sciences and Engineering (ATSE) that was held in October at Hokkaido University through joint sponsorship with the Eight-University Engineering Association and Hokkaido University. It has broadened the scope of the ERLEP as an educational program for emerging leaders in Japan and Australia.

(6) Ninth Academy of Engineering President's Meeting (AEPM) at STS Forum 2019

This meeting was held during the STS Forum 2019 held in Kyoto from October 5 to 8, 2019. For this occasion, we invited university deans and research laboratory directors and drew participations from a total of 10 countries, including Australia, Germany, France, Holland, Singapore, Switzerland, Sweden, Thailand, and Korea. Under the central theme of the EAJ Urgent Proposal 2019: To Stop the Fall of Japan's Level of Engineering and Technological Sciences, a focused exchange of opinions took place on improving global competitiveness, industry-university collaborations, and the role of universities and research centers in the education of emerging engineers as the main topics.

The conference proceedings were approved by all participants and summarized as the AEPM Kyoto Declaration (2019), which is published on the EAJ website.

Appendix : AEPM Kyoto Declaration (2019)

AEPM Photo Report 2020

STS *forum*

Science and Technology in Society Forum



Kyoto International Conference Center

Vision of STS *forum*

1. Lights and Shadows
2. Collaboration among Academia, Industry and Government
3. Long-Term Perspective



Shinzo Abe: Prime Minister of Japan

List of Participants in the AEPM 2019 (Representatives from 10 countries)

Hiroyuki Abé (Chairman, Japan)	President, The Engineering Academy of Japan
Hideaki Koizumi (Co-chairman, Japan)	Executive Vice President, The Engineering Academy of Japan
Brian P. Schmidt (Australia)	Vice-Chancellor, The Australian National University (Nobel Laureate)
Margaret Sheil (Australia)	Senior Fellow, Australian Academy of Technology and Engineering
Reinhard F. Hüttl (EU, Germany)	Chairman, The European Council of Academies of Applied Sciences, Technologies and Engineering (Euro-CASE), Former President, acatech
Yves Bamberger (France)	Member, National Academy of Technologies of France
Oh-Kyong Kwon (Korea)	President, National Academy of Engineering of Korea
Martijn Ridderbos (The Netherlands)	Deputy Chairman Executive Board, Leiden University
Eng Chye Tan (Singapore)	President, National University of Singapore
Ole Petter Ottersen (Sweden)	President, Karolinska Institutet
Willy R. Gehrer (Switzerland)	President, Swiss Academy of Engineering Sciences
Paritud Bhandhubanyong (Thailand)	Acting Dean, Panyapiwat Institute of Management
Hiroshi Nagano (Japan)	Senior Executive Director, The Engineering Academy of Japan
Kenji Oeda (Japan)	Executive Director, The Engineering Academy of Japan
Terutaka, Kuwahara (Japan)	Member, The Engineering Academy of Japan
Miyuki Tanaka (Secretary, Japan)	Secretariat, The Engineering Academy of Japan

Terutaka, Kuwahara
 Hiroshi Nagano
 Yves Bamberger
 Martijn Ridderbos
 Eng Chye Tan
 Willy R. Gehrer
 Paritud Bhandhubanyong
 Reinhard F. Hüttl
 Margaret Sheil
 Oh-Kyong Kwon
 Kenji Oeda
 Ole Petter Ottersen
 Hideaki Koizumi
 Brian P. Schmidt
 Koji Omi
 Hiroyuki Abé



JAPAN
 Prof. Dr. Hideaki Koizumi

JAPAN
 Prof. Hiroyuki Abé

AEPM at STS forum 2019

AEPM Kyoto Statement 2019

Research and Development Aiming for Continual Emergence of Innovation toward Human Security and Well-Being

Preface

In today's world, people aspire to pass on the natural environment and their cultural heritage to future generations. In line with the digital transformation in society, there is an urgent need to develop appropriate scientific technologies and determine the best direction to apply such technologies in society. Society hopes that the world's scientific and engineering academies will play a leading role as a compass in determining the right direction.

For sustainable economic development to enrich people's lives, an ecosystem that facilitates continuous changes/transitions through powerful innovations is needed (i.e., disruptive technologies). Engineering academies have a mission to strive for innovation-driven economic development that contributes to human security and well-being based on ethics.

To fulfill the expected mission, the Engineering Academy of Japan (EAJ) submitted an "Urgent Proposal" to the Japanese government to stop the decline in Japan's level of engineering and technological sciences. At the Academies of Engineering Presidents' Meeting (AEPM) 2019, the "Urgent Proposal" was further discussed by overseas organizations and experts from a global perspective, through which a lot of insightful views and useful information were shared among the participants.

The essential points of the meeting are summarized in this "AEPM Kyoto Statement 2019."

AEPM Kyoto Statement 2019

Research and Development Aiming for Continual Emergence of Innovation toward Human Security and Well-Being

Preface

In today's world, people aspire to pass on the natural environment and their cultural heritage to future generations. In line with the digital transformation in society, there is an urgent need to develop appropriate scientific technologies and determine the best direction to apply such technologies in society. Society hopes that the world's scientific and engineering academies will play a leading role as a compass in determining the right direction.

For sustainable economic development to enrich people's lives, an ecosystem that facilitates continuous changes/transitions through powerful innovations is needed (i.e., disruptive technologies). Engineering academies have a mission to strive for innovation-driven economic development that contributes to human security and well-being based on ethics.

To fulfill the expected mission, the Engineering Academy of Japan (EAJ) submitted an "Urgent Proposal" to the Japanese government to stop the decline in Japan's level of engineering and technological sciences. At the Academies of Engineering Presidents' Meeting (AEPM) 2019, the "Urgent Proposal" was further discussed by overseas organizations and experts from a global perspective, through which a lot of insightful views and useful information were shared among the participants.

The essential points of the meeting are summarized in this "AEPM Kyoto Statement 2019."

I. Necessary Points of View for New Research and Development (R&D)

1. Efforts of Universities under Fierce Competition

As with business entities, universities are exposed to fierce global competition. Globalization has increased the mobility of students and professors beyond national borders. At some major universities, most of the professors are from foreign countries (e.g., Eidgenössische Technische Hochschule (ETH) (Switzerland)). As the next step, universities are encouraged to develop unique programs to attract both students and professors (e.g., Universiteit Leiden (The Netherlands), University of Strasbourg (France)). Having such innovative programs is effective in attracting superior professors and students beyond national borders.

2. Evaluation System for Research and Education

A reliable evaluation system for research and education is important. For this purpose, in-house evaluation alone should be avoided because the insiders would have similar concepts and basis for judgment. Evaluation should rather be made from an outsider's perspective. In other words, in today's global era, international peer review is essential (e.g., The European Research Council (ERC)).

3. English as the *Lingua Franca* (Common Language) in Science and Technology

To conduct evaluation and judgment from a global perspective, the use of English, the *lingua franca*, is essential in today's academic R&D fields. Therefore, it is necessary to establish a system that supports evaluation in English. At the world's leading universities and administrative organizations (including experts' conferences and top-level forums), discussions and evaluations are conducted in English

respecting a common global standard regardless of one's native language (e.g., entities in Switzerland, Sweden, Germany, France).

4. Need for Long-Term Research

Concerning R&D projects, both short- to medium-term projects (2–5 years) and long-term projects (10–15 years) are important. For long-term projects, a fair interim evaluation must be conducted and projects with low evaluations should be suspended. (In Germany, approximately 5% of low-evaluated projects are suspended.)

5. Close Collaboration among the Government, Universities, Corporations and Citizens

It is important to carry out R&D via deep collaboration among the government, universities, corporations and citizens (NPOs/NGOs). Especially, the involvement of corporations in university R&D planning is desirable (e.g., in Germany, R&D investments made by corporations exceed \$100 billion; two-thirds of national R&D expenses are paid by corporations; half of the holders of doctorate degrees in engineering are from the corporate sector; and most university professors in the engineering field have working experience in industry.)

6. Diversity and Inclusivity

It is an important issue to improve the female ratio of graduate students and professors. Countries in Northern Europe are ahead in this respect. Men and women, sharing a common comprehensive vision, should collaborate toward such a vision, which thereby leads to diversity and inclusivity. (The incumbent President and most of the cabinet members in Finland are female.)

7. Positioning of Career Development

To develop scientific technology, it is important to ensure career development for scientists and engineers (a career path to raise public recognition of their societal positions and guarantee their high living standard based on performance). In education as well, career development for educators (in early child education, primary to middle and high schools) is a high priority (e.g., the career development structure in Sweden).

8. University Education, Exploratory Research at Universities and Corporate Research for Practical Application

In addition to ensuring education and exploratory research as an inherent mission of universities, universities must strive and thrive through healthy competition utilizing grants from the government and the industrial sector, which become the financial sources of innovation (e.g., as implemented in many advanced countries).

Corporations, on the other hand, want universities to nurture human resources with solid basic knowledge and engage in exploratory research that cannot be handled easily by corporations. Universities and government ministries and agencies should not focus solely on practical and extended applications, even though that might be what corporations want.

9. Quantitative Planning and Evaluation

In applying for competitive funds, basic plans must include target metrics as well as numerical and quantitative analysis. It is difficult to achieve goals described only in the abstract. The accuracy of the metrics and a quantitative road map should be improved in line with the progress of a plan.

With universities, it is crucial to discuss not only a broad range of universities in general but also universities by role and standard category.

10. Inspire Enthusiasm and Passion in R&D

Although corporations have tried to apply the concept of design, which is the generalized concept of art, such efforts have not yet born substantial fruit because corporations rely on market- and demand-oriented linear R&D models. A recently observed trend is a return to the concept of art, a point of origin, and inspiring enthusiasm and passion in researchers.

II. Importance of R&D for Bridging and Fusion of Different Fields

1. Ecosystem of Innovation

The original meaning of “innovation” is the concept of “*neue Kombination* (new combination)” as advocated by Joseph A. Schumpeter in his *Theorie der wirtschaftlichen Entwicklung* (Theory of Economic Development) in 1912. It is important to establish an ecosystem for innovation based on the unity of industry, government, university and citizens. Although nurturing individual specialty fields is a basic function, there is an urgent need to utilize R&D for the bridging and fusion of different fields (“bridging and fusion-type R&D”). Bringing together large and small companies and start-ups with universities and local authorities in a region to innovate industrial sectors led by the region is a good way of building an ecosystem of innovation (e.g., *pôles de compétitivité* in France).

2. Social System that Enables Continual Transitions

Although the concept of bridging and fusion-type R&D has been advocated, it is not easy to achieve actual results from such R&D. Innovation itself is referred to as transitions through “new combinations,” which is called disruptive technology. Because transitions are non-continuous, such R&D differs from the linear model of R&D in which the results are obtained by incremental improvements. A system to continuously create non-continuous transitions becomes an ecosystem for innovation, and the ecosystem needs unconventional R&D based on co-creation.

3. Bridging and Fusion-Type R&D

Bridging and fusion-type research originated at the crossover point of two academic fields. Early interdisciplinary research started with biophysics. Multidisciplinary research was developed from crossover points of more than two different academic fields. This trend is further progressing to transdisciplinary research (the creation of a new field by combining many different fields).

III. Establishment of Bridging and Fusion-Type R&D

1. Efforts by Universities to Voluntarily Establish Their Own In-House Framework for Bridging and Fusion-Type Research

As the government naturally forms silos, it is difficult for government to propose specific themes and projects for bridging and fusion-type R&D. Therefore, research institutes and universities need to individually secure budgets for bridging and fusion-type research. Some forward-looking universities put aside part of their budget for their own framework of bridging and fusion-type research (e.g., Universiteit Leiden and The Australian National University, among others).

2. Bridging and Fusion-Type R&D in Corporations

In R&D at large corporations, a vertical structure by product naturally exists in the research

administration department. Therefore, an R&D structure with a separate budget for bridging and fusion-type R&D is needed.

3. Setting Specific Purpose- and Value-Oriented Themes

In many cases, bridging and fusion-type R&D arises in the process of promoting purpose- and value-oriented research to address social challenges. As the original meaning of innovation is referred to as transitions driven by new combinations, bridging and fusion-type research that aims for a new combination from the beginning rarely succeeds. In the process of engaging in sincere and down-to-earth R&D toward useful goals for humanity and society, new combinations are naturally created to address issues (e.g., such as the R&D developed by The Australian Academy of Technology and Engineering (ATSE)).

4. The Sustainable Development Goals (SDGs) and Bridging and Fusion-Type R&D

The SDGs, which were established based on humanity's values to achieve "Human Security and Well-Being," are suitable themes for bridging and fusion-type R&D.

5. R&D on Scientific Technology via Collaboration among the Social Sciences, Humanities and the Arts

As shown by the R&D history of the digital synthesizer in music, art and scientific technology have had a deep relationship (e.g., The Australian National University).

Innovation is a process of co-creation that is similar to art in one aspect. Inspiring passion in researchers and developers is a key.

Moreover, engineering ethics and engineering education lie at the basis of innovation. Co-creation via collaboration with the social sciences and humanities is important (e.g., the AEPM Kyoto Declaration).

10 February 2020



Hiroyuki Abé
President (Chairman)
The Engineering Academy of Japan



Hideaki Koizumi
Executive Vice President (Co-chairman)
The Engineering Academy of Japan

List of Participants in the AEPM 2019

Hiroyuki Abé (Chairman, Japan)	President, The Engineering Academy of Japan
Hideaki Koizumi (Co-chairman, Japan)	Executive Vice President, The Engineering Academy of Japan
Brian P. Schmidt (Australia)	Vice-Chancellor, The Australian National University
Margaret Sheil (Australia)	Senior Fellow, Australian Academy of Technology and Engineering
Reinhard F. Hüttl (EU)	Chairman, The European Council of Academies of Applied Sciences, Technologies and Engineering
Yves Bamberger (France)	Member, National Academy of Technologies of France
Oh-Kyong Kwon (Korea)	President, National Academy of Engineering of Korea
Martijn Ridderbos (The Netherlands)	Deputy Chairman Executive Board, Leiden University
Eng Chye Tan (Singapore)	President, National University of Singapore
Ole Petter Ottersen (Sweden)	President, Karolinska Institutet
Willy R. Gehrler (Switzerland)	President, Swiss Academy of Engineering Sciences
Paritud Bhandhubanyong (Thailand)	Acting Dean, Panyapiwat Institute of Management
Hiroshi Nagano (Japan)	Senior Executive Director, The Engineering Academy of Japan
Kenji Oeda (Japan)	Executive Director, The Engineering Academy of Japan
Terutaka Kuwahara (Japan)	Member, The Engineering Academy of Japan
Miyuki Tanaka (Secretary, Japan)	Secretariat, The Engineering Academy of Japan

Appendix

Background of This Statement

1. Review of the Content of the “Urgent Proposal” by Specialists from a Global Perspective

Many governmental policies of Japan are developed into actual administrative policies based on the results of specific experts’ meetings held by the Cabinet Office of Japan or individual ministerial agencies. Although the results of in-depth discussion by members with excellent specialist knowledge should be respected, the current members of such meetings are mostly limited to those with Japanese nationality. In view of today’s rapid globalization and drastic changes, there is an urgent need to acquire overseas cutting-edge knowledge directly from foreign members and obtain highly objective perspectives at a global standard. In other countries, high-level forums consisting of outstanding experts from around the world are common, and there are public organizations specializing in searching for overseas human resources (e.g., China). In Japan as well, some corporations, universities and university research institutes have been implementing a peer review by foreign reviewers.

Moreover, the “Urgent Proposal—to stop the decline in Japan’s level of engineering and technological sciences (April 8, 2019)” by the Engineering Academy of Japan (EAJ) has been gradually recognized in related ministerial agencies in Japan. This “Urgent Proposal” has been released to the public via the EAJ Web site:

https://www.eaj.or.jp/app-def/S-102/eaj/wp-content/uploads/2019/04/Teigen-20190408_wagakuninokogaku.pdf

The English version of the “Urgent Proposal” is attached to this Statement.

At the AEPM (the 9th Academy of Engineering Presidents’ Meeting) held at the STS *forum* 2019 (the 16th Annual Meeting of Science and Technology in Society Forum), the “Urgent Proposal” was thoroughly reviewed from a global perspective and the results have been shared among the participants.

The AEPM 2019 newly invited the presidents of major overseas universities in addition to the presidents of global academies. The minutes of the meeting were circulated among the participants for confirmation and additional comments, the essence of which are summarized and reorganized into this Statement.

3. AEPM Kyoto Declaration

At the last AEPM (the 8th Academy of Engineering Presidents’ Meeting) held at the STS *forum* 2018 (the 15th Annual Meeting of Science and Technology in Society Forum), the results of the discussion on engineering ethics and engineering education were summarized as the “AEPM Kyoto Declaration.” The declaration has been released to the public via the EAJ Web site and the CAETS Web site (members only):

<https://www.eaj.or.jp/app-def/S-102/eaj/wp-content/uploads/2019/02/PP-20181125EJ.pdf>

<https://www.newcaets.org/>

AcTI Annual program 2019

1. AcTI Member Meetings

In 2019, five member meetings were organized around five themes:

Theme: "Biobased industry" at Avantium, February 12, 2019, with the following speakers:

- Heather Leslie, researcher microplastics, Institute for Environmental Affairs, Vrije Universiteit Amsterdam
- Nelleke van der Puil, Vice President Materials at LEGO
- David Strik, assistant professor of Environmental Technology, Wageningen University

Theme: "Sustainable Packaging" at Besi in Duiven, April 10, 2019, with the following speakers:

- Richard Blickman, CEO of Besi, guided tour of Besi, together with colleague Ruud Boomsma, presentation on semiconductor industry
- Kouchi Zhang, Professor of Electronic Components, Technology and Materials (ECTM) at Technische Universiteit Delft
- Arco Berkenbosch, VP Innovation & Development at Smurfit Kappa
- Eline van Beest, Young innovator and founder NightBalance on sleep apnea

Theme: "Mutual reinforcement", House of Representatives in The Hague, 20 June 2019, with the following speakers:

- Eppo Bruins, member of parliament ChristenUnie and also AcTI member and host
- Thom Palstra, Principal University Twente presents KNAW advice "Mutual reinforcement", committee with, among others, AcTI chairman Margrethe Jonkman and board member Cees Buisman has investigated whether government investments in the field of R&D may slow down private investment in this area.
- Jorrit Kuipers (Director Green Dino and Treasurer AcTI) and Robert Thijssen (Economic Affairs) present the draft advice in which AcTI makes recommendations for increasing the potential of startups and scale ups.
- Presentation Young Innovators Paul Vulto and Marjolein Helder about experiences within SMEs

Theme: "Regenerative medicine" at Eindhoven University of Technology, September 19, 2019,

with the following speakers:

- Frank Baaijens, Principal of the Technische Universiteit Eindhoven, talks about the development of a scaffold, a biodegradable polymer framework that acts as a heart valve placed directly in the body.
- Ger Benning, head of pediatric heart surgery in Cologne, sheds light on the topic heart valve from the clinical perspective.
- Young Innovator Martijn Cox gives a tour of his company Xeltis, producer of the scaffolds.

Theme: "The value of maintenance for a sustainable infrastructure" at SHIP in IJmuiden, December 10, 2019

- Introduction by Michiel Spee, project manager SPIE Nederland, working on the performance contract Noorzeekanaal, as maintenance partner for Rijkswaterstaat (Department of Waterways and Public Works).
- Lieve Declercq, SPIE's general director since 2017, explains how the company operates within the Dutch installation industry.
- Jenne van der Velde, strategic asset management advisor at Rijkswaterstaat explains that RWS is responsible for water systems, national roads and main waterways.

2. Global Entrepreneurship Summit

AcTI has shaped the idea of becoming a partner through a working group of the Global Entrepreneurship Summit that was held in the Netherlands from 4-6 June 2019.

The Global Entrepreneurship Summit 2019 was an opportunity for academic startups to get in touch with more than 350 investors, companies and industry leaders from around the world. The hosts were Dutch Prime Minister Mark Rutte and US Secretary of State Mike Pompeo.

AcTI wants to challenge Dutch universities to think thoroughly about their tech transfer performance. With this, AcTI wants to contribute to the national discussion how to effectively translate excellent science into social impact.

3. Academic Startup Competition

AcTI, in collaboration with VSNU (Association of Universities in the Netherlands) and Start Up Delta, has launched the Academic Startup Competition. AcTI is proactive in this competition implementation of an important part of the Professionalization advice of the golden triangle (June

2018) on strengthening the technology transfer capacity and importance of valorisation of the Dutch knowledge infrastructure. AcTI, the VSNU and Start up Delta strive to build a sustainable cooperative relationship. This Dutch groundbreaking competition for science based innovations challenges universities and scientific institutions to nominate their best spin-out companies. Ten spin-out companies were selected and could automatically participate in the University Olympic Games, which were held at GES on June 4 and 5, 2019.

With this, VSNU and AcTI want to contribute to the national discussion about the more effective translation of excellent science into social impact.

The jury consisted of the following AcTI members:

- Kees de Koning
- Peter Haring
- Eline Vrijland
- Margot Weijnen
- Mark van Loosdrecht
- Maarten Steinbuch

4. Mini symposia

On December 9, 2019, the AcTI-KNAW mini symposium 'Autonomous driving' took place in the Tinbergen Room of the Trippenhuis of the KNAW in Amsterdam.

- Opening by Peter-Paul Verbeek, Professor of Philosophy of man and technology, University of Twente
- Henk Nijmeijer, Professor of Mechanical Engineering, Dynamics and Control, Eindhoven University of Technology
- Eric Tjong Tjin Tai, Professor of Private Law, Tilburg University
- Jorrit Kuipers, owner robotTUNER, PhD candidate Mechanical Engineering Delft University of Technology
- Panel discussion led by Peter-Paul Verbeek, professor of Philosophy of Technology and co-director of the DesignLab of the University of Twente, followed by questions from the audience

5. Collaboration with the KNAW

The feasibility of the preferred scenario of establishing an Academy of Engineering in the Netherlands under the umbrella of the KNAW was further investigated in 2019.

The board has requested the consent of the members to set up a working group, to be appointed by the AcTI board and KNAW, who carry out the assignment and is responsible for the elaboration of the 'Academy of Engineering' Survey. The goal is to enable parties to develop this plan in a short period of time and further investigate and develop its feasibility in order to arrive at a document that may be submitted to the board for decision-making. And furthermore the aim was to submit the proposal during the first AcTI general meeting of 2020 to make a final decision on the Academy.

6. Young Innovators

Young innovators meeting

The board of AcTI decided in the autumn of 2017 to start with a pilot of young innovative entrepreneurs and connect them with the Academy: called the **AcTI Young Innovators initiative**.

In late 2017 and early 2018 a selection process took place involving both current AcTI members and external organizations. They were called upon to nominate young innovative entrepreneurs under the age of 40. The board has mandated the working group Young Innovators to function as a selection committee on an ad hoc basis. In the end nine young entrepreneurs were selected and installed on 1 February 2018 as Young Innovator within AcTI.

The young members are regular members of AcTI with the same rights and obligations as any other AcTI member, but with a temporary membership for a period of two years. Every Young Innovator has one so-called buddy assigned within AcTI who will familiarize the young entrepreneur with AcTI and can provide advice in this respect to further develop his / her business. The Young Innovators working group has been converted to the **Young Innovators Commission** to further shape the initiative together with the Young Innovators. On May 21, 2019, a meeting took place with the following program:

- Opening meeting and welcome by Hans Schikan, Member Topteam LSH Topsector
- Introduction of new class of Young Innovators 2019
- Hans Schikan – "From start-up to scale-up - About the importance of collaboration
- Eric Claassen, CEO Vironovative, Professor Vrije Universiteit Amsterdam – 'Classical angels and foot traps' at the exit of your company

- Rob van der Werf, Director new business development ASML –How to support the scale up process of high tech companies from a corporate perspective
- Discussion

Besides that AcTI members will make themselves and their networks accessible to the Young Innovators, it is also expressly intended that AcTI itself open to the insights and advice of these Young Innovators. Here the Young Innovators Committee plays an important role. The commission is under chairmanship of Hans Schikan. Other members are:

- Jorrit Kuipers
- Jos Nelissen
- Dennis Schipper
- Bert-Jan Kampherbeek

7. International networks

As the Dutch Academy of Engineering, the Netherlands Academy of Technology and Innovation has international contacts with Academies of Engineering, at European level through the European Council of Academies for Applied Sciences, Technologies and Engineering (Euro-CASE) and globally via the Council of Academies of Engineering and Technological Sciences (CAETS).

Euro-CASE

The Netherlands Academy of Technology and Innovation is the Dutch member of the European Council of Academies of Applied Sciences, Technologies and Engineering (Euro-CASE). Euro-CASE is chaired by Prof. Reinhard Hüttl, also president of the German sister organization Acatech.

AcTI was represented in Euro-CASE in 2019 by Foreign Secretary for European Affairs Bertrand van Ee, board member Jorrit Kuipers and general secretary Robert Thijssen.

2019 Euro-CASE Annual Conference and Board Meeting

The annual conference of Euro-CASE and the subsequent board meeting took place from 20 to 22 October 2019 in Oslo, Norway and was all about : **The Future of Work - The Content of Jobs.**

The conference was organized by the Norwegian Academy of Technological Sciences. AcTI was represented by Foreign Secretary of European Affairs Bertrand van Ee.

Scientific Advice Mechanism

The European Union has set itself the goal of implementing policy-making on factual and base scientific knowledge. The European Commission decided to set up the Scientific Advice Mechanism, SAM, in 2015 in order to work in an objective and independent way and provide knowledge for EU policy-making and thus contribute to the debates about the benefits and risks of existing and possibly new EU policy. Within the Group of Chief Scientific Advisors within SAM, consisting of seven prominent scientists, Prof. Dr. Pearl Dykstra, former vice-president of the KNAW, is vice-chairman of the Group of Chief Scientific Advisors. The Group of Chief Scientific Advisors is supported by staff from the Directorate-General for Research and Innovation and the Joint Research Council.

In addition, the European Commission has involved the scientific, technical and medical academies in Europe through their umbrella organizations and Academia Europea directly with SAM. As a member of Euro-CASE, AcTI is one of the two organizations in the Netherlands that participate in the SAM. The KNAW is the other organization in the Netherlands, as a member of the umbrella organizations ALLEA, EASAC and FEAM2. ALLEA, EASAC, Euro-CASE and FEAM have partnered with the Academia Europaea set up the SAPEA project, Science Advice for Policy by European Academies. SAPEA and the Group of Chief Scientific Advisors make up the Scientific Advise Mechanism.

The Scientific Advice Mechanism published the following reports in 2019:

- Scientific Advice to European Policy in a Complex World Group of Chief Scientific Advisors Scientific Opinion on 7 September 2019
- Transforming the future of aging, June 2019
- Scientific opinion - Microplastic pollution (April 2019) informed by SAPEA evidence review report (January 2019).

CAETS

The Netherlands Academy of Technology and Innovation is the Dutch member of the International Council of Academies of Engineering and Technological Sciences. CAETS, the consultative body of presidents of 26 Academies of Engineering worldwide. AcTI provides experts for international study on request, groups and conferences, and participates in activities under the auspices of CAETS.

The annual CAETS meeting in 2019 took place in Stockholm, Sweden from June 25 to 27. The theme "Engineering a Better World - the next 100 years' was chosen because of the global grand

challenges and the need for engineering leadership, AcTI was represented by Secretary for International Affairs Lucas Noldus.

8. Other Activities

The NWO Spinoza Prize is a personal award for top researchers with international reputations. NOW requests selected persons to nominate candidates for this prize. A maximum of four prizes are awarded annually. Each prize amounts to 2.5 million euro to spend on scientific research.

NWO Spinoza Prizes 2020

The chairman of the Netherlands Academy of Technology and Innovation has made no nominations of candidates in 2019 for the Spinoza Premiums 2020.

NWO Stevin Premium 2020

The chairman of the Netherlands Academy of Technology and Innovation has made no nominations in 2019 for the Stevin Premiums 2020.

Annual Report by Royal Society Te Apārangi to CAETS

1 July 2019 – 30 June 2020

Context

Royal Society Te Apārangi is a multi-disciplinary academy, within which technology, applied science and engineering (TASE) is one of six major domains. In this report we highlight those aspects of our work of particular relevance to the TASE domain, and hence to CAETS members.

Governance

Professor Geoff Chase FRSNZ was the Convenor – TASE, the senior leadership role for TASE in the Society throughout the year in question, and continues in that role for two further years. The Council has just elected Dr Brent Clothier, an applied soil scientist, as President-elect of the Society – he commences a three-year term as President, our highest role, on 1 July 2021. Dr Russell Burton, a chemical engineer has served on the Society Council during the year in review.

Senior Staff

Dr Andrew Cleland FRSNZ, an engineer, steps down as Chief Executive at the end of the calendar year 2020. The search is underway with the goal of a small overlap. Our long serving Academy Executive Officer retired and was replaced by an internal appointment, Dr Marc Rands in March 2020.

Fellowship and Awards

Whilst there are no quota for each domain, three new fellows in the TASE domain were elected to Fellow amongst a cohort of 18 new Fellows across the six domains. We continue our drive to increase election from under-represented groups in the academy, and this includes from the TASE domain. We were delighted to have participation of a fellow from the Australian Academy of Technology and Engineering in our Fellowship selection process, something we will continue in future years. We continue to interface with the main professional engineering body, Engineering New Zealand, to identify candidates worthy of recognition in either context.

We launched Tahunui-a-Rangi, a new award for invention/creation not necessarily arising from a research base in October 2019, the inaugural Tahunui-a-Rangi will be awarded late 2020.

Expert Advice

Our legislated role is to provide expert advice to the public and government of New Zealand on important public issues. In this, Fellows and other experts contribute as volunteers to assemble evidence that can be used to inform policy decisions. We have two types of output – distillations of evidence on complex, multi-disciplinary issues, and simpler fact sheets aimed to improve public understanding. This programme slowed during Covid-19 lockdown due to limited availability of experts.

During the year, of relevance to the TASE domain, we completed a major piece of work providing fact sheets on the impacts of plastics in the environment, means of breakdown of plastics, opportunities for recycling, reuse etc. Additionally, there were outputs on use of artificial intelligence, gene editing technologies and the medical use of cannabis. There was continued distribution of earlier work on the impacts of blue light.

Our Convenor – TASE continues to attend the national Engineering Leadership Forum, and we work with that Forum on issues affecting engineering and technology more generally such as reforms of vocational education.

Research Practice

The Society has a role to support good research practice in New Zealand. Working with the major research sector organisational groupings, we have co-developed the “Research Charter for Aotearoa New Zealand” – a resource available to research organisations and funders to assist them develop and update their policies for supporting excellent research practices.

We are undertaking a major study of the research workforce, with emphasis on identifying funding system factors contributing to the sizeable “precariat” of temporarily employed early career researchers.

Public Programmes

Our public programmes such as lecture series, have been hardest hit, by Covid-19 and many have not operated. Some were switched to digital delivery mode. This gets reasonable viewing numbers but loses the networking benefits of face to face events.

Engagement with Māori Communities

Engagement with Māori communities (Māori are the indigenous people of this country) is vitally important as we seek to recognise the knowledge and enquiry methods that pre-date the arrival of Europeans. Many technologies developed by Māori for sea transport, defence and food preservation, and the ability of Pacific people to navigate accurately over very long distance sea travel by the stars are good examples of advanced knowledge at the time of first encounters with Europeans in the 1700s.

International

Our international strategy is three-pronged – sharing best practice with other similar bodies (including national engineering and technology academies), contributing to global organisations such as CAETS, and collaborating in our region, the South Pacific. Of course none of the anticipated travel has occurred, but we seek to contribute as we can by other means. We are keeping Pacific relationships alive in the major countries within the Pacific Islands Forum region (encompassing Micronesia, Melanesia and Polynesia), towards a future visit collaboratively with Australian academies.

Impacts and Learning from Covid-19

New Zealand locked down from late March 2020 to about the end of May 2020, and since then there has been no community transmission whatsoever with incoming cases (so far) trapped at the border. Hence business activity all but fully resumed, and the Society offices have been fully open bar the eight week period.

We had commenced equipping all staff for remote working a week before the lockdown requirement was introduced so everyone landed at home sufficiently equipped. We also had agreed paper-less approval protocols so that the core operational business could occur. We were glad to have eight Zoom licences already in place! Hence multiple meetings, including of our governance, by Zoom occurred. We even had tikanga/kawa (cultural protocols) already agreed for use on Zoom.

Some staff did struggle emotionally on return to office, whereas others thrived. We staged our return with an expectation of all back in early June, but with increased flexibility to work remotely for a minority of their service to the organisation. We are reviewing relevant Human Resources policies as a result of what we learnt.

Surprisingly, the net effect on our financial position of the disruptions has been positive – the savings (travel in particular) have offset small losses of income.

allrecipes

Perfect Butternut Squash Muffins



Similar to pumpkin muffins, these are a great way to use up butternut squash and are not too high in sugar. Even my picky husband enjoys these! Feel free to play around with the spice amounts to your liking.

Prep: 20 mins

Cook: 35 mins

Total: 55 mins

Servings: 10

Yield: 10 muffins



Ingredients

1 small butternut squash

3 eaches eggs

½ cup water

½ cup vegetable oil

½ cup white sugar

½ cup brown sugar

2 cups whole wheat flour

1 cup all-purpose flour

1 ½ teaspoons baking powder

1 ½ teaspoons baking soda

1 ½ teaspoons ground cinnamon

½ teaspoon salt

½ teaspoon nutmeg

½ teaspoon ground cloves

½ teaspoon pumpkin pie spice

¼ cup raisins

¼ cup chopped walnuts

Directions

Step 1

Preheat oven to 400 degrees F (200 degrees C). Grease 20 muffin cups.

Step 2

Cut a 1/2-inch hole into the larger part of the squash and cover with a damp paper towel.

Step 3

Cook squash in a microwave oven in 3-minute increments, turning slightly after each increment, until squash can be easily pierced with a fork, 9 to 12 minutes. Set aside until cool to the touch, about 20 minutes.

Step 4

Halve squash lengthwise and scoop out seeds. Measure 1 1/2 cups squash into a large bowl. Mash eggs, water, vegetable oil, white sugar, and brown sugar into the squash. Whisk whole wheat flour, all-purpose flour, baking powder, baking soda, cinnamon, salt, nutmeg, cloves, and pumpkin pie spice into the squash mixture until you have a smooth batter. Fold raisins and walnuts into the batter.

Step 5

Spoon batter into prepared muffin cups to about 1/2 to 2/3 full.

Step 6

Bake in the preheated oven until a toothpick inserted into the center of a muffin comes out clean, about 15 minutes. Cool in the pans for 10 minutes before removing to cool completely on a wire rack.

Nutrition Facts

Per Serving:

401.7 calories; protein 7.9g 16% DV; carbohydrates 63.9g 21% DV; fat 14.9g 23% DV; cholesterol 49.1mg 16% DV; sodium 406.4mg 16% DV.

© COPYRIGHT 2020 ALLRECIPES.COM. ALL RIGHTS RESERVED.

Printed from <https://www.allrecipes.com> 10/11/2020

© COPYRIGHT 2020 ALLRECIPES.COM. ALL RIGHTS RESERVED.

Printed from <https://www.allrecipes.com> 10/11/2020

SAAE Key Activities July 2019 to July 2020

Membership Participation

In order to increase opportunities for Members to participate in Academy activities, the SAAE initiated sector-based discussion groups. Following a survey of members' opinions on a national basis, Interest Groups were identified in the following sectors: Transportation, Water, Energy, Engineering Education, and the Engineering Profession in SA. Participation in virtual meetings is totally voluntary and is managed by a Convenor elected from among the members participating in the discussions and supported by the General Secretary of the Academy.

The Interest Groups are free to select their own topics for discussion and are requested to, if possible, focus on matters of current national interest and importance to society. Discussions on such topics should be conducted in a format appropriate for a Panel so that outcomes may be suitable for use by the Academy as the basis of Independent, Evidence Informed Advice to Government, to Industry, or to any other audience. The Interest Groups are free to discuss and share opinions and information on any topic, whether it may lead to Advice being offered or not.

Under the theme Building a Better post-COVID Water Sector, the Water Sector Discussion Group prepared statements on (a) the prioritisation of investment on urgently required, large strategic water resource development projects and (b) on the parlous state of water services in South African municipalities. A third statement on the unsustainably high loss of potable water from municipal water reticulation systems is close to finalisation.

The first two statements mentioned above have been submitted as Advisory Notes to the State President, and to relevant Cabinet Ministers and other entities. The third statement will probably follow a similar route to the relevant authorities.

Annual Academy Lectures

SAAE usually presents its Annual Academy Lecture by an invited speaker at three larger centres in the country. Fellow Dr Gustav Rohde made the third presented of his 2018 Academy Lecture, entitled *The Fourth Industrial Revolution: Digital Transformation – An Opportunity to Reposition*, in July 2019 at the University of Johannesburg. In November 2019 Fellow Peter Flower made his first presentation of the 2019 Annual Academy Lecture, entitled *Cape Town's Water Supply – Experience and the Way Forward*, at the University of Cape Town. Both these lectures were very well attended. Further presentations of the Annual Academy Lecture were cancelled due to the Covid pandemic.

Hendrik van der Bijl Memorial Lecture

The Hendrik van der Bijl Memorial Lecture is presented annually by the SAAE in collaboration with the University of Pretoria to commemorate the great contribution made by the late Dr Hendrik van der Bijl to the industrial and scientific development of South Africa. On 9 October 2019 SAAE Fellow Andrew Kirby, President and CEO of Toyota South Africa and President of NAAMSA, presented the Hendrik van der Bijl Memorial Lecture on the topic *Can the South African Automotive Industry contribute to the reindustrialisation of our country?* The lecture was attended by one hundred and ten people and the lecture was live-streamed via YouTube, a first for a SAAE lecture.

The 2020 Hendrik van der Bijl Memorial Lecture will be presented online by the former CEO of Anglo American Platinum Ltd, Chris Griffith, on 29 September 2020. The topic of his lecture will be *An economic recovery strategy for South Africa - and the role we can play*.

Presentation of information from CAETS Convocations

In order that the South African public may benefit from SAAE's membership of CAETS, the SAAE presents a series of public lectures on the main subjects discussed at the CAETS Convocation each year. Fellow Felix Reinders, who attended the 2018 CAETS Convocation in Montevideo, Uruguay, made presentations on the proceedings of this Convocation at Universities in three provinces of South Africa. These lectures were very well attended.

Induction Dinners for New Members

New Fellows who are elected to the SAAE are inducted at formal dinners which are open to all members and their partners. These dinners took place in Cape Town and Pretoria in October 2019 when twelve new members were welcomed to the Academy.



REAL ACADEMIA DE INGENIERÍA

Memoria de actividades

Curso académico

2018-2019

ÍNDICE

1. Presentación	4
2. Sobre la RAI	5
3. De los académicos y académicas	8
Constituyentes	
De número	
Supernumerarios	
De honor y correspondientes	
4. Órganos de gobierno y comisiones	13
Pleno	
Junta de Gobierno	
Comisiones	
5. Sesiones académicas	14
Tomas de posesión académicos de número	
Clausura curso académico	
6. Premios y distinciones	22
Agustín de Betancourt y Molina y Juan López de Peñalver	
<i>Academiae Dilecta</i>	
Ingenieros Laureados	
Distinciones y reconocimientos a académicos	
7. Relaciones con otras academias	37
Instituto de España y Reales Academias	
Relaciones internacionales	
8. Jornadas, sesiones y colaboraciones	41
9. Otras actividades	48
Observatorios:	
• Energía e Innovación	
• Digitalización de los Medios de Comunicación	
Foro E2-I2. Ingenio en la escuela	
Proyecto Mujer e Ingeniería	
10. Publicaciones	57
Discursos de ingreso	
Sesiones <i>In Memoriam</i>	
Estudios	

1. PRESENTACIÓN

Esta memoria recoge el conjunto de actividades que ha llevado a cabo la Real Academia de Ingeniería en el curso académico 2018-2019 (octubre de 2018 a octubre de 2019).

El incremento de la visibilidad de la Academia y su compromiso con el cumplimiento de los objetivos institucionales dirigidos a impulsar el papel de la ingeniería en nuestra sociedad ha culminado, en el año 2019, con la celebración de su 25 aniversario, y ello gracias a la participación activa de los académicos a lo largo de todos estos años.

Las relaciones de la RAI con otras academias se han visto incrementadas con una mayor colaboración a nivel nacional, con las Reales Academias del Instituto de España, y a nivel internacional con Euro-CASE y CAETS, permitiendo el desarrollo de nuestros objetivos estatutarios.

La Real Academia de Ingeniería se relaciona administrativamente con el Ministerio de Ciencia e Innovación. Para el sostenimiento de las actividades que se describen en esta memoria, además de la subvención nominativa que recibe de dicho ministerio, cuenta con el apoyo de la Fundación *Pro Rebus Academiae* y de diversos patrocinadores entre los que se encuentran destacadas universidades, organizaciones profesionales y empresas del país: Acciona, Caja de Ingenieros, Endesa, Esteyco, Fundación ACS, Fundación para el Fomento de la Innovación Industrial, Fundación Iberdrola, Iberia, Idom, Indra, Isdefe, Sener, Talgo, Telefónica, Tragsatec, Colegio Nacional de Ingenieros del ICAI, Colegio Oficial de Ingenieros de Telecomunicación, Consejo General de la Ingeniería Técnica Industrial, Instituto de la Ingeniería de España, Universidad Carlos III de Madrid, Universidad de Navarra-Tecnun y Universidad Politécnica de Madrid.

En la relación de empresas e instituciones colaboradoras que figuran al final de esta memoria, se incluyen tanto las que contribuyen directamente con la Academia como las que lo hacen a través de la Fundación *Pro Rebus Academiae*.

Las actividades que se detallan a continuación reflejan la constante labor de la Real Academia de Ingeniería por difundir los avances de la ingeniería española a la sociedad.

2. SOBRE LA RAI

Por Real Decreto 859/1994 de 29 de abril, se crea la Academia de Ingeniería, convirtiéndose así en la primera Academia de carácter nacional fundada bajo el reinado de S.M. el Rey Don Juan Carlos I.

Constituye la Academia de Ingeniería una corporación de derecho público, con personalidad jurídica propia, que se rige por sus Estatutos y por su Reglamento de Régimen Interior. Tiene como fines promover la calidad y la competencia de la ingeniería española y fomentar el estudio, la investigación, la discusión y la difusión de las técnicas y de sus fundamentos científicos y sociales.

Sus primeros académicos fueron nombrados por Orden Ministerial de 1 de diciembre de 1994. Se designaron por el Ministerio de Educación a propuesta del Instituto de la Ingeniería de España (dieciocho académicos), las Universidades (siete académicos), el Instituto de España (seis académicos) y la Secretaría de Estado de Universidades e Investigación (cinco académicos).

Desde su creación y hasta principios de 1999, la Academia estuvo bajo el protectorado del Ministerio de Educación, siendo su presidente el Secretario de Estado de Universidades e Investigación quien delegó la presidencia en el académico Excmo. Sr. D. Elías Fereres. Acompañaron al presidente-delegado formando una junta de gobierno provisional los académicos Excmos. Sres. D. Emilio Llorente, D. José Antonio Garrido, D. Antonio Luque, D. José Ramón Irisarri, D. César Dopazo, D. Manuel Elices y D. Andrés Ripoll.

En esos primeros años de funcionamiento, entre otras actividades, los académicos constituyentes elaboraron un reglamento de régimen interior en el que, entre otros aspectos, se regulaba el procedimiento de elección de nuevos miembros.



Académicos constituyentes (1994)

Dicho procedimiento se ha seguido aplicando mediante convocatorias nacionales con la finalidad de cubrir el número máximo de sesenta plazas de académico de número que establecen los estatutos.

Concluida la etapa de protectorado del Ministerio de Educación, el 19 de enero de 1999 la Academia de Ingeniería eligió los académicos de su primera Junta de

Gobierno. Las siguientes Juntas se constituyeron para los períodos 2003-2007; 2007-2011; 2011-2015; 2015-2019.

El 14 de julio de 2003, S.M. el Rey Don Juan Carlos I tuvo a bien conceder el título de Real a la Academia de Ingeniería. Este hito histórico se vio acompañado por otro igualmente importante cuando, el 11 de diciembre del mismo año, S.M. el Rey presidió la sesión pública en la que tomó posesión como académico de honor el expresidente del Gobierno Excmo. Sr. D. Leopoldo Calvo-Sotelo y Bustelo.

Por iniciativa de la Real Academia de Ingeniería, el 9 de mayo de 2005 se constituyó la Fundación *Pro Rebus Academiae*, cuyo objetivo es respaldar las actividades de la Real Academia de Ingeniería y contribuir a su sostenimiento, apoyándose en la ayuda de empresas e instituciones interesadas en el desarrollo y la mejora de la ingeniería.

El 7 de junio de 2005 el Patrimonio del Estado, a través del Ministerio de Educación y Ciencia, cedió para su uso a la Real Academia de Ingeniería la parte pública del palacio del marqués de Villafranca (que forma parte del Patrimonio Histórico Español) donde tiene la sede y en la que la corporación lleva a cabo sus actividades.

El palacio está situado en el número 10 de la calle Don Pedro, en pleno casco histórico de Madrid, muy cerca de la calle Bailén, Las Vistillas y el Palacio Real. Su construcción comenzó en el siglo XVII y fue terminado en el XVIII, por el V Marqués de Villafranca, don Pedro Álvarez de Toledo, a quien debe su nombre la calle en la que está situado.

La Real Academia de Ingeniería se hizo cargo del proyecto de rehabilitación tras movilizar los fondos necesarios para ello y a los que contribuyeron el Ministerio de Fomento a través de su 1% cultural, y en una importante medida algunas de las empresas integradas en la Fundación *Pro Rebus Academiae*, y más en concreto el Grupo Villar Mir, Telefónica y Repsol YPF. La obra tuvo como objeto no sólo rehabilitar las dependencias de la Academia sino reintegrar todos los elementos artísticos de que disponía en su situación original, haciendo que la historia que ha pasado ante sus salones pueda sentirse con los ojos del siglo XXI.

S.M. el Rey D. Juan Carlos I inauguró oficialmente la sede de la Real Academia de Ingeniería el 16 de noviembre de 2010, tras veinte meses de obras de rehabilitación y acondicionamiento del edificio.



La Real Academia de Ingeniería ingresó en el Instituto de España con fecha 14 de julio de 2015, según Real Decreto 536/2015, de 26 de junio. Su integración en el Instituto de España

fue en reconocimiento de la trayectoria, miembros y actividades de ésta. También supuso para el Instituto una ampliación de sus capacidades para seguir actuando en cumplimiento de sus objetivos y fines de interés público.

Desde su creación, la Academia ha venido trabajando con continuidad y rigor, en cumplimiento de los fines que tiene encomendados: promover la calidad y

competencia de la ingeniería española, fomentando el estudio, la investigación, la discusión y la difusión de las técnicas y de sus fundamentos científicos y sociales.

La Real Academia de Ingeniería es una institución que promueve la excelencia, la calidad y la competencia de la Ingeniería española en sus diversas disciplinas y campos de actuación. Sus miembros cubren diferentes áreas de la ingeniería y de la técnica y representan a diversos sectores en los ámbitos de la docencia, la investigación y la empresa.

Por otra parte, en los años transcurridos desde 1994, la presencia de la tecnología en la vida humana y su relevancia económica, social, educativa y cultural, no han hecho sino crecer. Las nuevas perspectivas, experiencias y conocimientos que aportará la Real Academia de Ingeniería dentro del Instituto de España, concebido como punto de encuentro y ámbito de colaboración e intercambio de las Reales Academias, resultarán muy beneficiosas para el cumplimiento de los fines de interés público atribuidos al Instituto, en relación con una materia esencial para el bienestar de las personas.



S.M. el Rey D. Juan Carlos I junto a los académicos el día de la inauguración de la sede

Desde sus primeros años de vida, la Academia de Ingeniería ha tenido reconocimiento internacional al ser admitida como miembro del *International Council of Academies of Engineering and Technological Sciences* (CAETS) y siendo uno de los miembros fundadores del *European Council of Academies of Applied Sciences, Technologies and Engineering* (Euro-CASE), organizaciones con las que colabora y contribuye dentro de sus plataformas de Educación, Energía e Innovación.

3. DE LOS ACADÉMICOS Y ACADÉMICAS

De acuerdo con los estatutos de la RAI (R.D. 397/2013, de 7 de junio) la Academia se compone de las siguientes clases de académicos: de número (constituyentes y por elección), supernumerarios, correspondientes y de honor.

Tal como se indica más arriba, los primeros académicos fueron los constituyentes, nombrados por Orden Ministerial de 1 de diciembre de 1994, llevándose a cabo la toma de posesión del primer académico de número en el año 1998.

A continuación figuran los listados de los Excmos. Sres.:

ADÉMICOS CONSTITUYENTES⁽¹⁾

- D. Eugenio Andrés Puente (†15-07-2017)
- D. Javier Aracil Santonja
- D. Ramón Argüelles Álvarez (21-11-2017)
- D. José Luis Díaz Fernández
- D. Gabriel Ferraté Pascual
- D. José Antonio Garrido Martínez
- D. José Ramón Irisarri Yela (†15-08-2015)**
- D. Antonio Luque López
- D. Emilio Llorente Gómez
- D. Manuel Márquez Balín (†19-05-2019)
- D. José Antonio Martín Pereda
- D. Elías Muñoz Merino
- D. Luis Alberto Petit Herrera
- D. Rafael Portaencasa Baeza (†27-02-2015)**
- D. Andrés Ripoll Muntaner (†22-01-2017)
- D. Enrique Sánchez-Monge Parellada (†1-07-2010)
- D. Jaime Torroja Menéndez
- D. Mateo Valero Cortés
- D. Enrique Alarcón Álvarez (04-09-2018)
- D. Eduardo Alonso Pérez de Ágreda
- D. Antonio Barrero Ripoll (†26-04-2010)
- D. Pere Brunet Crosa
- D. Luis Castañer Muñoz
- D. Elías Fereres Castiel
- D. Francisco García Olmedo (19-10-2000)
- D. Manuel Elices Calafat
- D. José Antonio Fernández Ordoñez (†03-01-2000)
- D. Amable Liñán Martínez
- D. Adriano García-Loygorri y Ruiz
- D. Manuel Valdivia Ureña (†29-04-2014)
- D. Enrique Castillo Ron

¹ Entre paréntesis fecha de fallecimiento o de paso a condición de supernumerario

- D. Avelino Corma Canos
- D. César Dopazo García
- D. Rafael Moneo Vallés (01-01-2012)
- D. Ignasi de Solá-Morales i Rubió (†12-03-2001)
- D. Ángel Ramos Fernández (†02-01-1998)

ACADÉMICOS NUMERARIOS POR ELECCIÓN⁽²⁾

- D. Javier Rui-Wamba Martija (17-03-1998) (02-10-2017)
- D. Juan Ramón Sanmartín Losada (18-06-1998)
- D. Juan-Miguel Villar-Mir (27-04-1999)
- D. Juan José Martínez García (15-06-1999) (†06-08-01)
- D. Miguel Ángel Lagunas Hernández (25-10-1999)
- D. Aníbal R. Figueiras Vidal (30-05-2000)
- D. Miguel Ángel Losada Rodríguez (29-09-2000) (29-09-2016)
- D. Enrique Cerdá Olmedo (20-10-2000)
- D. Manuel Silva Suarez (14-11-2000)
- D. Roberto Fdez. de Caleyá y Álvarez (30-10-2001) (†23-01-04)
- D. Jaime Domínguez Abascal (27-11-2001)
- D. Ricardo Torrón Durán (26-02-2002)
- D. José Alberto Pardos Carrión (29-04-2003)
- D.^a Pilar Carbonero Zalduegui (03-06-2003)
- D. Joan Margarit i Consarnau (25-09-2003)
- D. José Ignacio Pérez Arriaga (28-10-2003)
- D.^a María Vallet Regí (18-02-2004)
- D. José Luis López Ruiz (22-03-2004) (†20-04-09)
- D. Andrés López Pita (29-04-2004)
- D. Antonio Colino Martínez (14-12-2004)
- D. Joaquim Coello Brufau (29-03-2005)
- D. Javier Jiménez Sendín (14-02-2006)
- D.^a Josefina Gómez Mendoza (21-03-2006)
- D. Luis Lada Díaz (06-06-2006)
- D. Manuel Doblaré Castellano (17-06-2008)
- D. Luis Alfonso Gil Sánchez (23-09-2008)
- D. Jaime Conde Zurita (28-10-2008) (†10-03-2018)
- D. José Manuel Sanjurjo Jul (27-10-2009)
- D. Manuel Hita Romero (25-05-2010)
- D. Ramón Agustí Comes (22-06-2010)
- D. Juan Antonio Zufiria Zatarain (29-11-2011)
- D. José Domínguez Abascal (28-02-2012)
- D. Eloy Ignacio Álvarez Pelegry (27-03-2012)

² Entre paréntesis fecha de toma de posesión y en su caso de paso a supernumerario, o de fallecimiento

D. Rafael del Pino Calvo Sotelo (16-12-2014)
D.^a Nuria Oliver Ramírez (11-12-2018)
D. Íñigo J. Losada Rodríguez (19-02-2019)
D. Francisco Herrera Triguero (21-05-2019)
D. Javier Ventura-Traveset Bosch (18-06-2019)
D. Ignacio Romagosa Clariana (24-09-2019)

ACADÉMICOS SUPERNUMERARIOS⁽³⁾

D. Francisco García Olmedo (19-10-2000)
D. Rafael Moneo Vallés (01-01-2012)
D. Miguel Ángel Losada Rodríguez (29-09-2016)
D. Javier Rui-Wamba Martija (02-10-2017)
D. Ramón Argüelles Álvarez (21-11-2017)
D. Enrique Alarcón Álvarez (04-09-2018)

ACADÉMICO DE HONOR

D. Leopoldo Calvo-Sotelo y Bustelo (11-12-2003) (†03-05-08)

ACADÉMICOS CORRESPONDIENTES⁽⁴⁾

Alemania

Dr. Johann F. Böhme (06-06-2006)
Dr. Jörg Schlaich (01-04-2003) (13-06-2006)
Dr. Peter Beyer (29-10-2013) (14-10-2014)
Dr. Michael Graetze (26-04-2016) (25-04-2017)

Australia

Dr. Martin A. Green (19-01-1999) (01-09-2000)

Canadá

Dra. Cristina Amon (06-06-2006)

España

Dr. Pedro Duque (19-01-1999) (13-12-1999)
Dr. Rafael Muñoz-Carpena (28-05-2015) (15-03-2016)

Estados Unidos

Dr. Raymon J. Krizek (19-01-1999) (01-06-2000)
Dr. Ángel G. Jordán (19-01-1999) (01-07-2000)
Dr. Jesús A. del Álamo (19-01-1999) (25-10-1999)
Dr. Juan Fernández de la Mora (19-01-1999) (26-06-2002)
Dr. Manuel Martínez Sánchez (19-01-1999) (13-12-1999)

³ Entre paréntesis fecha de paso a dicha condición

⁴ Entre paréntesis fecha de elección y de entrega de medalla y/o diploma

Dr. Juan Carlos Lasheras (19-01-99) (24-02-2004)
 Dr. Michael Ortiz (19-01-1999) (14-09-1999)
 Dr. John L. Hennessy (13-12-1999) (24-06-2005)
 Dr. Steven N. Anastasion (01-02-2000) (01-05-2003)
 Dr. Norman Borlaug (06-03-2001) (†12-09-2009)
 Dr. Jeffrey Hoffman (29-05-2001) (19-10-2004)
 Dr. James R. Rice (29-05-2001) (01-12-2001)
 Dr. William Wulf (06-03-2001) (01-05-2003)
 Dr. Janos Galambos (26-06-2001) (01-12-2001)
 Dr. Ángel Carlos Fernández-Pello (30-10-2001) (19-10-2004)
 Dr. Bora B. Mikic (01-10-2002)
 Dr. Judea Pearl (17-12-2002)
 Dr. Thomas Kailath (01-04-2003) (09-04-2003)
 Dr. Jose M. Roesset (01-04-2003) (14-06-2004)
 Dr. Mark E. Davis (23-09-2008)
 Dr. Zdenek P. Bazant (23-09-2008) (24-03-2009)
 Dr. Subra Suresh (28-09-2010)
 Dr. Sergio Verdú (29-10-2013) (04-07-2016)
 Dr. Robert Dalrymple (29-10-2013) (30-09-2014)
 Dr. Parviz Moin (29-10-2013) (16-09-2014)
 Dra. Saskia Sassen (28-04-2015) (25-10-2017)
 Dr. Hojjat Adeli (28-04-2015) (23-06-2017)
 Dr. Samuel I. Stupp (28-04-2015)
 Dr. Ricardo Hausmann (23-10-2018)

Francia

Dr. Germain Sanz (26-06-2001) (27-01-2004)
 Dr. Claude Wolff (30-10-2001) (04-12-2003)
 Dr. Antoine Kremer (29-10-2013) (21-04-2016)
 Dr. Francisco Chinesta (29-10-2013) (28-10-2014)

Holanda

Dra. Louise O. Fresco (01-02-2000) (02-10-2001)

Hungria

Dr. Norber Kroo (26-06-2001) (23-11-2003)

Italia

Dr. Federico Mazzolani (01-02-2000) (30-10-2001)
 Dr. Sergio Benedetto (28-05-2015)

México

Dr. Francisco José Sánchez Sesma (01-04-2003) (28-10-2003)
 Dr. Baltasar Mena (23-05-2009) (08-06-2010)
 Dr. José Miguel González Santaló (29-10-2013) (08-05-2014) (†07-08-2019)
 Ing. Carlos Slim Helu (26-04-2016) (29-06-2017)

Portugal

Dr. Emanuel Jose Leandro Maranhã das Neves (23-09-2008)

Dr. Manuel Valsassina Heitor (29-10-2013) (23-09-14)

Dra. Maria Da Graça Carvalho (26-04-2016)

Reino Unido

Sir Robert Malpas (19-01-1999) (18-10-2005)

Dr. Maurice V. Wilkes (19-01-1999) (25-10-1999) (†noviembre 2010)

Dr. Basil R.R. Butler (19-01-1999) (14-06-2004)

Dr. Christopher Bishop (23-09-2008) (26-05-2009)

Dr. Geoffrey Hinton (28-04-2015)

Dr. Dame Ann Dowling (23-10-2018)

Rusia

Dr. Viacheslav M. Andreev (19-01-1999) (02-10-2001)

Dr. Zhores I. Alferov (29-05-2001) (02-10-2001)

Dr. Vladimir Fortov (29-10-2013) (13-11-2014)

Suecia

Dr. Hans G. Forsberg (19-01-1999) (01-07-2000)

Dr. Per Stenstrom (29-10-2013)

Dr. Carl-Henric Svanberg (23-10-2018)

Suiza

Dr. Bruno Thurlimann (19-01-1999) (14-09-1999) (†29-07-2008)

Dr. Werner Arber (29-05-2001) (26-11-2002)

Uruguay

Dr. Andrés Tierno Abreu (23-06-2009) (23-03-2010)

4. ÓRGANOS DE GOBIERNO Y COMISIONES

Los órganos de gobierno y las comisiones están contemplados en el capítulo IV de los Estatutos, Real Decreto 397/2013, de 7 de junio, y en el capítulo II del Reglamento de Régimen Interior.

Desde el comienzo del curso académico, el 23 de octubre de 2018, han tenido lugar las reuniones del Pleno de la Academia en el año 2018 en las fechas que se indican a continuación: 23 de octubre, 20 de noviembre y 11 de diciembre; y en el año 2019: 22 de enero, 19 de febrero, 26 de marzo, 23 de abril, 21 de mayo, 18 de junio y 24 de septiembre.

Las reuniones de la Junta de Gobierno tuvieron lugar en las mismas fechas que las reuniones del Pleno de la Academia.

La Junta de Gobierno durante el curso académico 2018-2019 estuvo integrada por los siguientes miembros:

Presidente:	Excmo. Sr. D. Elías Fereres Castiel
Vicepresidente:	Excmo. Sr. D. Manuel Márquez Balín (†19-05-19)
Vicepresidente:	Excmo. Sr. D. Joaquim Coello Brufau
Vicepresidente:	Excmo. Sr. D. Luis Castañer Muñoz
Secretario General:	Excmo. Sr. D. Antonio Colino Martínez
Tesorero:	Excmo. Sr. D. Joaquim Coello Brufau
Bibliotecario:	Excmo. Sr. D. Elías Muñoz Merino
Interventor:	Excmo. Sr. D. José Manuel Sanjurjo Jul
Vocal:	Excmo. Sr. D. Javier Aracil Santonja
Vocal:	Excma. Sra. D. ^a Josefina Gómez Mendoza
Vocal:	Excmo. Sr. D. Enrique Castillo Ron

Entre las comisiones que se contemplan en los Estatutos como comisiones permanentes figuran las de Gobierno, Hacienda, Relaciones Exteriores y Premios. A continuación se detalla la composición de las distintas comisiones, formadas por los Excmos. Sres.:

Comisión de Gobierno: D. Elías Fereres Castiel (presidente), D. Javier Aracil Santonja, D. Antonio Colino Martínez y D. Manuel Márquez Balín (†19-05-19).

Comisión de Hacienda: D. Joaquim Coello Brufau (Presidente), D. José Manuel Sanjurjo Jul, D. Luis Alberto Petit Herrera y D. Manuel Hita Romero.

Comisión de Premios: D. Ramón Agustí Comes (presidente), D. Eduardo Alonso Pérez de Ágreda, D. Enrique Castillo Ron, D. Joaquim Coello Brufau, D. Luis Gil Sánchez, D. Manuel Hita Romero y D. Elías Muñoz Merino

Comisión de Relaciones Exteriores: D. Manuel Márquez Balín (Presidente) (†19-05-19), D. Eloy Álvarez Pelegry, D. Pere Brunet Crosa, D. Enrique Cerdá Olmedo, D. Jaime Domínguez Abascal, D. Elías Muñoz Merino y D. José Manuel Sanjurjo Jul.

Comisión de Candidaturas: D. Elías Fereres Castiel (presidente) D. Ramón Agustí Comes, D. Eduardo Alonso Pérez de Ágreda, D. Eloy Álvarez Pelegry, D. Javier Aracil Santonja, D. Luis Castañer Muñoz, D. Enrique Cerdá Olmedo, D. Joaquim Coello Brufau, D. Jaime Domínguez Abascal, D. César Dopazo García, D.^a Josefina Gómez Mendoza, **D. Miguel Ángel Lagunas Hernández**, **D. Manuel Márquez Balín (†19-05-19)**, D. José Antonio Martín Pereda, D. Javier Rui-Wamba Martija, D. José Manuel Sanjurjo Jul, D. Juan Ramón Sanmartín Losada, D.^a María Vallet Regí y D. Juan Antonio Zufiria Zatarain.

5. SESIONES ACADÉMICAS

Durante el curso académico 2018-2019 tuvieron lugar las sesiones académicas solemnes de lectura de discurso de ingreso y toma de posesión de los académicos de número Excma. Sra. D.^a Nuria Oliver Ramírez y Excmos. Sres. D. Íñigo Losada Rodríguez, D. Francisco Herrera Triguero, D. Javier Ventura-Traveset Bosch y D. Ignacio Romagosa Clariana, así como la clausura de curso académico el 23 de octubre de 2018.

TOMAS DE POSESIÓN

La Excma. Sra. D.^a Nuria Oliver Ramírez, fue elegida en sesión plenaria de 22 de mayo de 2018 a propuesta de la académica Excma. Sra. D.^a Josefina Gómez Mendoza y los académicos Excmos. Sres. D. Javier Aracil Santonja, D. Manuel Márquez Balín y D. Elías Muñoz Merino.

El Excmo. Sr. D. Íñigo Losada Rodríguez, fue elegido en sesión plenaria de 22 de mayo de 2018 a propuesta de los académicos Excmos. Sres. D. Enrique Castillo Ron, D. Manuel Doblaré Castellano y D. José Manuel Sanjurjo Jul.

El Excmo. Sr. D. Francisco Herrera Triguero, fue elegido en sesión plenaria de 20 de noviembre de 2018 a propuesta de los académicos Excmos. Sres. D. Manuel Doblaré Castellano, D. José Domínguez Abascal y D. Aníbal R. Figueiras Vidal.

El Excmo. Sr. D. Javier Ventura-Traveset Bosch, fue elegido en sesión plenaria de 20 de noviembre de 2018 a propuesta de los académicos Excmos. Sres. D. Luis Castañer Muñoz, D. Miguel Ángel Lagunas Hernández y D. Amable Liñán Martínez.

El Excmo. Sr. D. Ignacio Romagosa Clariana, fue elegido en sesión plenaria de 20 de noviembre de 2018 a propuesta de los académicos Excmos. Sres. D. Enrique Cerdá Olmedo, D. Elías Fereres Castiel y D. José Antonio Martín Pereda.

Toma de posesión de la Excma. Sra. D.^a Nuria Oliver Ramírez

El 11 de diciembre de 2018 tuvo lugar la toma de posesión como académica de número de la Excma. Sra. D.^a Nuria Oliver Ramírez. Su discurso de ingreso, titulado: [*Inteligencia Artificial: ficción realidad y sueños*](#), fue contestado por el Excmo. Sr. D. Elías Fereres Castiel.

En su discurso señaló que a lo largo de la historia ha existido cierto enfrentamiento entre dos escuelas de pensamiento con respecto a la IA: el enfoque simbólico-lógico, que postulaba que para desarrollar máquinas que razonaran era necesario que siguiesen un conjunto de reglas predefinidas y principios de la lógica, y el enfoque basado en datos, que proponía que la inteligencia artificial debería inspirarse en la biología, aprendiendo a partir de la observación y la experiencia, es decir, a partir de datos. No obstante, no fue hasta 1984 cuando nació el primer esfuerzo científico por implementar en una máquina el razonamiento de sentido común, creando una base de datos masiva que contendría todo el conocimiento sobre el mundo que tiene de media una persona.

Destacó también que el interés por la IA ha experimentado unos niveles exorbitantes, en parte alimentado por la consecución de hitos importantes que hace 25 años parecían inalcanzables. Para la nueva académica es indudable que la IA permitirá que tengamos una medicina de precisión (personalizada, preventiva y predictiva), una educación personalizada y permanente, ciudades inteligentes, una

gestión más eficiente de los recursos y una toma de decisiones más justas, transparentes y basadas en la evidencia. Pero, este impacto no vendrá exento de cambios sociales profundos que comportan unos principios éticos centrados en las personas.



Nuria Oliver entrando en la sala acompañada de los académicos Eloy Álvarez y Rafael del Pino



Las cuatro académicas de la RAI: Josefina Gómez, Nuria Oliver, María Vallet y Pilar Carbonero



Nuria Oliver durante su intervención



Elías Fereres durante su contestación

Toma de posesión del Excmo. Sr. D. Íñigo Losada Rodríguez

El 19 de febrero de 2019 tuvo lugar la toma de posesión del Excmo. Sr. D. Íñigo Losada Rodríguez. Su discurso de ingreso: [Ingeniería para un océano de retos y oportunidades](#), fue contestado por el académico Excmo. Sr. D. Enrique Castillo Ron. El acto contó con la asistencia de la ministra de Transición Ecológica, D.^a Teresa Ribera Rodríguez y del rector de la Universidad de Cantabria, D. Ángel Pazos Carros.

Tras reconocer a aquellas personas que han facilitado su larga trayectoria profesional y vital, el nuevo académico hizo un recorrido por esos momentos y por aquellos que, según su opinión, han cambiado y cambiarán el rumbo de su campo de actividad científico-técnica, la ingeniería del océano. Nos embarcó así en una travesía para identificar aquellos retos y oportunidades, que nos ofrece el binomio océano-ingeniería en el futuro.

El rápido crecimiento de nuestras sociedades más prósperas y tecnológicamente más avanzadas está afectando cada vez más a su entorno ambiental más cercano,

pero también en el ámbito global y el océano no es una excepción. La ingeniería es esencial para abordar los riesgos y oportunidades presentes y futuros asociados a nuestros océanos.

Como primer paso, durante las próximas décadas la ingeniería del océano debería abordar aquellos aspectos que contribuyan a una mejor comprensión de los procesos oceánicos y costeros, así como a los desarrollos tecnológicos necesarios para generar nuevos conocimientos y la información para abordar las soluciones que la sociedad demanda. Este esfuerzo servirá de base para garantizar la coexistencia de aquellas iniciativas orientadas a la reducción de las presiones e inductores de cambio en el océano, la preservación y el restablecimiento de la diversidad biológica de los ecosistemas con un desarrollo sostenible de las oportunidades que nos brinda la economía azul.

La ingeniería debe abordar el reto de la sostenibilidad para salvaguardar nuestra prosperidad íntimamente ligada con los océanos. Y debe hacerlo con mayores capacidades tecnológicas para poder satisfacer las demandas de una población global cercana a los 9.000 millones de personas.

Debemos crear una ingeniería del océano que mejore la interacción entre hombre y océano y garantice su sostenibilidad.

Este cambio debe partir necesariamente de una profunda reflexión que realice un diagnóstico y visualice el futuro y que, sobre todo, transforme la formación de los futuros ingenieros que van a trabajar en el medio marino.



Teresa Ribera acompañada por Elías Fereres, Joaquín Coello y Antonio Colino



Íñigo Losada y Enrique Castillo



Íñigo Losada, Enrique Castillo, Teresa Ribera y Ángel Pazos

Toma de posesión del Excmo. Sr. D. Francisco Herrera Triguero

El 21 de mayo de 2019 tuvo lugar la toma de posesión del Excmo. Sr. D. Francisco Herrera Triguero. Su discurso de ingreso: [Inteligencia Computacional: sistemas inteligentes inspirados en la naturaleza](#), fue contestado por el académico Excmo. Sr. D. Aníbal R. Figueiras Vidal.

El nuevo académico presentó la inteligencia artificial desde una perspectiva divulgativa, lejos de la formalización que se puede encontrar en muchos libros. Por ello, recuperando una incursión descriptiva a la inteligencia computacional que hizo cuando recibió el galardón Natural de Jaén, se planteó construir su discurso sobre las tecnologías de la inteligencia computacional, su presente y algunos de sus retos. También hizo una breve parada por algunas de sus aportaciones, que suponían ciertos hitos en su trabajo, sin ser exhaustivo y con el riesgo de dejarse muchas aportaciones destacadas sin mencionar.

Señaló también la inteligencia artificial como el gran ámbito de conocimiento. La inteligencia artificial se ha situado como una tecnología central en la nueva revolución industrial que nos está empujando a una transformación digital sin precedentes, la cuarta revolución industrial. España está situada en una buena posición a nivel europeo, entre los cuatro países con más desarrollos en inteligencia artificial. En Granada se presentó, en marzo de 2019, la Estrategia Española de I+D+I en inteligencia artificial, en cuya elaboración tuvo el honor de participar. Por ello, hizo una breve incursión en la inteligencia artificial, la citada estrategia, y la oportunidad que tenemos ante un gran reto de desarrollo tecnológico e innovación.



Francisco Herrera tras su discurso



Aníbal Figueiras durante su intervención



Francisco Herrera acompañado por la rectora de la Universidad de Granada, M^a Pilar Aranda, y por José Domínguez, académico y secretario de estado de Energía

Toma de posesión del Excmo. Sr. D. Javier Ventura-Traveset Bosch

El 18 de junio de 2019 tuvo lugar la toma de posesión del Excmo. Sr. D. Javier Ventura-Traveset Bosch. Su discurso de ingreso: [*Quo vadis space: una perspectiva del sector espacial actual y de sus oportunidades de futuro*](#), fue contestado por el académico Excmo. Sr. D. Amable Liñán Martínez.

El nuevo académico enfocó su discurso como una reflexión sobre el estado actual de sector espacial y sus perspectivas de futuro. Para muchos de los ingenieros y científicos de su generación, las misiones Apolo fueron además una extraordinaria **fuentes de inspiración durante su infancia: “queríamos ser como ellos”**.

El sector espacial es, 50 años después, un sector maduro y diversificado, con carácter global, presente en todas las facetas de nuestra sociedad, con una participación fundamental de la industria privada y con un enorme potencial de crecimiento. Un sector sin el cual el mundo, tal como lo concebimos hoy, simplemente, no podría existir.

Expuso que el espacio se presenta como un actor esencial en la vigilancia y mitigación del cambio climático y que puede favorecer la colaboración internacional, potenciando además un mundo global más solidario, mejor comunicado y con menos desequilibrios. Pero para que esto sea así, y como en todos los ámbitos de la ingeniería, es primordial situar siempre al ser humano y a la sociedad al frente de todas nuestras reflexiones e iniciativas tecnológicas. Es esencial asegurar que las futuras decisiones sobre el sector espacial y sus prioridades tengan siempre en cuenta este principio, preguntándonos siempre sobre el uso final de las tecnologías que queremos desarrollar y sus implicaciones.

Finalmente, el nuevo académico señaló que es preciso asegurar, a través de un refuerzo en la educación en valores, que nuestros ingenieros, científicos e instituciones vivan siempre la necesidad imperiosa de que todo lo que hagan, lo hagan al servicio de los demás y de nuestra sociedad.



Amable Liñán durante su intervención

Javier Ventura-Traveset



*Enrique Castillo, Javier Ventura-Traveset, Amable Liñán,
Luis Castañer y Josefina Gómez*

Toma de posesión del Excmo. Sr. D. Ignacio Romagosa Clariana

El 24 de septiembre de 2019 tuvo lugar la toma de posesión del Excmo. Sr. D. Ignacio Romagosa Clariana. Su discurso de ingreso: [La cebada, mucho más que cerveza y pienso](#), fue contestado por el académico Excmo. Sr. D. Elías Fereres Castiel.

El nuevo académico comenzó exponiendo que, el reto de la agricultura moderna es alcanzar una auténtica intensificación sostenible, mediante la conjunción de su vertiente más tradicional con las nuevas tecnologías de la información, de la ciencia de datos, de la inteligencia artificial, de los sensores terrestres y espaciales y de todas las herramientas moleculares, particularmente genómicas, disponibles. Esto es, en su conjunto, ingeniería en su estado más puro.

"Nunca en la historia de la humanidad hemos tenido acceso a tanta comida y de tanta calidad". Damos por supuesto que la agricultura sea capaz de suministrar, sin apenas esfuerzos, alimentos para toda la población y, por ello la sociedad ha dejado de valorar su actividad. Hemos pasado del reconocimiento social al cuestionamiento creciente.

En los últimos años, ciertos sectores sociales están trasladando a la opinión pública una falsa sensación de riesgo hacia el medio ambiente y para la salud de los consumidores asociando el riesgo a una agricultura industrializada, en contraposición con una agricultura tradicional o ecológica que, sin ningún tipo de análisis objetivo, suponen (erróneamente) más adecuada para resolver los retos planetarios a los que nos enfrentamos. Sin embargo, frente a este debate hay unos hechos irrefutables. Si analizamos el incremento de la población mundial en relación con el incremento de la producción agrícola en los últimos 60 años, constatamos que la población se ha multiplicado casi por 2,5, mientras que la producción de cereales, así como de muchos otros cultivos, por 4. Gracias a las nuevas tecnologías se sigue superando el reto demográfico y así debería seguir sucediendo en los próximos decenios.

Pero, más allá de profundizar detalladamente en los logros pasados, perspectivas y oportunidades futuras de la agricultura en general, o de la mejora genética vegetal,

en particular, Ignacio Romagosa prosiguió centrando su intervención en un cultivo concreto como es la cebada, *Hordeum vulgare L.* Cultivo infravalorado por muchos, olvidado para ciertos usos y al que ha dedicado la mayor parte de su vida profesional, de forma que podamos apreciar el enorme interés que los cultivos agrícolas, y como consecuencia la ingeniería agronómica, presentan actualmente para la sociedad.



Los académicos dan la bienvenida al nuevo compañero



Elías Fereres, Ignacio Romagosa y Luis Castañer

Ignacio Romagosa entra en la sala acompañado de Francisco Herrera e Íñigo Losada

CLAUSURA DEL CURSO ACADÉMICO

La conferencia de clausura del curso académico 2018 la dictó, el 23 de octubre de 2018, el académico D. Javier Rui-Wamba Martija, bajo el título [20 años después...](#)

D. Javier Rui-Wamba fué el primer académico electo de la Real Academia de Ingeniería (en aquel entonces, sólo Academia de Ingeniería). Veinte años más tarde, pronunció esta conferencia magistral en el acto de clausura del curso académico 2018.

En su discurso, el académico, señaló que uno de los déficits más característicos de la parte más cultivada de la sociedad actual es su desconocimiento de la ingeniería, la lamentable ausencia en su bagaje intelectual de una "cultura de la ingeniería";

actividad o sector que, sin embargo, ha hecho posible la existencia de la sociedad actual y ha construido, decisivamente, el progreso social y económico al haber concebido y realizado infraestructuras que utilizamos en cada momento, que tenemos bien a la vista y que han modernizado nuestro país. Hay, sin duda, un lamentable déficit de "cultura de la ingeniería" y considera que, ciertamente, los ingenieros han contribuido a ello.

Para superar este déficit tan lamentable y tan real, el conferenciante aportó una reflexión sobre los orígenes de la ingeniería, tratando, por otra parte, de identificar los rasgos que forman lo esencial del carácter de una profesión polifacética y bicentenaria.



Antonio Colino, Elías Fereres, Luis Castañer y Javier Rui-Wamba



Javier Rui-Wamba durante su intervención



Antonio Colino durante su intervención

6. PREMIOS Y DISTINCIONES

En este apartado se recogen los premios *Agustín de Betancourt y Molina* y *Juan López de Peñalver* dedicados a jóvenes investigadores en el campo de la ingeniería, así como el premio *Academiae Dilecta* dirigido a reconocer a aquellas empresas cuya actividad tenga su origen en el estudio y la investigación de los fundamentos científicos y técnicos de la ingeniería, sus aplicaciones tecnológicas y sus técnicas operativas, así como cuanto se refiere al proyecto, desarrollo y explotación de sus realizaciones.

Igualmente se otorga la distinción de *Ingeniero Laureatus* o *Ingeniera Laureata* a aquellos ingenieros o arquitectos que hayan realizado una actividad profesional que se pueda considerar como referente y modelo capaz de suscitar la vocación técnica en las nuevas generaciones.

PREMIOS AGUSTÍN DE BETANCOURT Y MOLINA Y JUAN LÓPEZ DE PEÑALVER

La Real Academia de Ingeniería, con el copatrocinio de la Fundación *Pro Rebus Academiae*, convoca cada año los premios *Agustín de Betancourt y Juan López de Peñalver* destinados a investigadores o profesionales que hayan realizado contribuciones originales y relevantes en cualquiera de los ámbitos de la ingeniería, valorándose específicamente en ambos premios los aspectos relacionados con la transferencia de tecnología. Los aspirantes deben tener menos de 40 años de edad a 1 de enero del año de la convocatoria y mantener vinculación con España, en donde hayan desarrollado parte significativa de sus trabajos.

El premio *Agustín de Betancourt y Molina* se destina a personas individuales que hayan realizado labores notorias de investigación en el campo de la ingeniería, conducentes a asentar las bases y/o propiciar nuevos desarrollos e innovaciones en cualquiera de sus ámbitos profesionales.

El premio *Juan López de Peñalver* está destinado a personas individuales o a equipos de trabajo formados por miembros que mayoritariamente tengan menos de 40 años de edad, que hayan realizado labores notorias de desarrollo e innovación, contribuciones profesionales destacadas u obra singular en cualquiera de los ámbitos profesionales de la ingeniería española. En el caso de un equipo se hará explícito el director del mismo, que tendrá, en todo caso, una edad menor de 40 años y que firmará la candidatura.

El día 20 de noviembre de 2018, tuvo lugar en la RAI el acto de entrega de los premios Jóvenes Investigadores *Agustín de Betancourt y Molina* y *Juan López de Peñalver*.

La sesión comenzó con unas palabras de bienvenida por parte del presidente de la RAI, D. Elías Fereres, y continuó con la intervención del secretario general, D. Antonio Colino, que leyó el acuerdo de concesión de los premios y medallas tomado por el Pleno de la Academia.

D. Ramón Agustí, presidente de la comisión de premios, presentó los premios y las medallas concedidas.

El premio *Agustín de Betancourt y Molina* fue concedido al Dr. Raúl Muñoz Torre, ingeniero químico y actualmente profesor titular de la Universidad de Valladolid, por sus contribuciones a la Ingeniería química y medioambiental en el ámbito del

tratamiento biológico de la contaminación atmosférica y tratamiento de aguas residuales en fotobiorreactores de microalgas y bacterias.

La comisión de premios valoró la relevancia de su trayectoria, tal como avalan sus excelentes indicadores en todas las actividades investigadoras llevadas a cabo, y en particular, en lo relativo a la transferencia de tecnología tanto a nivel nacional como internacional.

El premio *Juan López de Peñalver*, fue concedido a D. David Gascón Cabrejas, ingeniero informático y actualmente director de Ingeniería de Libelium Comunicaciones Distribuidas S.L., por sus contribuciones a la ingeniería informática en el ámbito de los sensores inteligentes y a los protocolos de seguridad dentro del paradigma de internet de las cosas.

La comisión de premios valoró muy especialmente su trayectoria como innovador por la creación de la empresa Libellium, actualmente referente mundial en tecnología del internet de las cosas y cuyos desarrollos se exportan a más de 120 países. De hecho, cabría destacar que ya en 2012 fue nombrado por el prestigioso *Massachusetts Institute of Technology* (MIT), uno de los 20 principales innovadores del mundo.



David Gascón, Elías Fereres y Raúl Muñoz

Las medallas se concedieron a las personas siguientes por los motivos que en cada caso se indican:

Dr. Luis Cueto-Felgueroso Landeira, ingeniero de caminos canales y puertos, actualmente investigador del programa Ramón y Cajal en la UPM; por sus contribuciones a la aplicación de la mecánica de fluidos en ambientes subterráneos introduciendo nuevas teorías de flujo multifase y desarrollando y aplicando nuevos esquemas numéricos de alto orden a problemas de flujo en medios porosos y geomecánica.

Dr. Pedro Castaño Sánchez, ingeniero químico, actualmente profesor asociado de la Universidad del País Vasco; por sus contribuciones a la ingeniería química en las áreas de valorización de residuos, ingeniería de catálisis, desactivación de catalizadores y modelado cinético e ingeniería de reactores.

Dr. David Fernández Llorca, ingeniero de telecomunicación, actualmente profesor titular en la Universidad de Alcalá de Henares; por sus contribuciones a la ingeniería de telecomunicación en las áreas de los sistemas de asistencia a la conducción y sistemas de conducción autónoma en carretera. Se valoró también de manera

específica su encomiable labor en transferencia de tecnología con 10 patentes en explotación, entre otras muchas aportaciones.

Dr. David Carrera Pérez, ingeniero informático, actualmente profesor contratado en la Universidad Politécnica de Cataluña e investigador en el Centro Nacional de Supercomputación de Barcelona; por sus contribuciones a la ingeniería informática en el área de integración holística de tecnologías emergentes de supercomputación y su amplia colaboración con empresas de referencia a nivel mundial en el campo de la informática.

D^a Mónica Pardo Herrero y D^a Elena García Llorente, ingenieras industrial y aeronáutica respectivamente, actualmente líderes del equipo de investigación: sistemas orientados al avión más eléctrico de CESA; por sus contribuciones a la ingeniería aeronáutica. En particular se valoraron las destacadas aportaciones del equipo a los sistemas de actuación puramente eléctrico y al desarrollo de generación de potencia basados en pilas de hidrógeno.

Dr. Tobías Koch, máster of science en *Information Technology and Electrical Engineering* por el *Swiss Federal Institute of Technology* (ETH) de Zurich, actualmente investigador Ramón y Cajal en la Universidad Carlos III de Madrid; por sus contribuciones a la ingeniería de telecomunicación en el área de teoría de la información y, en particular, en lo relativo al estudio de las comunicaciones inalámbricas de baja latencia.

Dra. Marta Vivar García, ingeniera de telecomunicación, actualmente investigadora Ramón y Cajal en la Universidad de Jaén; por sus contribuciones en el diseño y desarrollo de nuevos conceptos para dispositivos híbridos solares fotovoltaicos, térmicos y fotoquímicos para la producción de electricidad, agua purificada y/o calor.

Dra. María Fernández Raga, ingeniera forestal y del medio natural, actualmente profesora ayudante doctor de la Universidad de León; por sus contribuciones a la ingeniería forestal y del medio natural en el área de la erosión por salpicadura resultante del bombardeo de la superficie del suelo por las gotas de lluvia.



Algunos medallistas con el vicepresidente y el secretario general de la RAI

ACADEMIAE DILECTA

La Real Academia de Ingeniería convoca anualmente el premio *Academiae Dilecta* con el fin de reconocer a aquellas empresas cuya actividad tenga su origen en el estudio y la investigación de los fundamentos científicos y técnicos de la ingeniería, sus aplicaciones tecnológicas y sus técnicas operativas, así como cuanto se refiere al proyecto, desarrollo y explotación de sus realizaciones.

El día 20 de noviembre tuvo lugar la entrega del premio *Academiae Dilecta 2018* a la Compañía Española de Sistemas Aeronáuticos, S.A.U. (CESA).

El secretario general de la RAI dio lectura del acuerdo de proclamación como *Academiae Dilecta 2018* a la empresa CESA, como sigue: “CESA es una empresa altamente cualificada, contando con cerca del 50% de su fuerza laboral con titulación universitaria. De hecho, en 2017 dedicó el 17% de su volumen de ventas a actividades de I+D, con implicaciones destacadas en la resolución de los desafíos en el campo de la aeronáutica actualmente presentes. CESA, por otra parte, presenta actividad en muchos campos en el entorno manufacturero aeronáutico, donde cuenta con numerosas acreditaciones. Esta Academia ha valorado muy positivamente el esfuerzo continuado realizado por CESA para conseguir estar en la vanguardia de la industria y de la ingeniería aeronáutica”.

La exposición de los méritos que concurrieron en la empresa CESA, fue realizada por el académico D. Manuel Hita Romero, quien expuso la presencia de esta empresa en el mundo, sus productos y servicios, así como sus programas especiales de grandes infraestructuras de investigación, programas de aeronaves y helicópteros y sus dominios tecnológicos de innovación en materiales y procesos, fabricación aditiva, fábrica inteligente, sistemas de accionamiento electromecánico, sistemas de gestión del aire, sistemas de pilas de combustible, sistemas de amortiguación magnetorreológicos.



José Leal recibiendo la escultura

Tras su intervención, se procedió a la entrega de la escultura y del diploma a D. José Leal Rocafull, consejero ejecutivo de CESA. Tras unas palabras de agradecimiento, hizo un recorrido por el desarrollo y la progresión de la empresa, sus proyectos y realizaciones, destacando que, gracias a los programas de investigación y desarrollo, CESA participa plenamente en la mayoría de los cambios tecnológicos, tanto nacionales como europeos, de la industria aeronáutica. Estos proyectos de I+D se encuentran en áreas tan diferentes como sistemas de gestión

del aire, celdas de combustible, sistemas de amortiguación semiactivos en trenes de aterrizaje, acción electromecánica, fabricación aditiva, etc.

HOMENAJES

Homenaje a la Escuela de Ingeniería Minera e Industrial de Almadén y a las Minas de Almadén

Los días 24 y 25 de abril de 2019, la Real Academia de Ingeniería, coincidiendo con su XXV aniversario, rindió homenaje a la Escuela de Ingeniería Minera e Industrial de Almadén (EIMIA) y a las Minas de Almadén.

El Homenaje a la Escuela, en reconocimiento a sus más de 240 años formando ingenieros, tuvo lugar el día 24 de abril. Comenzó con el descubrimiento de una placa conmemorativa que fue seguido por un acto institucional en cuya apertura participaron: el rector de la Universidad de Castilla La Mancha, el alcalde de Almadén, el director de la EIMIA, el presidente de MAYASA y el presidente de la RAI.



A continuación, el profesor de la EIMIA, D. Luis Mansilla Plaza, pronunció la conferencia *De la Academia de Minas a la Escuela de Ingeniería Minera e Industrial de Almadén*, en la que hizo un recorrido por los 240 años de historia de la Escuela.

Posteriormente, D. Francisco Javier Carrasco Milara, director de las Minas de Almadén, pronunció la conferencia *Las minas de Almadén, pasado, presente y futuro*



Mesa presidencial

La jornada del 25 de abril estuvo marcada por la visita técnico-cultural al parque minero dónde se descubrió otra placa conmemorativa.



Grupo de académicos a las puertas de la mina



Académicos en el interior de la mina

INGENIEROS LAUREADOS

La distinción de Ingeniero Laureado se otorga a aquellos ingenieros y arquitectos que hayan realizado una actividad profesional que se pueda considerar como referente y modelo capaz de suscitar la vocación técnica en las nuevas generaciones.

Éstos habrán desarrollado una obra técnica o científica que haya tenido influencia destacada en su área profesional. El desarrollo de la mayor parte de su obra científica y técnica debe estar vinculada con su actividad en España.

El premio consiste en la entrega de un diploma acreditativo que reconozca sus méritos y su trayectoria profesional y una escultura en bronce que reproduce el elemento artístico que representa a la Real Academia de Ingeniería.

En el curso académico 2018-2019, la Real Academia de Ingeniería ha premiado, con el reconocimiento de Ingenieros Laureados, la trayectoria extraordinaria de D. Javier García Jalón de la Fuente, D. Alfonso Fernández Canteli, D. Justo Nieto Nieto, D. Antonio Gens Solé, D. César Sagaseta Millán, D. José Luis de Justo Alpañés y D. Gregorio Montero González.

Reconocimiento como Ingenieros Laureados de D. Javier García Jalón de la Fuente, D. Alfonso Fernández Canteli y D. Justo Nieto Nieto

El día 28 de mayo de 2019, en la Real Academia de Ingeniería tuvo lugar la entrega de distinciones a la trayectoria profesional de estos insignes ingenieros.

Tras la apertura de la sesión académica por parte del presidente de la RAI, D. Elías Fereres, el secretario general, D. Antonio Colino, procedió a dar lectura del acta de concesión de las distinciones:

D. Javier García Jalón de la Fuente, ingeniero industrial, en base a su destacada labor académica y por ser impulsor de los métodos numéricos aplicados a la ingeniería de máquinas en España, especialmente a la dinámica de sistemas mecánicos, y ser uno de los referentes internacionales de esta materia.

D. Alfonso Fernández Canteli, ingeniero industrial, por su destacada labor académica en el ámbito de la fatiga en metales, vidrio y polímeros y su dimensionado probabilístico donde ha desarrollado la mayor parte de su actividad investigadora.

D. Justo Nieto Nieto, ingeniero industrial, por su destacada obra en el campo de la ingeniería industrial, tanto en sus vertientes académicas como de gestión universitaria. En particular, Justo Nieto ha sido el impulsor de la transformación de la ingeniería de máquinas en las escuelas de ingeniería industrial españolas, así como uno de los principales impulsores de la biomecánica en España.

En primer lugar, tras la intervención del secretario general, se dio paso al reconocimiento de D. Javier García Jalón de la Fuente, cuya *laudatio* corrió a cargo del académico D. Manuel Doblaré Castellano, que destacó, entre otras cosas, sus dos pasiones principales, la docencia universitaria y la investigación. Esta última en dos campos: la dinámica de máquinas y los métodos numéricos, que, muy pronto aunó en una metodología revolucionaria que, como la mayoría de ellas, es aparentemente simple: utilizar los grados de libertad del análisis estructural mediante elementos finitos para la simulación de elementos de máquinas.

Finalizada la *laudatio*, D. Javier García Jalón de la Fuente recibió la escultura de reconocimiento y D. Javier Cuadrado, catedrático de Ingeniería Mecánica de la Universidad de A Coruña, en nombre del laureado pronunció la conferencia magistral: *Las coordenadas naturales: origen y circunstancias*, donde se hizo referencia al compendio de sus trabajos entre 1979 y 1994 y al origen, definición y evolución de las coordenadas naturales.



Javier García Jalón de la Fuente tras recibir el diploma

En segundo lugar, se dio paso al reconocimiento de D. Alfonso Fernández Canteli, cuya *laudatio* fue pronunciada por D. Enrique Castillo Ron, destacando el gran impacto de su investigación, especialmente en el tema de fatiga de materiales, por la originalidad de sus modelos y por haber introducido su carácter aleatorio en los mismos.

D. Enrique Castillo destacó también que había formado el laboratorio de ensayos de fatiga, posiblemente el más completo de la universidad española; habiendo conseguido todo el material de sus proyectos de investigación y, muy especialmente, la donación del Politécnico de Zürich de la única máquina de 100 toneladas entonces disponible en España para estos ensayos.

Tras recibir la escultura de reconocimiento, de manos del presidente de la RAI, D. Alfonso Fernández Canteli pronunció una conferencia magistral sobre: *Modelización probabilística en fractura y fatiga en el grupo de Integridad Estructural: Materiales y Estructuras (IEMES) de la Universidad de Oviedo.*



Alfonso Fernández Canteli saludando a Enrique Castillo tras recibir el diploma

En tercer lugar, se procedió al reconocimiento de D. Justo Nieto Nieto cuya *laudatio* estuvo a cargo de D. Jaime Domínguez Abascal que destacó su trabajo continuo en el impulso y transformación de la ingeniería de máquinas en España promoviendo y consiguiendo la adhesión de España a la Federación Internacional para la Promoción de la Ciencia de las Máquinas y Mecanismos.

Tras recibir la escultura de reconocimiento, de manos de D. Antonio Colino, el ingeniero laureado en su intervención señaló que la ingeniería intenta encontrar aproximaciones razonables a óptimos deseables de conflictos del vivir (lo que con anterioridad denominó retos). Por eso se dice que la ingeniería es oportunidad y oportunismo, genio e ingenio, gestión de azares, etc. Justo Nieto no cree que estas búsquedas de óptimos fueran las motivaciones y atractivos que hacen a un joven estudiar ingeniería. Desde luego no fue su caso y, en todo caso, a medida que uno entra en el ritual de la escuela, **especialidad, contacto con la técnica, la ciencia, los profesores, ... van apareciendo querencias y adherencias**, y se va insinuando un destino a recorrer. En su caso fue la propia universidad. Ha tenido el privilegio de vivir con cierta intensidad, las siete miradas posibles de un universitario a la universidad: como estudiante, profesor, investigador, gestor universitario, responsable de políticas universitarias, intelectual y espectador, que pasó a comentar brevemente.



Justo Nieto recibiendo la escultura de manos de Antonio Colino



El presidente y el secretario general junto con los laureados y los académicos que pronunciaron las laudatio

Reconocimiento como Ingenieros Laureados de D. Antonio Gens Solé, D. César Sagaseta Millán y D. José Luis de Justo Alpañés

El día 26 de septiembre de 2019, tuvo lugar el acto de reconocimiento a la trayectoria profesional de estos insignes ingenieros.

Tras la apertura de la sesión académica por parte de D. Enrique Castillo, el académico D. José Manuel Sanjurjo, en nombre del secretario general, procedió a dar lectura del acta de concesión de las distinciones a los ingenieros que siguen en base a los méritos que se indican:

A D. Antonio Gens Solé en base a su destacada obra académica y profesional en el ámbito de la geotécnica de la ingeniería de caminos, canales y puertos. En particular ha jugado un papel fundamental en el establecimiento del paradigma moderno de la mecánica de suelos no saturados. Sus contribuciones en el campo geotécnico han sido objeto de numerosos reconocimientos, tanto a nivel nacional como internacional.

A D. César Sagaseta Millán en base a sus destacadas contribuciones, tanto académicas como profesionales, a la ingeniería de caminos canales y puertos. Siendo pionero en la introducción de importantes soluciones analíticas que son utilizadas por muchas oficinas de ingeniería, en el ámbito de la ingeniería del terreno. En particular, ha sido presidente del *European Committee on Numerical Methods in Geotechnical Engineering* durante 20 años.

A D. José Luis de Justo Alpañés en base a sus destacadas contribuciones a la ingeniería de caminos, canales y puertos en el ámbito de la ingeniería del terreno, del que fue el primer catedrático por oposición en España. Su obra trasciende su faceta académica, que cuenta en su haber con numerosos estudios y libros hoy día considerados clásicos como *Geotecnia y Cimientos*, con aportaciones muy significativas a nivel profesional en grandes obras de infraestructura.

En el acto, en primer lugar, se procedió al reconocimiento de D. Antonio Gens Solé cuya *laudatio* fue pronunciada por el académico D. Eduardo Alonso Pérez de Ágreda, que hizo un recorrido por su vasta trayectoria profesional.

Tras la entrega de la escultura y el diploma, D. Antonio Gens Solé trató sobre los geomateriales, su historia geológica, su comportamiento, etc. Expuso también el procedimiento en la estabilización de la Torre de Pisa, como un éxito de la ingeniería geotécnica, el procedimiento para el almacenamiento geológico profundo de los residuos nucleares y sobre las roturas en materiales licuefactables.



Antonio Gens durante su intervención

En segundo lugar, D. Enrique Castillo pronunció la *laudatio* de D. César Sagaseta Millán, y resaltó, entre otras cosas, su participación en la redacción de un programa de cálculo por elementos finitos, método que entonces se encontraba en sus comienzos y que fue, durante mucho tiempo, el único existente en España y pionero a nivel mundial en algunos aspectos,

obteniendo importantes soluciones para las deformaciones producidas por pérdidas o ganancias de terreno. Los resultados de este programa superaron las expectativas y se publicó en la revista *Géotechnique*, publicada por la *Institution of Civil Engineers* de Londres, que es la de más prestigio en el área. Treinta años más tarde, el método más utilizado para evaluar los asientos en túneles está basado en esta publicación.

Tras la *laudatio*, D. César Sagaseta recibió la escultura y el diploma que le acreditan como Ingeniero Laureado y pronunció su conferencia, en la que analizó algunas soluciones analíticas para problemas geotécnicos como: un análisis de ensayo de penetración estática en arcillas, pérdida de terreno sin drenaje a profundidad finita, extracción o inyección de material, rotura por *toppling* de taludes rocosos, inestabilidades y refuerzos superficiales de taludes, análisis de columnas de grava bajo terraplenes y cimentaciones, etc.



César Sagaseta recibiendo la escultura

En tercer lugar, se dio paso al reconocimiento de D. José Luis de Justo Alpañés con la *laudatio* de D. Miguel Ángel Losada, que destacó, además de su actividad como docente, su actividad como investigador principal y responsable profesional de 34 proyectos de investigación y contratos de asistencia técnica financiados por empresas nacionales e internacionales, incluyendo la Comisión Europea. En el ámbito técnico y profesional de la ingeniería del terreno ha tenido una participación relevante como miembro de comités y sociedades profesionales. Destacan, así mismo, sus estudios sobre suelos expansivos y colapsables y los progresos en el estudio geotécnico de canales y en el estudio de los asientos de la escollera. Ha sido pionero en los estudios de ingeniería sísmica en España, por ejemplo, en sismicidad histórica.



José Luis de Justo durante su intervención

Finalizada la *laudatio* el Prof. de Justo recibió la escultura de reconocimiento y procedió a presentar sus realizaciones académicas y en ingeniería. Presentó los trabajos realizados en ingeniería sísmica, sus actuaciones como presidente de la Real Academia Sevillana de Ciencias, los proyectos de ingeniería realizados en líneas de alta velocidad, en el metro de Sevilla y en la restauración del Tajo de San Pedro de la Alhambra de Granada, entre otros.



Laureados y académicos intervinientes en la sesión

Reconocimiento como Ingeniero Laureado de D. Gregorio Montero González

El día 1 de octubre de 2019, en la Real Academia de Ingeniería tuvo lugar el acto de reconocimiento a la trayectoria profesional de D. Gregorio Montero con el reconocimiento de Ingeniero Laureado.

Tras la apertura de la sesión por parte de D. Luis Castañer, vicepresidente de la RAI, D. Antonio Colino, secretario general, dio lectura del acuerdo adoptado en sesión plenaria de la Academia de conceder la distinción como Ingeniero Laureado al ingeniero de montes D. Gregorio Montero González.

La *laudatio*, *Gregorio Montero, una vivencia plena del monte*, fue pronunciada por D. José Alberto Pardos, académico de la RAI, en donde destacó su trayectoria rica en acontecimientos marcados por el esfuerzo continuado y la superación en el marco de la vida, y, por ende, en el ámbito profesional.

En su inmensa labor extendida en el tiempo, cabría destacar tres líneas en las que se enmarcan los trabajos con mayor proyección forestal. La primera, sobre modelos de producción de corcho en alcornoques en función de la calidad de la estación y de los tratamientos selvícolas. La segunda línea, centrada en la conexión ecología y economía proyectada en la silvicultura, en aplicación de la cual se desarrolló el modelo *Modern Forest* para la elección de especie y origen de la semilla en repoblación forestal. Y una tercera línea, del desarrollo del proyecto RECAMAN que ha permitido la medición de la renta y el capital en base a la producción de madera, frutos y fijación de carbono con el desarrollo de modelos de silvicultura aplicados en los montes de Andalucía.



José Alberto Pardos

D. José Alberto Pardos finalmente resaltó los resultados y conclusiones de los trabajos de Gregorio Montero y de sus colaboradores, que suponen valiosas aportaciones al conocimiento de la silvicultura, con especial repercusión en los sistemas forestales mediterráneos.

A continuación, tuvieron lugar distintas intervenciones que permitieron una visión global del laureado. D. Ricardo Alía Miranda, profesor de investigación CIFOR-INIA, presentó la **Actividad internacional y expansión y organización de la ciencia forestal de Gregorio Montero**. En su intervención explicó la contribución activa del laureado al fortalecimiento institucional del INIA, a la creación del CIFOR (Centro de Investigación Forestal), con una proyección internacional esencial para abordar los retos de investigación globales que plantea la sociedad a los bosques del futuro y que impulsó el exitoso Instituto Mixto Universitario IuFOR, centro que mantiene la visión de una investigación de excelencia en el monte mediterráneo. Fue también impulsor de la revista de investigación agraria: **Forest Systems**, consolidada a nivel internacional. Así mismo creó Selvired, una red sobre silvicultura en España que se ha mantenido activa promoviendo el intercambio de conocimientos entre silvicultores e investigadores.

D. Felipe Bravo Oviedo, catedrático de la Universidad de Valladolid, presentó la **Actividad profesional e investigadora de Gregorio Montero**, dándonos la visión de un discípulo que con el paso del tiempo se convirtió en un compañero, colaborador y amigo. Gregorio ha sido el maestro de investigadores que hoy trabajan en muchas universidades españolas y en centros y universidades de Chile, Suiza y Grecia. Es difícil encontrar en la generación de investigadores a la que pertenece Gregorio un impacto mayor y más diverso en cuanto a la formación de investigadores forestales comprometidos con la aplicación práctica de los conocimientos generados. D. Felipe Bravo destacó cuatro conceptos que han orientado la acción profesional de Gregorio Montero: ciencia forestal, ingeniería, gestión de montes y beneficio de la sociedad.

D. Pablo Campos Palacín, profesor de investigación del CSIC, elogió **la contribución de Gregorio Montero a las investigaciones de las economías de los sistemas silvopastorales**. Las aportaciones técnicas aplicadas de las investigaciones del laureado, en los ámbitos de las especies arbóreas y de matorrales mediterráneos, son pioneras en la integración en las economías silvo-pastorales de las producciones leñosas y frutales en los ciclos completos de explotación simulados de las especies. Los resultados de las investigaciones pioneras y únicas del Dr. Montero y sus colaboradores sobre los crecimientos naturales de la encina, el alcornoque, el pino piñonero y los matorrales mediterráneos, y de sus producciones físicas de bellota, leña, corcho, piña y biomasa en el ciclo completo de vida productiva de las especies son la base del diseño de las silviculturas aplicadas compatibles con la continuidad del pastoreo de animales controlados.

D. Alfonso San Miguel Ayanz, catedrático de la UPM, presentó **la actividad académica de Gregorio Montero**, destacando que la trayectoria vital de Gregorio Montero es a la vez atípica y brillante, transgresora de estereotipos y rica en frutos, tanto en su aspecto científico como en el académico. El laureado ha podido y ha sabido transmitir a los estudiantes desde la sólida base del conocimiento forestal más elemental hasta las últimas innovaciones del saber científico al que él tanto ha contribuido. Resaltó que ha sido y es un maestro de estudiantes, de profesores y de investigadores: un espécimen generador de vocaciones y conocimiento.

D. Rafael Serrada Hierro, de la Sociedad Española de Ciencias Forestales, destacó los **aspectos personales de Gregorio Montero**, remarcando su condición de profesor de profesores, por la abundante generación de profesionales dedicados a la gestión, la docencia y la investigación forestal y por su condición de impulsor de numerosas carreras que han contribuido a activar e innovar el sector forestal español. Rafael

Serrada señaló que Gregorio Montero sigue publicando monografías y secciones fijas en revistas especializadas, formando parte de equipos que hacen divulgación mediante las nuevas tecnologías e ideando e impulsando nuevas líneas de investigación y de su aplicación a la gestión.



Rafael Serrada, Alfonso San Miguel, Antonio Colino, Luis Castañer, Gregorio Montero, Felipe Bravo, Ricardo Alía y Pablo Campos

Tras las distintas intervenciones D. Gregorio Montero recibió la escultura de reconocimiento como Ingeniero Laureado y pronunció una conferencia magistral sobre: *Origen y evolución de la Selvicultura en España*. En dicha conferencia destacó que la selvicultura nace en centroeuropa a finales del siglo XVIII y durante la primera mitad del siglo XIX se fue consolidando un cuerpo doctrinal que reunía casi todos los elementos técnicos y modos de aplicación de la selvicultura. Como consecuencia del auge de las ciencias naturales y del avance de la experimentación, se hacen grandes progresos en la segunda mitad del siglo XIX, llegando a finales de siglo con una selvicultura experimental, con base ecológica y con los conocimientos prácticos obtenidos a lo largo de 100 años de aplicación.



Los académicos ingenieros de montes: Ramón Argüelles y José Alberto Pardos, junto a Gregorio Montero



Antonio Colino, Luis Castañer y Gregorio Montero tras finalizar la sesión

La selvicultura es la única ciencia ecológica que posee las herramientas necesarias para abordar la gestión de los montes, gestión que crea hábitats más diversos e interesantes para el fomento de la biodiversidad y sostenibilidad de los sistemas forestales. La selvicultura, aplicada de forma continuada en el monte, crea un equilibrio cultural que sustituye al equilibrio natural sin menoscabo para la biodiversidad, sostenibilidad y funcionalidad del monte, en definitiva, la selvicultura

constituye el eje central de la gestión forestal, recomendando el homenajeado que se busquen soluciones para compatibilizar el uso y la conservación de los montes.

DISTINCIONES Y RECONOCIMIENTOS A ACADÉMICOS



El 7 de noviembre de 2018, SM el Rey Felipe VI entregó los premios *Rei Jaume I 2018* a D.ª María Vallet en la modalidad de *Investigación Básica* y a D. Íñigo Losada en la de *Protección del Medio Ambiente*. SM el Rey les otorgó la medalla que les acredita como ganadores de los respectivos galardones.

El 11 de abril de 2019, D. Íñigo Losada fue distinguido como *Cántabro del Año* por el Diario Montañés.

El 27 de febrero de 2019, D. María Vallet recibió el premio *El Confidencial y Herbert Smith Freehills* por la excelencia de toda su carrera.

El 9 de mayo de 2019, recibió la *Medalla al Mérito en Investigación y Educación Universitaria*, que otorga el Consejo de Ministros, creada para reconocer los servicios relevantes de aquellas personas que han destacado en el campo de la educación universitaria y de la investigación científica.



El 4 de septiembre de 2019, recibió el *FEMS Materials Innovation Prize 2019*, que concede la Federación Europea de Sociedades de Ciencia de Materiales a distinguidos científicos o ingenieros en reconocimiento a contribuciones excepcionales al desarrollo tecnológico y a la innovación, basadas en ciencia de materiales y la ingeniería. María Vallet es la primera mujer en recibir este premio a lo largo de su historia.

El 11 de septiembre de 2019, fue galardonada con el *George Winter Award 2019*, que concede la Sociedad Europea de Biomateriales (European Society for Biomaterials). María Vallet es la primera mujer en recibir esta distinción, que recogió en el ámbito del Congreso Anual de la Sociedad Europea de Biomateriales celebrado en Dresden.

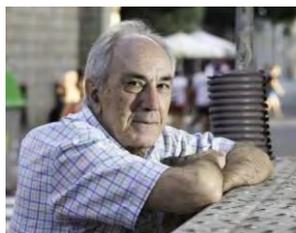
El 14 de noviembre de 2018, en un acto celebrado en la Real Academia de Ciencias Exactas, Físicas y Naturales, D. Aníbal Figueiras recibió el premio *Miguel Catalán 2018* a la *Carrera Científica*.



El 10 de diciembre de 2018, D. Amable Liñán recibió el galardón de *Ingeniero Ilustre* del Colegio Oficial de Ingenieros Aeronáuticos de España.

El 18 de septiembre de 2019, en acto solemne tomó posesión como *Académico de Honor* de la Real Academia de Doctores de España.

El 13 de febrero de 2019, D. José Manuel Sanjurjo y Ricardo Torrón recibieron el *European Award for Citizenship, Security and Defence*, que concede la Asociación Civil de Ingenieros de Defensa.



El 26 de febrero de 2019, D. Miguel Ángel Losada recibió el *Premio Nacional de Ingeniería Civil 2018*, en reconocimiento a su larga y fecunda labor profesional, por lo que ha representado, y sigue representando en el campo de la ingeniería civil y, más concretamente, para el prestigio internacional de la ingeniería marítima y portuaria española.

Así mismo, el 26 de marzo de 2019, fue investido Doctor *Honoris Causa* por la Universidad de Córdoba, por su prestigio académico e investigador y por su destacada labor de transferencia y divulgación científica, así como por su intensa y continua colaboración con la UCO.

El 5 de abril de 2019, D. José Antonio Martín Pereda fue investido Doctor *Honoris Causa* por la Universidad de Cantabria. El Sr. Martín Pereda fue introductor de la fotónica en España y pionero en la investigación de cristales líquidos y en los estudios de biestabilidad óptica y fenómenos.



El 4 de julio de 2019, D. José Antonio Martín Pereda recibió la distinción de *Socio de Honor de la Sociedad Española de Óptica* por su labor en favor de la óptica en España. Esta distinción se concede por primera vez, desde su creación en 1972, a un ingeniero.



El 16 de abril de 2019, D. Enrique Castillo recibió el *XVIII Premio de Investigación Juan María Parés 2018* en la modalidad de *actividad investigadora*, otorgado por el Consejo Social de la Universidad de Cantabria, por su "trayectoria científica meritoria".

El 7 de mayo de 2019, D.^a Nuria Oliver fue nombrada miembro de la *CHI Academy*, la academia más importante a nivel mundial que valora aquellos investigadores que han realizado contribuciones significativas en el campo de la interacción hombre-máquina.



El 5 de septiembre de 2019, recibió el premio *Data Scientist of the Year*, otorgado por la *Big Data Value Association* en un acto celebrado en Dublín.

7. RELACIONES CON OTRAS ACADEMIAS

En este apartado se recogen las actividades más relevantes con otras Reales Academias del Instituto de España, la participación en las reuniones de dicho Instituto por parte del presidente de la RAI y la participación en las organizaciones internacionales, Euro-CASE a nivel europeo y CAETS a nivel mundial.

REALES ACADEMIAS DEL INSTITUTO DE ESPAÑA

En el curso académico 2018-2019 tuvo lugar una sesión científica conjunta sobre *Big Data*, una sesión Inter-Academias sobre *Inteligencia Artificial* y otra que trató sobre *Reflexiones sobre el poder*.

Sesión científica conjunta sobre Big Data

El día 27 de noviembre de 2018, el Instituto de España organizó una sesión científica conjunta con las Reales Academias de Ingeniería, Nacional de Medicina; Ciencias Exactas, Físicas y Naturales y Nacional de Farmacia sobre *Big Data*, que tuvo lugar en el salón de actos del Instituto de España.

La presentación de la sesión corrió a cargo del presidente de la RAI, Excmo. Sr. D. Elías Fereres, que dio la bienvenida a los participantes. A continuación, el Excmo. Sr. D. Rafael Sentandreu, académico de la Real Academia Nacional de Farmacia, pronunció la conferencia *Big Data: Impacto en la Sociedad*.

El Excmo. Sr. D. Ángel Alonso Sánchez, académico de la Real Academia Nacional de Medicina de España, habló sobre *Big Data y tecnologías de la información para el desarrollo de una medicina genómica, personalizada y de precisión*.

Big Data y el avance científico fue el título de la conferencia impartida por el Ilmo. Sr. D. Daniel Peña Sánchez de Rivera, académico correspondiente de la Real Academia de Ciencias Exactas, Físicas y Naturales.

Por último, el académico de la Real Academia de Ingeniería, Excmo. Sr. D. Aníbal R. Figueiras, intervino con una conferencia bajo el título *Problemas singulares en aprendizaje máquina*.

Sesión Inter-Academias sobre Inteligencia Artificial: el valor de los datos

La sesión Inter-Academias, *Inteligencia Artificial: el valor de los datos*, tuvo lugar el 19 de junio de 2019, y contó con la colaboración de las Reales Academias Nacional de Medicina, de Ciencias Exactas, Físicas y Naturales y de Ingeniería.

La sesión estuvo presidida por el Excmo. Sr. D. Aníbal R. Figueiras, académico de la RAI y coordinador de la sesión, quien pronunció unas palabras de bienvenida. Tras su intervención, el Excmo. Sr. D. Francisco Herrera, académico de la RAI, introdujo la sesión dando paso a las diferentes ponencias.

Comenzaron éstas con la intervención del Excmo. Sr. D. Pedro R. García Barreno, académico de la Real Academia Española y Real Academia de Ciencias Exactas, Físicas y Naturales, con una conferencia titulada *De Culturómica y criptofasia*.

El Excmo. Sr. D. Antonio López Farré, académico correspondiente de la Real Academia Nacional de Medicina, pronunció una conferencia titulada *Aplicación actual de la IA en investigación biomédica*.

Inteligencia y datos en Seguridad y Ciberseguridad fue el título de la intervención del Excmo. Sr. D. David Ríos, académico de la Real Academia de Ciencias Exactas, Físicas y Naturales.

Por último, el Excmo. Sr. D. José Domínguez Abascal, académico de la Real Academia de Ingeniería, habló sobre los *Objetivos de Desarrollo Sostenible y Transición Energética: la importancia de los datos*.



Aníbal R. Figueiras Vidal, Francisco Herrera Trigueros, Antonio López Farré, José Domínguez Abascal, Pedro García Barreno y David Ríos Insua

INSTITUTO DE ESPAÑA

El presidente de la Real Academia de Ingeniería, Excmo. Sr. D. Elías Fereres, ha participado en las reuniones ordinarias de la Junta Rectora del Instituto de España, que tuvieron lugar los días 29 de enero, 26 de febrero, 26 de marzo, 30 de abril, 28 de mayo, 25 de junio, 9 de julio y 24 de septiembre.

La Junta Rectora mantuvo, además, una reunión el 29 de octubre de relevo de presidencia (comprobar fecha en 2018). En el mes de diciembre de 2018 la Junta Rectora se reunió para conmemorar el *Homenaje a la Antigüedad Académica*.

EURO-CASE

La Real Academia de Ingeniería participa en la plataforma de Energía de Euro-CASE, representada por el académico D. Eloy Álvarez Pelegry. La plataforma tuvo varias reuniones, una de ellas en Madrid a finales de septiembre de 2018. Como resultado del trabajo del grupo se ha elaborado el informe [*Energy Transitions in Europe common goals but different paths*](#) (publicado en formato digital y en papel).



Representantes de la Plataforma de Energía de Euro-CASE: Krzysztof Galos, Eloy Álvarez Pelegrí, Eberhard Umbach, Katharina Schätzler, Yves Caristan, Zoran Marinšek, Wolf Gehrlich

Los días 14 a 17 de abril de 2019, tuvo lugar en Ma'nshan (China) el *Forum on evidence based* scientific Policy Advice, organizado por la Academia China de Ingeniería (CAE) y Euro-CASE, con objeto de promover el intercambio de *think tanks* entre los países europeos y China, y contó con la intervención del Sr. Álvarez Pelegrí con una conferencia sobre *Exchanging information on Energy: future challenges and energy transitions*.



Vista parcial de los participantes

El programa contó con intervenciones del presidente y vicepresidente de la Academia China de Ingeniería: HE Huawu y GAN Yong, así como del presidente de la *Anhui University of Technology* WEI Xianwen y del vicegovernador del *Anhui Provincial People's Government*, DENG Xiangyan, entre otros, y de representantes de academias europeas de ingeniería y tecnología, encabezadas por el secretario general de Euro-CASE Yves Caristan. Entre las academias europeas se encontraban la francesa representada por Yves Bamberger, la sueca por Magnus Bredine, la eslovena por Mark Plasko y la británica por David Thomlinson. Dentro del programa se realizaron una serie de visitas a empresas chinas del ámbito energético y tecnológico.

CAETS

Durante el curso académico 2018-2019 se celebró el Congreso Anual y el *Council Meeting*, que tuvieron lugar en Estocolmo los días 25 y 26 de junio de 2019, el primero, y el 27 del mismo mes, el segundo. En representación de la RAI asistió el académico Pere Brunet, quien había participado previamente en la organización del Congreso.

El Congreso se celebró bajo el lema *Engineering a better world: the next 100 years*. En él se plantearon algunos de los retos de la ingeniería para el futuro, como son el desarrollo digital, el diseño de una educación efectiva o la generación de infraestructuras inclusivas. Uno de los aspectos a destacar es que las academias deben adaptarse a los retos planteados por la sostenibilidad y deben intentar colaborar para cubrir algunas brechas existentes como son las que existen entre ciencia y sociedad, la industria y el sistema financiero o la ciencia y la administración. Se destacó que las academias pueden desarrollar un papel importante desde su posición de independencia, rigor y ausencia de sesgos.

En el *Council* participaron 26 academias, aprobándose la entrada de las academias de Nueva Zelanda, Nigeria y Serbia. En dicho *Council* se analizó el desarrollo de los trabajos de los grupos de Energía, Educación, Diversidad e inclusión, Desarrollo sostenible, y Comunicación con la sociedad y los políticos. También se avanzó en el desarrollo de los objetivos estratégicos de la nueva página web de CAETS.

Los dos próximos congresos de CAETS serán en Seúl, en 2020, bajo el lema *Smart Society* y Buenos Aires, en 2021, bajo el lema *Energía*.

8. JORNADAS, SESIONES Y COLABORACIONES

En este apartado se reseñan las diferentes jornadas, sesiones, mesas redondas, conferencias, presentaciones y colaboraciones que tuvieron lugar durante el año académico.

Industria, desarrollo tecnológico y política industrial

Esta jornada, organizada en colaboración con la Asociación de Ingenieros Industriales de Madrid (AIIM), tuvo lugar el 13 de noviembre de 2018. D. Luis Lada, académico de la RAI y D. Francisco Cal, presidente de la AIIM, fueron los encargados de introducir la misma.

A continuación, intervinieron D. Andrés Muñoz Machado, profesor *ad-honorem* de la UPM, D. Luis Vilches, presidente del Comité de Industrialización del Instituto de la Ingeniería de España y D. Galó Gutiérrez, director general de Industria y Pymes del Ministerio de Industria, Comercio y Turismo.

La pérdida de capacidad industrial manufacturera de la Unión Europea y los intentos de la comisión por recuperarla han hecho de la política industrial uno de los temas más importantes de nuestros días. Más de la mitad de la capacidad manufacturera de Europa se ha desplazado hacia Oriente.

El contenido de lo que se denomina política industrial no ha estado bien definido durante años. Sus grandes líneas no han encontrado una definición precisa, siendo muy poco frecuentes las monografías que pretenden recoger los contenidos de la misma con profundidad y amplitud. El libro *La Política Industrial. Un reto de nuestro tiempo*, que presentó su autor, D. Antonio Muñoz Machado, pretendía llevar a cabo esta empresa.



Galó Gutiérrez, Francisco Cal, Luis Lada, Andrés Muñoz Machado y Luis Vilches

Privacidad TIC

El día 28 de noviembre de 2018, tuvo lugar la mesa redonda *Privacidad TIC*, organizada por la RAI en colaboración con Telefónica y coordinada por el académico D. Aníbal R. Figueiras. Dicha mesa contó con la participación de D. Pablo Rodríguez,

CEO de Telefónica Innovación Alpha, D. Aníbal R. Figueiras, D.ª Ofelia Tejerina, abogada y especialista en derecho de las tecnologías y D. Tomás de la Cuadra Salcedo, catedrático de la UC3M.

En la mesa redonda, entre otros temas, se trataron las posibilidades de los algoritmos de inteligencia artificial que son inmensas, y que nos ayudan a predecir variables como los precios de mercado, las sequías, las migraciones o una futura escasez de alimentos; y transformando la democracia, la seguridad, la salud, las finanzas, o el aprendizaje.

También se trató sobre la preocupación de las personas por la violación de las bases de datos, el rápido avance comercial de las capacidades de IA que siguen desafiando la habilidad de la sociedad para garantizar la no discriminación o la fiabilidad de los sistemas automatizados, entre otros casos, en las elecciones democráticas.



Tomás de la Cuadra Salcedo, Aníbal R. Figueiras, Ofelia Tejerina y Pablo Rodríguez

Retos en la transición energética: claves del cambio

El diálogo *Retos en la transición energética: claves del cambio*, organizado en colaboración con la Universidad de Navarra-TECNUN, tuvo lugar el 29 de noviembre de 2018 y contó con la participación de dos expertos del sector energético: D. Iván Martén, Vice Chairman, Energy Practice de Boston Consultin Group y D. Ignacio Martín San Vicente, consejero de empresas, de entre ellas del sector energético.



Iván Martén

Los expertos a través de preguntas como ¿Cuáles son los retos del sector? ¿Es sostenible la situación actual? mostraron la situación de desafío en la que se encuentra el sector energético y sus múltiples factores influyentes como el cambio climático, los nuevos modelos de negocio y regulaciones gubernamentales y reflejaron la situación del sector energético en la actualidad.



Ignacio Martín

El papel de la ingeniería ante los desastres naturales

Coordinada por el académico D. Íñigo Losada, la RAI organizó la sesión *El papel de la ingeniería ante los desastres naturales*, que tuvo lugar el 20 de febrero de 2019 y contó con la participación del prof. Robert A. Dalrymple, académico correspondiente de la Real Academia de Ingeniería y académico de la National Academy of Engineering (USA) y del Dr. Guillermo E. Franco, director de investigación en riesgos de catástrofe de Guy Carpenter & Company LLC.

En su presentación *Coastal natural hazards: a view from the field*, el prof. Dalrymple hizo una revisión general sobre las conclusiones que se pueden extraer a partir de las campañas de campo realizadas después de diferentes desastres naturales en la costa (tsunamis, huracanes) y también sobre el efecto del aumento del nivel medio del mar.



Guillermo E. Franco, Íñigo Losada y Robert A. Dalrymple

El Dr. Guillermo E. Franco en su presentación *Seguros paramétricos para riesgo sísmico ¿Qué son, cómo se construyen y cuál es su potencial impacto social?*, explicó que la industria del sector de los seguros está adoptando, en los últimos años, los seguros paramétricos como una alternativa ideal para afrontar grandes desastres y describió los últimos avances en el diseño de este tipo de seguros con ejemplos específicos de aplicación ante riesgo sísmico.

Presentación de los volúmenes VIII y IX de la colección Técnica e Ingeniería en España

Publicada por el consorcio formado por la Real Academia de Ingeniería, la Institución Fernando 'El Católico' y Prensas Universitarias de Zaragoza, la colección está compuesta por diez tomos que ofrecen no solo análisis técnicos sino también lingüísticos, filosóficos, científicos, estéticos, económicos y sociológicos.

El día 26 de marzo de 2019 tuvo lugar la presentación de los volúmenes [*Del noventayochismo al desarrollismo: pensamientos, profesiones y reflejos*](#) (vol. VIII) y [*Trazas y reflejos culturales externos, 1898-1973*](#) (vol. IX) de la colección Técnica e Ingeniería en España, coordinada y editada por D. Manuel Silva Suárez, académico de la RAI.

El acto contó con las intervenciones del presidente de la RAI, D. Elías Fereres, que pronunció unas palabras de bienvenida, y del rector de la Universidad de Zaragoza, D. José Antonio Mayoral.

Posteriormente, intervinieron D. Javier Aracil, académico de la RAI, D. Antoni Roca, Institut d'Estudis Catalans y D. Manuel Silva Suárez, académico de la RAI.



Antoni Roca, José Antonio Mayoral, Elías Fereres, Javier Aracil y Manuel Silva

Presentación de la publicación *Historia general de la Agricultura*

El 19 de abril de 2019 tuvo lugar en la RAI, la presentación de la publicación *Historia general de la agricultura. De los pueblos nómadas a la biotecnología* de D. José Ignacio Cubero Salmerón, donde describe el épico recorrido de los cultivos, la cría de animales y la transformación de sus productos desde sus orígenes en varios continentes hasta las fronteras de los desiertos y de las nieves perennes: desarrollo de instrumentos, dominio de la distribución del agua, migraciones y conquistas, grandes imperios, expediciones en busca de nuevas plantas y animales, aplicaciones de la ciencia moderna y prodigios de la biotecnología contemporánea.

La presentación contó con la participación del presidente de la RAI, D. Elías Fereres, y del rector de la Universidad de Córdoba D. José Carlos Gómez Villamandos, que abrieron la sesión.

D. Enrique Cerdá, académico de la RAI, realizó la presentación del autor y la publicación; D. Ignacio Romagosa, académico de la RAI, tuvo una intervención sobre *La agricultura del último siglo* y D. José Ignacio Cubero, pronunció una conferencia sobre *Episodios disruptivos en la historia de la agricultura*.



Ignacio Romagosa, José Carlos Gómez, Elías Fereres, Enrique Cerdá y José Ignacio Cubero

Conferencia Agustín de Betancourt, ingeniero español en la corte de los zares

El 19 de mayo de 2019 tuvo lugar, en colaboración con el Instituto de Estudios Históricos Bancos y Valdés una conferencia sobre *Agustín de Betancourt, ingeniero español en la corte de los zares*, cuya presentación fue realizada por D. Antonio Colino, secretario general de la RAI.

La conferencia contó con las intervenciones de D. Vicente Alcaraz y Álvarez de Perea, Instituto de Estudios Históricos Bancos y Valdés, D. Oleg Kolomin, primer secretario de la Embajada de la Federación de Rusia y D. Fernando Sáenz Ridruejo, académico correspondiente de la Real Academia de la Historia.



Participantes en la sesión

Emisiones de GEI en el sistema agroalimentario español y europeo

La Real Academia de Ingeniería, con la colaboración de Corteva Agriscience, Ebro Foods, Idainature, Ceigram y la Universidad Complutense de Madrid, inicio el proyecto del estudio sobre *Emisiones de Gases Efecto Invernadero en el sistema agroalimentario español y europeo*, que pretende mediante una metodología pionera de última generación calcular la huella de carbono del sistema en su conjunto, estudiar la evolución de la huella de carbono de la producción de alimentos en el largo plazo, comparar con otros países europeos y aportar conclusiones y recomendaciones para consolidar en España la tendencia hacia una agricultura realmente sostenible.

El proyecto se presentó en dos ocasiones: en Valencia el 2 de abril y en Sevilla el 30 de Mayo.

La primera tuvo lugar el 2 de abril de 2019 en la Escuela Técnica Superior de Ingeniería Agronómica y del Medio Natural de la Universidad Politécnica de Valencia, y su director, D. Alberto San Bautista hizo la introducción a la sesión. Tras sus palabras intervino el gerente de la RAI y D. Jaime Gómez Arnau, que presentó a los investigadores del proyecto: D Eduardo Aguilera y D. Alberto Sanz-Cobeña, de la Universidad Politécnica de Madrid.

La segunda presentación tuvo lugar en la Escuela Superior de Ingeniería de la Universidad de Sevilla. El presidente de la RAI, D. Elías Fereres dio la bienvenida a los participantes, y tras la misma intervinieron D. Francisco Rodríguez Rubio, director de la ETS de Ingeniería de la Universidad de Sevilla, y D.^a Susana Magro, directora general de Calidad Ambiental y Cambio Climático. Tras las intervenciones

anteriores tomó la palabra D. Jaime Gómez Arnau, que presentó a los investigadores del proyecto: D. Eduardo Aguilera, D. Pablo Piñero y D. Alberto Sanz-Cobeña, de la Universidad Politécnica de Madrid.



Presentación en Sevilla. Vista de la sala

Conferencia-visita guiada Exposición sobre el Apolo 11

La colaboración de la RAI con el Museo de la Informática y las Transformaciones Digitales, trasladó a la Academia desde Robledo de Chavela la exposición "ExpoLuna69" para ilustrar con una conferencia y visita guiada la evolución de la electrónica y la informática, desde la galena al ordenador del Apolo.

El acto tuvo lugar el 8 de octubre de 2019 y contó con la presentación de D. Antonio Colino, secretario general de la RAI y con la participación de los académicos D. Javier Ventura-Traveset y D. José Manuel Sanjurjo.

A continuación, D. Javier García Álvarez, fundador del Museo de la Informática y las Transformaciones Digitales pronunció la conferencia: **1869-1969: visita guiada por las conquistas científicas que la ingeniería coronó en el Apolo 11**, que fue seguida de una interesante visita guiada por "Expoluna69".



Javier García Álvarez



Javier García Álvarez explicando algunos equipos de la exposición al público asistente

Presentación de la colección Técnica e Ingeniería en España en la Universidad de La Rioja

El día 4 de julio de 2019, el rector de la Universidad de Zaragoza, D. Julio Rubio García, rector de la Universidad de La Rioja, recibió la donación de los diez tomos que componen la colección Técnica e Ingeniería en España, de manos de su editor y académico de la RAI, D. Manuel Silva Suárez.

Los volúmenes, que pasaron a formar parte del catálogo de la Biblioteca de la Universidad de La Rioja, fueron entregados en el transcurso de la celebración en el campus del simposio conjunto del Grupo de Control Inteligente (CI) y el Grupo de Modelado Simulación y Optimización (MSO) del Comité Español de Automática (CEA), así como el décimo congreso internacional de EUROSIM, la Federación de Grupos Europeos en Simulación.



Julio Rubio García y Manuel Silva Suárez

9. OTRAS ACTIVIDADES

En este apartado se detallan aquellas actividades de la RAI que por sus características tienen una duración prolongada en el tiempo y que se desarrollan gracias a patrocinios específicos. En el curso académico 2018-2019 tuvieron lugar las que se detallan a continuación.

OBSERVATORIO ENERGÍA E INNOVACIÓN

El Observatorio *Energía e Innovación* es una plataforma de análisis de las tendencias y soluciones en el sector energético, así como de planteamiento de estrategias de innovación en un contexto global; que cuenta con el patrocinio de Endesa.

En el curso académico 2018-2019, el Observatorio focalizó sus trabajos en el análisis del fomento de la movilidad eléctrica. El 22 de enero de 2019 tuvo lugar la presentación de la publicación [Propuestas para el fomento de la movilidad eléctrica: Barreras identificadas y medidas que se deberían adoptar.](#)

La sesión contó con la participación de D. Elías Fereres, presidente de la RAI, y D. José Bogas, consejero delegado de Endesa, que tras unas palabras de bienvenida y apertura dieron paso a la presentación del estudio que contó con la intervención de D. Ángel Arcos, coordinador del estudio, y D. José María Maza, ambos de la Universidad de Sevilla. A continuación, D. Josep Trabado, director general de Endesa X, habló sobre *La visión de la industria*. D. José Domínguez Abascal, académico de la RAI y secretario de estado de Energía clausuró la sesión.

En el estudio se abordaban los elementos técnicos complementarios al vehículo eléctrico que deben desarrollarse para el fomento de la movilidad eléctrica, haciendo especial énfasis en las estaciones de recarga. Para ello se analizó el estado de las redes de recarga en diferentes países, así como su regulación. Igualmente se analizaron varios modelos para el despliegue de los vehículos eléctricos y las medidas necesarias para ello.



José Bogas, Elías Fereres, José Domínguez Abascal, Ángel Arcos y Josep Trabado

OBSERVATORIO: DIGITALIZACIÓN DE LOS MEDIOS DE COMUNICACION

El Observatorio nació en el año 2017, de la colaboración de la Real Academia de Ingeniería con RTVE, con el objetivo de realizar actividades de investigación, de estudio, intercambio de conocimientos y difusión de las experiencias sobre la transformación digital del sector audiovisual.

El día 13 de noviembre de 2018 tuvo lugar la jornada: ***Iberspeech-RTVE-Challenge 2018: desarrollo y análisis de resultados***, que contó con la colaboración de la Cátedra RTVE de la Universidad de Zaragoza.

La apertura contó con las intervenciones de D. Javier Pérez de Vargas, gerente de la RAI y D. Fran Llorente, director de Proyectos y Estrategia Corporativa de RTVE. La introducción a la jornada fue llevada a cabo por D. Miguel Ángel Lagunas, académico de la RAI, D. Pere Vila, director de Estrategia Tecnológica e Innovación Digital de RTVE y D.ª Pilar Zaragoza, vicerrectora de Transferencia e Innovación de la Universidad de Zaragoza.

D.ª Carmen Pérez Cernuda, subdirectora de Innovación y Estrategia Tecnológica de RTVE, disertó sobre ***El reto desde dentro: preparación, cronología y desafíos***. A continuación tuvo lugar una mesa redonda sobre: ***Tecnologías puestas a prueba***, cuya moderadora fue D.ª Virginia Bazán, responsable de gestión de Proyectos Fondo Documental RTVE, que contó con las intervenciones de D. Aitor Álvarez de Vicomtech, D. Alfonso Ortega de la Universidad de Zaragoza, D. José Luis Alba de la Universidad de Vigo, D. Javier Tejedor de la Universidad San Pablo CEU, y D. Doroteo Torre de la Universidad Autónoma de Madrid.

Finalmente, D. Eduardo Lleida, director de la Cátedra RTVE de la Universidad de Zaragoza, tuvo una intervención sobre ***Análisis de los resultados del reto***.



Participantes en la jornada

El 7 de mayo de 2019 tuvo lugar la ***I convocatoria Ayudas a la investigación impulsada por la visión RTVE para estudios oficiales de máster***. El acto contó con la participación de D. Elías Fereres, presidente de la RAI, D. Pere Vila, director de Estrategia e Innovación Tecnológica de RTVE, D. Miguel Ángel Lagunas, académico de la RAI, D. Federico Montero, director general Corporativo de RTVE, y D.ª Ángeles Heras Caballero, secretaria de estado de Universidades, Investigación, Desarrollo e Innovación.

A continuación, D. Esteban Mayoral, dio paso a la presentación de las premiadas en esta primera convocatoria: D.^ª Nathalie Rodríguez Egas, de la Universidad Complutense de Madrid, D.^ª Beatriz Gutiérrez Caneda de la Universidad de Santiago de Compostela y D.^ª Ana María Silva Ortiz de la Universidad Europea de Madrid, a quienes se entregó el diploma acreditativo.



Participantes en la sesión junto a las premiadas

FORO E2-I2: INGENIO EN LA ESCUELA

El Foro E2-I2 (Educación + Emprendimiento + Innovación + Inversión) nació, en el año 2015, como **Foro de debate** orientado a la identificación, análisis e implantación de mejores prácticas en las áreas de Educación, Emprendimiento, Innovación e Inversión. El foro cuenta con el patrocinio de Ferrovial a través de la Fundación **Pro Rebus Academiae**.

Tras unos primeros años en los que se realizaron estudios sobre innovación y educación superior, en junio de 2018 se abordó un plan con el objetivo de analizar los resortes que se están utilizando en España para acercar a las aulas, en los primeros ciclos de la educación, conceptos y prácticas tecnológicas que estimulen la creatividad y el emprendimiento con base tecnológica.

El plan tiene varias fases y durante el curso 2018-2019, se abordó la formación de maestros y profesores de educación secundaria y FP mediante un acuerdo con la Consejería de Educación de la CM y del Centro de Formación de profesorado CTIF Madrid-Este con el objetivo de ayudar a su capacitación en herramientas y kits educativos. Esta acción se centró en 'Internet de las cosas (IoT)' mediante un curso de doce horas para 30 inscritos, que se inició el día 30 de septiembre de 2019 y se celebró en las salas de la RAI. Esta acción se complementó con el préstamo de los kits a los profesores inscritos al curso para el desarrollo de experiencias educativas en las aulas de sus respectivos colegios. Se prevé continuar con esta iniciativa durante el próximo curso académico.



M^a Mercedes Marín, Elías Fereres, Luis Castañer y Federico Flórez

PROYECTO MUJER E INGENIERÍA

En el curso académico 2018-2019 se han realizado las siguientes actuaciones: programa de **Mentoring**, programas TECHMI y UPISteam, Diálogos **Mujer e Ingeniería**, Desayunos **Mujer e Ingeniería** y I Congreso Nacional la Mujer en la Ingeniería, la Tecnología y la Industria (MITI).

Las actividades del proyecto Mujer e Ingeniería contaron con el patrocinio de las siguientes empresas, instituciones y universidades: Adif, Airbus, BBVA, EDPr, Fundación Caja Ingenieros, Fundación Orange, Cartif, Michelin, Indra, Legrand, Nippon Gases, Reale Seguros, Oracle, Consejo Social UPV, Consejo Social Universidad Valladolid, Universidad Rey Juan Carlos, Universidad Carlos III de Madrid, Universidad Castilla La Mancha, Universidad de Valladolid, Universidad Politécnica de Madrid, Universidad CEU San Pablo.

Programa de Mentoring

La **3ª edición del programa de Mentoring profesional en Madrid** estuvo integrada por 190 estudiantes de los últimos cursos de grado y de máster en Ingeniería que se inscribieron en este programa para ir de la mano de 190 grandes profesionales del mundo de la tecnología en su tránsito del mundo académico al profesional.



Algunas participantes Mentoring Madrid

A la 1ª edición del programa de *Mentoring profesional en Valencia* concurrieron 60 parejas de estudiantes y de profesionales. El programa, en cada una de las comunidades, desarrolló sesiones de formación tanto para estudiantes como para mentoras.

Programas TECHMI y UP!STEAM

La RAI dentro de su Proyecto Mujer e Ingeniería, lanzó en Madrid la II edición TECHMI y la I en Valladolid, así como la I edición UP!Steam en Valencia, para que profesores y padres mostrasen a niños y niñas que las ciencias, las matemáticas, la ingeniería y la tecnología son divertidas y son la base de los recursos tecnológicos.

En la Comunidad de Madrid participaron 250 jóvenes estudiantes de la ESO, en la Comunidad de Castilla y León 150, y en la Comunidad Valenciana más de 500.



Finalistas TECHMI Madrid



Finalistas Up!Steam Valencia



Finalistas TECHMI Valladolid

Diálogos Mujer e Ingeniería

El día 25 de octubre de 2018, tuvo lugar el diálogo *Mujer e Ingeniería-Girls 4 Tech: an opportunity for a better world*, en el que participaron D.^a Nuria Oliver, académica de la RAI, directora de investigación de la ONG Data POP Alliance y directora de Investigación de Datos de Vodafone, y Mrs. Njideka Harry, CEO de Youth for Technology Foundation, máxima exponente a nivel mundial de esta temática.



Javier Pérez de Vargas, Nuria Oliver, Esperanza Navarro, Antonio Colino y Njideka Harry

Dicho diálogo tuvo lugar en el marco de la colaboración entre la Fundación Esperanza Pertusa de Gioseppo y la Real Academia de Ingeniería, enmarcado en el su programa Mujer e Ingeniería.

Desayunos Mujer e Ingeniería

Desayunos Mujer e Ingeniería reúne en desayunos a un número de directivos de empresas con el objetivo de que uno de ellos comparta su experiencia profesional en el diseño e implantación de políticas corporativas de diversidad de género, mostrando casos prácticos y analizando su impacto en la organización. La intervención de la empresa invitada es seguida por un coloquio en el que el resto de asistentes comparte su visión y experiencias.



De esta manera, se facilita el intercambio de buenas prácticas ante el reto de reconocer y señalar la importancia del talento femenino. En el curso 2018-2019, tuvieron lugar los días 31 de mayo y 26 de septiembre de 2019 sendos desayunos con BBVA y Telefónica como empresas invitadas.

I Congreso Nacional la Mujer en la Ingeniería, la Tecnología y la Industria (MITI)

Bajo la presidencia de honor de S.M. la Reina Doña Letizia, el congreso se celebró el día 4 de marzo de 2019 en Valencia y contó con la colaboración del Foro Ingeniería y Sociedad y el apoyo de instituciones y entidades como: la Consejería de Economía Sostenible de la Generalitat Valenciana, el Consejo Social de la UPV, Colegio Oficial de Ingenieros Agrónomos de Levante, Okapihabitat, IdaiNature, Banco Sabadell, Schneider Electric, Walker's y Designable.

El congreso es una iniciativa pionera enfocada a la importancia de la mujer en la Ingeniería, la Tecnología y la Industria que respondió al objetivo estratégico de reconocer y promocionar el talento femenino en las áreas STEM.

El congreso, de un día de duración, se organizó en tres bloques que recorrieron los siguientes temas: La transformación de la sociedad a través de la digitalización, la energía como palanca de crecimiento y desarrollo social y económico; y el talento femenino y su valor en la sociedad actual. El congreso contó con la participación de más de veinte ponentes y con la asistencia de cerca de quinientas personas.

D. Elías Fereres, presidente de la RAI y D. Javier Pérez de Vargas, gerente de la RAI, fueron los encargados de realizar la apertura institucional de este congreso.

La presentación del congreso fue llevada a cabo por D.ª Blanca Marín, secretaria autonómica de Economía Sostenible de la Generalitat Valenciana y el presidente de la Generalitat Valenciana, D. Ximo Puig, inauguró oficialmente el Congreso.

D.ª Nuria Oliver, académica de la RAI, pronunció la conferencia inaugural que dio paso a cada una de los bloques del congreso, que se indican a continuación.



Nuria Oliver

Bloque I. **La transformación de la sociedad a través de la digitalización.** Contó con el testimonio de D.ª Alicia Mora, cofundadora de Emotion Research LAB. La mesa redonda moderada por D.ª Carolina Pascual, decana del Colegio Oficial de Ingenieros de Telecomunicación de Valencia, contó con la participación de D.ª Ángeles Delgado, presidente de Fujitsu España, Portugal y Latinoamérica, D. Andrés Pedreño, presidente de AlicanTEC y D.ª Elena Pisonero, presidenta de Hispasat.

D.ª Mercedes Iborra, VisualNACert, transmitió su experiencia y tras su testimonio tuvo lugar la intervención de D.ª Mónica Bragado, presidenta del Consejo Social de la Universidad Politécnica de Valencia sobre **"Brecha de sueños: Up!Steam.**



Componentes de una de las mesas redondas

Tras la entrega de reconocimientos a empresas e instituciones, se llevó a cabo el Bloque II. **Energía: una palanca de crecimiento y desarrollo social y económico,** que contó con el testimonio de D.ª Soledad Berbegal, consejera y directora de Comunicación Estratégica de Actiú, y continuó con la mesa redonda moderada por D.ª Bianca Dragomir, directora de AVAESSEN, con las intervenciones de D.ª Blanca

Losada, presidenta de FORTIA, D.^ª Eva Pagán, directora general de Transporte de Red Eléctrica de España y D.^ª Ángeles Santamaría, consejera delegada de Iberdrola España.

A continuación, tuvo lugar el Bloque III. *El talento femenino: su valor en la sociedad actual*, que contó con el testimonio de D.^ª Regina Monsalve, presidenta del Foro Ingeniería y Sociedad, y continuó con la mesa redonda moderada por D.^ª Mónica Alegre, presidenta de AVIA con la participación de D.^ª Gloria Lorenzo, fundadora del programa **Oracle Women's Leadership**, D.^ª Empar Martínez Bonafé, directora general de Industria y Energía de la Generalitat Valenciana, D.^ª Teresa Riesgo, directora general de Investigación, Desarrollo e Innovación del Ministerio de Ciencia, Innovación y Universidades y D.^ª Sara Gómez, directora del proyecto *Mujer e Ingeniería*.



Elías Fereres y Ximo Puig

PALABRA DE INGENIERO

Palabra de Ingeniero es un espacio de la Real Academia de Ingeniería, en colaboración con Radio 5 de RTVE, que se inició en el año 2017 y que pretende dar a conocer y poner en valor el idioma español como lengua científico-técnica para más de 560 millones de hispano-hablantes en todo el mundo.

El Diccionario Español de Ingeniería recoge más de 50.000 términos, siendo una obra de acceso abierto a los ciudadanos que quieran descubrir y disfrutar de la riqueza y el enorme potencial del vocabulario técnico en español empleado hoy en día en el mundo. De la mano del periodista Manuel Seara Valero, los académicos de la RAI los van explicando diferentes palabras y términos a la audiencia de RNE.

En el curso académico 2018-2019 han intervenido: Javier Rui-Wamba con *Hormigón, Puente y Roblón*; José Manuel Sanjurjo con *Armas guiadas por láser, Androides bipedismo, Sistema de armas, Radar y Sonar*; María Vallet con *Biomateriales, Biocerámicas, Vidrios Bioactivos, Ciencia para la paz de la OTAN e Hidroxiapatita*; Luis Castañer con *Ley de Moore, Circuito integrado y Diodo*; Miguel Ángel Losada con *Espigón, Espigón exento y Dique de encauzamiento*.

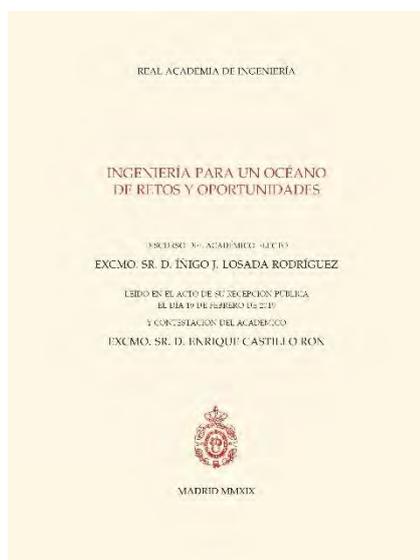
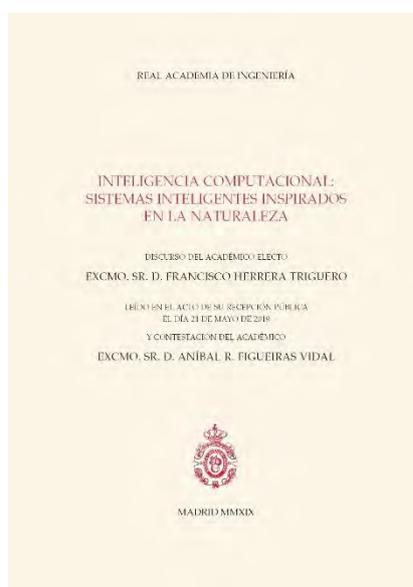
Participaron también José Antonio Martín Pereda con *Cristal líquido, Lidar, Coherencia, Multiplexado y Paquetes de información*; Manuel Doblaré con

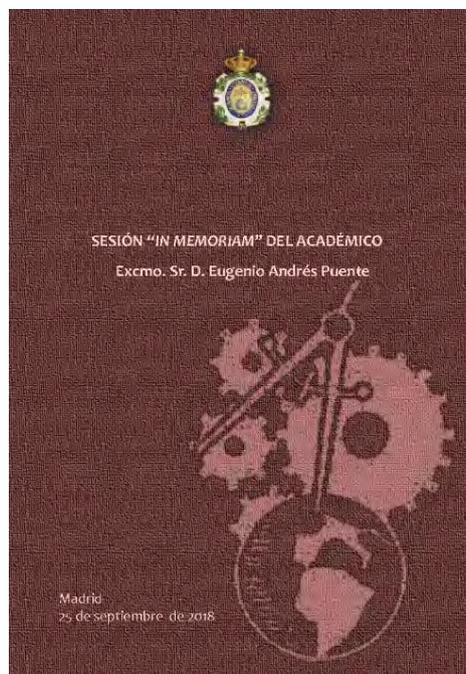
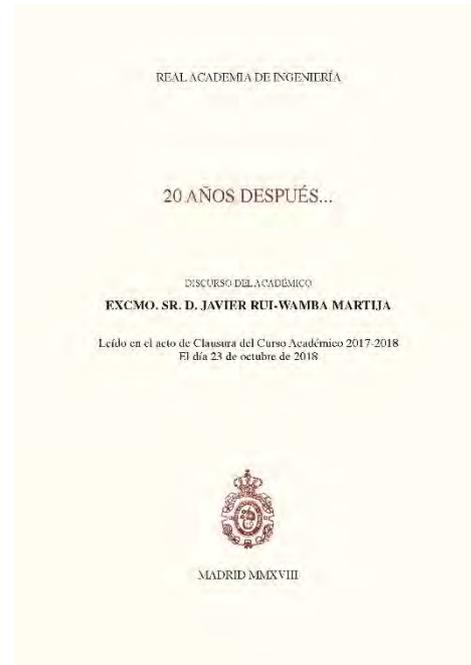
Biomecánica, Dispositivos médicos inteligentes, Sistemas microfluídicos y Diagnóstico multimodal; José Alberto Pardos con *Ordenación de montes, Contaminación forestal y Fitorremediación*; Javier Aracil con *Control borroso*; Antonio Colino con *Residuos radiactivos de baja y media actividad, Residuos radiactivos alta actividad, Ciclo combustible nuclear y Átomos para la paz*.

En este curso académico también se contó con las interacciones de Aníbal R. Figueiras con *Redes neuronales profundas, Problemas singulares de clasificación, Máquinas entrenables e Inteligencia computacional colectiva*; Luis Gil con *Eucalipto y Encina*; Enrique Castillo con *Probabilidad condicionada y Fatiga de materiales*; Pere Brunet con *Color en informática*; y, Elías Fereres con *Economía azul*.

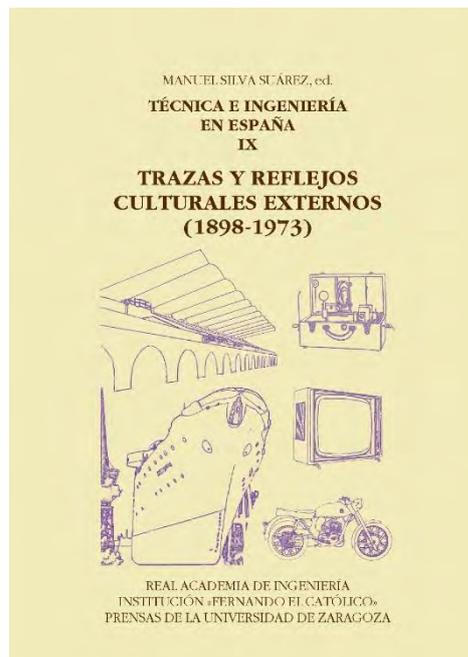
10. PUBLICACIONES

De las sesiones solemnes de la Academia se publicaron las relacionadas con la clausura del curso académico 2018, las tomas de posesión como académica de número de la Excm. Sra. D^a Nuria Oliver Ramírez y de los académicos de número Excmos. Sres. D. Íñigo Losada Rodríguez, D. Francisco Herrera Triguero, D. Javier Ventura-Traveset Bosch y D. Ignacio Romagosa Clariana, y de la sesión *In Memoriam* del Excmo. Sr. D. Eugenio Andrés Puente, se ha procedido a la edición de las respectivas intervenciones tanto en papel como en formato digital, que son las siguientes: [Inteligencia Artificial: Ficción, realidad y... sueños](#); [Ingeniería para un océano de retos y oportunidades](#); [Inteligencia Computacional: Sistemas inteligentes inspirados en la naturaleza](#); [Quo Vadis Space. Una perspectiva del sector espacial actual y de sus oportunidades de futuro](#); [La cebada, mucho más que cerveza y pienso](#); [20 años después...](#); e, [In Memoriam del Excmo. Sr. D. Eugenio Andrés Puente](#).

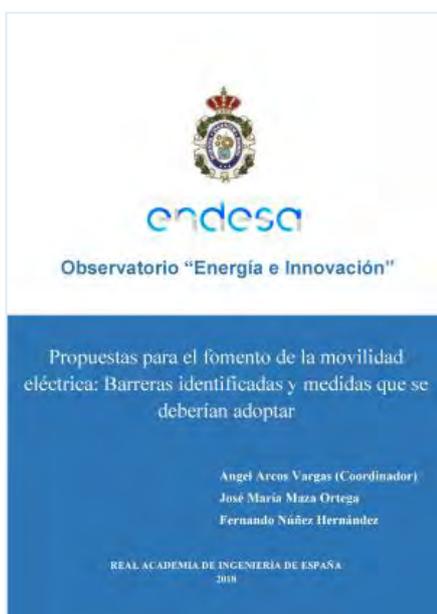




Se procedió también a la edición en papel, de los volúmenes VIII y IX de la colección Técnica e Ingeniería en España: [Del noventayochismo al desarrollismo](#) y [Trazas y reflejos culturales externos, 1898-1973](#).



También se procedió a la edición, tanto en papel como digital, del estudio realizado por el Observatorio de Energía e Innovación, en colaboración con Endesa: [Propuestas para el fomento de la movilidad eléctrica: Barreras identificadas y medidas que se deberían aportar](#) y del informe de Euro-CASE, en el que colaboró la RAI, sobre [Energy Transitions in Europe. Common goals but different paths](#).



INSTITUCIONES Y EMPRESAS COLABORADORAS Y PATROCINADORAS







Don Pedro, 10 / 28005 - Madrid Spain

T. +34 91 528 20 01
secretaria@raig.es
www.raig.es

IDENTITY



Antonio COLINO MARTÍNEZ
Chairman

Founding date: 1994

Number of members: 56 Full members

Number foreign members: 42

Corresponding members 64 (16 nationalities)

In November 2019, Mr. Antonio Colino was elected as RAI President.

In December 2019, the members of Governing Board were elected. Among them as vice presidents; Dr. María Vallet Regí, Dr. José Manuel Sanjurjo and Mr. Luis Lada Díaz and Dr. Eloy Álvarez Pelegry as Secretary General.

MISSION

- To promote quality and competence in Spanish engineering, fostering study, research and progress in those sciences on which it is based, in the techniques required by its applications and in the methods that encompass its creative activity.
- To collaborate with other Academies and similarly-oriented institutions, whether located in Spain or other countries, as well as with those of an international nature, on matters and programs of common interest.

Committees

- Treasury
- External Relations
- Governance
- Awards

HIGHLIGHTS ACADEMIC COURSE 2018/2019

The Royal Academy of Engineering of Spain has organized several sessions and seminars, and other events during 2019. Due to their relevance, the following should be highlighted:

- Opening session of the Royal Academies of the Institute of Spain with the lecture “5G in perspective”, under the presidency of HM the King Felipe VI, at the RAI headquarters.

- Reception ceremony of the five new members as Academics.
- Annual awards “Academiae Dilecta” and “Young Engineers”.
- “Engineers Laureados” awards
- Homage to the Mining and Industrial Engineering School and the Almadén Mines.

In collaboration with other Academies:

– A representative of the RAI has participated in the Euro-CASE - Energy Platform. The Report “Energy Transitions in Europe common goals but different paths”, has been published.

– Participation of RAI representative in the Euro-CASE & CAE Forum on Evidence-based Scientific Policy Advice that took place on April 15th-17th, 2019, in Ma’anshan, Anhui, China.

Several publications have taken place during 2018/2019:

- Reception speeches of the new Academics, and of the awarded Engineers “Ingenieros Laureados”.
- Volumes VIII and IX of the collection “Technique and Engineering in Spain”, and report of the “Energy Observatory”.

Annual Report 2019



Royal Swedish Academy of
Engineering Sciences

»The Academy's mission is to promote the engineering and economic sciences and the development of industry for the benefit of society«

IVA's statutes, §1

1919



IVA IS FOUNDED

In June His Majesty the King establishes the Academy's statutes, in August 40 individuals are inducted as members, in September additional members are elected and on 24 October **Axel F. Enström** is appointed as President.

1920



FIRST ANNUAL MEETING

On 17 April the first Annual Meeting is held in the Banquet Hall in the building on Grev Turegatan. The following year the Annual Meeting is moved to 24 October, the date the Academy was founded. The King attends for the first time.

1922

The Academy gets involved in the **electric vehicle issue** and publishes a report on the topic. Based on experiences in the USA, experts claim that electric lorries could be a commercial success.

1923

The **electrical heating institute** – the first in a long list of industry institutes – is launched and moves into offices in the Academy's back building. During its first decade the institute carries out close to 500 studies.



1927

A study is carried out to **compare wood stoves, gas stoves and electric stoves** and the results are presented in three reports. An association called *Fera* is created to promote the use of electricity and Edy Velander is its director.

1926



A MUSEUM IN THE LOFT

Tekniska museet (National Museum of Science and Technology) is formed in 1923 and opens a temporary exhibition in the loft of the building. A prototype of Baltzar von Platen's and Carl Munter's refrigerator is one of the items on display.

1924

The Academy receives a special government grant to start an **aeronautics committee**, but more investment is needed in the area. IVA starts working on establishing a "testing institute" which later becomes the Aeronautical Research Institute of Sweden (FFA).

1928



10,000 NATURAL SCIENCES VOLUMES

Anna Sjögren donates the library of her husband, Professor **Hjalmar Sjögren**, consisting of 10,000 volumes of natural sciences literature. The books are placed in the newly created library in a room in the IVA building.

1929

A **charcoal laboratory** is established with support from *Jernkontoret* (Swedish Steel Producers Association) among others. It produces numerous products, not only made from wood; **wood, peat and tar** are hydrogenated and liquid engine fuel is produced.

1930



FIRST EDITION

The IVA magazine is launched to share the results from the growing number of institutes with a wider public. A first attempt is made to take stock of all industrial R&D in Sweden. Surveys and reply postcards are sent out with the magazine.

The Annual Meeting venue is moved from the Banquet Hall in the building to the significantly larger **Vinterträdgården** (Winter Garden) at Grand Hotel in Stockholm. It returns to Grev Turegatan and the Banquet Hall in 1939, the first autumn of WWII.



1931

The steam heating institute is established in cooperation with the electric heating institute. Two thirds of the institute's activities are in the form of commissioned research for industry and the private sector – a pioneer initiative.



NOT A COMMERCIAL SUCCESS

The IVA stove that cuts wood consumption in half is launched in an advertising campaign aimed at Swedish housewives. Although the stove is licensed to around ten manufacturers, it is not a commercial success.

1932

The corrosion commission is formed to gather knowledge in the area and publishes a handbook on using anti-rust paint. Large-scale field trips are also arranged to study rust protection.

1935



HEAD OF ASEA IS THE NEW CHAIRMAN

During the years 1935–1936 the number of international members almost doubles – 21 members are inducted. The internationally oriented head of Asea, **Sigfrid Edström**, becomes Chairman of IVA.

1939

WOOD GAS

When the war breaks out the Government establishes a wood gas committee chaired by Axel F. Enström. A fast transition to wood gas to fuel the fleet of vehicles is planned and put in place.



1938

Axel F. Enström is elected Chairman of the Academy. **Edy Velander** takes over from him as President. In the beginning Velander only serves as deputy and Enström continues to hold the address at the Annual Meeting.

A new building to house the **Swedish National Museum of Science and Technology** is officially opened in the presence of Crown Prince Gustaf Adolf and Prime Minister Per Albin Hansson. A donation of SEK 2 million from the Knut and Alice Wallenberg Foundation provides funding for it.

After pressure from IVA, a **measurement technology institute** is established and arranges conferences, exhibitions and lectures on the technology. An X-ray control section subsequently becomes Tekniska Röntgencentralen.

1936



1940

IVA's statutes are amended. The Executive Committee gets two vice chairs, the number of working members is increased to 120 and two new departments are established: **Forest Technology** (VIII) and **Economics** (IX).

1941

The dynamic **Edy Velander** also formally takes over as President when Axel F. Enström resigns as Chairman. Velander becomes a member of a high-level government committee on how research is organised.

1942



The first government research council is created. *Tekniska forskningsrådet, TFR*, (engineering research council) takes over significant parts of IVA's role as the main actor in engineering research. President **Edy Velander** is a member of the council and stays on until 1960.

1943

A **division for biotechnology** (X) is established. The possibility of developing and synthetically producing vitamins, enzymes and hormones increases. Microbiology also impacts the food industry.

1944



RESEARCH STATION AT KTH

In connection with the Academy's 25th anniversary celebration **IVA's Research Station** is built adjacent to the Royal Institute of Technology (KTH). This is an initiative to provide smaller research teams with resources similar to those of universities and large corporations.

1944



Focusing on the Future

An intensive jubilee year has come to an end. We celebrated our first 100 years by anticipating the future while also remembering our history in an exciting and beautiful book.

In preparation of the jubilee year we challenged our twelve divisions and our regional sections in the north, west and south to organise a top-class jubilee seminar, this with full support from the Academy staff to celebrate our 100 years!

And what a success it was! Full house everywhere; enthusiastic reactions on interesting themes and excellent speakers – most of them IVA's international or Swedish members. This is an example of IVA at its best – our fellows generously sharing their expertise, identifying future challenges and discussing how science and new technology can help us find solutions.

IVA runs many specific projects with funding in the short term, but also needs support for larger initiatives over a long-term perspective. In 2019 we made excellent progress. We received generous donations from companies, foundations and individuals, resulting in close to SEK 300 million for future initiatives over a ten-year period. These resources will be spent on initiatives to develop Swedish school education and support and encourage entrepreneurship and entrepreneurs.

IVA celebrates its birthday on the last Friday in October. In 2019 we did so with finesse and elegance at our Annual Meeting in Aula Medica in Solna and at a banquet at Stockholm City Hall. More than 1,000 guests from near and far joined the King, IVA's Patron, to celebrate the Academy.

Throughout its history IVA has been a force to induce positive change in the society. The Academy was born at a time of transition from the old to the modern Sweden. The energy supply was one of the main issues of that day. How to raise the status of the engineer – the profession of the future – by establishing engineering sciences research programmes was also a key topic. These issues have remained on IVA's agenda throughout our history.

In 2019 the *Climate Crossroads* project presented a number of reports on the future energy supply. Research and the challenge of inspiring more and more people to adopt engineering careers are at the top of our agenda.

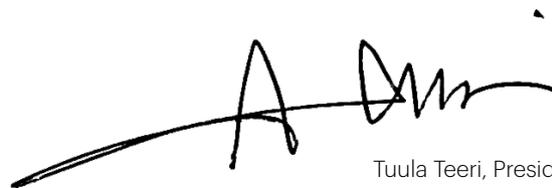
I am convinced that IVA will be a strong and trustworthy voice in the public debate for the next 100 years as well. In the 2019

Annual Report we provide examples of the hard work of members of our extensive network in a number of areas: the climate challenge, circular economy, energy, sustainable water supply, digitisation of society, entrepreneurship and collaboration between the research community and the private sector. We have a long-term plan to promote the development of Swedish schools and important research – both of which are essential for sustainable development and Sweden's strong competitiveness. We're also working to increase interest in sciences and engineering while also helping university graduates who have moved to Sweden to enter the job market and contribute their professional capacity here.

As part of the jubilee celebrations IVA, together with 30 international Academies of Engineering, arranged a large conference in Stockholm in June. The theme was *Engineering a Better World – the next 100 years*.

Many technological advances and promising plans for the future were presented, but the most important message was that sustainable technology development needs to benefit more people and impact all of the countries of the world. If we fail this mission it is possible that fear of and resistance to technology will take over and we will miss out on opportunities to find solutions to the great challenges we face. Through facts and insightful policies we must therefore show that new technology can help us – regardless of where in the world we live.

This is the third time that I've had the privilege of introducing the Annual Report as President. On the following pages you will find many examples of how our fellows, representatives of companies in the Business Executives Council, the Student Council and the Academy staff are helping to maintain IVA's relevance. I want to thank you all for your efforts in 2019 and I look forward to your strong future commitment now that IVA has entered its 101st year.



Tuula Teeri, President of IVA

Vera on tour from Luleå to Lund

Sweden's first female engineer, Vera Sandberg, graduated from Chalmers University of Technology in 1917.

Just over a century later she was celebrated at a festive event at IVA, marking the launch of the Vera Roadshow project – a tour visiting Sweden's universities that offer engineering programmes. 13 universities were visited – from Luleå in the north to Lund in the south.

“The idea of the event was to apply an approach that is fun, engaging and energetic and inspire more women to become engineers,” says Katarina Mellström, Project Director for Vera Roadshow.

The universities were hosts and were free to arrange their own “inspiration day.” Representatives from IVA's Tekniksprånget project participated and new contacts were made.

The Vera Roadshow project had three main target groups: young people aged 12–20 who will start university within a few years, students who have begun engineering degree programmes and decision-makers from the private sector, universities and the political sphere.

In total almost 2,000 people participated at the events which were documented in articles and films published on the universities' websites. The regional media and Sveriges Radio and SVT (Swedish public radio and television) have all covered Vera Roadshow.

ABOUT VERA ROADSHOW

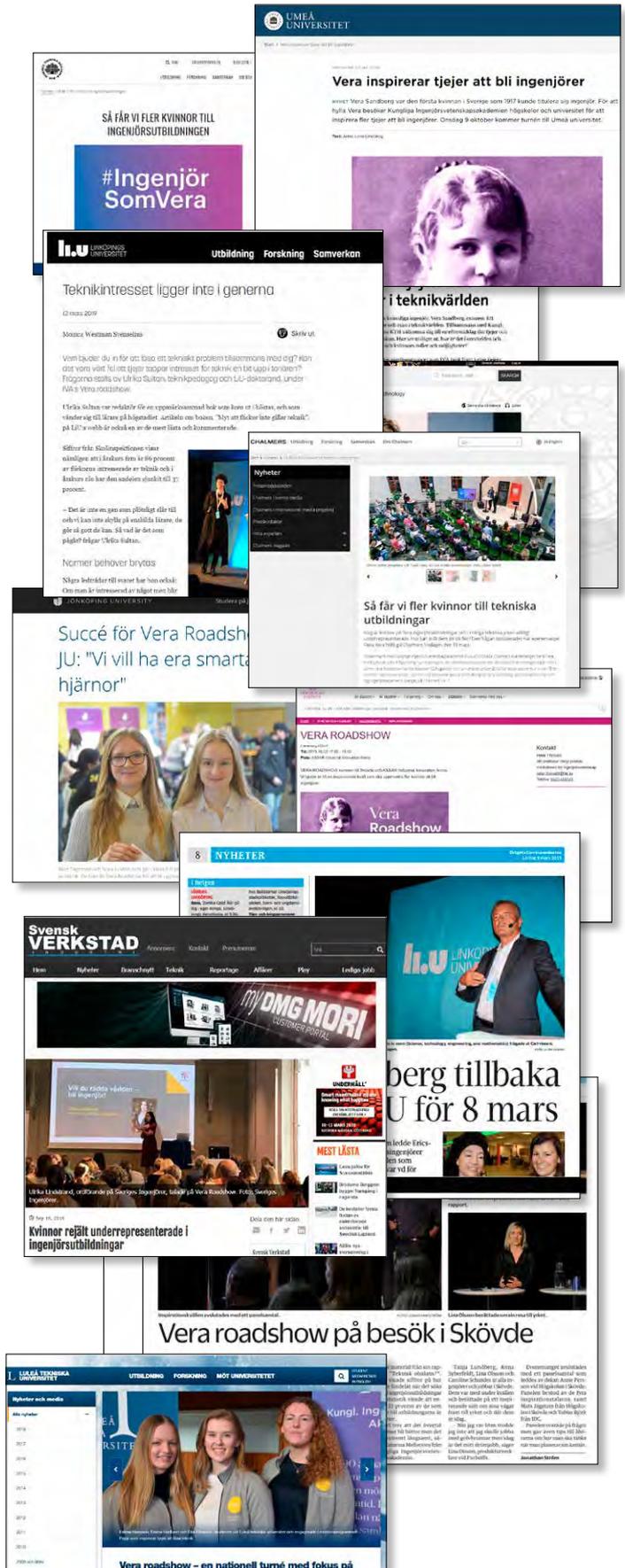
Arranged by: IVA, Swedish Association of Graduate Engineers, Association of Swedish Engineering Industries.

Date: February–November.

Location: Nationwide.

Participating universities: Luleå University of Technology, Linköping University, Chalmers University of Technology, Faculty of Engineering (LTH) at Lund University, the Royal Institute of Technology, Örebro University, Umeå University, University of Skövde, Jönköping University, Uppsala University, Blekinge Institute of Technology, Mälardalen University.

Project Manager: Katarina Mellström.



Festive beginning to the jubilee year



Tuula Teeri, Carl-Henric Svanberg

»Our future is not something that just happens, it's something we create.«

Watch the full seminar at IVA's website:



Balloons, ribbon cutting, a buffet and everyone mingling with pleasant music in the background – this was the official start of IVA's centennial celebration on 21 February.

The evening also offered musings about the past, present and future. First up was the premier of a short film that started with the words "Our future is not something that just happens, it's something we create."

Professor Sverker Sörlin explored how we study the future.

"The future was hot in the 1950s. IVA has also made predictions about the future – in the beginning with mixed success. Eventually this practice changed into creating foresights for the future. IVA's technology-focused foresights, focus groups and a process that leads to consensus is a formula that works – the

process is just as important as the result," says professor Sverker Sörlin.

LOOKING INTO THE FUTURE AND LOOKING BACK ON PAST PREDICTIONS FOR THE FUTURE

The official start of IVA's 100 year jubilee celebration.

DATE: 21 February 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Carl-Henric Svanberg, Sverker Sörlin, Tuula Teeri, Anna Wedell.

Green future for innovative forest companies

»Our main competitor is not fast-growing forests in Brazil but oil.«

Annica Bresky

Watch the full seminar at IVA's website:



Annica Bresky

McKinsey consultant Peter Berg along with five Nordic forest company CEOs analysed and discussed the opportunities and challenges in the forest industry.

Increasing e-commerce is presenting new challenges for transport packaging. Half of the growth in demand for corrugated cardboard is due to e-commerce.

"It's increasing the need for innovation in areas such as package tracking. But the metal, plastic and glass industries are investing more in developing packaging than the forest industry," said Peter Berg.

New cellulose-based packaging is an opportunity for the forest industry. Textiles are another.

Peter Berg pointed out that the forest industry also faces challenges – competition from raw material from deciduous trees in the Southern Hemisphere is one of them.

Annica Bresky is the new President and CEO of Stora Enso. "Our main competitor is not fast-growing forests in Brazil but oil," she said.

Lack of knowledge in other countries – particularly the rest of the EU – about the sustainable Swedish forest industry is a challenge. The other forest company CEOs agreed with Annica Bresky.

"Interest in the forest has never been this big in Sweden. We should be able to capitalise more on our positive effect on the climate and how we are a sustainable industry," said Henrik Sjölund, CEO of Holmen.

A national bioeconomy strategy would, according to Södra's CEO Lars Idermark, be a step in the right direction.

SCA's CEO Ulf Larsson said that the industry is communicating well with universities.

"But we mustn't forget the existing products. I would like to see a bridge between basic research and industry," he said.



Hannele Arvonen



Henrik Sjölund



Susanne Björkqvist, Andreas Ewertz, Anna Palme, David Quist, Anna Stridsman

THE FOREST INDUSTRY OF THE FUTURE - CHALLENGES FOR COMPANIES, RESEARCH AND YOUNG TALENT

ARRANGED BY: Forest Technology division.

DATE: 11 November 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Hannele Arvonen, Peter Berg, Susanne Björkqvist, Annica Bresky, Lena Ek, Andreas Ewertz, Lars Idermark, Ulf Larsson, Anna Palme, David Quist, Fredrik Rosén, Henrik Sjölund, Anna Stridsman, Daniel Söderberg, Anna Wiberg.



Lena Ek

Generous donors fund long-term initiatives



Fundraising for IVA's Jubilee Fund ended at the end of the 2019 jubilee year. The goal was SEK 300 million.

"We have come very close thanks to generous donations from businesses, foundations and private individuals. If we include donations pledged in 2019 that will be fulfilled in 2020, I think we'll reach our goal," says Katarina Mellström, head of the fundraising campaign.

Funds raised will go to two decade-long initiatives: *World-Class Knowledge* and *Entrepreneurship for the Future*. Work in both of these areas is in full swing.

"In addition to funding for a specific project, it's important for IVA to be able to finance long-term initiatives like these. The money is needed in order to act fast on a specific issue, which can be difficult when funding is earmarked for projects."

The donations were the result of many conversations on how and in which areas IVA can make a difference in the future.

"These conversations have led to our decision to continue our fundraising work to provide long-term financing for IVA's other two themes as well: *People – Technology – Society* and *Climate – Resources – Energy*. I hope that IVA will be able to act

swiftly and independently on these important themes too," says Katarina Mellström.

DONORS TO IVA'S JUBILEE FUND 2019

Anders Scharp, ASSA ABLOY, AstraZeneca, Atlas Copco, Autoliv, Axel Johnson Gruppen, Bertil Edlunds Stiftelse, Billerud-Korsnäs, Björn Savén, Bo and Gunilla Pehrsson, Carl Bennet AB, Carl-Henric Svanberg, Chalmers University of Technology, Clas Ohlson, Ericsson, Erling-Persson Family Foundation, Hakon Swenson Foundation, Icomera, Industrivärden, Investment AB Latour, Knut and Alice Wallenberg Foundation, Lars Backsell, Laurent Leksell, Leif Johansson, Leif Östling, Ljung Toolbox, LKAB, Marianne and Marcus Wallenberg Foundation, Mycron AB, Märta Christina & Magnus Vahlquist Stiftelse, Perstorp, Saab, SKF, Stefan Widegren, Stena Metall, Marcus and Amalia Wallenberg Memorial Foundation, Mellby Gård Foundation, Stora Enso, Sven Tyrén Foundation, Confederation of Swedish Enterprise, Tetra Laval, Thomas Eldered, Volvo Group, ÅF.

Jobbsprånget

Jobbsprånget is an internship programme that offers a four-month internship for university graduate engineers, architects, scientists and economists who have recently arrived in Sweden. The purpose of the programme is to embrace the participants' knowledge and expertise and to fast-track entry into the Swedish job market.

Jobbsprånget was launched in 2015 and interest in it is growing rapidly. Today Jobbsprånget can be found at around 50 locations in Sweden. Large and small employers in both the private and public sectors are participating and the results are very good:

- 7 out of 10 interns get a job after completing an internship
- 5 out of 10 interns are women
- 4 months is the average time from completed internship to employment

Head of Jobbsprånget: Alexandra Ridderstad.



Engineer for a day at the museum

»Above all we want to provide inspiration; to show that studying pays off because you can experience great things.«

Christer Fuglesang



During a packed day at *Tekniska museet* in Stockholm (Sweden's National Museum of Science and Technology), 600 students in year 7 from the whole of Sweden learned more about working as an engineer.

"It's been fun to look around at everything here. My favourite thing was the robots that answered our questions," said Colin Hellner from class 7C at Vättleskolan outside Gothenburg.

Numerous lecturers, researchers and engineers with exciting jobs fired up the students.

"Above all we want to provide inspiration; to show that studying pays off because you can experience great things," said Christer Fuglesang.

Many of the students already had a big interest in technology.

"I'd like to be a mechanic and fix motorbikes," said Oliver

Vrubel, a student at Vättleskolan outside Gothenburg, while learning to program a route for a remote controlled vehicle.

One of the more unusual lectures was about how to cultivate meat to make hamburgers without any animals being harmed.

"There are different ways of cultivating meat, just like when we grow tissue and organs for humans. We take stem cells from animals and try to get them to multiply," said Julia Gold, an associate professor at Chalmers University of Technology.

David Sumpter, a professor in applied mathematics at Uppsala University and a data analyst at Hammarby IF football club uses mathematics to develop football.

"Football is a very geometric sport. Think about all of the angles that are involved, all of the moves, all of the patterns that a team creates. A lot of it is based on mathematical patterns and principles," he told the students, as an example of how research and technology can have broad application areas.



DISCOVER, EXPERIENCE, EXPLORE – AS AN ENGINEER

ARRANGED BY: Basic and Interdisciplinary Engineering Sciences division in cooperation with the National Museum of Science and Technology.

DATE: 17 September 2019.

LOCATION: Stockholm, the National Museum of Science and Technology.

PARTICIPANTS: Christer Fuglesang, Julie Gold, Kristina Höök, Lena Klasén, David Sumpter.

The whole of humankind is a sensor

»The existing algorithms are already changing the world.«

Anders Sandberg

Watch the full seminar at IVA's website:



Are we quickly approaching the point when machines will be smarter than humans? Will machines give us new capabilities or take over? These questions were explored from several perspectives at the seminar.

Anders Sandberg researches the future at the University of Oxford.

“Even if no one discovers anything new in AI and machine learning, the existing algorithms are already changing the world,” said Sandberg.

Danica Kragic, robot researcher at the Royal Institute of Technology (KTH) pointed out that robot development is making them more interactive in their interactions with humans.

Staffan Truvé is CTO at Recorded Future.

“Sensors and AI are the basis for predictions on the future. And now the whole of humankind is a sensor,” he said.

It is unclear how fast the world will be transformed by AI,

machine learning, augmented reality (AR) and other new technologies. There are some factors that are slowing things down and fundamental decisions are needed to prevent development from getting out of hand. This was the opinion of Virginia Dignum, a professor of computer science at Umeå University.

“We will probably still be in about the same place in fifty years’ time. It’s not just the technology that controls what happens; it’s also about what we want the technology and enterprises to be able to do,” she said.

She made the point that the important choices that will make it possible for new technology to provide real benefits must also include eliminating the risk of bias, discrimination and loss of human control, among many other things.

“Responsible AI needs to be ethical, law-abiding and reliable. It also needs to know that it is, in fact, artificial and that humans are the ones who decide,” said Virginia Dignum.



Irem Boybat



Mouna Esmailzadeh



PEAK HUMAN

ARRANGED BY: Electrical Engineering and Information Technology divisions.

DATE: 3 December 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Irem Boybat, Virginia Dignum, Mouna Esmailzadeh, Fredrik Heintz, Darja Isaksson, Jonas Ivarsson, Danica Kragic, Anders Lansner, Anders Sandberg, Thomas Schön, Robin Teigland, Staffan Truvé, Anders Ynnerman.



John and Margaretha Aspegren Scholarship 2019

The John and Margaretha Aspegren Scholarship of SEK 100,000 was awarded to Lea Porsager for her artistry and in particular her work Gravitational Ripples which is inspired by scientific observations and cosmic phenomena. This very moving memorial to the tsunami disaster has elements of both engineering and the humanities.

Lea Porsager, who was born 1981 in Frederiksund, Denmark, is a Danish artist working with film, sculpture and photography.

The John and Margaretha Aspegren Scholarship is awarded every two years, alternatingly between an engineer/scientist and a humanities scholar. The foundation's board selects the scholarship recipients.

Leaders of the future are visionary team players



»Business management consists of 40 percent improvisation and short-term problem-solving.«

Ingaliill Holmberg

Watch the full seminar at IVA's website:



How do Swedish management principles hold up today with the current challenges and new generations to lead?

“Business management consists of 40 percent improvisation and short-term problem-solving. 20 percent of it is visualising the future and 40 percent is creating goals, recruiting and budgeting,” said Ingaliill Holmberg, a professor at Stockholm School of Economics.

Representatives from several knowledge-intensive, creative companies talked about their leadership models that are based, among other things, on cross-functional teams, short-term budgets, mutual understanding, discussion and openness.

SWEDISH MANAGEMENT – IS IT KEEPING UP WITH THE TIMES?

ARRANGED BY: Management division.

DATE: 23 October 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Marianne Dicander Alexandersson, Sofia Börjesson, Mats Engwall, Ingaliill Holmberg, Johan Johansson, Fredrik Lagergren, Johan Lassing, Dennis Nobelius, Stefan Palskog, Carl-Henric Svanberg, Katarina Walter.

1945

In the autumn a **technical contact person** is stationed in New York tasked with gathering information from journals, conferences and exhibitions.



1946

AMERICAN INDUSTRIALISTS ON TOUR

The Academy arranges a tour of Scandinavia for 24 industrialists and research directors from the USA. The tour receives a lot of attention. They spend two weeks in Sweden travelling in a specially-equipped train from Skåne in the south to Örnköldsvik in the north.

1947

Nordforsk is created to promote collaboration between engineering academies and technical research councils in the Nordic countries. Edy Velander is appointed Secretary General and remains in the position until 1959.

1948

INDEPENDENT MUSEUM

Tekniska museet is converted into an independent foundation and is no longer part of IVA. The Academy and other founders remain as governors for the foundation.



1953



SHIPBUILDING RESEARCH

Based on a donation from Sweden's General Consul Axel Ax:son Johnson, research into the blooming shipbuilding industry is launched. Sweden is one of the world's leading nations in the area.

1951

The Academy arranges meetings at locations outside Stockholm

– first in Gothenburg where Academy member Gustaf Larson speaks about “The Modern Car” and then in Malmö and Helsingborg the following year.

1950



BOOK ABOUT WOOD GAS

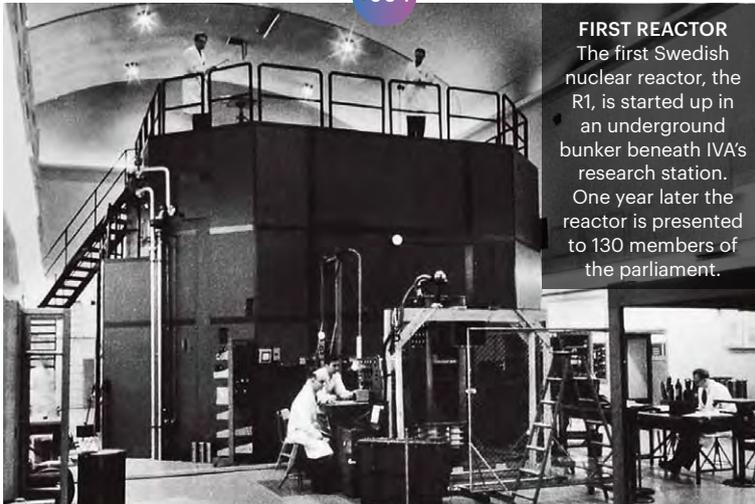
The rapid transition to wood gas in Sweden during WWII is described in a thick book entitled Wood Gas. It describes Swedish experiences from 1939–1945.

1949

In conjunction with the Annual Meeting, the heads of 35 of the country's largest industrial companies form the **Academy's Industrial Council**.

The Council's name is changed to its current one: Business Executives Council.

1954



FIRST REACTOR

The first Swedish nuclear reactor, the R1, is started up in an underground bunker beneath IVA's research station. One year later the reactor is presented to 130 members of the parliament.

1955

A water committee is established to address the increased need for laws in the area. A large conference with 900 delegates discusses the increasing concerns of municipal politicians about **water and sewage systems**.

1957

Statens tekniska forskningsråd (the state technical research council) is launched based on an English model and IVA arranges **field trips and presentations** for parliament members. In 1959 the **Society for Members of Parliament and Researchers (Rifo)** is formed.



1958

TECHNICAL ATTACHÉ IN WASHINGTON

The technical contact person in New York moves into the Swedish Embassy in Washington. At the beginning of the 1960s the contact person gets a new title at the Embassy: Science & Technology Attaché.



1959

CONTACT IN MOSCOW

Sputnik fever spreads around the world. Edy Velander manages to raise enough funds from research councils and industry to station a science attaché in Moscow.

1960



BROHULT TAKES OVER

Sven Brohult who has a PhD in chemistry takes over as President. This brings the Academy closer to the TFR engineering research council. After he spends time there the council's IVA grant is increased.

1966

OFFICE IN TOKYO

IVA stations a scholarship recipient in Tokyo. The next year an office is opened in Tokyo and in 1970 the Swedish Centre is opened in the Tokyo district of Roppongi. The Academy owns 20 percent of the property company.



1965

A special foreign secretariat is established at the Academy's offices in Stockholm.

Hans G. Forsberg, who later serves as President of the Academy, is the secretariat's first director. A technology attaché is stationed in Paris.

1963



SURFACE CHEMISTRY AT THE RESEARCH STATION

A surface chemistry lab is created within the research station at KTH. The lab is run by IVA until 1967. It then becomes the Surface Chemistry Institute.

1962

To answer the question of how innovations come about, a study on **business and innovation** is launched. The study report is published in 1969 and contains a diagram of "the innovation process."

1967

An eleventh division is established to focus on research policy. The name is considered too charged and is changed to **Technical research general planning and economics (XI)**.



1968

WICKMAN REARRANGES THE FURNITURE

The TFR engineering research council is discontinued. Minister for Industry Krister Wickman gives the newly formed National Swedish Board for Technical Development (STU) responsibility for allocating government funding. STU takes over IVA's research station; government funding for the attachés and IVA's government grant is cut in half.

1969



BIG 50-YEAR CELEBRATION

50 years are celebrated with four conferences, two commemorative lectures and two booklets.

Herman Kahn who researches the future, US economist **J. Kenneth Galbraith** and physicist **Werner Heisenberg** (the last two are Nobel Laureates) are among the pre-eminent speakers. A publication entitled *Utvecklingslinjer inom forskning och teknik 1919-2019* (Development lines in research and technology) is published in conjunction with the 50th anniversary.



1969

A focus on Gothenburg of tomorrow



Helena Bjarnegård, who holds the position as Sweden's first "national architect," started the seminar with good examples that can show the way forward for Gothenburg, but pointed out that political control mechanisms are needed to create the right conditions. Dialogue and conversation are also needed. The most important thing is to remember that, apart from its physical structures, the city is also made up of all the activities that take place within them.

In order to reach the sustainability goals, some drastic measures are needed. Holger Wallbaum, professor in sustainable building, talked about examples such as free public transport and more wood in construction.

Gothenburg is a sprawling city and transport-dependence has increased among its residents. Meanwhile the centre has moved southwards," said Jan Jörnmark.

But, according to Dennis Nobelius at Zenuity, mobility could

be adapted at the individual level with public transport that intuitively knows where and when we want to travel. Robin Teigland, a professor at Chalmers University of Technology, questioned the whole concept of mobility. With all the possibilities of working remotely, people will not need to move very far in the future.

Chrisna du Plessis, a sustainability professor at the University of Pretoria, regards Gothenburg as a leader in sustainability. According to her, sustainability goals have existed in some form or other for 70 years. It is highly unlikely that the goals we have today will be met because we have already missed several critical targets.

Important aspects of future urban planning will be avoiding segregation and increasing equality. This was highlighted by Mohamed Hama Ali of Gårdstensbostäder. He maintained that having a mix of condominiums (Sw: *bostadsrätt*) and rental homes is important to create equality.



Chrisna du Plessis



Jan Jörnmark

#GÖTEBORG100 - A SUSTAINABLE SOCIETY IN TRANSITION

ARRANGED BY: IVA West and the Education and Research Policy division.

DATE: 11 April 2019.

LOCATION: Gothenburg, Chalmers Conference Centre.

PARTICIPANTS: Mohamed Hama Ali, Helena Bjarnegård, Hans Bjur, Elisabeth Björk, Michael Browne, Erik Gatenholm, Jan Jörnmark, Dennis Nobelius, Felicia Olsson, Chrisna du Plessis, Robin Teigland, Holger Wallbaum.



Prince Daniel's Entrepreneurship Day

Prince Daniel's Fellowship arranged an Entrepreneurship Day for the fifth consecutive year in 2019. More than 100 young entrepreneurs from the whole of Sweden and many inspiring business leaders sat down in a packed Wallenberg Auditorium. One of the speakers was Jessica Schultz from Northzone who talked about the time when she founded the successful meal kit delivery company Hello Fresh. Another speaker was Ilkka Panaanen, founder of Finnish game developer Supercell. His advice for the young entrepreneurs in the audience was to be persistent and think big right from the start. Contacts were made, business cards exchanged and the room was filled with the sound of entrepreneurs mingling and networking with expectations for and confidence in the future.

ABOUT PRINCE DANIEL'S FELLOWSHIP

The purpose of the project is to inspire young people to become entrepreneurs and to support young entrepreneurs. The project has gathered a group of experienced entrepreneurs and inspiring leaders. It includes a mentoring programme for young entrepreneurs as well as visits to upper secondary schools and higher education institutions where Prince Daniel and inspiring leaders discuss the many aspects of entrepreneurship with students. The project also arranges an annual networking event called Prince Daniel's Entrepreneurship Day.

Project Manager: Jenny Nordlöw.



Health checks not always a good thing



Mathias Uhlén, Emma Frans, Edzard Ernst, Eugen Steiner

More and more diseases are being discovered and predicted earlier and earlier. But that's not always a good thing, according to Eugen Steiner, a partner in venture capital company HealthCap. Demanding analysis methods can mean health risks for patients.

Professor Edzard Ernst from the University of Exeter in the UK specialises in examining alternative medicine.

"If it really works, the medicine is real and not an "alternative," he said. But one problem with alternative treatments is that patients may not seek evidence-based, conventional care. Refusal among proponents of alternative medicine to vaccinate their children has led to dangerous outbreaks of diseases like the measles.

Mathias Uhlén, a professor at KTH and KI, pointed out that most medicines these days target the proteins that are natu-

rally found in the body. We should therefore work on individualised treatments, for example for diseases such as Alzheimers.

HOW DO YOU FEEL? NAVIGATING MEDICAL ADVICE

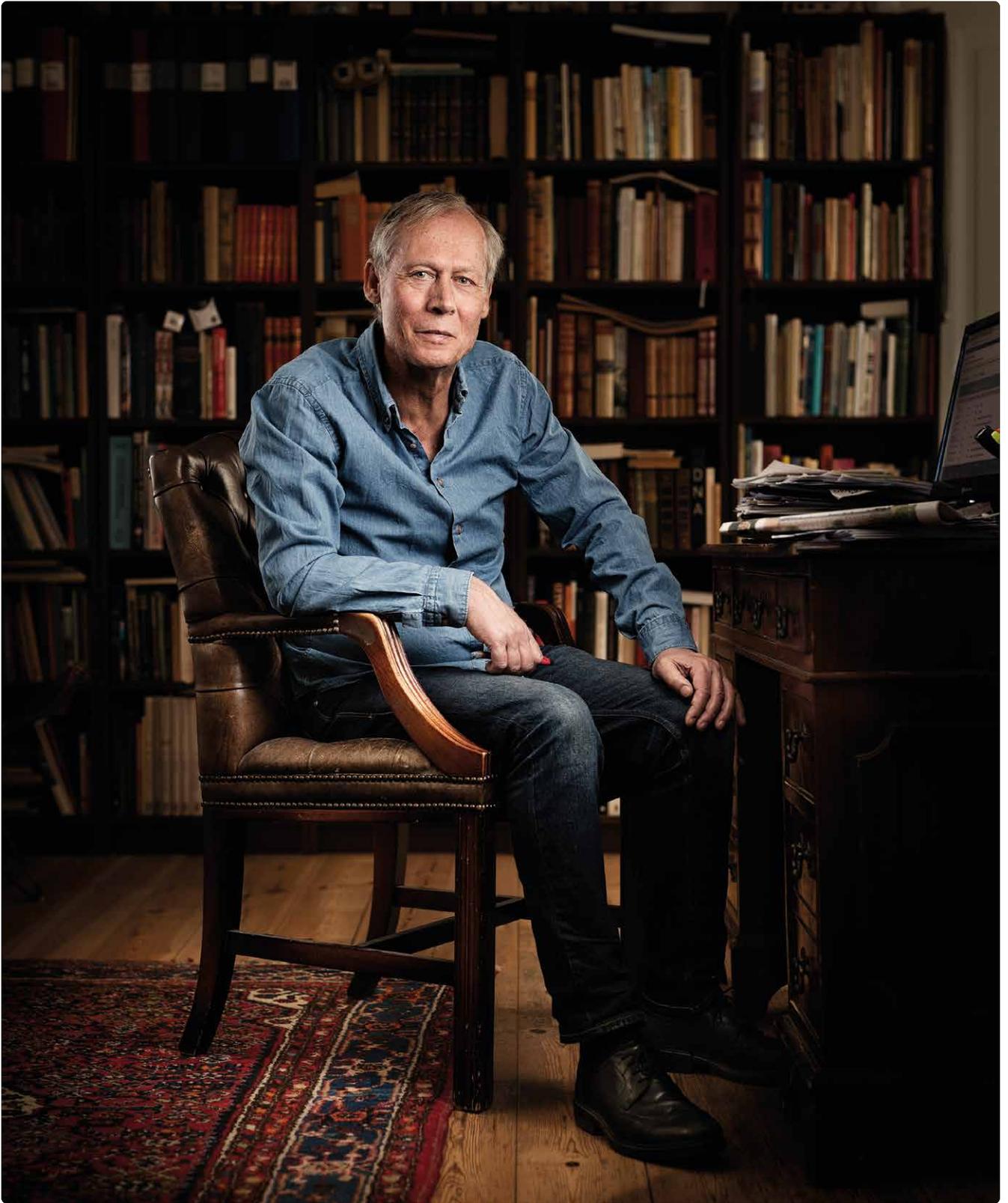
ARRANGED BY: Biotechnology division.

DATE: 19 September 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Edzard Ernst, Emma Frans, Eugen Steiner, Mathias Uhlén.





Well-read and easy to read with a local angle

MEDICAL JOURNALIST **ÅKE SPROSS** HAS RECEIVED THE HANS BERGSTRÖM AWARD, IVA'S AWARD FOR SCIENTIFIC JOURNALISM

For forty years he has covered an entire world of science and research with a local perspective for Upsala Nya Tidning (UNT). It became clear at the beginning of the 1980s that the newspaper would have its own medical section. At that time there were also two reporters covering the university and in the 1990s a student reporter was added.

Thanks to his curiosity, an introduction at the National Board of Health and Welfare's medicinal department, which would become the Medical Products Agency, Åke Spross soon started looking for his own news stories – always incorporating a local angle so that his articles could compete for space in the paper.

“A big part of my job has always involved very careful reading. At conferences and medical congresses a lot of the information comes from unpublished studies. But over the years I've also streamlined the type of reporting I do.”

He has had embargo agreements for many years with numerous scientific journals.

“That allows me to read the reports three or four days before they're published in the journal, which is great because it gives me time to work longer on each article.”

Explaining its decision, the jury wrote that “Spross is always well-read and easy to read. His work is just as appreciated in the research community as it is by his broad readership.”

“I write for readers with a general interest but who are also prepared to think for themselves. I try to avoid terms that make my articles harder to read. When covering things like DNA research, this can be a problem. I try to give the reader an understanding of the subject without including difficult terminology,” he says.

In a university town like Uppsala with all the professors and scholars who are critical readers, this can be a challenging task. But according to Åke Spross, any angry phone calls or emails do not come from the research community. In 2011 he was awarded an honorary doctorate by Uppsala University Faculty of Medicine. His integrity and ability to incorporate the interests of researchers and pharmaceutical companies when reporting on medicine were highlighted as reasons for this distinction.

“I think it raised my status in some way – not among my normal readers, but in the scientific community.”

In August Åke Spross retired after forty years on the hunt for news stories. He ended his career with a series under the heading “*Born at the right time.*” In eight articles UNT readers could read about people who would not have been alive today if it hadn't been for medical advances in areas such as pacemakers, new cancer treatments, heart transplants, artificial insemination or advanced care for premature babies. He has met and reported on several of these individuals in the past.

“The idea during my time covering the field was to highlight advances in medicine – and to do it differently.”

ABOUT THE HANS BERGSTRÖM AWARD

IVA's award for scientific journalism – the Hans Bergström Award – recognises a scientific approach in the media and excellent journalism in science, technology, innovation and entrepreneurship – in a tradition of informing, educating, detailed explanation, integrity and a belief in the future. The amount awarded is SEK 100,000.

AI challenges ethics and integrity

»Humans have always learnt from their mistakes, but that's not enough anymore.«

Max Tegmark

Watch the full seminar at IVA's website:



Fredrik Heintz, Max Tegmark, Prince Daniel

"It's hard to tell if a text or image of a person is computer-generated or not," said Fredrik Heintz at IVA's Science & Society Forum, which this year was on the theme of artificial intelligence and its consequences for society. Heintz is a researcher and member of the European Commission High-Level Expert Group on AI.

He pointed out that artificial intelligence is different from human intelligence. AI lacks intuition, but it can process much more information; it's faster, but it cannot break rules and has no needs of its own.

"AI is a tool for us to achieve what we want. We complement each other," he said.

The term artificial intelligence encompasses more than machine learning and algorithms. It includes application, ethics, laws and values as well.

"But which values? Not just one person can determine that,"

says Virginia Dignum, professor of social and ethical AI at Umeå University.

It needs to be based on the common values in a society. However, these vary depending on shifting norms in different societies. "This is making it hard to achieve ethical AI globally,"

Up to now an AI system can only do one thing, like diagnose a disease. But Max Tegmark, a cosmologist and professor at MIT, predicts that in a few decades there will be general artificial intelligence.

"By then machines will be able to do everything that we can do. Humans have always learnt from their mistakes, but that's not enough anymore," he said.

Security therefore needs to be a common theme in all AI development.

"We have to stop believing that we will always be better at some things than a machine. We're not going to be the smartest ones on the planet in the future," he said.



Paulina Modlitba



Yongqi Lou



Student choir from Nacka Music classes



Max Tegmark, Virginia Dignum, Fredrik Heintz, Joel Hellermark

SCIENCE & SOCIETY FORUM: ARTIFICIAL INTELLIGENCE AT WHAT PRICE?

ARRANGED BY: IVA.

DATE: 24 October 2019.

LOCATION: Stockholm, IVA.

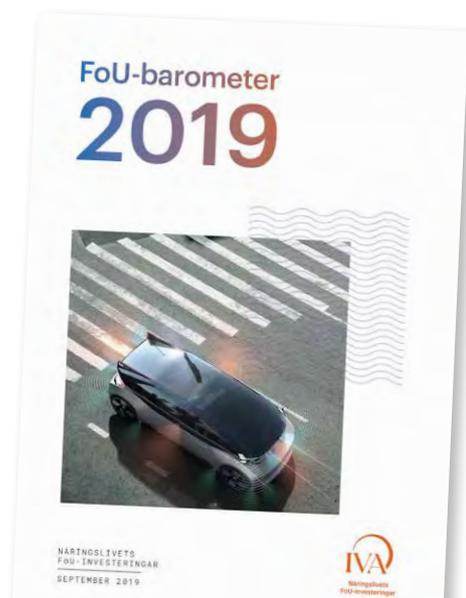
PARTICIPANTS: Evelina Anttila, Virginia Dignum, Fredrik Heintz, Joel Hellermark, Max Tegmark.

Barometer measures pressure of private sector R&D

We need to gain a greater insight into how private sector R&D investments are developing and being impacted and managed. More knowledge is also needed about which policy measures can effectively make Sweden more attractive for R&D investment.

IVA has therefore launched an annual R&D barometer as a means of showing progress. The first one, published in September, shows that finding the right talent for R&D in Sweden is very difficult.

The conclusions are based on responses from the heads of R&D at 48 of the country's most R&D-intensive companies. The companies that responded to the survey have a total of around 42,000 employees working in R&D, equivalent to just over half of all R&D employees in the private sector. Seven companies were also interviewed at length in addition to completing the survey.



ABOUT PRIVATE SECTOR R&D INVESTMENT

The project produces an annual R&D barometer. It highlights how companies view the R&D investment climate in Sweden and shows the investment trend over time.

Chair of the Steering Committee: Pontus de Laval, Saab.

Project Manager: Martin Wikström.



New Chair for Business Executives Council

Magdalena Gerger, CEO of Systembolaget, became the Business Executives Council's new Chair on 1 January 2020. She has a MSc in Business & Economics from Stockholm School of Economics and has previously worked for Nestlé, ICI Paints and Procter & Gamble. Magdalena Gerger took over from Eva Hamilton who had served as Chair of the Council since 2016. Eva Hamilton continues to work with IVA's regional hubs and started IVA East (in Östergötland County). She launched the CTO Round Table and Future Digital Leaders networks. Maria Rankka and Håkan Dahlström are new Vice Chairs and Johan Hjertonsson joined the Council's Executive Body in 2020.

Changed climate increases need for sustainable water supply



A warmer climate and a growing population are presenting new challenges for our water supply. Finding ways to tackle these is the objective of the project *Sustainable Water Supply – access to clean water in a changing climate*.

“The summer 2018 drought in Sweden brought home the issue of our water supply, but the fundamental problem is how to manage our water resources by closing the cycle and, not least, safeguarding the water supply in growing cities,” says Staffan Eriksson, Project Manager.

The project has gathered actors from industry, academia and the public sector. One key task is to create a platform that will live on long after the end of the project’s two-year period where the research community and public administration can come together to address the supply of fresh water.

The project began in autumn 2019 and will end in 2021.

ABOUT SUSTAINABLE WATER SUPPLY – ACCESS TO CLEAN WATER IN A CHANGING CLIMATE

The project is focusing on issues surrounding fresh water. There are three main themes: Water as a limited resource – cycle and management; Climate change – consequences and large precipitation variations; and Urban environments – How can we safeguard the water supply in our growing cities and communities?

The project wants to create a platform for all important actors in the water supply sector for meetings between R&D and public administration to facilitate development of common methods, processes and tools.

Chair of the Steering Committee: Tord Svedberg.

Project Manager: Staffan Eriksson.

Harvard professor shows the way to good jobs

»When I speak in other countries and get asked about what they should do, I usually answer: Do what Sweden is doing.«

Dani Rodrik

Watch the full seminar at IVA's website:



"We need a new, modern industrial policy," said Harvard professor Dani Rodrik, who spoke at a packed jubilee seminar.

According to Professor Rodrik, the new industrial policy needs to lead to good jobs. He stressed that the trend in Western Europe and the USA towards fewer good middle class jobs must be turned around.

He also pointed out that while globalisation and free trade benefit nations, they can also take opportunities away from individual groups. Policy-makers must therefore be active in addressing the increasing income inequality that automation and globalisation create.

"The main change that has taken place over the past 20 years

is the shift in the labour market. This has made people worried, which populists are now exploiting," he said.

The main question now is how to manage the anxiety that technological development is fuelling in large parts of the labour market.

He praised Sweden's social safety net, cooperation and openness to change, and confessed that coming to Sweden to speak was a little challenging.

"Sweden is a special country. When I speak in other countries and get asked about what they should do, I usually answer: Do what Sweden is doing."

He was of course asked what Sweden should do, and answered: "Try to be an even better version of Sweden."



Elisabeth Svantesson, Martin Flodén



Carl-Henric Svanberg, Sara Öhrvall



Harry Flam, Anna Ekström, Elisabeth Svantesson, Martin Flodén

ECONOMIC POLICY IN A TIME OF INTENSE TECHNOLOGICAL DEVELOPMENT

ARRANGED BY: Economics division.

DATE: 27 September 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Pontus Braunerhjelm, Lars Calmfors, Karolina Ekholm, Harry Flam, Martin Flodén, Mats Kinnwall, Katarina Lundahl, Dani Rodrik, Carl-Henric Svanberg, Elisabeth Svantesson, Sara Öhrvall.



Pontus Braunerhjelm, Lars Calmfors, Karolina Ekholm

Zero emissions with new climate action plan



Sweden must reach zero net emissions of greenhouse gases by 2045. A big majority of the parties in the Sweden’s parliament agree on this.

Working at the strategic level and taking a comprehensive approach, the *Climate Crossroads* project will deliver an action plan with the measures needed for Sweden to reach its climate goals. This will make it easier for policy-makers and business leaders to weigh different options. Actions taken to reach the climate goals must also make Sweden more competitive.

Through its five sub-projects, *Climate Crossroads* has focused on key areas: industry, energy, agriculture, transport and society as a whole. The sub-projects’ analysis and observations are summarised in a synthesis report which presents a number of recommendations.

Project Director Karin Byman is an energy expert.

“It’s obvious that a comprehensive approach is needed if we’re to reach our climate goals. Riding political hobby-horses is meaningless. Policy-makers need to focus on the right things,” she said, pointing out that the electricity market is key and that the transport system is the biggest challenge.

“But Sweden cannot make the transformation on its own; cooperation with the EU is really important if we’re to reach our goals.”

A single sector of society cannot take overall responsibility for the necessary transformation in Sweden.

“The risks need to be shared between the public sector, with the Government taking the lead, and the private sector. Here, public procurement can play an important role,” says Karin Byman, adding that the sub-project reports have received a lot of media attention and that the politicians in the project’s reference group agree on the goals but differ on the best way to reach them.

ABOUT CLIMATE CROSSROADS

The project will produce a plan of action for how Sweden can achieve zero emissions and be more competitive by 2045. It will also support the Government’s Climate Policy Council, analyse progress in other countries and perform a broad consequence analysis of all climate measures that are under way.

Chair of the Steering Committee: Elisabeth Nilsson.

Chairs of the sub-projects: Mikael Dahlgren, Hans Folkesson, Stefan Nyström, Eva Pettersson and Andreas Regnell.

Project Manager: Karin Byman.

Female engineers want to improve the world



»We need to look at the whole picture to get more people to study engineering.«

Matilda Ernkrans

Watch the full seminar at IVA's website:



"Diversity at all levels is important. It creates innovative environments," says Aldert Kamp, education director at one of the faculties at Deft University of Technology in the Netherlands.

The university has been varying and adapting its programmes according to specific needs. As a result, the number of applications to engineering programmes has increased by 5 percent annually.

According to Birgitta Bergvall-Kåreborn, Vice-Chancellor of Luleå University of Technology, Swedish universities need to follow suit.

"Women are interested in getting an education that will enable them to help address the challenges facing society. We therefore need to adapt what we can offer them," she said.

Matilda Ernkrans is Sweden's Minister for Higher Education and Research.

"We need to look at the whole picture to get more people to study engineering. Role models and cooperation are important," she said.

WHAT DO FUTURE ENGINEERS NEED TO KNOW?

ARRANGED BY: Education and Research Policy division.

DATE: 28 August 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Kristina Axén Olin, Birgitta Bergvall-Kåreborn, Jonathan Edin, Johan Eklund, Matilda Ernkrans, Aldert Kamp, Peter Larsson, Annika Pontén, Anna Yman, Martin Wikström.

Mines and space are Norrbotten's future

»We're moving towards AI, but also towards an exciting area for future development.«

Jan Moström



Leif Östling, Björn O. Nilsson, Birgitta Bergvall-Kåreborn

The seminar highlighted how artificial intelligence can be used in one of Sweden's vital basic industries, mining, and in a growing sector, space technology.

At LKAB, digital control processes were introduced back in the 1980s. The systems have been developed over time into advanced and integrated solutions.

"Today, for example, we have ball bearings with built-in sensors and we're now using data from all of these sensors to further develop products and performance. We're gathering a lot of data, but we still don't know what to use some of it for today. We're moving towards AI, but also towards an exciting area for future development," said Jan Moström, CEO of LKAB.

Olle Nordberg, Vice Rector for Space at Luleå University of Technology (LTU), pointed out that Sweden has large companies in the space industry as well as smaller niche actors. There

is also excellent research being done in the field in Sweden, especially at LTU, Chalmers University of Technology and the Royal Institute of Technology (KTH).

Tor Björn Minde of Rise said that demand for "green" data centres has increased. Customers recognise the added value in being able to market more sustainable services to their own end-customers.

Based on education and research, industrial collaboration and strong institutions, Luleå has a good ecosystem for data centres.

Marcus Liwicki, a professor at LTU and specialist in machine learning and image analysis, talked about technologies that can be used in applied AI. Systems for voice recognition, image analysis and translation are already well developed, for example as apps for phones. With increasing amounts of data available there are huge opportunities if it is used in the right way.



Jennie Hägg

**SPACE, MINES, DATA STORAGE AND AI
- HOW ARE THEY ALL CONNECTED?**

ARRANGED BY: IVA North.

DATE: 11 June 2019.

LOCATION: Luleå, Vetenskapens hus (Science House).

PARTICIPANTS: Birgitta Bergvall-Kåreborn, Emma Fryer, Christian Landgren, Marcus Liwicki, Jan Moström, Tor Björn Minde, Björn O. Nilsson, Olle Norberg, Mikael Nyström, Michael Rast, Tuula Teeri.



Marcus Liwicki

1970

The Industrial Research Committee (IRC) is created to increase interactions with a selection of R&D leaders in industry.

Committee members, who are recommended by Academy members, serve a three-year term and then become IRC alumni.



FIRST WOMAN

Physiologist **Irma Åstrand** is the first woman to be inducted into the Academy. She is a well-qualified and sharp-witted researcher who, later in her career, becomes a professor and head of the Work Environment Institute.

1971



TV PERSONALITY

Engineer **Gunnar Hambræus** is appointed as President. He is a strong communicator, was IVA's contact person in the USA, Editor-In-Chief of the journal *Teknisk Tidskrift*, started *Ny Teknik* and became a TV personality in a popular program about space.

1972

Gunnar Hambræus visits China at the beginning of the year after an invitation from the Chinese Academy of Sciences. A delegation of 30 people from China visit IVA and KVA (Royal Swedish Academy of Sciences) for a week the same autumn.

1973



YEARBOOK GROWS

The yearbook entitled **Progress in Research and Technology**, issued for the first time in 1967, grows from a booklet of 150 pages to a 250-page bound volume and is distributed to members of *Civilingenjöröförbundet* (now the Swedish Association of Graduate Engineers).

1981



STATT FOUNDATION

Birgit Engren is recruited from STU and is named head of the attaché programme. The programme is restructured into the STATT Foundation overseen by the Government and IVA. STATT moves out of IVA and into its own offices

1980

SPECIAL INITIATIVE

A special initiative is created to explore **People-Technology-Society**. A committee of the same name is formed. The emphasis is on electronics, computers and communication technology.



1979



THE BIG PROJECT

In a report on knowledge och competitiveness, often called "The Big Project," IVA is tasked by the Government with providing an overview of Sweden's technical and industrial future and competitiveness.

1975

The annual Attaché Day attracts record participation.

More than 400 people gather to listen to lectures on the theme of international environmental conservation. The lectures are published in a report under the heading "Environmental conservation policy and industry."

1976

Information for industry and organisations

is gathered under one umbrella: IVA's Information Service.

1981

The Academy gains a footing regionally, first through **IVA West** in Gothenburg and then **IVA South** in Skåne.



SHIPPING BOSS

Engineer **Hans G Forsberg** takes over as President. In the years 1965–1971 he serves as head of IVA's international section but works throughout the 1970s in shipping and shipbuilding at the shipyards in Salén and Öresund.

1984



INSPIRED BY THE BRITISH PARLIAMENT

The Wallenberg Auditorium is officially opened. It is built based on donations from the business community in connection with Marcus Wallenberg's 80th birthday in 1979. The design is inspired by the British parliament.

1984



FIRST ROYAL TRIP
The west coast of the USA is the destination of the first Royal Technology Mission. The delegates visit the Palo Alto Research Center, HP and Boeing. The following year 25 delegates travel to Japan and in 1986 to West Germany.

1985

The shortage of engineers is a hot topic and between the years 1984–1993 IVA forms **four committees** to address the need, quality, recruitment and education of Swedish engineers in the future.

1986

The **Management of Technology** project aims to increase understanding of the factors that make Swedish industry and Swedish engineers successful. A video-based education package is produced.

1990



WERTHÉN FOUNDATION
Ericsson honours Hans Werthén by donating money to a foundation. Scholarships are to be awarded for international study and research in science, engineering, management, economics and law.

1989

ECONOMIC SCIENCES

The mission statement is changed to include the economic sciences when IVA hears of plans for an academy of economics. The idea to merge the divisions is scrapped.

»The Academy's mission is to promote the engineering and economic sciences and the development of industry for the benefit of society.«

1988

YES ON NUCLEAR ENERGY

In a referendum 89.5 percent of the members (80 percent participating) support the Academy's position on nuclear energy; the reactors are to be operated as long as they are profitable and meet safety criteria.



1987

A twelfth division, **Information Technology** (XII), is established. At the end of the 1980s a study is also conducted of a proposal to combine division VI and division IX as they are considered to have overlapping activities.

1991

The **financial crisis** forces restructuring of all of IVA and a savings programme is created. Academy activities are limited to fewer areas (called programmes) and the secretariat is streamlined.

1992

A productivity study under the heading **Best in the World** receives a lot of attention and is followed up by **Best in Services** which compares service companies and organisations in Sweden and other countries.

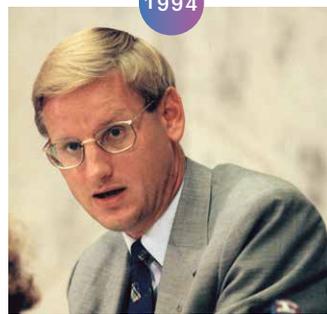
1993



A BEST SELLER

The Environmental Committee, formed in 1983, conducts its final study of **environmentally driven business** development. **Leif Johansson** chairs the committee. The committee's report becomes a "best seller." There are both risks and opportunities associated with environmental awareness.

1994



IVA CELEBRATES 75 YEARS

IVA turns 75 and celebrates with 20 or so jubilee symposiums. Prime Minister **Carl Bildt** gives a speech on "Investing in the future" in Kista, Stockholm, and announces the creation of the Government's IT Commission.



1994

Royal interest in sustainability and the climate

»We're not designing for circularity today. We need to think about it right from the drawing board stage.«

Elin Larsson



A seminar on sustainability attended by the King and Queen, Crown Princess Victoria and Prince Daniel, was opened by the King.

“Just look at the history of Swedish engineering sciences – it’s a history of exceptional individuals and ideas; of constant innovation and development,” said the King.

The focus of the seminar was Sweden’s ability to promote climate benefits and resource efficiency. Examples include the success of the landfill ban and CHP plants as a significant export opportunity for system and technical expertise.

Klas Gustafsson is Vice President of Tekniska verken in Linköping.

“If we look at waste as refuse, the question we ask is how to get rid of it. This is how the question is framed in many other countries,” he said.

But the Swedish example shows that it is possible to turn sig-

nificant challenges into opportunities. Brand new environmental technology initiatives can become a Swedish export success. Northvolt’s new battery plant in Skellefteå can become a Sweden export success.

The need for engineers is great in many industries. The textile industry is one example.

“We’re not designing for circularity today. We need to think about it right from the drawing board stage,” said Elin Larsson, former Sustainability Director at Filippa K.

Another sector facing major challenges is the plastics industry. This is also the case in several other sectors of industry, as well as households around the world.

“We need a competitive transformation of industry and transport systems; we need a circular system for plastics and textiles, and we need to reduce food waste,” said IVA’s Chairman Carl-Henric Svanberg, commenting on the challenges.



Magnus Huss, Elin Larsson, Johan Kuylenstierna



Birgitta Resvik



FROM LANDFILL BAN TO CIRCULAR ECONOMY - WHAT SOLUTIONS CAN SWEDEN PROVIDE TO THE WORLD?

ARRANGED BY: The projects Resource Effectiveness and the Circular Economy and Climate Crossroads.

DATE: 12 November 2019.

LOCATION: Stockholm, Royal Palace, Bernadotte Library.

PARTICIPANTS: Peter Carlsson, Klas Eklund, Klas Gustafsson, Magnus Huss, Johan Kuylenstierna, Elin Larsson, Björn Ola Linnér, Birgitta Resvik, Carl-Henric Svanberg, Tuula Teeri.

Sweden at the forefront in sustainable transport



Håkan Samuelsson, Henrik Henriksson, Monica Bellgran

According to Director General of the Swedish Transport Administration, Lena Erixon, Sweden is at the forefront in a number of areas – one of them is sustainable transport.

“But the regulatory frameworks are not keeping up with developments in technology,” she said.

“In 2025 cars are to either be hybrids or fully electric powered,” said Håkan Samuelsson,” CEO of Volvo Cars.

Henrik Henriksson, CEO of Scania, wants to see a long-term, party-neutral agreement for the transport sector. He believes biofuel is a good thing because it will take a long time before heavy vehicles can run on electricity.

Lars Stenqvist is Chief Technology Officer at AB Volvo.

“City buses are already perfect for electricity. Plant machinery could also be powered by electricity,” he said.

PEOPLE, TECHNOLOGY AND ENTERPRISE IN THE FUTURE TRANSPORT SYSTEM

ARRANGED BY: Mechanical Engineering division.

DATE: 21 January 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Anders Blom,
Anna Dubois, Lena Erixon,
Henrik Henriksson, Johan Rockström,
Håkan Samuelsson, Lars Stenqvist,
Tuula Teeri, Annika Stensson Trigell,
Björn Westerberg.



Student Council provides perspective

Climate leadership and more female engineers are areas the Student Council is focusing on. In its own project on combining efforts and resources for the climate, the Student Council has delved into the great challenge of our times. One of the conclusions is that climate leadership is essential if the climate goals are to be reached. Speakers at a seminar to answer the question: “What type of climate leadership is needed to meet the Paris Agreement goals?” included Johan Kuylenstierna, Vice Chair of the Climate Policy Council and Katarina Kolar, SCA’s Sustainability Director.

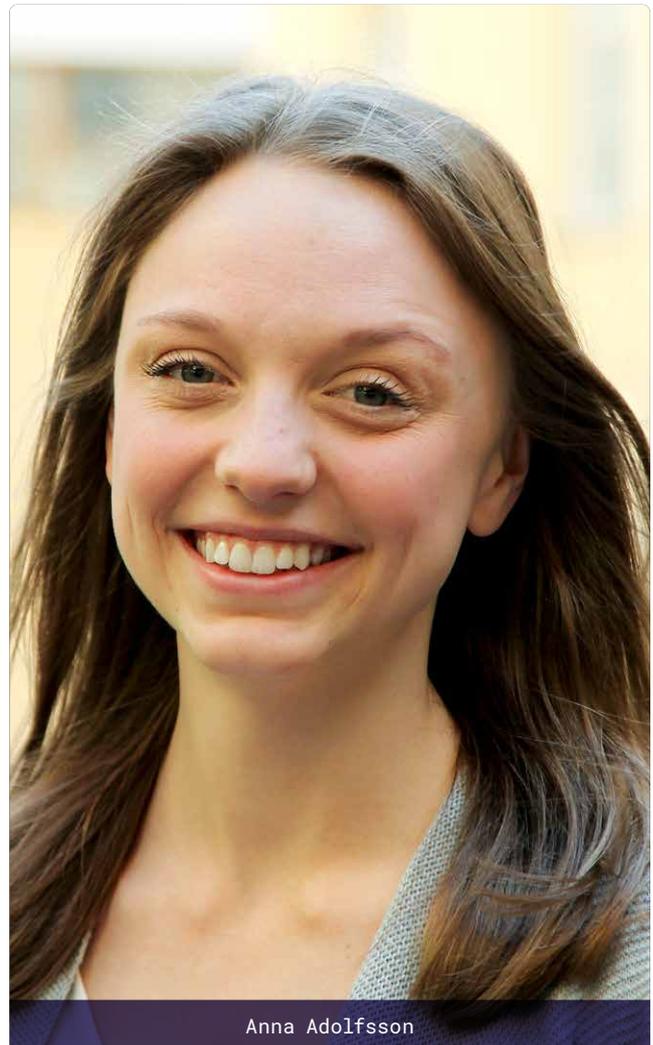
In 2019 the Student Council presented women who are engineers and role models under the heading *Vera of the Month* (Månadens Vera) on IVA’s website.

Representatives from the Student Council also took part in a jubilee seminar in Gothenburg arranged by IVA West and the Education and Research Policy division.

ABOUT THE STUDENT COUNCIL

The Academy’s Student Council exists to provide IVA with a student perspective. The Council consists of students from universities that offer engineering programmes, the Swedish University of Agricultural Sciences, Stockholm School of Economics and the School of Business, Economics and Law at the University of Gothenburg.

Chair: Anna Adolfsson, Linköping University.



Anna Adolfsson

Scholarships for young academics

The 2019 scholarships from the Hans Werthén Foundation went to 18 young university graduates – eleven women and seven men. They shared a total of SEK 1,840,000.

The Foundation was established in 1990 in honour of Hans Werthén for his lifework as an engineer and business leader. Since the Foundation was established, 472 scholarships totalling SEK 55.2 million have been awarded. The purpose

is to give young graduates an opportunity for development in another country and to gain new knowledge and experience that they can use in industry, business or the academic sphere in Sweden. Green light-weight batteries, algorithms to ensure self-driving cars make good decisions, bumblebees and risk capital management are a few of the subjects that this year’s scholarship recipients are planning to study.

International science conference

»Climate change is fairly easy to solve – from a purely technical point of view – but there is no easy technical solution to the issue of biological diversity.«

Olle Olsson



What role will engineering play over the next 100 years? This question was discussed for three days in July at the annual conference of the International Council of Academies of Engineering and Technological Sciences (CAETS), arranged by IVA. The participants included researchers from Sweden and around the world.

The themes were broad ones. Topics discussed among prominent experts and speakers included gravitational waves, medicines of the future and the origins of the internet.

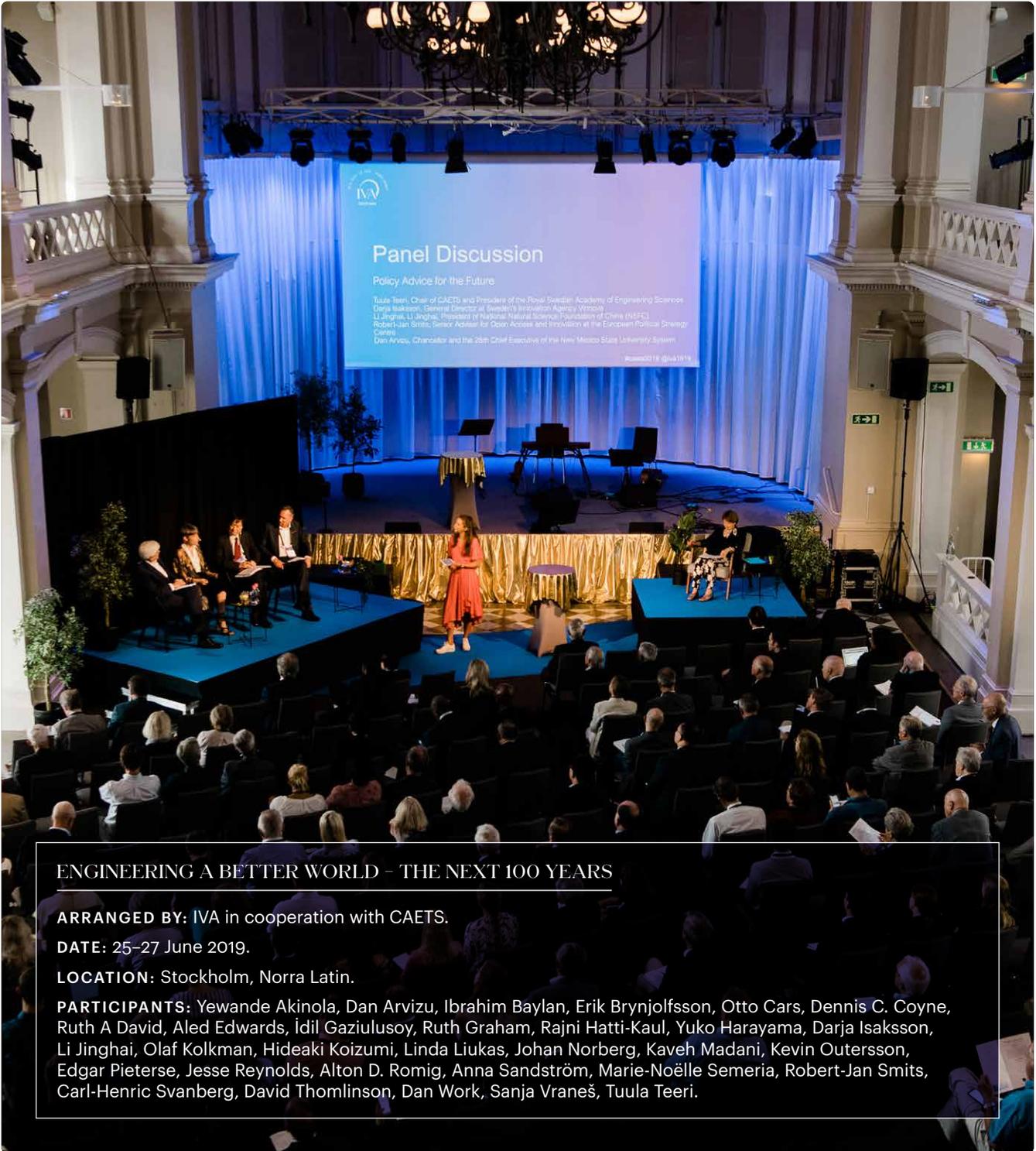
One of the experts was MIT professor Erik Brynjolfsson. He considers it a paradox that the rapid development of AI has not led to a corresponding increase in productivity, but he is sure the effects will come eventually.

Researchers from an observatory at the California Institute

of Technology were awarded a Nobel Prize in 2017 for capturing the universe's gravitational waves in images. Behind this achievement was technology developed under the leadership of Dennis C. Coyne, Chief Engineer at the observatory. He spoke about the technology and the event that led to the prize.

The need to quickly develop new antibiotics was underscored by Otto Cars, a senior professor at Uppsala University. More cooperation between academies of sciences and engineering sciences and decision-makers is something that Robert-Jan Smits from Eindhoven University of Technology said he would like to see so that political decisions can be based on science.

In addition to listening to numerous speakers, the participants at the Wallenberg Wood Science Center were able to learn about the latest advances in Swedish forest research.



ENGINEERING A BETTER WORLD – THE NEXT 100 YEARS

ARRANGED BY: IVA in cooperation with CAETS.

DATE: 25–27 June 2019.

LOCATION: Stockholm, Norra Latin.

PARTICIPANTS: Yewande Akinola, Dan Arvizu, Ibrahim Baylan, Erik Brynjolfsson, Otto Cars, Dennis C. Coyne, Ruth A David, Aled Edwards, idil Gaziulusoy, Ruth Graham, Rajni Hatti-Kaul, Yuko Harayama, Darja Isaksson, Li Jinghai, Olaf Kolkman, Hideaki Koizumi, Linda Liukas, Johan Norberg, Kaveh Madani, Kevin Outersson, Edgar Pieterse, Jesse Reynolds, Alton D. Romig, Anna Sandström, Marie-Noëlle Semeria, Robert-Jan Smits, Carl-Henric Svanberg, David Thomlinson, Dan Work, Sanja Vraneš, Tuula Teeri.

New honorary members with strong commitment

At the Assembly of the Academy on 3 June, Peter Wallenberg Jr, Mary Walshok and Jan-Eric Sundgren were named as honorary members.

“We want to highlight in particular these three inspiring leaders for driving change and helping to make Sweden more competitive – both inside and outside academia,” says Tuula Teeri, President of IVA.

The Executive Committee’s explanations for its choices are summarised as follows:

Peter Wallenberg Jr, a member of the Education and Research Policy division, has demonstrated a strong personal commitment to IVA’s activities, including as an active member of the Business Executives Council and in division activities. He was also an initiator/catalyst for the creation of IVA’s Jobbsprånget project.

Mary Walshok, an international member, has made important contributions to IVA’s work on the themes of innovation and entrepreneurship. She founded Connect in San Diego, which

connects entrepreneurs with capital and talent, and was instrumental in establishing the model in Sweden.

Jan-Eric Sundgren, a member of the Basic and Interdisciplinary Engineering Sciences division, has been deeply committed to IVA’s activities for many years. His contributions as Steering Committee Chair for Teknicsprånget and Jobbsprånget have been invaluable.

ABOUT THE ACADEMY’S HIGHEST DISTINCTION

As honorary members, IVA may appoint individuals who “through their work or by other means have contributed greatly to the promotion of the Academy’s objectives.”

The first honorary members were appointed back in 1919.

They were HRH Crown Prince Gustaf Adolf and Director General Karl Axel Fryxell.

Current honorary members, in addition to the new ones: Arne Wittlöv, Lena Treschow Torell and Prince Daniel.



Peter Wallenberg Jr



Mary Walshok



Jan-Eric Sundgren

Luleå company Mobilaris wins Smart Industry



Luleå-based software company Mobilaris was the winner in the fourth round of the Smart Industry Enterprise Competition. Moelven Valåsen AB and Moving Floor AB received an honourable mention.

The jury explained its decision as follows: Mobilaris was named the winner of the 2019 Smart Industry Enterprise Competition for its contributions to the digitalisation of traditional industries. With a strong understanding of customer needs, Mobilaris has used the possibilities of digital technology to increase productivity, improve personal safety and reduce energy consumption. Through its digital service offering aimed at mines and other basic industries, in five years the company has quadrupled its sales, increased its headcount from 17 to 70 employees and now has 25 customers from all parts of the world.

The jury also awarded two honourable mentions.

One went to one of Sweden's biggest sawmills, Moelven Valåsen AB, which "in a business that up to now had a relatively low level of digitalisation, implemented an internal 'digitalisation jour-

ney' for the entire production process – from timber to finished products. The Company has systematically sought access to knowledge and combined best practice with its own solutions."

The second honorary mention went to Moving Floor AB, an environmental technology company with technology for automatic self-cleaning boxes, which "in an industry with very little digitalisation, demonstrated the possibilities and great potential of digitalisation."

ABOUT IVA'S SMART INDUSTRY

Since 2016 Smart Industry has been recognising and rewarding companies that are embracing the possibilities of digitalisation. The project arranges business forums throughout the country for knowledge transfer between companies, organisations and public agencies.

Project Manager: Johan Carlstedt.

Brilliant companies for an innovative future

»We need to invest much more in education, research and innovation. One of the world's ten best universities needs to be in Sweden.«

Jan-Olof Jacke

Watch the full seminar at IVA's website:



Christian Landgren, Jan-Olof Jacke

More than a century ago, brilliant inventions brought success and fast growth to companies like Ericsson, SKF and Asea.

“Now Sweden is trying to find a new model for innovation,” said Arne Kaijser at a jubilee seminar on innovation and the future.

Jan-Olof Jacke, Director General of the Confederation of Swedish Enterprise, predicted that the reduced birth rates around the world will lead to tougher competition for talent.

“We need to invest much more in education, research and innovation. One of the world's ten best universities needs to be in Sweden,” he said.

Irena Pozar, Editor-in-Chief of Veckorevyn magazine, pointed out that what is relevant today will not be relevant to those living a 100 years from now.

“The values and desires of today's youth will shape the future of technology,” she said.



Arne Kaijser, Samuel Engblom



Irena Pozar



Darja Isaksson



Peter Holmstedt

200 YEARS OF INNOVATION

ARRANGED BY: Industrial Research Committee (IRC).

DATE: 2 December 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Samuel Engblom, Darja Isaksson, Jan-Olof Jacke, Arne Kaijser, Christian Landgren, Irena Pozar.

Materials that will dominate the century



Robert Langer

Discoveries in physics dominated the first half of the 1900s and advances in molecular biology dominated the second half. New materials will dominate the next 100 years.

A clear future perspective was the theme at a packed jubilee seminar arranged by the Chemical Engineering division.

Energy research, how to design drugs to be active for a precise period, and the challenges and opportunities of polymers were explored by a long list of international and Swedish top researchers and business representatives – many of them IVA members.

THE SIGNIFICANCE OF MATERIALS IN SOCIETY

ARRANGED BY: Chemical Engineering division.

DATE: 14 May 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Ann-Christine Albertsson, Lennart Bergström, Brad Chmelka, Ulrica Edlund, Kristina Edström, Anders Hagfeldt, Thomas Hjertberg, Werner Kunz, Martin Malmsten, Karin Markides, Robert Langer, Virgil Percec, Fredrik Tiberg.



Successful start for Junior Academy

Junior Academy is a collaboration between IVA and the New York Academy of Sciences. Young people from different countries work together in teams online to solve great societal challenges. The winners attend a ceremony in New York to receive their prize.

In 2019 an initiative was launched to encourage Swedish youth to apply. It was a success – 68 of the applicants accepted came from Sweden. This represents the most accepted applicants per capita of all the participating countries. Maja Neiman, Project Manager, has received many responses from participants and their parents.

“I’ve received reports on the work being done by the teams from the young people themselves and their parents. One father wrote that he was happy to see his daughter and her teammates really having fun.”

The challenges the teams were asked to work on in 2019 were Space, where they were tasked with creating a framework for and designing a self-sufficient colony for humans on the moon, and Intelligent Homes & Health. In this category, two Swedish girls were part of the winning team that included teenagers from Australia, the Philippines and the USA.

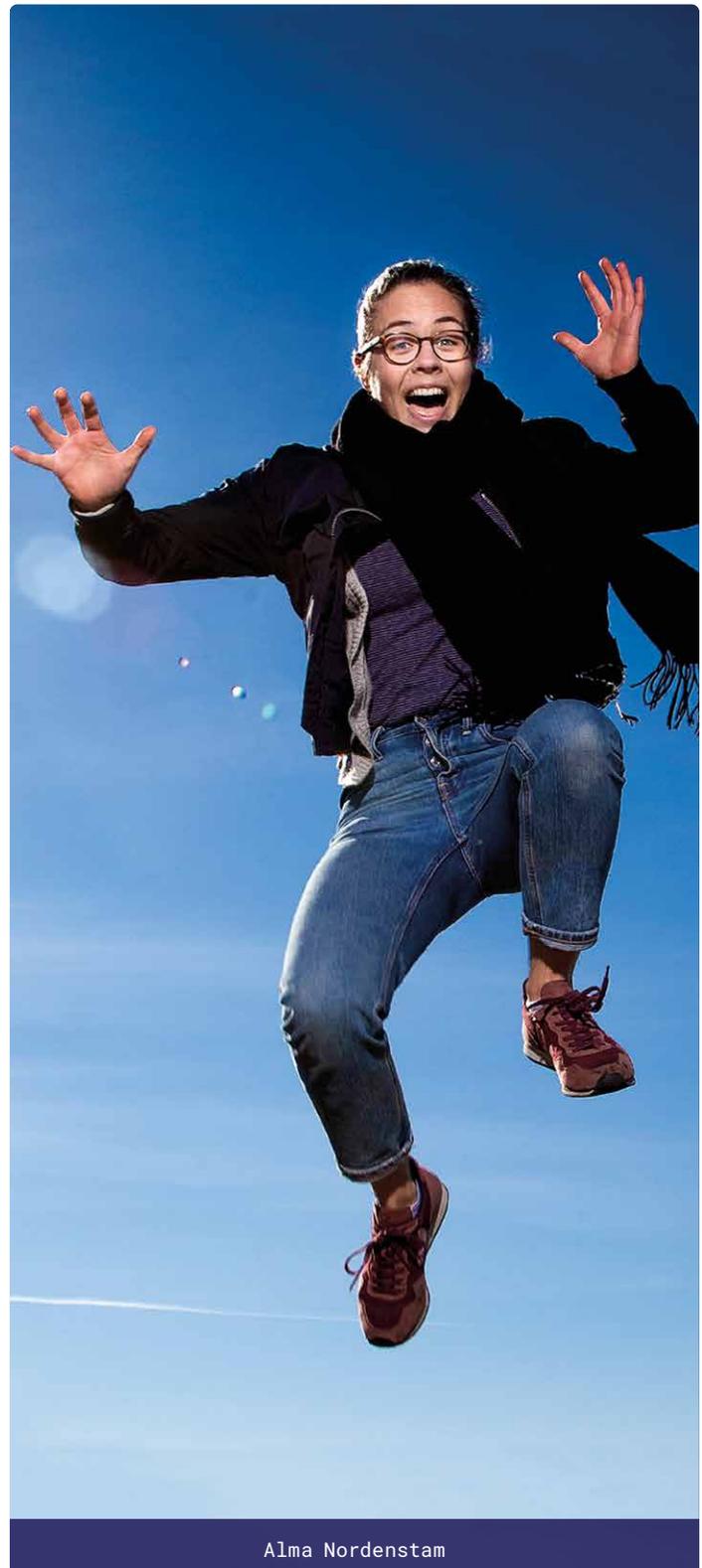
In explaining its selection, the jury pointed out that the team’s solution, called HealthSync, shows an understanding of the complexity of the significant challenges that health systems are facing, with a focus on prevention as a critical success factor. The jury also noted that the members of the winning team are already thinking about the complex systems that engineers of the future will be working on.

Up to now the members of the winning team have only interacted over the web. But in July 2020 they will meet each other in person in New York to receive their prize.

ABOUT JUNIOR ACADEMY

The competition, which is entirely web-based, is for young people all around the world between the ages of 13 and 18. The teams are supported in their work by mentors and experts.

Project Manager: Maja Neiman.



Alma Nordenstam

Focus on learning in Washington



Amelie von Zweigbergk, France A. Córdova, Anna Nilsson-Ehle

On 14–15 October IVA, in cooperation with the National Academy of Engineering and the Embassy of Sweden in Washington D.C., organised a jubilee seminar and a reception at House of Sweden.

Members of both academies alongside many participants from universities, public agencies, the diplomatic corps and various organisations gathered for the activities on 14 October. The reception, which included speeches and discussions, was opened by H.E. Karin Olofsdotter, Swedish Ambassador to the United States, Dr. John L. Anderson, President, National Academy of Engineering and Professor Tuula Teeri, IVA's President.

The themes for the full-day seminar on 15 October were life-long learning, how the education system has changed and how to attract underrepresented groups to higher education, especially in sciences, engineering and mathematics.

The speakers included Dr. France A. Córdova, Director, National Science Foundation; Dr. Anna Nilsson-Ehle, Chair, Vinnova (Sweden's innovation agency); Dr. Norman Fortenberry, Executive Director, American Society for Engineering Education; Dr. Henni Buckley, Associate Professor of Mechanical Engineering, University of Delaware; and Björn Åstrand, Umeå University, Inquiry Chair of the Swedish Government's national action for the teaching profession.



Jenni Buckley



Amelie von Zweigbergk, Christine Cunningham



Kyle Gibson



Camilla Mod er, Martin A. Wikstr m

INCLUSIVE LEARNING, EDUCATION AND WORK-FORCE DEVELOPMENT IN FUTURE SOCIETIES

ARRANGED BY: IVA, National Academy of Engineering and the Embassy of Sweden in Washington D.C.

DATE: 14-15 October 2019.

LOCATION: House of Sweden, Washington D.C.

PARTICIPANTS: John L. Anderson, Jenni Buckley, France C rdova, Christine Cunningham, Norman Fortenberry, Kyle Gipson, Okhee Lee, Eva Lundgren, Camilla Mod er, Anna Nilsson-Ehle, Karin Olofsdotter, Bill Rouse, Tuula Teeri, Martin A. Wikstr m, Amelie von Zweigbergk, Bj rn  strand.

1995



Doctor **Kurt Östlund**, a veterinarian, becomes IVA's President. The economy is weak. Programmes are cut back and reorganised. A new strategy is produced with a clear focus on societal development.

1996

The Environmental Council is formed to promote debate about the environment. The target group consists of decision-makers in the private sector, politics and education.

1997



LIGHTYEAR IGNITED

The idea is to promote renewal of business and industry for 18 months through nationwide "challenges." The Ministry of Enterprise and around 30 organisations support the project.

1998

Connect is launched and involves voluntary initiatives to support entrepreneurs. The idea comes from a field trip to California. The project becomes independent after seven years.



FOCUS ON THE FUTURE
The **Technology Foresight project** with eight themed panels is launched. The focus is on the coming decades.



2003



DEREGULATION ANALYSIS

The project **Collaboration for Growth** analyses what happens to R&D in deregulated markets. The focus areas are telecommunications, energy, the railway and defence.

2002

The Engineer of Tomorrow project is launched aimed at producing proposals to make Sweden the leading European nation in engineering education.

2001



Professor **Lena Treschow Torell** leaves her position as Research Director at the European Commission to become IVA's President.

2000



Sigrun Hjelmquist takes over as Chair of the Business Executives Council. She launches breakfast meetings to be attended by successful business leaders.

1999



Enrico Deiacco, who was formerly Secretary to the Academy, is appointed as acting President.

2004

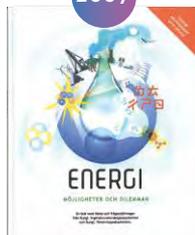


NOTHING VENTURED, NOTHING GAINED
Healthy Successful Companies – 3F, a five-year initiative is launched. Professor **Gunn Johansson** is Project Director.

2005

Elkrafteringen is launched and its name is later changed to **Power Circle**. The programme receives government support and is gradually expanded. Which sectors will bring growth? How do we increase competitiveness in business and industry? The project **Industry and Enterprise of the Future** finds out.

2007



WELL-RECEIVED TEXTBOOK

The textbook **Energy – Possibilities & Predicaments** is produced by IVA and KVA. The book is very well-received by schools and several new editions are published.

2008



Associate Professor **Björn O. Nilsson**, previously at Biovitrum, is the new President.

2008

Energy Crossroads is launched. The goal is to produce a forward-looking and fact-based body of information with and for politicians in the Government and the parliament.



ALMEDALEN PREMIERE

Three seminars are arranged and the participants include Minister for Enterprise and Energy, Maud Olofsson.

2009

Innovation for Growth is launched. The results are to be presented on an ongoing basis rather than only in a final report. Motto: From words to actions.



The Business Executives Council focuses on service companies. A special initiative for this is launched. **Marie Ehrling** chairs the initiative.

2010



Prince Daniel's Fellowship is launched and begins an inspiration tour of schools and universities.

IVA North is added as another regional hub.



TEKNIKSPRÅNGET TAKES ITS FIRST STEPS

19 April Minister for Education Jan Björklund launches the **Tekniksprånget** internship programme at a press conference in the Government's Rosenbad building.

2012

Efforts to improve Sweden's competitiveness through innovation continue through the project **Innovation Powerhouse Sweden**.

Energy efficiency is in focus in a multi-year project called **An Energy Efficient Society**.

2011

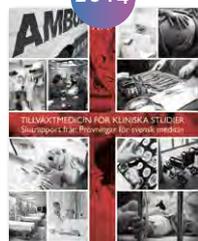
INNOVATION PLAN SWEDEN

The **Innovation for Growth** project presents Innovation Plan Sweden to Annie Lööf as she makes her first appearance as Minister for Enterprise.



2013

The **Wallenberg Auditorium** is reopened after a year-long total renovation.



The project **Trials for Swedish Medicine** presents its final report.

The **Attractiveness for Sustainable Growth and Resource Efficient Business Models** projects are launched.

2014

Jobbsprånget, an internship programme that gives graduates who have recently arrived in Sweden a chance to enter the labour market, is supported by both the Government and the Wallenberg Foundation.



2016

2017



Professor **Tuula Teeri** is IVA's new President. She had previously served as President of Aalto University in Finland.

2019



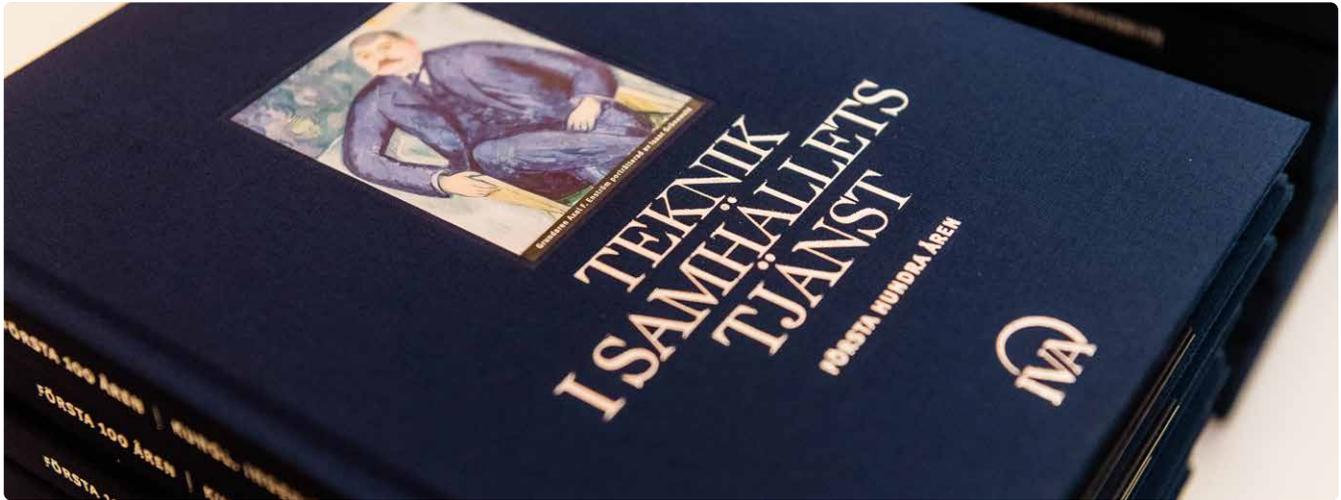
Kungl. Ingenjörsvetenskaps Akademien

A new strategy is adopted for the period up to 2025. The themes are: World-Class Knowledge, Industry and Enterprise of the Future, Climate-Resources-Energy and People-Technology-Society.

Multiple jubilee activities are arranged and new projects are launched during the anniversary year.

2019

Book on IVA – the first 100 years



The jubilee book entitled *Teknik i samhällets tjänst (Engineering in the Service of Society)* presents key individuals, events and buildings from IVA's 100-year history.

However, according to one of the book's authors, Arne Kaijser, speaking when it was launched in August, even fourteen essays, short articles, paragraphs and a treasure trove of images from the past and present do not tell the whole story.

The authors of the book – all scholars of the history of engineering – focused on events and developments and, in particular, described individuals who have played an important role in society and for IVA.

Axel F. Enström, the Academy's first President, is one of those portrayed.

"I became fascinated with the link between IVA's founding and the electrification of Sweden. At that time – the beginning of the 20th century – it wasn't clear that our country would become an industrial nation. We didn't have coal, but we did have plenty of water power," said Gunnar Wetterberg, who took an in-depth look Axel F. Enström's achievements and significance.

Energy, like research and research policy, has been an important theme for the Academy ever since 1919. At the end of the

1960s the Government took over full responsibility for funding engineering research. That was a bit disconcerting for the Academy, according to Sverker Sörlin, who describes IVA's process of exploring future scenarios in his essay.

"Previously we considered ourselves stewards of the future. Now the relationship is more relaxed," he said, adding that things have not always gone the way IVA wanted them to.

"Several of our big initiatives never took off, but when IVA works in collaboration with others, it's a success," says Sverker Sörlin.

ABOUT THE JUBILEE BOOK

Teknik i samhällets tjänst – första hundra åren (Engineering in the Service of Society – the first 100 years) was published as part of the Academy's 100th anniversary celebration.

Contributing authors: Mats Benner, Ylva Hasselberg, Anders Houlitz, Thomas Kaiserfeld, Arne Kaijser, Ingemar Pettersson, Ulrika Sax, Daniel Svensson, Sverker Sörlin, Gunnar Wetterberg, Nina Wormbs.

Editors: Arne Kaijser, Lars Nilsson.

MPs get a dose of technology

A quarter of the 349 members of the Swedish parliament got together to chat and listen to a speech about technology at the annual gathering of IVA and the Society for Members of Parliament and Researchers (Rifo) one evening in November. The parliamentarians with Speaker Andreas Norlén and Rifo's Chair Betty Malmberg (M) listened to Tuula Teeri talk about progress in research and technology and applauded to express their gratitude.

Betty Malmberg pointed out that the Academy's origins can be traced back to bills passed within the parliament before IVA was formed. The parliament had, however, envisioned a different solution than an academy, but added: "Who can complain when the results have been so good?"

ABOUT THE SWEDISH SOCIETY FOR MEMBERS OF PARLIAMENT AND RESEARCHERS (RIFO)

Rifo is a forum for contact and dialogue between members of the parliament and researchers. Members of parliament and researchers involved in public or private research can become members. Rifo has around 600 members, 100 of whom are members of parliament.

Chair: Betty Malmberg (M).



Tuula Teeri, Andreas Norlén



Digitalisation for Increased Competitiveness

In March the *Digitalisation for Increased Competitiveness* project released its final report. The report presents analysis and proposals for digital infrastructure, security, talent, integrity and industrial platforms for increased Swedish competitiveness. One of the proposals is for a new coordination role at the Government Offices. The project involved numerous politicians and representatives from public agencies, the public and private sectors and the research community. They all contributed to nuanced and insightful discussions on the changes that digitalisation is bringing about. The challenge was to highlight the many positive effects of digitalisation while not forgetting the more problematic aspects. IVA will continue its focus on digitalisation in 2020. The Project Manager was Per Hjérten and the Chair of the Steering Committee was Jan Nygren.

Sweden's image important in fight for talent

»The problem of finding housing makes people think twice about moving here.«

Magdalena Gerger

Watch the full seminar
at IVA's website:



Knowledge about Sweden is low internationally – but on the plus side, Sweden has a lot going for it in the hunt for international talent. James Savage is CEO and publisher of The Local, an English-language website that reports news about Sweden. He has taken a closer look at how we're perceived in other countries.

"In general the image of Sweden is a bit vague," he said at a Business Executive Council jubilee seminar.

The Local's readers think the country is innovative and people have a good work-life balance. The fact that all Swedes speak English is a bonus. The public sector is efficient, particularly the Tax Agency. Our flat organisational structures are considered to have both advantages and disadvantages. Examples of the latter are that it's hard to make a career and there are bureaucratic issues. The Swedish Migration Agency's long waiting times are evidence of this. According to The Local, since 2000 the influx

of labour from EU countries has tripled, doubled from the OECD area and increased five-fold from the BRIC countries.

"Sweden's employers should be better at identifying and embracing talent," said James Savage.

Magdalena Gerger, CEO of Systembolaget, is the Business Executives Council's new Chair. She also believes we should make better use of talent from other countries.

"The problem of finding housing makes people think twice about moving here," she said.

Despite this, she thinks the Swedish private sector is attractive. Investment in employees and flexibility are examples of the reasons for this.

"We are also good at working across organisational boundaries. Interplay between politics, academia and industry is another benefit."



**SWEDEN AND TALENT
– DESTINATION OR DEPARTURE GATE?**

ARRANGED BY: Business Executives Council.

DATE: 29 November 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Johan Carlstedt,
Magdalena Gerger, Peter Larsson, Maria Rankka,
James Savage, Martin Wikström.

Five areas in focus for circular business models and resource effectiveness

The participants in the project *Resource Effectiveness and the Circular Economy* have worked to find ways to make material flows more efficient and to promote a circular economy. The project has focused on: mobility, facilities, food, textiles and plastics. Hundreds of individuals have been involved. The reference groups included politicians and representatives from the financial sector.

Åke Svensson was Chair of the Steering Committee.

“Swedish industry has been taking a resource-efficient approach for a long time. Now it’s time to develop business models that are non-linear. This will create opportunities to improve competitiveness internationally” he says.

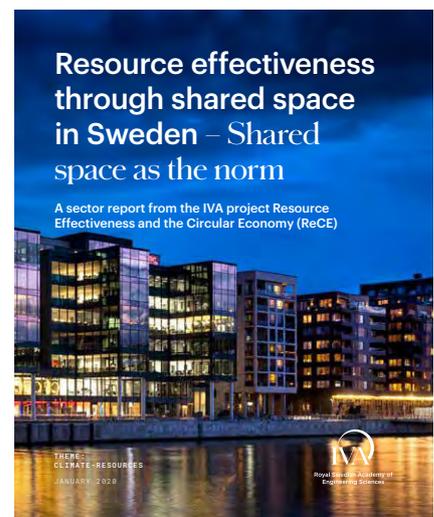
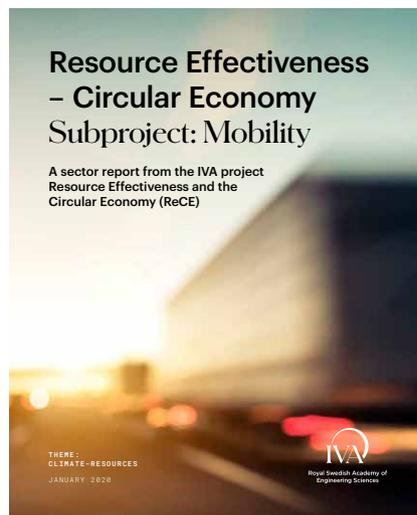
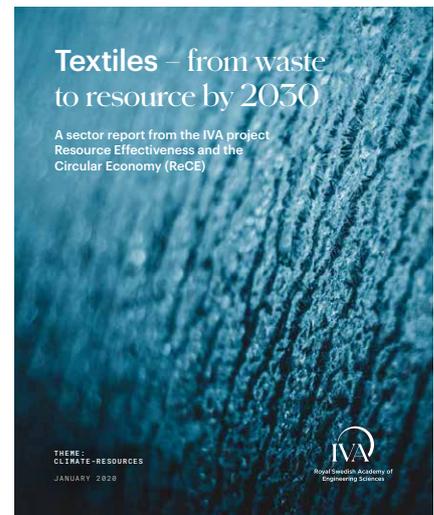
ABOUT RESOURCE EFFECTIVENESS AND THE CIRCULAR ECONOMY

The project’s goal is to create a platform for resource effectiveness and the circular economy.

The work was carried out by five groups focusing on the themes: mobility, facilities, food, textiles and plastics.

Chair of the Steering Committee: Åke Svensson.

Project Managers: Caroline Ankarcróna and Jan Nordling.



New materials challenge today's product design



Jari Kinaret

The development of materials has had a profound impact, dramatically changing the way people live their lives – from the Bronze Age and the Iron Age to today when 3D printers are printing materials with built-in sensors.

The new materials and processes are challenging today's product design. There are more and more ways to reduce the weight of products and more of them are being electrified. Demand for metals for batteries is also growing and it is increasingly important to find the most efficient ways to recycle them.

These themes were addressed at a jubilee seminar arranged by IVA's Mining and Materials division. In a packed Wallenberg Auditorium the seminar participants met both Swedish and international researchers and industry representatives.

MATERIALS ARE DEVELOPMENT – INDUSTRY, SUSTAINABILITY AND SOCIETY

ARRANGED BY: Mining and Materials division.

DATE: 15 May 2019.

LOCATION: Stockholm, IVA.

PARTICIPANTS: Annika Borgenstam, Jari Kinaret, Kerstin Konradsson, Charlie Kuehmann, Gert Nilson, Vincenzo Palermo, Martin Pei, Tresa Pollock, Roger Reed, Olle Wijk.

Meetingplace for researchers and businesses



Ibrahim Baylan, Sweden's Minister for Business, Industry and Innovation

The Research2Business project started publishing its annual 100 List in 2019 to highlight research with commercial potential taking place at Sweden's universities. The theme in 2019 was digitalisation.

The List focuses attention on current research and makes it easier for researchers and businesses to find each other and together create innovation and new commercial opportunities.

The research projects on the first 100 List presented in March all have commercial potential and relate to digitalisation. By building bridges between the research and business communities, research results with the capacity to change the world have a better chance of being turned into actual benefits and of making Sweden more competitive.

In 2019 more than 300 research projects were registered. The

nominated proposals were examined by an expert team and then reviewed by a selection committee. The final decisions on which projects would make the list were made by the project's Steering Committee. 67 projects were selected to be part of the R2B Summit on 20 March.

At the event, researchers presented their projects, shared their knowledge and experiences and formed new contacts with business representatives. Hot topics around digitalisation, competitiveness and cooperation were at the top of the agenda.

The speakers included Anita Schjöll Brede who runs AI company Iris.ai, Professor Amy Loutfi from Örebro University and Darja Isaksson, Director General of Vinnova.

Sweden's Minister for Business, Industry and Innovation, Ibrahim Baylan, was a guest at the R2B Summit and presented the Government's view of how Sweden is equipped for digitalisation.



ABOUT RESEARCH2BUSINESS

Research2Business (R2B) is a 10-year initiative to promote cooperation between researchers, the private sector and society. The goal is to improve Sweden's international competitiveness and sustainable development.

Chair of the Steering Committee: Marianne Dicander Alexandersson.

Project Manager: Malin Mohr.

Hudiksvall trio win prize for smart hay packaging



Line Skoglund, Soline Andersson and Liv Krantz from class 8 at MTH Utbildning, a school in Hudiksvall, took home the prize in IVA's E-battle competition for students ages 13–16 with their "Smart Hay" business idea, a practical solution for packaging hay in the stable. According to the jury, in their solution the girls combine their favourite hobby with enterprise. The students won SEK 30,000 for their class and at the end of November travelled to Stockholm for a visit and to receive their prize. The Hudiksvall girls' road to success was via one of the five regional competitions in which 200 classes from schools throughout Sweden participated. All of the regional winners shared a strong focus on sustainability.

ABOUT E-BATTLE

The purpose of E-battle (*E-kampen*) is to give students ages 13–16 the chance to spend two days learning about entrepreneurship. E-battle is also a competition where the winners are rewarded with SEK 30,000 in prize money for their class.

This was the competition's second year.

E-battle is organised by IVA and STARTcentrum.

Project Manager: Johan Carlstedt.

Telecom cluster and cutting edge research in the south



Mikael Eriksson

Cutting edge research in a range of areas is taking place in Sweden's southern county of Skåne. At a jubilee seminar two areas were in focus: the strong telecom cluster and world-leading research infrastructure in the form of MAX IV and ESS.

For two days 115 seminar participants heard from experts from academia and industry who explored several aspects of communication technology of the future. Researchers also talked about how MAX IV and ESS are helping to advance the front lines of research in areas such as energy, forestry, life science and food. The participants toured MAX IV with an expert guide, Mikael Eriksson, the legendary creator of the first MAX facility in Lund.

A jubilee seminar without a festive dinner? Not an option in Skåne. The many guests at the dinner were welcomed by IVA President Tuula Teeri and Chair of IVA South, Per Eriksson.

TECHNOLOGY FOR THE GREAT SOCIETAL CHALLENGES

ARRANGED BY: IVA South.

DATE: 8–9 October 2019.

LOCATION: Lund, Medicon Village.

PARTICIPANTS: Ove Edfors, Per Eriksson, Björn Ekelund, Mikael Eriksson, Jesper Harholt, Hanna Isaksson, Peter Karlsson, Thomas Laurell, Sven Lidin, Cecilia Nebel, Linda Persson, Mats Qvarford, Lars Samuelson, Ola Svedin, Daniel Söderberg, Tuula Teeri, Björn Walse, Viktor Öwall.

Climate and talent in focus in Almedal

During Almedal Week IVA attracted large audiences at seminars covering topics such as the talent supply, the climate and resource use, as well as the business community's links to research.

Tekniksprånget, which arranges engineering internships for young people, was another focus area. The programme has had good results.

The Government's commission on governance of universities was discussed. One problem highlighted was the fact that the commission had not made more progress on the issues of innovation and collaboration.

One of the seminars addressed industrial platforms and digital collaboration. Darja Isaksson, Director General of Vinnova, talked about the need for common IT architecture. The IVA Student Council launched its campaign under the heading "My promise to the climate and the planet." The next 100 leaders of today and tomorrow made their promises and were photographed with them.

ABOUT ALMEDAL WEEK

IVA has participated in Almedal Week since 2009. The Academy is able to strengthen its network through the seminars and meetings it organises. Topical issues are addressed and discussed, particularly those relating to IVA's projects. Many IVA members participate in activities arranged by other organisations as well.

Project Manager: Anna Lindberg.



Ibrahim Baylan, Johan Svenningsson, Tuula Teeri



Eva Lundgren, Inger Ashing



Carina Håkansson, Andreas Regnell



Janine Alm Ericson, Cecilie Tenfjord-Toftby, Hampus Hagman, Johan Hultberg, Patrik Engström, Birger Lahti



Karin Byman

Elevated with technology in the cloud



Each year 40,000 people participate in a total of 2,600 meetings at the IVA Conference Centre. Many seminars and meetings are organised by IVA itself, but the majority are arranged by other organisations, companies and individuals.

The IVA building was constructed at the end of the 1800s, which is plain to see in the well-preserved Banquet Hall. But something quite different distinguishes the Wallenberg Auditorium and the other conference rooms today.

“We have a very high standard of technology in all of our conference rooms. The new huge LED screen in the Wallenberg Auditorium provides us with a lot of possibilities,” says Fredrik Adamsson, a technician at the Conference Centre.

The technology making the biggest difference is the video conferencing system in all of the rooms. Good screens and microphones in the ceiling make it easier to be seen and heard wherever you are.

“Video conferencing has been around for a long time, but there has been fast development on the software side. We use an entirely cloud-based system and it provides great flexibility.”

Participants who can't be at Grev Turegatan in person can easily connect via phone, tablet or computer. No special soft-

ware is needed because it is in the cloud and launches through a link to the meeting.

“IVA uses videoconferencing a lot because we have members throughout Sweden and in many other countries. The new technology is easy and reliable. With this quality and reliability I'm convinced that it will be used increasingly by speakers who can't physically be here. The challenge is to create an environment that is more interesting to watch than a speaker looking down at a computer screen. We're happy to help with that as well,” concludes Fredrik Adamsson.

ABOUT THE IVA CONFERENCE CENTRE

At Grev Turegatan there are 10 conference rooms of various sizes and a large Banquet Hall in a style dating back to the turn of the last century.

At IVA Conference Centre around 2,600 meetings are held every year with some 40,000 guests – ranging from breakfast meetings, seminars and AGMs to training and courses. Food and beverages are served in cooperation with the Grodan restaurant which is in the same building.

Conference Director: Charlotta Svedberg.



Tekniksprånget

Through *Tekniksprånget* young people throughout Sweden get the opportunity to test a career in engineering through a paid four-month internship. The idea is to inspire young people to study for an engineering degree by giving them a better idea of what to expect after graduation. About 200 employers are participating in the programme, offering internships in 100 locations all around Sweden. The results are good:

- 50 percent the interns are women. 50 percent go on to study for an engineering degree.
- 60 percent of the young people applying to *Tekniksprånget* say they have reservations about studying for an engineering degree.
- 80 percent of those who completed a *Tekniksprånget* internship in one of the first four terms state that they are now studying or intend to study for an engineering degree or another technical degree.
- 75 percent of the interns who go on to study engineering consider the internship to have influenced their decision.

Head of *Tekniksprånget*: Alexandra Ridderstad.

Annual Meeting







Peter Wallenberg Jr



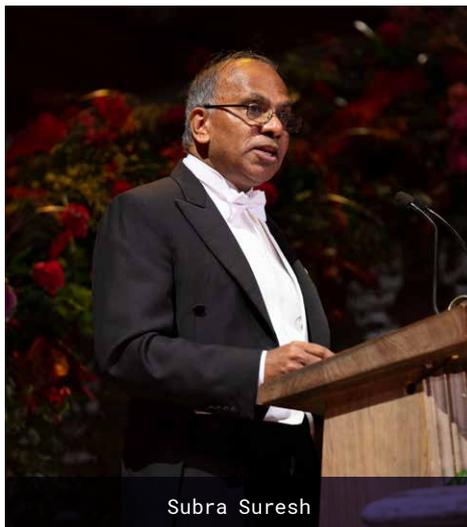
Gunnar Wetterberg



Helena Norlén, Andreas Norlén



Elin Malmsköld, Max Tegmark



Subra Suresh



Martin Lorentzon,
Tara Derakshan

Medals, a banquet and mingling

The world's first engineering sciences academy celebrated its 100 years in existence with an Annual Meeting in Aula Medica in Solna and a banquet at Stockholm City Hall.

As per tradition there were speeches, Gold Medals were awarded, a commemorative booklet was presented and the guests enjoyed dinner and a chance to mingle.

In his speech, IVA Chair Carl-Henric Svanberg made connections to the Academy's long history:

"Today Sweden is in an era of entrepreneurship – and it was the same 100 years ago. We got the separator, the three-phase electric power system and ball bearings – and many of the so-called "genius enterprises" are still with us today.

Since 1921 it has been the Academy's tradition to award Gold Medals. The 2019 Gold Medallists were Hans Dalborg, Lena Olving, Max Tegmark and Spotify duo Martin Lorentzon and Daniel Ek. The annual address on *Progress in Research and Technology* was given by Tuula Teeri, the Academy's 10th President. The audience got a surprise when her speech was unexpectedly started by Axel F. Enström, IVA's first President, who stepped onto the stage as a hologram to say a few words.

"The image of engineers as creators of prosperity – which he described in his speech in late autumn 1939 – is just as relevant today," said Tuula Teeri.



Carl XVI Gustaf, Hans Dalborg



Anna Ekström

ABOUT THE ANNUAL MEETING

The Annual Meeting of the Academy is always held on the last Friday in October. The Chair opens the meeting and gives an account of the Academy's activities. As per tradition, deceased members are remembered. One individual is memorialised for meritorious achievements further back in time. New members are welcomed and the Academy's medals are presented. The President holds a speech under the heading *Progress in Research and Technology*. The Chair closes the meeting and the evening is rounded off with a banquet, entertainment and dancing.

Project Manager: Anna Lindberg.

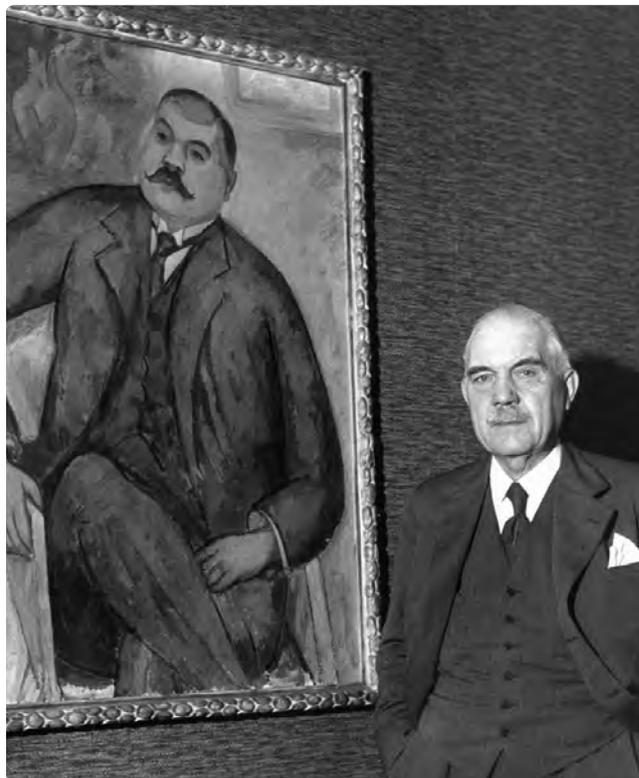
Axel F. Enström, IVA's founder

Axel F. Enström was IVA's first president. With his charisma and position at the centre of the engineering network he dominated the first 25 years of IVA's history. He was the face of IVA while others took care of day-do-day activities.

Enström was one of the first batch of students to graduate in 1894 from the Royal Institute of Technology's new school of electrical engineering. His choice of career put him at the centre of the great electrification revolution in Sweden. Electrical engineers were at the cutting edge of the new future. Enström and a team of colleagues would play a dominant role in Sweden's industrial and economic development in the decades to come. As a consulting engineer he would work on a number of new technological developments, but the work that would have the greatest significance over time was done when Enström served on government commissions and committees. Back in 1901 he was asked by the Board of Trade to provide expert advice and the following year he was appointed to assist on a special committee for a proposed bill on electrical installations. Over the years Enström built up a network of contacts which included several influential members of the parliament.

Meanwhile, a lot of hope was pinned on hydropower and electricity for the fast industrialisation of Sweden. The most important source of energy was coal, which dominated the entire Swedish import system at the beginning of the 20th century. WWI broke out in 1914 bringing the energy issue to a head. The blockades meant that other energy sources had to be found and the electrification of Sweden was accelerated. The energy supply became one of the main economic issues of the day. 64 members of the parliament got behind a fuel policy bill in 1916. The idea was to create a "permanent, practical scientific institution" to promote a national energy policy.

Axel F. Enström was assigned to write a response to the bill proposal. In 1917 he gathered around 20 industrialists, researchers and engineers at a meeting to address a broader notion "creating a Swedish engineering sciences academy." The proposal fell on fertile soil and an "academy inquiry commission" was formed. The commission also started to raise funds for a foundation for the academy. In 1918 the Board of Trade wrote to the King to propose that the Government establish the academy. A bill was presented in June 1919, the Government established the



statutes in June, appointed the first academy members in August and on 24 October 1919, approved the election of the Chairman and Vice Chairman as well as the appointment of the President. Even before all of the decisions had been made, Enström had secured premises for the Academy using funds raised to take over the shares in a property company with a building on Grev Turegatan. IVA was able to move into the second floor immediately after the Academy was established.

The rest is history – a 100-year history in the service of society.

ABOUT THE COMMEMORATIVE BOOKLET

Every year IVA publishes a Commemorative Booklet to honour a person who has made a significant contribution to society in the areas of engineering sciences, technology, economics or industry. The honourees were born at least 100 years ago. The Commemorative Booklet is published in conjunction with the Annual Meeting at which the individual is honoured in a commemorative address. The 2019 Commemorative Booklet was written by historian and author Gunnar Wetterberg.

The Gold Medallists of 2019



Hans Dalborg, PhD Econ., received IVA's Great Gold Medal for his achievements in developing the Swedish financial sector and the Swedish model for corporate governance, in combination with his commitment to social issues involving significant contributions to research and culture.

Four deserving individuals were awarded IVA's Gold Medal:

Daniel Ek, Chairman and Martin Lorentzon, D.Eng h.c., for creating the company Spotify which has fundamentally changed the music industry and put an end to music piracy. As innovators and entrepreneurs, they have built what may be the only European tech company to succeed in competing with Chinese and American giants.

Lena Olving, MSc Eng., for her achievements as an innovator and leader of successful businesses at the front lines of technology. Her progressive and ground-breaking leadership makes her a role model for leaders of technically advanced companies in a global market.

Professor Max Tegmark for his contributions to our understanding of humanity's place in the cosmos and the opportunities and risks associated with artificial intelligence. He has courageously tackled these existential questions in his research and, in a commendable way, succeeded in communicating the issues to a wider public.

NOBEL LAUREATE PAYS A VISIT

Akira Yoshina, 2019 Nobel Laureate in Chemistry, visited IVA in connection with the Nobel festivities in December. He was the keynote speaker at a seminar on the future of battery technology and ecosystems. Akira Yoshina is usually described as the father of lithium-ion batteries. Although he shared the Nobel Prize with the two American researchers, Stanley Whittingham and John Goodenough, who laid the foundation for the technology, it was Akira Yoshina who in 1985 created the first commercially viable lithium-ion battery. The first batteries came out on the market in 1991 and got their breakthrough in consumer electronics. Today the batteries can be found in, for example, electric cars. This is the second time Akira Yoshina has visited the Academy. He was a guest back in 2013.



IVA Documentation 2019

A from 31 December unless otherwise stated. Division affiliation is noted in parentheses.

THE EXECUTIVE COMMITTEE

Carl-Henric Svanberg (VI),
Chair of the Academy 2018–2020
Cecilia Hermansson (IX),
Vice Chair 2019–2021
Pia Sandvik (XI), Vice Chair 2018–2020
Johan Sterte, (IV), Vice Chair 2018–2020
Hand Stråberg (I), Vice Chair 2017–2019
Eva Hamilton (VI), Business Executives
Council Chair 2016–2019
Tuula Teeri (IV), President of the
Academy 2017–2023
Adjunct member: Anna Adolfsson,
Chair of IVA's Student Council

Elected member of the Executive Committee from 1 January 2020

Magdalena Gerger (VI), Chair of the
Business Executives Council 2020–2022
Magnus Hall (VIII), Vice Chair 2020–2022

THE ADVISORY COUNCIL

The Advisory Council includes the Chair of the Academy, the chairs or vice chairs of the Academy's divisions, chairs of the regional networks and IVA's President. The Secretary to the Academy as well as the chairs of the Business Executives Council and the Industrial Research Committee are also called upon to attend meetings.

Carl-Henric Svanberg (VI), Chair
Tuula Teeri (IV), President
Johan Weigelt, Secretary to the Academy

Division chairs

Monica Bellgran (I)
Birgitta Resvik (II)
Jonas Eliasson (III)
Martin Malmsten (IV)
Gert Nilson (V)
Sofia Börjesson (VI)
Sophia Hober (VII)
Lena Ek (VIII)
Anders Lindberg (IX)
Stefan Ståhl (X)
Peter Larsson (XI)
Staffan Truvé (XII)

Chairs of IVA's regional sections

Per Eriksson (XI), IVA South
Erik Höglund (I), IVA Nord
Marianne Dicander Alexandersson (VI),
IVA West

Chairs of IVA's Business Executives Council (BEC) and Industrial Research Committee (IRC)

Eva Hamilton (VI), BEC
Peter Holmstedt (I), IRC

Chairs of IVA's Theme Councils

Maria Anvret (X), World-Class
Knowledge
Karl Bergman (II),
Climate–Resources–Energy
Carola Lemne (VI), Industry
and Enterprise of the Future
Åsa Söderström Winberg (III),
People–Technology–Society

MEMBERS

The Academy has 963 Swedish
members and 264 international
members.

Elected members in 2019

Mats Rahmström (I), President & CEO
Atlas Copco Group
Catharina Tunberg (I), General Manager
Shared Technologies, Assa Abloy AB
Klas Wåhlberg (I), Director General,
Association of Swedish Engineering
Industries
Elna Holmberg (II), Vice President
Volvo Group Electromobility
Andreas Regnell (II), Senior Vice
President, Strategic Development,
Vattenfall AB.
Lena Erixon (III), Director General,
Swedish Transport Administration
Svante Hagman(III), MSc Bus. Econ.
Jan Jörmark (III), Associate Professor,
University of Gothenburg School of
Business, Economics and Law
Staffan Asplund (IV), Global RD&I
Director, Nouryon, Surface Chemistry
Mats Larhed (IV), Professor,
Uppsala University
Magnus Nydén (IV), Chief
Scientist, Nouryon
Eva Pétursson (V), Executive
Vice President, Research and
Innovation, SSAB
Pontus Sjöberg (V), Managing
Director, Swerim
Signhild Arnegård Hansen (VI),
Chair, Svenska Lantchips AB
and Utah Chips Corporation
Jan-Olof Jacke (VI), Director General,
Confederation of Swedish Enterprise
Anne Lidgard (VII), Director, Vinnova
Erik Lindahl (VII), Professor,
Stockholm University/KTH,
Science for Life Laboratory
Johan Åkerman (VII), Professor,
University of Gothenburg

Peter Berg (VIII), Director,
McKinsey & Company
Marie Johansson (VIII), Professor,
Linnaeus University and Senior
Researcher, RISE
Johan Eklund (IX), Managing
Director, Entrepreneurship Forum
Lena Hagman (IX), Senior Economist,
Association of Swedish Engineering
Industries
Per Josefsson (IX), entrepreneur,
owner, Brummer & Partners
Eva Mörk (IX), Professor,
Uppsala University
Mai-Lis Hellenius (X), Professor,
Karolinska University Hospital
Roger Johanson (X), Founding
Partner, Carneo Alternative Solutions
Martin Gren (XI), Founder
and board member, Axis AB
Sylvia Schwaag Serger (XI), Professor
and Pro Vice-Chancellor, Lund University
Erik Elmroth (XII), Professor, Department
of Computing Science Umeå University
Fredrik Heintz (XII), Lecturer, Associate
Professor Linköping University
Robin Teigland (XII), Professor,
Chalmers University of Technology

Elected international members 2019

Björn Birgisson, Professor
Texas A&M University, USA
Magnus Egerstedt, Professor
Georgia Institute of Technology, USA
Kari Jordan, Chair Outokumpu Oyj,
Finland
Casper von Koskull, President
and CEO Nordea, Finland
Junbai Li, Professor, Chinese
Academy of Sciences, Beijing,
China
Anders Petersson, Partner,
IK Investment Partners GmbH,
Germany
Caterina Petrillo, Professor, Dept.
of Physics and Geology, Perugia
University, Italy
Yongqi Lou, Professor,
Tongji University, China

Deceased members 2019

(Year elected in parentheses)
Sven Axsäter (VI, 1994), Professor,
Associate Professor
Holger Bohlin (VI, 1969), MSc Bus. Econ.,
Professor Arne Elmroth (III, 1990),
Professor, D.Eng, MSc Eng
Stig Ericsson (I, 1983), MSc Eng, Director
Bengt Eskilson (VI, 1994), MSc Eng
Bengt Hallström (X, 1984), Professor,
Lic. Eng.
Gunnar Hambræus (XI, 1970), Professor
Bjarne Holmqvist (VI, 2008), MSc Eng,
Director
Bengt Hultqvist (VII, 1972), Professor
Lars Högberg (VII, 1991), Former
Director General
Inge Johansen (Int, 1986) Professor
Hans Jørgen Larsen (Int, 1987), MSc Eng
Jan-Olov Liljenzin (IV, 1991), Professor
Per-Arne Lindqvist (V, 2000), D.Eng.,
Professor
Leif Nilsson (I, 1990), D.Eng., Ass. Professor
Nils J. Nilsson (Int, 1993), Professor
Bin Ning (Int, 2017), Vice-Chancellor,
Professor
Anders Nyrén (IX, 2011), Director
Ragnar Ohlson (X, 1976), Professor
Hans Rausing (IX, 1984), MSc Eng
Evelyn Sokolowski (VII, 1991), D.Eng.,
Associate Professor
Dirk Thoenes (Int, 1985), Professor, dr, ir
Director Gunnar Wessman (XI, 1984),
MSc Eng
Nils Åslund (VII, 1987), Professor
Gustaf Östberg, Lic. Eng., Professor
Emeritus (V, 1978 / XI, 1988)

IVA DIVISIONS

Division I: Mechanical Engineering

Monica Bellgran, Professor,
Chair 2016–2019
Per Grunewald, board member,
Vice Chair 2019–2021
Rikard Söderberg, Professor,
Vice Chair 2017–2019
Secretary: Ingrid Jansson, IVA
Number of members: 91

Division II: Electrical Engineering

Birgitta Resvik, Vice President,
Chair 2017–2020
Alf Isaksson, Programme Manager,
Vice Chair 2017–2019
Karl Bergman, Research Director,
Vice Chair 2017–2019
Secretary: Karin Byman, IVA
Number of members: 51

Division III: Building and Construction

Jonas Eliasson, Professor,
Chair 2019–2021
Kristina L Nilsson, Professor,
Vice Chair 2019–2021
Johan Woxenius, Professor,
Vice Chair 2017–2019
Secretary: Staffan Eriksson, IVA
Number of members: 80

Division IV: Chemical Engineering

Martin Malmsten, Professor,
Chair 2018–2020
Henrik Thunman, Professor,
Vice Chair 2018–2020
Ulrika Edlund, Professor,
Vice Chair 2019–2021
Secretary: Jan Westberg, IVA
Number of members: 81

Division V: Mining and Materials

Gert Nilson, D.Eng.,
Chair 2018–2020
Lars Hultman, Professor,
Vice Chair 2018–2020
Ingegerd Annergren, D.Eng.,
Vice Chair 2017–2019
Secretary: Elin Elliot, IVA
Number of members: 67

Division VI: Management

Fredrik Wirdenius, CEO,
Chair 2019–2021
Sofia Börjesson, Professor,
Vice Chair 2016–2019
Marcus Lindahl, Professor,
Vice Chair 2019–2021
Secretary: Malin Mohr, IVA
Number of members: 127

Division VII: Basic and Inter-disciplinary Engineering Sciences

Sophia Hober, Professor, Chair 2017–2019
Ann Louise Johansson, CEO,
Vice Chair 2017–2019
Fredrik Höök, Professor,
Vice Chair 2019–2021
Secretary: Per Hjertén, IVA
Number of members: 99

Division VIII: Forest Technology

Lena Ek, Board Chair,
Chair 2018–2020
Birgitta Sundblad, CEO,
Vice Chair 2017–2019
Jon Haag, Director,
Vice Chair 2018–2020
Secretary: Johan Weigelt, IVA
Number of members: 58

Division IX: Economics

Anders Lindberg, Board Chair,
Chair 2019–2021
John Hassler, Professor,
Vice Chair 2019–2021
Cecilia Hermansson, PhD Econ.,
Vice Chair 2018–2020
Secretary: Hampus Lindh, IVA
Number of members: 115

Division X: Biotechnology

Stefan Ståhl, Professor,
Chair 2017–2019
Lena Gustafsson, Professor,
Vice Chair 2017–2019
Magnus Lundberg, Board Chair,
Vice Chair 2018–2020
Secretary: Maja Neiman
Number of members: 64

Division XI: Education and Research Policy

Peter Larsson, Director of Social Policy,
Chair 2018–2020
Susanne Ås Sivborg, Director General,
Vice Chair 2018–2020
Hans Hentzell, CEO,
Vice Chair 2019–2021
Secretary: Martin Wikström, IVA
Number of members: 75

Division XII: Information Technology

Staffan Truvé, Research Director,
Chair 2017–2019
Ulf Wahlberg, MSc Eng,
Vice Chair 2019–2021
Jane Walerud, Entrepreneur,
Vice Chair 2017–2019
Secretary: Linda Olsson, IVA
Number of members: 69

REGIONAL SECTIONS

IVA North

Erik Höglund (I), Pro Vice-Chancellor,
Chair 2018–2020
Lars-Eric Aaaro (V), Director of Sales,
Vice Chair 2015–2019
Stina Blombäck (VIII), CEO,
Vice Chair 2018–2020
Secretary: Eva Lagerblad

IVA South

Per Eriksson (XI), Professor,
Chair 2018–2020
Sven Mattisson (II), Associate Professor,
Vice Chair 2019–2021
Judith Melin (VII), Doctor,
Vice Chair 2018–2020
Secretary: Jan Westberg, IVA

IVA West

Marianne Dicander Alexandersson (VI),
Board Chair, Chair 2019–2020
Sofia Börjesson (VI), Professor,
Vice Chair 2017–2019
Torbjörn Holmström (I), Director,
Vice Chair 2018–2020
Secretary: Gustaf Wahlström, IVA

Participants in IRC – IVA's Leadership Programme

Peter Holmstedt, Chair, 2014–2019
Niclas Andersson, BTG Process
Solution, 2018–2020
Anders Berglund, Scania CV AB,
2017–2019
Henrik Blomberg, Telia, 2018–2020
Catherine Boissier, AstraZeneca AB,
2019–2021

Lena Bruce, Sveaskog, 2017–2019
Dilip Chandrasekaran, Kanthal AB,
2019–2021
Jeanette Edblad, Ministry of Enterprise,
Energy and Communications, 2017–2019
Fredrik Edström, Drupps, 2018–2020
Elena Fersman, Ericsson, 2018–2020
Richard Furberg, Electrolux AB,
2019–2022
Olof Johansson, Swedish Transport
Administration, 2017–2019
Karin Johnson, RISE Processum AB,
2019–2022
Gustaf Kylberg, Vironova AB, 2019–2022
Sofia Lundberg, VTI-KTH Campus,
2019–2021
Jonas Mann, Atlas Copco AB, 2019–2021
Sandra Olivera Sánchez, Government
Offices of Sweden, 2019–2022
Per Sahlholm, Scania CV AB,
2019–2022
Ylva Strander, VINNOVA, 2019–2021
Anna-Maria Wiberg,
Vattenfall, 2018–2020
Maria Åstrand, Swerea
KIMAB AB, 2017–2019
Coordinator: Elin Elliot, IVA
Chair from 1 January 2020
Torbjörn Holmström (I), AB Volvo,
2020–2022

BUSINESS EXECUTIVES COUNCIL

237 companies, government agencies
and organisations were members of the
Business Executives Council in 2019.

Executive Body

Chair: Eva Hamilton (VI),
LKAB 2016–2019
Vice Chair: Håkan Dahlström,
board member, 2019–2021
Vice Chair: Maria Rankka (XI),
board member, 2019–2021
Lars Stugemo (VI), HiQ 2015–2019
Lena Olving (I), Mycronic 2018–2020
Mohammed Homman,
Vironova 2018–2020
Mikael Pawlo, CEO Red Flag,
2019–2021

Adjunct members

Fredrik Gustafsson, IVA's Business Executives Council Östergötland
Marc Hoffmann (IVA South)
Torbjörn Holmström (I), Volvo (IVA West)
Beatrice Kämpe Nikolausson, Linnéakademien
Lars Lindblom, Samarkand
Thomas Nilsson, NJT Konsult (IVA North)

Chair from 1 January 2020

Magdalena Gerger (VI), Systembolaget 2020–2022

SEMINARS AND MEETINGS

17 January in Karlstad

Smart Industry
– What are the opportunities?
Seminar – IVA's Smart Industry project

21 January in Stockholm

Jubilee Seminar: People, technology and business in the future transport system
Seminar – IVA's Mechanical Engineering division

23 January in Ludvika

Progress in Research and Technology 2018
Seminar – IVA's Business Executives Council and Samarkand

24 January in Lund

The model behind Ingvar Backhamre's and Tarkett's commercial success in the USA
Seminar – IVA South

25 January in Växjö

Progress in Research and Technology 2018
Seminar – IVA's Business Executives Council and Linnéakademien

29 January in Stockholm

How to capture carbon dioxide and store it in the ground
Seminar – IVA's Climate Crossroads project

31 January in Stockholm

Smart Industry – how SMEs are becoming more competitive
Seminar and award ceremony with IVA's Smart Industry project

5 February in Stockholm

STRUT report submitted to the Government – time for the next step
Seminar – IVA
Education and Research Policy division

8 February in Stockholm

Breakfast meeting with Lotta Lyrå
– Clas Ohlson 100 years – from mail order to meeting customers
IVA's Business Executives Council

12 February in Stockholm

AI – How are Sweden and Europe doing in a global perspective?
Roundtable – IVA's Electrical Engineering and Information Technology divisions

12 February in Lund

How has life on our planet been affected by the history of the solar system?
Seminar – IVA South

13 February in Stockholm

Innovation Procurement
– How far have we come?
Seminar – IVA's Building and Construction and Economics divisions.

14 February in Luleå

The lasagne model
– Is it robust enough for Norrbotten's digital infrastructure?
Seminar – IVA's Digitalisation for Increased Competitiveness project, Luleå Science Park and IVA North

21 February in Stockholm

Jubilee Seminar: Looking into the future and looking back on past predictions for the future
Seminar – Assembly of the Academy

3 March in Gothenburg

Field trip to Cellink, Chalmers University of Technology
Ventures, Zenuity and Na-kd with the mentoring programme
IVA's Prince Daniel's Fellowship project

4 March in Stockholm

Jubilee Seminar: Increased Digital Competitiveness – What does Sweden need to do?
Seminar – IVA's Digitalisation for Increased Competitiveness project

4 March in Stockholm

Field trip – SSE Business Lab
– Stockholm School of Economics and IVA's Prince Daniel's Fellowship project

6 March in Stockholm

Innovative environments
Workshop – IVA's Resource Effectiveness and the Circular Economy project

8 March in Linköping

Vera on Tour
IVA and Linköping University

15 March in Stockholm

Breakfast meeting with Kjell A Nordström Deglobalisation – the next trend?
IVA's Business Executives Council

15 March in Gothenburg

Vera on Tour
IVA and Chalmers University of Technology

20 March in Stockholm

R2B Summit 2019
IVA's Research2Business project

20 March in Gothenburg

Mechanical engineers make the world better and our existence smarter
Seminar – Chalmers University of Technology in cooperation with IVA Mechanical Engineering division

20 March in Västerås
Field trip to ABB Industrigymnasium
and Mälardalen University
IVA's Prince Daniel's Fellowship project

26 March in Gothenburg
Digital Twins and Intelligent Processes
Chalmers University of Technology
in cooperation with IVA's Mechanical
Engineering division

29 March in Stockholm
What type of climate leadership is needed
to comply with the Paris Agreement?
Breakfast seminar and workshop
– IVA's Student Council

4 April in Stockholm
The Patient in Focus
– Breakfast seminar with Gunilla Osswald
Seminar – IVA's Biotechnology division

9 April in Stockholm
Prince Daniel's Entrepreneurship Day
IVA's Prince Daniel's Fellowship project

9 April in Luleå
Innovation-critical metals
– Can Norrbotten show the way for
sustainable industry of the future?
Seminar – IVA North, Norrlandsfonden
and Invest in Norrbotten

9 April in Stockholm
Wood Mechanical Industry in a
globalised world
Seminar – Royal Swedish Academy of
Agriculture and Forestry (KSLA) and IVA
Forest Technology division

9 April in Kalmar
Meeting with Linnéakademien and
company visit to Electra
IVA's Business Executives Council and
Linnéakademien

10 April in Lund
Brain Computer Interfaces (BCI)
– this is how big the opportunities are
Seminar – IVA South

11 April in Gothenburg
Jubilee Seminar: #Göteborg100
– A sustainable society in transition
Seminar – IVA's Building and
Construction division, IVA West and
Chalmers University of Technology

23 April in Stockholm
How to make industry climate-neutral
Seminar – IVA's Climate Crossroads project

26 April in Stockholm
Future of the automotive industry,
Martin Lundstedt, President and CEO
AB Volvo
Breakfast meeting – IVA's Business
Executives Council

26 April in Stockholm
Digital leadership of the future
Leadership Programme IRC
in cooperation with Atlas Copco

7 May in Stockholm
Workshop: The financial sector
IVA's Resource Effectiveness
and the Circular Economy project

14 May in Stockholm
Electric Power and Grid Capacity
– How did we get here?
Roundtable – IVA's
Electrical Engineering division.

14 May in Stockholm
Jubilee Seminar: The Significance
of Materials in Society
Seminar – IVA's
Chemical Engineering division

15 May in Stockholm
Jubilee Seminar: Materials are
Development – industry, sustainability
and society
Seminar – IVA's Mining and Materials
division

15 May in Luleå
Creating a Global Watch Centre
Seminar – IVA North

16 May in Jönköping
School visit – UF school
– Finnvedens gymnasium
IVA's Prince Daniel's Fellowship project

17 May in Stockholm
Field trip
– AI company Peltarion
IVA's Prince Daniel's Fellowship project

20–22 May in Singapore
Entrepreneur trip
IVA's Prince Daniel's Fellowship project

22 May in Linköping
How engineers make the world
better and our existence smarter
Seminar – IVA's Mechanical Engineering
division and the Institute of Technology
at Linköping University

23 May
Webinar for young people who
want to apply to Junior Academy
Junior Academy – IVA and the NYAS

27 May in Stockholm
Roundtable – Ethics guidelines
for trustworthy AI
IVA's Information Technology
division

3 June in Stockholm
Future of Regional Newspapers
– What do they need?
Seminar and award ceremony
The Hans Bergström Award
Assembly of the Academy

3 June in Simrishamn
Simris – Sweden's first
local electrical grid
Field trip to Eon's plant in Simris,
Österlen – IVA South

11 June in Luleå
Jubilee Seminar: Space, mines,
data storage and AI – How are
they all connected?
Seminar – IVA North

12 June in Stockholm

How the transport sector will meet the climate goals

Seminar – IVA's Climate Crossroads project

13 June in Gothenburg

IVA West – Summer Party

24 June in Stockholm

This is how to get young people fired up about engineering and sciences

Seminar – Education and Research

25–28 June in Stockholm

Engineering a Better World – the next 100 years International conference arranged by IVA and CAETS

1 July in Visby

Internships get women to choose an engineering degree, provide a vision for students and motivation

Seminar – IVA in Almedalen

1 July in Visby

Governance of research and higher education – What will happen following the STRUT report?

Seminar – IVA in Almedalen

1 July in Visby

School segregation – a threat to Swedish competitiveness

Seminar – IVA in Almedalen

1 July in Visby

Efficient Industrial Platforms

– the key to Swedish competitiveness?

Seminar – IVA in Almedalen

1 July in Visby

Research – a good deal for business

Seminar – IVA in Almedalen

1 July in Visby

IVA reception in Almedalen

2 July in Visby

Crossroads for Sweden

Seminar – IVA in Almedalen

20 August in Stockholm

Launch: Book on IVA – the first 100 years

28 August in Stockholm

Jubilee Seminar – What do future engineers need to know?

Seminar – IVA's Education and Research Policy division

30 August in Karlstad

Värmland – a future hub in the Swedish forest industry

Workshop in cooperation with Business

Värmland, IVA, Paper Province and Region Värmland

2 September in Stockholm

Breakfast meeting with Birgitte Bonnesen who is analysing new challenges and commercial opportunities for the financial industry – IVA's Business Executives Council

10 September in Stockholm

Field trip

– Start-up generator Antler

IVA's Prince Daniel's Fellowship project

11 September in Södertälje

Field trip – Scania

IVA's Management division

12 September in Stockholm

Vera Roadshow Stockholm: Technical balance – the roles of women and girls in the world of technology

IVA and KTH

17 September in Stockholm

Jubilee Seminar– Discover, experience, explore – as an engineer

Seminar – IVA's Basic and Interdisciplinary Engineering Sciences division

19 September in Stockholm

New report from Climate Crossroads: How Swedish society will meet the climate goals

Seminar – IVA's Climate Crossroads project

19 September in Stockholm

Jubilee Seminar: How do you feel?

Navigating medical advice

Seminar – IVA's Biotechnology division

19 September in Gävle

The resource-efficient, sustainable and profitable company – Anna Denell, Sustainability Director at Vasakronan

Seminar – Norrlandsfonden and IVA's Business Executives Council

20 September in Gothenburg

Positive effects of space activity on business,

research and education

Seminar – IVA West and IVA Building and Construction division

24 September in Stockholm

IVA barometer checks the temperature of private sector R&D

Seminar – IVA

Education and Research Policy division

24 September

Field trip – Swerin

IVA's Mining and Materials division

24 September in Uppsala

Field trip Testa Center and SciLifeLab

IVA's Chemical Engineering division

25 September in Luleå

Are engineers equipped for the challenges of today and tomorrow?

Seminar – IVA's Mechanical Engineering division and Luleå University of Technology

26 September in Stockholm

Roundtable on entrepreneurship

IVA's Entrepreneurship Academy

26 September in Stockholm

How the Swedish energy system will meet the climate goals

Seminar – IVA's Climate Crossroads project

26 September in Södertälje
School visit – Täljegymnasium
IVA's Prince Daniel's Fellowship project

27 September in Stockholm
Jubilee Seminar: Economic policy in a time
of intense technological development
Seminar – IVA's Economics division

1 October in Stockholm
Roundtable on entrepreneurship
IVA's Entrepreneurship Academy

2 October in Östersund
Mid Sweden University as a growth
engine in the region
Seminar – IVA North, IVA's Business
Executives Council
and Norrlandsfonden

4 October in Stockholm
Focus on teachers
Workshop on IVA's new school initiative

8-9 October in Lund
Jubilee Seminar – Technology for the
great societal challenges
Seminar and field trip – IVA South

9 October in Stockholm
Resource-effective food transport
Seminar – IVA's Resource Effectiveness
and the Circular Economy project

10 October in Stockholm
Sustainability is the foundation for
profitable growth
Breakfast meeting with Petra Einarsson,
CEO of BillerudKorsnäs
IVA's Business Executives Council

11 October in Östersund
School visit – IVA's Prince
Daniel's Fellowship project

16 October in Stockholm
How Swedish agriculture
will meet the climate goals
Seminar – IVA's Climate Crossroads
project

21 October in Gothenburg
Who owns information about
me and on what terms?
Seminar – IVA West, Rifo and
IVA's Digitalisation for Increased
Competitiveness project

21 October in Stockholm
Roundtable on entrepreneurship
IVA's Entrepreneurship Academy

22 October in Lund
Boeing 737 Max 8 – the challenges
of autonomous systems
Seminar – IVA South

23 October in Stockholm
Jubilee Seminar: Swedish management
– Is it keeping up with the times?
Seminar – IVA's Management division

23 October in Stockholm
Being Human in the Age of Artificial
Intelligence – Max Tegmark
Seminar – IVA

24 October in Stockholm
Science & Society Forum:
Artificial intelligence at what price?
Seminar – IVA's Science & Society
Forum

30 October in Kiruna
Seminar with Stefan Gärdefjord
SSC Swedish Space Corporation
– Space is the key to global change
Seminar – LKAB, Norrlandsfonden,
IVA North and IVA's Business Executives
Council

5 November in Linköping
A whodunnit evening
on the theme of how to
investigate AI and IT crime
IVA's Business Executives Council

7 November in Stockholm
Breakfast meeting
with Jacob Wallenberg
IVA's Business Executives Council

11 November in Stockholm
Lunch with IVA's Business Executives
Council and theme leaders

11 November in Stockholm
Jubilee Seminar: The forest industry of
the future – challenges for companies,
research and young talent
Seminar – IVA's Forest Technology
division.

12 November in Linköping
Digitalisation opportunities –
Östergötland
Forum – IVA's Smart Industry and
Kickstart Digitalisation in cooperation
with Mjärdevi Science Park

12 November in Stockholm
After the National Negotiation on
Housing and Infrastructure – Is there a
national plan to meet future needs?
Seminar – IVA's Building and
Construction division

12 November in Stockholm
From landfill ban to circular economy
– What solutions can Sweden provide
to the world?
Seminar IVA

14 November in Stockholm
New report: How we can increase
the quality of Swedish research
Seminar – Swedish Research Council
Formas and IVA

17 November in Stockholm
Knowledge Day for teachers
IVA's school initiative

18 November in Växjö
Business forum: IVA's Smart Industry
and Kickstart Digitalisation
Forum – IVA's Smart Industry project

20 November in Ljungby
Business forum: IVA's Smart Industry
and Kickstart Digitalisation
Forum – IVA's Smart Industry project

22 November in Luleå

Breakfast seminar with Henry Ohlsson,
Deputy Governor of the Riksbank
(central bank)
Seminar – Norrbotten Chamber of
Commerce, Norrlandsfonden and IVA's
Business Executives Council

22 November in Skellefteå

Digitalisation with big
opportunities – But how do we
handle security and privacy?
A joint arrangement of Skellefteå
Municipality, Skellefteå Digital Alliance,
Region Västerbotten and IVA. Part of the
Digital@ldags national initiative

25 November in Stockholm

Field trip – Stockholm
Innovation and growth (STING)
IVA's Prince Daniel's Fellowship project

25 November in Stockholm

Roundtable on entrepreneurship
IVA's Entrepreneurship Academy

28 November in Stockholm

School visit – Royal College of Music
IVA's Prince Daniel's Fellowship project

28 November in Mölndal

Field trip – GoCo Health Innovation City
IVA West

29 November in Stockholm

Jubilee Seminar: Sweden and talent –
destination or departure gate?
IVA's Business Executives Council

2 December in Stockholm

Jubilee Seminar:
200 years of innovation
Seminar – IVA's leadership
programme IRC

3 December in Stockholm

Jubilee Seminar: Peak Human?
Seminar – IVA's Electrical
Engineering and Information
Technology divisions

4 December in Luleå

Progress in Research
and Technology 2019
Seminar – IVA North and
Norrlandsfonden

5 December in Stockholm

How world-leading universities
are created for the challenges
of the future?
Seminar – IVA's Education and
Research division and Vinnova

9 December in Karlskrona

Entrepreneurship Day
IVA's Prince Daniel's Fellowship project

10 December in Lund

Progress in Research and
Technology 2019
Seminar – IVA South

11 December in Stockholm

Future engineers for a better world
Seminar – IVA's Mechanical Engineering
division and KTH

13 December in Stockholm

Future battery technology
and ecosystems
Seminar with Akira Yoshino,
Nobel laureate in Chemistry 2019
IVA, Embassy of Japan, Sweden-Japan
Foundation and Japan Society for the
Promotion of Science (JSPS)

16 December in Gothenburg

Progress in Research and
Technology 2019
Seminar – IVA West

IVA PROJECT BY THEME

World-Class Knowledge

Private sector R&D investment
IVA School development
Junior Academy
Tekniksprånget
NTA Digital

Industry and Enterprise of the Future

Entrepreneurship Academy
Jobbsprånget
Research2Business
Smart Industry
Prince Daniel's Fellowship project

Climate-Resources-Energy

Resource Effectiveness and
the Circular Economy
Climate Crossroads

People-Technology-Society

Digitalisation for Increased
Competitiveness
Sustainable Water Supply

MEMBERS OF IVA THEME COUNCILS

World-Class Knowledge

Maria Anvret (X), Chair
Peter Gudmunson (I)
Ulla Sandborgh (II)
Anna Kadefors (III)
Lennart Bergström (IV)
Susanne Norgren (V)
Erik Bohlin (VI)
Anna Sandström (VII)
Charlotte Bengtsson (VIII)
Magnus Henrekson (IX)
Peter Larsson (XI)
Jan Gulliksen (XII)
Henrik Friman (BEC)
Anna Adolfsson (Student Council)

Industry and Enterprise of the Future

Carola Lemne (VI), Chair
Per Grunewald (I)
Birgitta Resvik (II)
Svante Hagman (III)
Michael E. Persson (IV)
Göran Carlsson (V)
Laszlo Fuchs (VII)
Jon Haag (VIII)
Claes de Neergard (IX)
Roger Johansson (X)



IVA's management team consists of Monica Krutmeijer, Katarina Arneving, Tuula Teeri, Johan Weigelt, Camilla Koebe and Lars Fog. In the photo is also Lisa Zarins (third from right) who served as an advisor in HR matters during parts of 2019.

Saeid Esmaeilzadeh (XI)
Staffan Truvé (XII)
Ulf Troedsson (BEC)
Henrik Larson (Student Council)

Climate-Resources-Energy

Karl Bergman (II), Chair
Margareta Norell Bergendahl (I)
Ingela Lindh (III)
Charlotte Turner (IV)
Per Storm (V)
Lars G Josefsson (VI)
Jonas Nycander (VII)
Birgitta Sundblad (VIII)
Per Kågeson (IX)
Elisabeth Lindner (X)
Hans Hentzell (XI)
Robin Teigland (XII)
Charlotta Sund (BEC)
Jonathan Edin (Student Council)

People-Technology-Society

Åsa Söderström Winberg (III), Chair
Ylva Fältholm (I)
Ingrid Skogsmo (II)
Gunnar Svedberg (IV)
Jan Olof Carlsson (V)
Peter Gårdenfors (VI)
Sven Ove Hansson (VII)

Elisabet Salander Björklund (VIII)
Agneta Dreber (IX)
Annika Åhnberg (X)
Susanne Ås Sivborg (XI)
Anette Novak (XII)
Martin Tivéus (BEC)
Patrik Gustafsson (Student Council)

Student Council

Chair: Anna Adolfsson,
Institute of Technology
at Linköping University
David Ameov, Mid Sweden University
Johan Bäckman Berg, Stockholm
School of Economics
Jonathan Edin, Royal Institute of
Technology, KTH
Patrik Gustafsson, Faculty of
Engineering, Lund University
Maria Gunnarsson, Faculty of
Engineering, Lund University
Henrik Larson, Chalmers
University of Technology
Linnea Michel, Institute of
Technology at Linköping University
Felicia Olsson, Swedish University of
Agricultural Sciences
Tamara Patrainika, Royal
Institute of Technology, KTH

Amanda Vikström, Umeå University
Linda Wäppling, Chalmers
University of Technology
Karin Östman, Luleå University of
Technology

STEERING COMMITTEES FOR IVA PROJECTS

Digitalisation for Increased Competitiveness

Chair: Jan Nygren (XI), PrimeKey AB
Karl Bergman (II), Vattenfall
Ann-Marie Eklund Löwinder (XII), IIS
Erik Ekudden, Ericsson
Patrik Fältström (XII), Netnod
Tobias Krantz, Confederation of Swedish
Enterprise
Cecilia Molinder (Student Council), KTH
Pia Sandvik (XI), RISE
Nils Svartz, MSB
Cecilia Sjöberg, Vinnova
Dag Ströman, FMV/CSEC
Karl-Petter Thorwaldsson, LO
Urban Wass, AB Volvo
Peter Wahlgren, Stockholm University
Johan Weigelt, IVA
Project Manager: Per Hjertén, IVA

Smart Industry – Jury

Chair: Johan Weigelt, IVA
Torbjörn Holmström (I), AB Volvo
Björn Langbeck, Swedish Agency for
Economic and Regional Growth
Sara Mazur (XI), Knut and Alice
Wallenberg Foundation
Hans Olofsson, Scania
Mikael Rudin, ABB
Robin Teigland (XII), Chalmers University
of Technology
Ulf Troedsson, Siemens
Klas Wåhlberg (I), Association of Swedish
Engineering Industries
Project Manager: Johan Carlstedt, IVA

Climate Crossroads

Chair: Elisabeth Nilsson
Anja Alemdar, Swedish Energy Agency
Mikael Dahlgren, ABB AB
Hans Folkesson, Hans Folkesson AB
Torbjörn Holmström (I), AB Volvo
Åke Iverfeldt, Mistra
Kenneth Johansson, InnoEnergy
Bo Krogvig, LKAB
Johan L. Kuylenstierna, Stockholm
Environment Institute
Maria Malmkvist, Swedish Gas Association
Marie Nilsson, IF Metall
Stefan Nyström, Swedish Environmental
Protection Agency
Aas Ellika Olsson, IF Metall
Bo-Erik Pers, Jernkontoret
Eva Pettersson, Royal Swedish
Academy of Agriculture and Forestry
Andreas Regnell, Vattenfall
Birgitta Resvik, Fortum Corporation
Gunilla Saltin, Södra Cell
Maria Sunér Fleming, Confederation of
Swedish Enterprise
Ulf Troedsson, Siemens
Project Manager: Karin Byman, IVA

Research2Business

Chair: Marianne Dicander Alexandersson
(VI)
Anna Nilsson Ehle (VI), Vinnova
Malin Persson (XI), Accuracy
Saeid Esmaeilzadeh (XI),
Serendipity Group

Anna Holmberg, Chalmers
School of Entrepreneurship and
Sahlgrenska School of Innovation and
Entrepreneurship
Mikolaj Norek, Forum for Innovation
Management
Tuula Teeri (IV), IVA

Mentor4Innovation

Tuula Teeri (IV), IVA
Johan Weigelt, IVA
Project Manager: Anders Gezelius,
Strategize

Prince Daniel's Fellowship project

Honorary Chair: H.R.H. Prince Daniel
Chair: Marcus Wallenberg (VI), SEB
Carl Bennet (XI), Carl Bennet AB
Karolin A. Johansson, The Royal Court
(until end of August)
Johan Skarborg, Academic Work
Johan Weigelt, IVA
Project Manager: Jenny Nordlöw, IVA

NTA Digital

Chair: Staffan Truvé (XII),
Recorded Future
Caroline Ankarcrona, Wallenberg
Foundations
Bengt Nilsson, NTA School
Development
Ylva Engström, Stockholm University
Agneta Gulz, Lund University
Anders Ynnerman (XII),
Linköping University
Project Manager: Hampus Lindh, IVA

Resource Effectiveness and the Circular Economy

Chair: Åke Svensson (I),
Association of Swedish Engineering
Industries
Caroline af Ugglas, Confederation
of Swedish Enterprise
Ola Alterå, Formas
Tim Brooks, Swedish Agency for
Economic and Regional Growth
Thomas Nilsson, Mistra
Annica Sohlström, Swedish National
Food Agency

Björn Stigson, Stigson & Partners
Henrik Sundström, Electrolux
Cecilia Tisell, Swedish Consumer Agency
Anders Wijkman, ÅI

Adjunct members:

Jonas Brännström, Vinnova
Uwe Fortkamp, Swedish Environmental
Protection Agency
Louise Staffas, Formas
Teeri Tuula (IV), IVA
Project Manager: Caroline Ankarcrona,
IVA and Jan Nordling, IVA

Tekniksprånget and Jobbsprånget

Chair: Jan-Eric Sundgren (VII)
Helen Dannetun (XI), Linköping University
Johan Forssell, Investor
Vesna Jovic, SKL
Tobias Krantz, Confederation of Swedish
Enterprise
Peter Larsson (XI), Swedish Association
of Graduate Engineers
Anders Lindberg (IX), JKL
Camilla Modéer (XI), IVA
Tuula Teeri (IV), IVA
Helena Stjernholm (IX), Industrivärden
Head of Jobbsprånget: Alexandra
Ridderstad, IVA
Project Manager Jobbsprånget:
Eva Glaumann, IVA

Private Sector R&D Investment

Chair: Pontus de Laval
Lars Hultman (V)
Anna Hultin Stigenberg
Peter Johansson
Per Klingbjer
Peter Larsson (XI)
Anders Lindberg (IX)
Göran Marklund
Torgny Persson
Anna Sandström (VII)
Johan Weigelt, IVA

IVA School development

Steering Committee (forming)

Entrepreneurship Academy

Steering Committee (forming)

PROGRAMME COUNCIL

Water (ended in June)

Eva Färnstrand (VIII)
Britt-Inger Andersson (VIII)
Georgia Destouni (III)
Tord Svedberg (IV)
Secretary: Staffan Eriksson, IVA

In preparation for the research bill

Tuula Teeri (IV), Chair
Margareta Norell Bergendahl (I)
Birgitta Resvik (II)
Ulrika Francke (III)
Karin Markides (IV)
Lars Hultman (V)
Lars Engwall (VI)
Hjalmar Brismar (VII)
Per-Olof Wedin (VIII)
Henrik Jordahl (IX)
Maria Anvret (X)
Peter Larsson (XI)
Ulf Wahlberg (XII)
Mohammed Homman (BEC)
Patrik Gustafsson (Student Council)
Project Manager: Martin Wikström, IVA

DISTINCTIONS, SCHOLARSHIPS AND AWARDS

Medal Committee

Chair: Camilla Modéer (XI)
Peggy Bruzelius (IX)
Pontus Johnson (II)
Jens Nielsen (X)
Aina Nilsson Ström (I)
Margareta Norell Bergendahl (I)
Susanne Norgren (V)
Rolf Skoglund (XII)
Örjan Wikforss (III)
Gabriel Urwitz (IX)

Medals

The Academy's Great Gold Medal is awarded to Hans Dalborg, PhD Econ, for his achievements in developing the Swedish finance sector and the Swedish model for corporate governance, in

combination with his commitment to social issues involving significant contributions to research and culture.

The Academy's Gold Medal is awarded to Lena Olving, MSc Eng, for her achievements as an innovator and leader of businesses at the front lines of technology. Her progressive and ground-breaking leadership makes her a role model for leaders of technically advanced companies in a global market.

The Academy's Gold Medal is awarded to Daniel Ek, Chair and Martin Lorentzon, D.Eng h.c., for creating the company Spotify which has fundamentally changed the music industry and put an end to music piracy. As innovators and entrepreneurs, they have built one of the few (possibly the only) European tech companies that has succeeded in competing with Chinese and American giants.

The Academy's Gold Medal is awarded to Professor Max Tegmark for his contributions to our understanding of humanity's place in the cosmos, and the opportunities and risks associated with artificial intelligence. He has courageously tackled these existential questions in his research and, in a commendable way, succeeded in communicating the issues to a wider public.

New honorary members

As honorary members, IVA may appoint individuals who through their work or by other means have contributed greatly to the promotion of the Academy's objectives.

In 2019 three new honorary members were inducted. The explanations for the selections are summarised below:

Peter Wallenberg Jr, who is a member of the Education and Research Policy division, has demonstrated a strong

personal commitment to IVA's activities, including as an active member of the Business Executives Council and in division activities. He was also an initiator/catalyst for the creation of IVA's Jobbsprånget project.

Mary Walshok, an international member, has made important contributions to IVA's work focusing on innovation and entrepreneurship. She founded Connect in San Diego, which connects entrepreneurs with capital and talent, and was instrumental in establishing the model in Sweden.

Jan-Eric Sundgren, member of the Basic and Interdisciplinary Engineering Sciences division, has been deeply committed to IVA's activities for many years. His contributions as Steering Committee Chair for Tekniksprånget and Jobbsprånget have been invaluable.

The first honorary members were appointed back in 1919. They were HRH Crown Prince Gustaf Adolf and Director General Karl Axel Fryxell.

Current honorary members, in addition to the new ones: Arne Wittlöv, Lena Treschow Torell and Prince Daniel.

IVA's award for scientific journalism – Hans Bergström Award

IVA's award for scientific journalism – Hans Bergström Award – was awarded in 2019 to science reporter for Upsala Nya Tidning, Åke Spross, for his extraordinary work. From a local newspaper perspective he has succeeded in covering a whole world of science and research.

Hans Werthén Foundation

In 2019 SEK 1,840,000 was shared between 18 scholarship recipients. The purpose is to give young graduates an opportunity for development in another country and to gain new knowledge and experiences that they can use in

industry, business or the academic sphere in Sweden. The Foundation was established in 1990 in honour of Hans Werthén for his lifework as an engineer and business leader.

King Carl XVI Gustaf 50th Anniversary Fund

The purpose of the Fund is to promote research, technical development and enterprise that contribute to the sustainable use of natural resources and the preservation of biodiversity. In 2019 the Fund distributed five scholarships of SEK 100,000 and nine of SEK 85,000. The candidates are nominated by members of IVA or individuals who are active in research and enterprise. The scholarship recipients are announced on H.M. The King's birthday and presented at a reception at the Royal Palace.

John and Margaretha Aspegren Scholarship

The mission of the John and Margaretha Aspegren Memorial Foundation is to promote a better mutual understanding between engineering sciences and the humanities. The scholarship of SEK 100,000 is awarded one year to an engineer and the next to a humanities scholar.

In 2019 the Aspegren Scholarship went to: Danish artist Lea Porsager for her artistry and in particular her work Gravitational Ripples, which is inspired by scientific observations and cosmic phenomena.

The Thulin Medal

The Thulin Medal is the highest distinction within the aerospace industry in Sweden. The Swedish Society of Aeronautics and Astronautics and IVA have selected winners of the medal every year since 1944. It is awarded to commemorate aircraft pioneer Enoch Thulin. The Thulin Medals in gold, silver and bronze are awarded to individuals who have made important contributions

to the development of aerospace engineering in Sweden.

In 2019 the Thulin Medal in gold was awarded to Torbjörn Johansson for his extraordinary and meritorious achievements in developing CTT from a small enterprise into a market and technology leader and supplier of products to actively control humidity in passenger planes. The Thulin Medal in silver was awarded to Dag Folkesson for his critical work developing software that works in realtime with multiple computers in fighter plane systems.

Smart Industry

Service company Mobilaris was named the winner of the 2019 Smart Industry Enterprise Competition for contributions to digitalisation of traditional industries. With a strong understanding of customer needs, Mobilaris uses the possibilities of digital technology to increase productivity, improve personal safety and reduce energy consumption among its customers. Through its digital service offering aimed at mines and other basic industries, the company has in five years quadrupled its sales, gone from 17 to 70 employees and now has 25 customers from all parts of the world.

Honourable mention

Moelven Valåsen AB received an honourable mention for, in a traditional business that up to now had a relatively low level of digitalisation, implementing an internal 'digitalisation journey' of the entire production process – from timber to finished products. The Company has systematically sought access to knowledge and combined best practice with its own solutions. Moving Floor AB received an honourable mention for, in an industry with a very low level of digitalisation, demonstrating the possibilities and great potential of digitalisation. Moving floor is a greentech companies with technology for automatic, self-cleaning boxes.

RESPONSES TO REPORTS REFERRED FOR CONSIDERATION

In 2019 IVA commented or expressed an opinion on the following proposals and reports for consideration:

Response to the commission report "Ökad attraktionskraft för kunskapsnationen Sverige" (Increased attractiveness for knowledge nation Sweden) (SOU 2018:78).

Response to "Frekvenser i samhällets tjänst" (Frequencies in the service of society) (SOU 2018:92).

Response to the report "En långsiktig, samordnad och dialogbaserad styrning av högskolan" (Long-term, coordinated and dialogue-based governance of universities) (SOU 2019:6).

Response to SOU 2019:15 "Komplementär och alternativ medicin och vård – säkerhet, kunskap och dialog" (Complementary and alternative medicine and care – safety, knowledge and dialogue) and SOU 2019:28 "Komplementär alternativ medicin och vård – ny lagstiftning" (Complementary alternative medicine and care – new legislation).

Input to the upcoming research bill

Response to the Swedish Agency for Marine and Water Management: "Synpunkter på förslag till nationell plan för omprövning av vattenkraft samt miljökonsekvensbeskrivningen" (Views on a proposed national plan to review hydropower and the environmental consequence description).

PUBLICATIONS

IVA-M series

IVA-M 498: Smart Industry – Warehouses, 2019, 36 p.

IVA-M 499: Final report of IVAs Digitalisation for Increased Competitiveness project, 2019 60 p.

IVA-M 500: Technical imbalance? Women and men in engineering, 2019, 44 p.

IVA-M 501: How Swedish industry will meet the climate goals. A report from the IVA Climate Crossroads project, 2019, 68 p.

IVA-M 502: How Swedish transport will meet the climate goals. A report from the IVA Climate Crossroads project, 2019, 64 p.

IVA-M 503: How Swedish society will meet the climate goals. A report from the IVA Climate Crossroads project, 2019, 56 p.

IVA-M 504: How the Swedish energy system will meet the climate goals. A report from the IVA Climate Crossroads project, 2019, 72 p.

IVA-M 505: Commemorative Booklet – A Tribute to the Memory of Axel F. Enström, 2019, 56 p.

IVA-M 506: Commemorative Booklet – In Memory of Axel F. Enström, 2019, 56 p.

IVA-M 507: Resource-effectiveness in food transport. A report from the IVA Resource Effectiveness and the Circular Economy (ReCE) project, 2019, 40 p.

IVA-M 508: How Swedish agriculture will meet the climate goals. A report from the IVA Climate Crossroads project, 2019, 56 p.

IVA-R-series

IVA-R 509: R&D Barometer 2019 – Private Sector R&D Investment. 2019, 24 p.

OMBUDSMAN

Erik Nymansson, Justice of the Supreme Administrative Court

AUDITORS

Anki Bystedt, appointed by the Government
Karl-Olof Hammarkvist (IX)
Peter Ekberg, Authorised Public Accountant

INVESTMENT COMMITTEE

Lars Heikensten (IX), Chair
Hans Dalborg (IX)
Irma Rosenberg (IX)
Tula Teeri, President of IVA (IV)
Katarina Arneving, CFO IVA

SELECTION OF DONORS TO IVA'S JUBILEE FUND

Knut and Alice Wallenberg Foundation
Marcus and Amalia Wallenberg Memorial Foundation
Volvo Group
Ericsson
Carl-Henric Svanberg
ASSA ABLOY
Investment AB Latour
Clas Ohlson
Hakon Swenson Foundation
LKAB
Ljung Toolbox
Laurent Leksell
Mellby Gård Foundation
Axel Johnson Group
Marianne and Marcus Wallenberg Foundation
Stora Enso
ÅF
Perstorp
Carl Bennet AB
Confederation of Swedish Enterprise
Chalmers University of Technology
Tetra Laval
Leif Johansson
Lars Backsell
Stefan Widegren
Autoliv
Bertil Edlund Foundation
BillerudKorsnäs
Erling Persson Family Foundation
Industrivärden

Saab
Atlas Copco
Sven Tyrén Foundation
SKF
Stena Metall
Mycronic AB
Björn Savén
Thomas Eldered
Anders Scharp
Icomera
Bo and Gunilla Pehrsson
AstraZeneca
Märta Christina & Magnus Vahlquist Foundation
Leif Östling

EMPLOYEES

Management team

Tuula Teeri, President
Johan Weigelt, Secretary to the Academy, Executive Vice President
Katarina Arneving, CFO
Lars Fog, Property Manager
Camilla Koebe, Vice President Business and Communications
Monica Krutmeijer, Assistant to the President

Development Office

Katarina Mellström

Academy and Projects

Johan Weigelt, Secretary to the Academy, Executive Vice President
Ingrid Jansson
Karin Byman, theme leader
Johan Carlstedt, theme leader
Staffan Eriksson, theme leader
Martin Wikström, theme leader

International Office

Elin Elliot

Thematic area:

World-Class Knowledge

Martin Wikström, theme leader
Hampus Lindh
Eva Lundgren

Alicia Parvin
Maja Neiman
Lars Nilsson

**Thematic area: Industry
and Enterprise of the Future**

Johan Carlstedt, theme leader
Jenny Nordlöw
Peter Mandahl
Malin Mohr
Sara Lodén
Jakob Rudberg
Maria Saker
Monica Sannerblom
Gustaf Wahlström
Sofia Yngwe

**Thematic area: Climate-
Resources-Energy**

Karin Byman, theme leader
Caroline Ankarcrona
Caroline Linden
Jan Nordling
Joakim Rådström

**Thematic area: People-
Technology-Society**

Staffan Eriksson, theme leader
Per Hjertén
Eva Lagerblad
Linda Olsson
Jan Westberg

Tekniksprånget and Jobbsprånget

Alexandra Ridderstad, Head of
Tekniksprånget and Jobbsprånget
Johan Persson
Sarah Bixo
Linus Brandin
Ellen Frostell
Louise Forsberg
Eva Glaumann
Helena Gyrulf
Annika Johansson
Helena Lind
Mattias Lindberg
Sabinor Lönnroth
Saba Mosazghi
Kristian Nilsson
Laras Pinjii
Sara Rhodes
Nina Rudbeck
Binette Seck
Karin Wachtmeister
Olle Wallin
Linnea Werlid

Business and Communications

Camilla Koebe, Vice President Business
and Communications
Pelle Isaksson
Henrik Lagertråd
Anna Lindberg
Helena Mehra
Lars Nilsson

Pär Rönnerberg
Johanna Theander
Jan Westberg
Sofia Yngwe

Finance, ICT and Administration

Katarina Arneving, CFO
Lena Anderson
Sherry Benzon
Jakob Bjarnason
Sacharias Hade
Linnea Strömstedt
Martina Tallstrand
Marika Thunberg Petersson

Property

Lars Fog, Property Manager
Lennart Ohlsson

IVA Conference Centre

Charlotta Svedberg, Conference Director
Fredrik Adamsson
Britta Aulio
Ann Clauson
Anna-Karin Friskopps
Linda Hillborg
Robert Komakech
Therese Pettersson
Lisa Wiklund

© Royal Swedish Academy of Engineering Sciences, 2020
P.O. Box 5073, SE-102 42 Stockholm
Tel: +46 (0)8 791 29 00
Fax: +46 (0)8 611 56 23
E-mail: info@iva.se
Web: www.iva.se

ISSN: 1100-5645
ISBN: 978-91-89181-03-8

Project Management: Jan Westberg, Anna-Karin Friskopps
Texts: Lars Nilsson, Pär Rönnerberg, Jan Westberg
Layout: Pelle Isaksson
Printed by: Göteborgstryckeriet AB

Photos: Elin Elliot, Adrian Pehrson, Erik Cronberg,
Daniel Söderberg, Jack Mikrut, Jonas Bilberg, Daniel Roos,
Pär Rönnerberg, Petra Älvstrand, Jenny Hammar, Sören Håkanlind,
Alexandra Örn, Katriina Mäkinen, Karina Ljungdahl

For 100 years the Royal Swedish Academy of Engineering Sciences (IVA) has been a meetingplace for Sweden's future. IVA builds bridges between the business community, the public sector, academia and the political sphere. We bring together the expertise and experience of more than 1,200 Academy members and 250 companies.



Royal Swedish Academy of
Engineering Sciences

Sweden – Activity Summary

In 2019, the Royal Swedish Academy of Engineering and Sciences (IVA), celebrated 100 years. During the year, IVA highlighted challenges and change needed in a number of areas e.g. the climate challenge, circular economy, energy, sustainable water supply, digitization of society, entrepreneurship and collaboration between the research community and the private sector. The academy did so during the year through meetings and seminars, working groups and networking.

The CAETS Convocation that took place in Stockholm and was hosted by IVA, was one of our key activities 2019. The role of engineering the next 100 years was in focus and the conference gathered more than 400 researchers and experts from all over the world. More information about the conference can be found [here](#).

Other international activities were when the 2019 Nobel Laureate in Chemistry, Akira Yoshino, visited IVA in connection with the Nobel festivities in December. Prof. Yoshino, also known as the father of lithium ion batteries, was the keynote speaker at a seminar at IVA, “[Future Battery – Technology and Ecosystem](#)”.

Another important international symposium that IVA hosted was the 2019 EU–US Frontiers of Engineering symposium, that was held 18–20 November in Stockholm. The Frontiers of Engineering is a programme run by the US National Academy of Engineering with the intent to bring together a select group of emerging engineering leaders from industry, academia and government labs, to facilitate collaboration in engineering as well as the transfer of new techniques and approaches across fields.

IVA ended the year by celebrating being Sweden’s youngest centenarian, with more than 1000 guests from across the world, during the Academy’s Annual Meeting in October.

2019 Annual Report: <https://www.iva.se/en/published/ivas-annual-report-2019/>

Report to CAETS

Highlights 2019

- SATW published the third edition of its biannual “Technology Outlook”, an overview of the most promising upcoming technologies for Switzerland, written by various leading experts. For the first time, the publication was also published as an extensive online-version and accompanied by a roadshow with multiple presentations for SME business owners and innovation professionals.
- Under the auspice of the SATW topical platform on artificial intelligence, leading experts in the field have published the whitepaper “Recommendations for an AI Strategy in Switzerland”. The experts describe areas with great potential for Switzerland, amongst others the creation of national data platforms. Without such efforts, Switzerland risks being left behind in this forward-looking technology.
- In 2019 SATW successfully completed the first implementation of the public-private partnership programme “Swiss TeCLadies”, an initiative to foster young female talent in the field of technology. After qualifying by completing an online test, 45 girls between 13 and 16 years were undergoing a versatile development programme for nine months while being accompanied by a female mentor.

Switzerland

Willy Gehrler, Rolf Hügli

Schweizerische Akademie der Technischen Wissenschaften SATW

Swiss Academy of Engineering Sciences

St. Annagasse 18

8001 Zürich

Tel: +41 44 226 50 11

www.satw.ch

Summary of the main activities of the National Academy of Engineering of Uruguay for
2019-2020

1.- EVENTS

a) "Autonomous vehicles". Conference from Academic Eng. Nicolás Jodal

Held on June 17th, 2019.

During this conference, it was reported that there is a group from Genexus working on autonomous vehicles for the forestry and agricultural sector.

b) "Challenges for sustainable water consumption in Uruguay". Roundtable led by Academic Engineers Liliana Borzacconi and Mario Allegri

Held on August 28th, 2019.

"The integrated management of water resources" - National Director of Water (DINAGUA) Engineer Daniel Greif

"Transport processes in bodies of water" - School of Engineering, University of the Republic Professor Engineer Mónica Fossati,

"Accountability of agricultural activities in the pollution of surface waters" - General Director of Natural Resources of the MGAP (Ministry of Agriculture, Livestock and Fishing) Academic Engineer Fernando García Préchac

"Plastics in Rivers and Oceans" - DINAMA Manager of Information, Planning and Quality of the Environment. Chemical Engineer Marisol Mallo

"Cyanobacteria" - ORT University School of Engineering MSc. Professor Mariana Umpiérrez

"Drinking water, challenges for OSE in quantity and quality" - OSE Drinking Water Manager Engineer Saúl Garat

c) "The future of work and the work of the future". Conference Academic Eng. Jorge Grünberg.

Held on October 14 th, 2019.

2.- ANIU members contributions to be highlighted at national level since March 13th, the date the first infected with covid19 was detected:

GACH (Honorary Scientific Advisory Group) conformed by Dr. Rafael Radi, Dr. Henry Cohen and Dr. Fernando Paganini.

Engineer Dr Fernando Paganini, PhD is a member of ANIU and his main contribution is the elaboration of mathematical forecast models.

The President and his Ministers consolidated an advisory group of experts, which has a triumvirate of top-level scientists working with 35 experts from different sciences.

The purpose of this team is to provide objective information to enhance the best decision-making process

The Presidency makes decisions based on the information from the GACH, the Budget and Planning office and from the board of Ministers, basically: the Minister of Health, the Minister of Economy, the Minister of Social Development, the Minister of Labor, the Minister of Social Security, and the Minister of Industry and Energy (Acad. Eng. Omar Paganini).

Coronavirus.uy Personal Tracking System

Academics Breogán Gonda, Nicolás Jodal, Gastón Milano

https://genexus.blog/es_ES/general-interest/aplicacion-coronavirus-uy-detras-de-la-pantalla/

Contribution of the Academics from the Agronomic area:

The agricultural sector contributes to guarantee the effectiveness and efficiency of the agro-food chains, ensuring the articulation between production and distribution to maintain a constant supply of food (“from the field to the plate”), incorporating innovative mechanisms, complying with restrictive measures of social distancing.

3.- At the meeting on 04/08/2020, the Board of Directors made it clear that from the current national emergency situation caused by the Corona virus 19 pandemic, the events program will undergo substantial changes in 2020.

Emphasis was placed on the vocation of the Academy to offer its support to the national community in any way possible. First of all, in the activities that are being carried out, and in those that are planned for the “post” coronavirus stage which will require supporting efforts on topics as varied as teaching, investments and support for activities that generate jobs.

Two working groups have been formed on the topics focusing on this medium-term objective:

- a) Search for opportunities to add value to the existing long-shift forest production in the country.
- b) Projects to develop value-added products based on waste, especially leather.

Based on the valuable experience of interaction of the various academics at the GACH, the invitation was accepted to jointly integrate with the National Academy of Medicine an inter-academic subcommittee with the aim of coordinating and promoting joint activities.

4.- Annual Contests

The eleventh call was communicated on April 2019 in the four Schools of Engineering and in the School of Agronomy through each School’s Deans.

Papers received from the Schools of Engineering from UDELAR, Universidad ORT, Universidad Católica del Uruguay, Universidad de Montevideo and the School of Agronomy from UDELAR

Año	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Doctor PhD	1	2	2	5	5	1	8	7	2	4	1
Magister	0	3	4	4	10	10	13	6	8	3	8
Engineer degree	12	14	8	10	16	8	17	20	15	13	15
	13	19	14	19	31	19	38	33	25	20	24

The 2020 Contests call has been successful, having received 36 works that are beginning the evaluation stage.

5.- Selection of Start up to participate at CAETS 2020 in Seoul (NAEK)

The three proposals received made the presentations on November 28th, 2020 and the unanimously selected by the ANIU was: Parconier (<https://youtu.be/pr4JH-VZFiE>)

The Final Result of CAETS 2020 Foreign Start up Program is:

- Session1. Hyper-connected life Dot Incorporation VImAI Oy
- Session2. Smart Energy Network in Urban Environment Relectrify
- Session3. Climate change issues Rens Coffee Shoe
- Session4. **Education for Smart Society** **Parconier**

6.- Visits of the President of the ANIU, Acad.Eng. Julio Fernández to ATSE and NAEK



NATIONAL ACADEMY OF ENGINEERING

Dr. Alton D. Romig, Jr.
Executive Office

To: Ruth A. David, Secretary/Treasurer, CAETS

From: James M. Tien, International Secretary, US National Academy of Engineering

Handwritten signature of James M. Tien in blue ink.

Alton D. Romig Jr., Executive Officer, US National Academy of Engineering

Handwritten signature of Alton D. Romig Jr. in blue ink.

Subject: Update on International Activities of the US National Academy of Engineering

Date: August 28, 2020

Greetings, Ruth,

We hope this message finds you well. We are pleased to report on a number of NAE activities that build on your excellent foundation as the NAE's former foreign secretary and that continue strengthening and extending the NAE's international engagement.

In addition to the ongoing and ever-popular bilateral and multilateral Frontiers of Engineering (FOE) program, the NAE this year launched a multigenerational initiative to address the covid-19 pandemic—an important new CAETS focus; achieved broader geographic representation among our elected international members; and pursued further international outreach and collaboration.

Engineering Call to Action on Covid-19

This cross-generational crowdsourcing initiative, launched in April, engages students, young professionals, and senior engineers to submit implementable ideas for combating the pandemic. More than 700 individuals have entered ideas! The teams consist of students and faculty associated with the Grand Challenges Scholars Program; a technical review committee is composed of FOE alumni to evaluate the submissions and recommend some for advancement; and an expert review committee of NAE members hears pitches by the top teams, critiques each presentation and prospectus, and connects the teams to potential avenues for investors. The first pitch session for the most promising ideas was held [June 26](#), and the second took place [August 6](#). I encourage you to watch the recordings—the thoughtful and entrepreneurial innovation of the young participants is admirable and encouraging, and it is inspiring to watch how the various generations learn from each other.

Membership

International members provide an invaluable link between the NAE and engineering leaders in other countries. They participate in activities of the NAE and the broader National Academies of Sciences, Engineering, and Medicine; help organize meetings of international members in key locations abroad, providing the opportunity for them to exchange ideas with NAE leadership; and

The National Academies of

SCIENCES • ENGINEERING • MEDICINE

500 Fifth Street NW, NAS 218 Washington, DC 20001
Phone 202.334.3677 Email aromig@nae.edu www.nae.edu

help the NAE to be aware both of recent technological developments in their countries and of possibilities for collaboration.

To further strengthen the role of international members, in each year's election we focus on growing the number of nations and regions represented as well as expanding representation from countries of increasing technological and geopolitical importance. To that end efforts are guided by a Special Nominating Committee for International Members, representing each of the NAE's 12 disciplinary sections.

This year 18 international members were elected; the NAE now has 279 international members who are citizens of 38 countries. The class of 2020 expands our footprint to include Egypt and increases representation in seven other countries.

Frontiers of Engineering

An important ongoing activity in building international linkages is the NAE's multi- and bilateral Frontiers of Engineering (FOE) program with Japan, Germany, China, and the European Union. These symposia bring together about 30 promising young researchers from each of these countries/regions and an equal number from the United States to address challenges that require multidisciplinary solutions. The gatherings also are valuable opportunities for network development among young engineers, a number of whom remain actively engaged in follow-on NAE activities.

The EU-US FOE symposium was held in Stockholm (November 18–20, 2019), but because of the covid-19 pandemic the Japan-America and EU-US FOE meetings scheduled for 2020 have been postponed to 2021.

Additional International Outreach

In partnership with the National Academy of Medicine, we are involved in providing advice to the EU Malaria Fund, a €118 million portfolio of 26 interventions based on an expanded systems engineering approach for vaccine prioritization previously developed in a joint NAE-NAM activity.

The NAE was represented through featured speaking engagements at the Global Solutions Summit and the World Health Summit in Berlin in 2019.

And we are in discussions with the Royal Academy of Engineering to develop a multiyear bilateral programmatic agreement.

NATIONAL ACADEMY OF ENGINEERING



ENGINEERING THE FUTURE

2019 Annual Report



The National Academies of
SCIENCES • ENGINEERING • MEDICINE

1	Letter from the President
3	In Service to the Nation
3	Mission Statement
4	NAE Strategic Plan
5	NAE Annual Meeting
5	2019 NAE Annual Meeting Forum: Human Spaceflight: Apollo 50 Years On
6	Program Reports
6	Postsecondary Engineering Education
	Engagement of Engineering Societies in Undergraduate Engineering Education
6	PreK–12 Engineering Education
	LinkEngineering
	Educator Capacity Building in PreK–12 Engineering Education
7	Media Relations
7	Global Grand Challenges Summit
8	Center for Engineering Ethics and Society
	The Online Ethics Center for Engineering and Science
10	Diversity of the Engineering Workforce
	EngineerGirl
	Sharing Exemplary Admissions Practices That Promote Diversity in Engineering
13	Collaborative Activities
	Roundtable on Linking Academic Engineering Research and Defense Basic Science
13	Frontiers of Engineering
	Armstrong Endowment for Young Engineers—Gilbreth Lectures
16	2019 NAE Awards Recipients
18	2019 New Members and Foreign Members
21	NAE Anniversary Members
26	A Message from NAE Vice President Corale Brierley
27	2019 Honor Roll of Donors
27	Lifetime Giving Societies
27	The Abraham Lincoln Society
27	The Benjamin Franklin Society
28	The Marie Curie Society
28	The Einstein Society
29	Golden Bridge Society
31	Heritage Society
32	Annual Giving Societies
32	Catalyst Society
32	Rosette Society
32	Challenge Society
32	Charter Society
35	Foundations, Corporations, and Other Organizations
38	National Academy of Engineering Fund
40	Statement of Financial Position
41	Statement of Activities
42	Statement of Functional Expenses
43	Statement of Cash Flows
44	Notes to Financial Statements
59	Officers
59	Councillors
60	Staff
60	NAE Publications



Letter from the President

When I assumed the responsibilities of the NAE presidency on July 1, the term *covid-19* did not exist and the prospect of a global pandemic was on no one's radar. I and my colleagues among the NAE members and staff were fortunate to simply continue pursuing robust programming and frequent interaction, especially in meetings both in Washington and around the country and world. Next year's annual report will record a very different account of our activities, but no less dynamic, resourceful, and committed to the NAE's mission to serve the engineering community and the nation.

No matter the conditions in which we operate, as the new NAE president I believe there are four concrete ways the NAE can drive action for public good:

- Identify and inform the frontiers of engineering theory, practice, and policy.
- Increase engineering talent through a strong commitment to diversity and inclusion.
- Instill a culture of ethical and environmental responsibility in engineering.
- Improve capabilities and competencies for complex systems engineering.

For all these priorities—call them the four “I”s—strong *member engagement* and robust NAE programs are vitally necessary, even prerequisites. I look forward to working with all of you and our staff in advancing new significant initiatives at the NAE in service to our profession and the nation.

Some Highlights from 2019

The 4th **Global Grand Challenges Summit**, held September 16–19 in London, was collaboratively organized by the NAE and the engineering academies of the UK and China. These biennial summits, based on the vision provided by the NAE's 14 Grand Challenges for Engineering issued in 2008, are aimed at catalyzing international cooperation to address the many challenges that confront engineering and where engineering can contribute to social welfare. This year's event, on the theme *Engineering in an Unpredictable World*, engaged over 900 participants, including innovators, entrepreneurs, and policymakers, with simultaneous events on every continent.

In observance of the 50th anniversary of the Apollo lunar landing, presentations at the **2019 annual meeting** reflected on the broader lessons from this stellar systems engineering achievement. Astronaut and US Air Force General Thomas P. Stafford shared his experiences on the Apollo missions and astronaut and former NASA administrator Charles F. Bolden Jr. discussed prospects for future human missions. Their insights, coupled with thought-provoking perspectives from other speakers and participants, help us consider implications for future exploration, workforce development, and public engagement.

The **2019 meeting of the NAE Grand Challenges Scholars Program (GCSP)** provided a forum for GCSP students, faculty, and leaders to learn from each other, engage with employers and other stakeholders, and generate ideas for growing the GCSP movement across the US and around the world.

EngineerGirl, launched as a resource website in 2001, has grown to include a number of interactive programs with opportunities for mostly middle school girls. The site also started featuring multiple perspectives on engineering-related questions of particular interest to young girls. And EngineerGirl's new **Ambassadors program** encourages high school girls to introduce younger girls to engineering through projects that include afterschool tutoring, summer camps, workshops...and a Girl Scouts Expo that resulted in 16 new girls' robotics clubs!



The **Frontiers of Engineering** (FOE) will celebrate its 25th anniversary in 2020. Since its inception, the program has brought together highly accomplished domestic and international early-career engineers from companies, universities, and government or nonprofit organizations to discuss selected topics across engineering fields. This year's US meeting was held at the Boeing Dreamliner factory in North Charleston, South Carolina.

The NAE's quarterly **The Bridge**—among the most popular pages on the NAE website—will celebrate its 50th anniversary in 2020. *The Bridge* and all publications of the National Academies of Sciences, Engineering, and Medicine are freely accessible online.

On a Path to Transformation

For a vibrant NAE, we need vibrant programs. In 2019 we initiated a major reform effort to:

- Make NAE program activities cohesive and progressive in service of the NAE mission.
- Significantly improve our project development, planning, and execution.
- Generate more creative ideas and marketable project and program proposals in close collaboration with our development team.
- Establish the leadership of NAE programs within the National Academies.
- Boost the visibility of NAE programs across the engineering and broader communities.

Armed with a new growth mindset, we are laying the groundwork for new program areas, including forums on inclusive and diverse engineering and on complex systems engineering. We are also significantly modernizing our portfolio of engineering education and ethics-related activities. These program areas have historically not only set new standards for thinking about complex issues but also motivated deeper reflection on implications for engineering practice and the evolving profession.

Each of these goals and program areas requires member participation. As a trusted source of advice, the NAE must also be dynamic and proactive to address complex and consequential issues. One of the related aims of the *Campaign for the NAE*—to empower the NAE—is to strengthen our endowment and ability to address issues such as engineering for climate change mitigation and adaptation, and better health and well-being.

Again, I look forward to serving this extraordinary institution as president and engaging you in our work. I am grateful for your commitment, participation, and generous support of NAE efforts.



John L. Anderson
President

In Service to the Nation

Membership in the National Academy of Engineering (NAE) is not only a surpassing honor but a call to serve the engineering profession and the nation. Since 1964 the NAE has provided independent, objective advice to the nation on engineering-related topics and policies. The NAE operates under the same congressional act of incorporation that established the National Academy of Sciences, signed in 1863 by President Abraham Lincoln, to respond, “whenever called upon by any department or agency of the government, to investigate, examine, experiment, and report upon any subject of science or art.”

The NAE has 2,492 peer-elected members and foreign members, approximately 57 percent from academia, 36 percent from industry, and 7 percent from nonprofit institutions and government. They are leaders in aerospace, bioengineering, chemical engineering, civil engineering, computer science and engineering, earth resources, electric power and energy systems, electronics, industrial engineering, materials engineering, mechanical engineering, and interdisciplinary engineering. They serve on study committees, plan and conduct symposia and workshops, and assist in the work of the Academy in many other ways. In addition to collaborative projects at home and abroad to examine technological problems, NAE activities involve advising Congress and government agencies on engineering-related matters of national importance, and recognizing and honoring outstanding engineers for their contributions to the well-being of the nation and the world.

The NAE not only responds to requests from the federal government but also engages in activities sponsored by foundations, industry, and state and local governments and funds projects through endowment funds supported by private contributions. Thus, the NAE is a unique organization that brings together distinguished engineers for the purpose of improving the lives of people everywhere.

The National Academy of Engineering, National Academy of Sciences, and National Academy of Medicine work together as the National Academies of Sciences, Engineering, and Medicine.

Mission Statement

The mission of the National Academy of Engineering is to advance the well-being of the nation by promoting a vibrant engineering profession and by marshalling the expertise and insights of eminent engineers to provide independent advice to the federal government on matters involving engineering and technology.

NAE Strategic Plan

The NAE under John Anderson's leadership has initiated a new strategic planning effort. The previous plan from 2015 was developed with an assessment of the strengths, weaknesses, opportunities, and threats facing the organization. The NAE has met most of the major goals of that plan, with improvements in the following areas:

1. **Membership Representation:** In 2019, 50 percent of newly elected members were from the business sector, 38 percent from academia, and 13 percent from government and other nonprofit organizations. The NAE membership elected 33 female members, 8 underrepresented minority members, and 17 international members.
2. **Industry Collaboration:** The NAE hosted three workshops in 2019 organized by the Alliance of Automobile Manufacturers to explore engineering contributions to establishing assistive technologies for the elderly and people with disabilities. In addition, NAE officers and senior staff continued to promote the involvement of NAE industrial members in program activities throughout the National Academies of Sciences, Engineering, and Medicine (NASEM).
3. **Public Understanding:** The NAE media relations staff has assisted journalists around the world with coverage of engineering-related topics and actively promoted NAE activities. In 2019 the NAE and/or NAE members were featured in a variety of outlets, such as *The New York Times*, San Diego Fox affiliate KSWB-TV, the Ghana News Agency, *IEEE Spectrum*, *Education Week*, *SWE Magazine*, and numerous university papers. NAE Communications Director Randy Atkins continued his weekly "Engineering Innovation" reports on the most listened-to radio station in the Washington, DC region, the all-news format WTOP, and on Federal News Radio. These reports are featured on the NAE website (www.nae.edu/radio) and podcasts of the radio stories are available to millions of subscribers via iTunes. The NAE continues to expand its social media presence, engaging the public and building awareness of engineering on Twitter, and has a robust web presence. The NAE "Spotlight on Engineering" newsletter, distributed to thousands of subscribers, provides information about NAE activities and items of interest related to engineering generally.

The 2019 EngineerGirl writing contest attracted nearly 1,500 entries from students in grades 3–12 who were asked to write a story that celebrates engineering design and problem solving. The stories are creative works of fiction about women and girls saving the day with their wits, skill, and whatever resources they can find. 2019 also saw the expansion of the EngineerGirl Ambassadors program, a hands-on outreach initiative that launched in 2018. Implemented in collaboration with the Society of Women Engineers (SWE), the Ambassadors program trains and supports female high school students who serve as ambassadors for engineering to younger girls in their community. Four ambassadors completed ambitious projects in 2019—they started engineering clubs and outreach programs in middle and elementary schools and trained Girl Scout leaders to implement robotics programming. For the 2019–20 school year 16 new ambassadors have launched programs around the country.

4. **Ensure Engineering Talent:** NAE program activities advanced this strategic goal in 2019 with (1) preparation of a consensus report assessing the nation's capacity to prepare K–12 engineering educators, (2) the LinkEngineering website (which is being transitioned to the engineering community), and (3) initiation of an activity to share exemplary admissions practices and policies that have increased diversity in undergraduate engineering education.

5. Global Engagement: The NAE's US and bi-/multilateral Frontiers of Engineering (FOE) symposia with Japan, Germany, China, and the European Union remain strong. The NAE is engaged in discussions with potential partners for FOE or Frontiers of Science, Engineering, and Medicine programs with the "Five Eyes" nations (Australia, Canada, New Zealand, United Kingdom, and United States) and sub-Saharan African nations.

The 2019 trilateral Global Grand Challenges Summit in London brought together thought leaders, engineers, innovators, entrepreneurs, students, and policymakers to foster collaboration, elaborate on the Grand Challenges vision, and motivate innovative thinking in engineering. Student participation has always been an important cornerstone of the summit, which features a student day during which 15 undergraduate teams from the three host countries (the UK, US, and China) compete in pitching entrepreneurial ideas to address one or more of the NAE Grand Challenges for Engineering. This idea was expanded at the 2019 summit when 300 students from the three countries worked both cross-culturally and across disciplines through a program of challenge-led innovation over a 5-day period. Thanks to generous help from sponsors the NAE was able to send 100 students to the 2019 summit. The next Global Grand Challenges Summit is scheduled for 2021 in Beijing.

6. Effective Advising: The NAE continued its active partnership with various divisions of the National Academies of Sciences, Engineering, and Medicine, including in developing a consensus study of opportunities and challenges for chemical engineering, and providing advice to the Department of Defense through the Roundtable on Linking Academic Engineering Research and Defense Basic Science. Several new joint activities with the National Academy of Medicine are in various stages of development.

Efforts to prepare a new strategic plan are being organized by a planning committee chaired by Executive Officer Alton D. Romig Jr. and with the participation of members representing the NAE's 12 disciplinary sections.

NAE Annual Meeting

2019 NAE Annual Meeting Forum: Human Spaceflight: Apollo 50 Years On



The 2019 meeting of the National Academy of Engineering celebrated not only the 50th anniversary of the Apollo 11 mission but human spaceflight in general, from the first ventures beyond Earth's atmosphere to future flights to the Moon, Mars, and beyond. Two plenary speakers represented both the origins of spaceflight and continued presence and ambitions in space. Thomas Stafford, an NAE member and NASA astronaut with the Gemini and Apollo programs, conducted the first rendezvous in space and designated the first lunar landing site when he flew the Apollo 10 mission around the Moon. He still holds the record for the highest speed ever attained by a human—Mach 36, as the Apollo 10 command module reentered Earth's atmosphere. Charles Bolden Jr. was pilot and mission commander on

four Space Shuttle flights and NASA administrator from 2009 to 2017. He oversaw the transition from the Space Shuttle system to the era of commercial spaceflight as well as the continuing robotic exploration of Mars to prepare for the arrival of astronauts. Both men had their listeners

alternately laughing and applauding as they recounted their adventures in space and in meetings of the Washington policymakers who oversaw the space program.

The next day, in the annual forum, four speakers joined Generals Stafford and Bolden to fill out the story of US exploration of space. NAE member Robert Crippen piloted the first Space Shuttle flight in 1981 and commanded three other Shuttle missions. Sandra Magnus flew on four Space Shuttle missions, including the shuttle's final flight, and spent 4½ months on the International Space Station. After three shuttle flights, Christopher Ferguson became Boeing's first commercial test pilot astronaut and will be among the first to fly to space aboard the CST-100 Starliner. Hans Koenigsmann, vice president of the Build and Flight Reliability Team at SpaceX, is responsible for the safe completion of the company's missions into space. The forum was moderated by Deanne Bell, a mechanical engineer, entrepreneur, television host (most recently of the CNBC show "Make Me a Millionaire Inventor"), and founder and CEO of Future Engineers.

Proceedings of the forum will be published in 2020.

PROGRAM REPORTS

Postsecondary Engineering Education

Engagement of Engineering Societies in Undergraduate Engineering Education

This project, supported by the National Science Foundation with additional funding from Purdue University, examined the engagement of engineering societies in undergraduate engineering education to determine how they can influence it. Among many roles, the societies may provide education opportunities to their members, set and maintain professional standards, help clarify the knowledge and skills needed by those practicing in the field, and serve as a bridge between employers and schools of engineering. The project was overseen by an ad hoc steering committee chaired by NAE member Leah Jamieson (Purdue University).

The project consisted of five interrelated workshops in 2016–18, with the publication of associated proceedings, and culminated in June 2019 when members of the project committee gave an overview presentation at the American Society for Engineering Education (ASEE) Annual Conference in Tampa.

PreK–12 Engineering Education

LinkEngineering

LinkEngineering, a website intended to support implementation of engineering in preK–12 education, launched publicly in August 2015 and grew to over 1,650 registered users and an average of 6,500 visits per month, with 1,745 individuals receiving a bimonthly newsletter. The project, which began in late 2013, was funded by Chevron Corp., with additional support from the Samueli Foundation and NAE member Robin McGuire, Lettis Consultants International, Inc., and overseen by a 21-member NAE committee. NAE members Bonnie Dunbar, Texas

A&M University, and Jackie Gish, Northrop Grumman (ret.), served on the panel. Five national organizations were enlisted as partners: Achieve, Inc., National Science Teachers Association, American Association for Engineering Education, International Technology and Engineering Educators Association, and Council of State Science Supervisors.

Educator Capacity Building in K–12 Engineering Education

The NAE, in collaboration with the Board on Science Education of the National Academies of Sciences, Engineering, and Medicine, is leading a consensus study to (1) determine what is known from the published literature about the preparation of K–12 educators to teach about engineering, identifying areas of promising practice as well as those in need of further research; (2) catalogue US pre- and in-service programs that support the preparation and professional development of K–12 engineering educators, describing the nature (e.g., curriculum) and history of the programs and, if known, the number of educators reached and evidence of impact (e.g., on individual teaching practice and on the spread of K–12 engineering education locally, regionally, or nationally); (3) review formal (e.g., state certification) and informal (e.g., “badging”) mechanisms that are or might be used to recognize expertise and support career pathway options for K–12 teachers of engineering, noting practical and policy impediments and how they might be addressed; and (4) explore the potential for the postsecondary education community, including but not limited to 4-year engineering and engineering technology programs, to take a more active role in the preparation of teachers of K–12 engineering. The committee is chaired by NAE member Ellen Kullman (Carbon), and NAE member Diran Apelian (Worcester Polytechnic Institute) serves on the committee. The consensus report will be published and disseminated in early 2020.

Media Relations

The NAE media relations staff assisted journalists around the world with coverage of engineering-related topics and actively promoted NAE activities. The NAE and/or NAE members were featured in a variety of outlets, such as *The New York Times*, local Fox affiliate KSWB-TV (San Diego), the Ghana News Agency, *IEEE Spectrum*, *Education Week*, *SWE Magazine*, and numerous university papers. NAE Communications Director Randy Atkins continued his weekly “Engineering Innovation” reports on the most listened-to radio station in the Washington, DC region, the all-news format WTOP, and on Federal News Radio. These reports are featured on the NAE website (www.nae.edu/radio) and podcasts of the radio stories are available to millions of subscribers via iTunes. The NAE continues to expand its social media presence, engaging the public and building awareness of engineering on Twitter, and has a robust web presence. The NAE “Spotlight on Engineering” newsletter, distributed to thousands of subscribers, provides information about NAE activities and items of interest related to engineering generally. A section in “Spotlight” links to advances and updates related to the NAE’s 14 Grand Challenges for Engineering to promote continued awareness of these important goals.

NAE Grand Challenges for Engineering

Global Grand Challenges Summit

The 2019 Global Grand Challenges Summit (GGCS) was held in London September 16–18 at the Southbank Centre’s Queen Elizabeth Hall, with 900 engineers, researchers, innovators, entrepreneurs, and students in attendance. It was broadcast worldwide, with satellite events on

every continent, and focused on two themes: “Will AI and other transformational technologies change humanity for the better?” and “Can we sustain 10 billion people?” Speakers included NAE member Dean Kamen, president of DEKA Research and founder of FIRST; Gitanjali Rao, former EngineerGirl writing contest winner and 14-year-old inventor and engineer; Chris Benson, principal artificial intelligence strategist at Lockheed Martin; and Her Royal Highness Princess Anne, among many others. This event launched the second series of summits, which are inspired by the NAE’s 14 Grand Challenges for Engineering and jointly hosted every two years by the US, UK, and Chinese academies of engineering.

During the five days leading up to the summit, 300 students from the UK, US, and China participated in a “collaboration lab” involving a business plan competition of country-specific teams and then a follow-up collaboration among students from different countries. Students were encouraged to develop tools for responding to global challenges in transformational ways while working cross-culturally and across disciplines. A team from the University of Surrey won the first stage of the competition and a £15,000 prize for designing a postharvest storage network that would work like an “Airbnb for grains,” implemented via a progressive web application. Teams from Hong Kong University and North Carolina State University were joint runners-up and each received £7,500. The students who won the second stage of the competition, in new teams with members from each of the three countries, developed a product to empower women in developing countries by providing inexpensive sanitary pads made from recycled clothing, “Empads.” The concept was developed by Juncheng Shen (University of Nottingham Ningbo China), Amrit Anup Menon and Ellenor Witton (Heriot-Watt University, UK), Angela Peter (Oklahoma State University), Zixi Hong (Wuhan University), and Travis Kelley (University of Iowa) to address the challenge that 43 million menstruating women in India cannot afford to buy feminine hygiene products at the current market price.

Lockheed Martin, founding sponsor of the GGCS, provided sponsorship for US participation in this year’s event.

Center for Engineering Ethics and Society

The Center for Engineering Ethics and Society is overseen by the CEES Advisory Group (AG), which is chaired by NAE member Paul Boulos (Digital Water Works), and directed by Rosalyn W. Berne. In 2019 the AG drafted a strategic plan putting forth a vision for CEES, *Engineering for the needs of people and the planet*, and proposed the following focal areas for CEES activities:

- Digitalization in design and manufacturing, especially “digital twins” and addressing bribery and corruption
- Ethics and autonomous vehicles/robotics
- Ethics in artificial intelligence/machine learning
- Ethics in the design of humanoid robots
- Energy/climate change/water nexus
- Ethics of human/nonhuman hybrid attempts
- Gene editing, gene-driven technologies

The AG recognizes that there will be different options for fulfilling the CEES mission, that all projects will be dependent on funding, and that the focal areas may shift based on what we learn along the way.

In 2019 CEES staff inaugurated a regular column in the NAE's flagship quarterly, *The Bridge*, examining ethical and societal aspects of each issue's topic.

The current major activity of CEES is the Online Ethics Center (OEC), which is the locus of a number of projects designed to provide resources for STEM faculty new to teaching ethics and to support diverse users involved in creating a culture of responsible conduct of research through use of the OEC's resources.

Online Ethics Center for Engineering and Science (OEC)

The OEC features a vast and constantly updated collection of resources on engineering, science, and research ethics that help engineers, scientists, scholars, educators, students, and interested citizens understand and address ethically significant topics and problems that arise in the practice of engineering and results of science. In 2019 the site benefited from functional enhancements, content updates, and expansion, including the addition of 41 new resources.

Funds from a no-cost extension of the NSF-funded project *Becoming the Online Resource Center for Ethics Education in Engineering and Science* were used to redesign the site landing page, add a section on Teaching Ethics

in STEM, add Project Pages, bring in a Mirzayan Fellow, and conduct a summative evaluation. The site had over 485,000 page views from nearly 167,000 users in 208 countries.

The NSF-funded project *Transforming Ethics Education: Connecting STEM Faculty, Research Administrators, and Ethics* (NSF award #1835232) began in February 2019. It aims to support the teaching of ethics by STEM faculty and researchers through mechanisms of engagement on the OEC site.

In 2019 NSF requested and funded a proposal for an OEC workshop on Promising Practices and Innovative Programs in the Responsible Conduct of Research. It supplements the *Transforming* project with an activity to identify institutions with exemplary RCR programs and practices for use by STEM faculty and RCR administrators. The project will culminate in a workshop in September 2020, to facilitate interdisciplinary discussions of effective strategies for building a culture of responsible conduct of research and of potential improvements and further research in the area. Video recordings of presentations by and interviews with invited workshop participants will be posted on the OEC and used to engage communities of practice that have an interest in RCR. An ad hoc planning committee appointed by the NAE president includes Academy members Arturo Casadevall (NAM, chair), Rita R. Colwell (NAS), David B. Allison (NAM), and Frances S. Ligler (NAE).

The NAE partnered with two organizations in its OEC efforts: the Center for the Study of Ethics in the Professions at Illinois Institute of Technology, home to the Engineering Ethics Library (EEL), which provides a searchable database of a wider range of materials than the curated collection available on the OEC; and the Center for Biology and Society at Arizona State University. Mirzayan Fellow Rebecca Monteleone, a graduate student from Arizona State University, developed the OEC project pages and did outreach to prospective contributors for them, in addition to work on other new elements of the OEC.



Online Ethics Center
FOR ENGINEERING AND SCIENCE

In June the OEC hosted a workshop at the annual conference of the American Society for Engineering Education (ASEE) on Creating and Incorporating Ethics Modules into Engineering Courses: Resources of the OEC. And in October, as part of its effort to reach STEM faculty new to teaching ethics, the OEC hosted a 2-day workshop on Working Ethics into the Conversation: Introducing STEM Faculty to Teaching Ethics. The event brought together STEM educators and expert presenters to identify opportunities and develop tools, skills, and resources to integrate ethics and RCR guidance in courses, mentoring, and research environments.

The OEC is guided by its diverse, interdisciplinary Advisory Group members and engages the voluntary services of an Editorial Board. In October the OEC Advisory Group, cochaired by Robert M. Nerem (NAE; Georgia Institute of Technology) and W. Carl Lineberger (NAS; University of Colorado Boulder), met with the Editorial Board and NAE staff to review the OEC *Becoming* project summative evaluation and the formative evaluation of the *Transforming* project; develop its oversight report to NSF; and continue planning for long-term sustainability of the site.

In collaboration with the National Academy of Construction, a proposal for *Toward an Ethical Culture of Safety: A Workshop for Engineering Educators* was submitted to the United Engineering Foundation. A proposal on *Using the OEC to Help Reduce Ocean Plastic Pollution* was submitted to the National Geographic Society. And, encouraged by NSF, a proposal was drafted for a project on *Plastics and Pollution: Engineering, Ethics, and Values*.

Diversity of the Engineering Workforce

EngineerGirl

EngineerGirl is the NAE's signature outreach program for girls. Initially a resource website launched in 2001, EngineerGirl was an extension of the Celebration of Women in Engineering project. From the beginning it has aimed to engage girls, particularly those in middle school, to inform them of the exciting opportunities available in engineering. New EngineerGirl programs continue this mission, connecting girls with engineering role models, providing engagement opportunities, and inspiring the next generation of engineers to change the world.

The EngineerGirl website is a resource for millions of students worldwide. In 2019 it had over 47,000 unique visitors per month. We also continued to build EngineerGirl outreach capacity by doubling our following on social media (Twitter, Instagram, and Facebook) and publishing a monthly newsletter. Updates included a new section of "Try This" design challenges and new subsites for the EngineerGirl writing contest and the Ambassadors program.

A longstanding EngineerGirl program is the annual writing contest. In 2019 it reached record-setting participation with 1,481 entries, a 160 percent increase over the previous year. Students were asked to write a fictional story about a female engineer who saved the day with her wits and engineering skills. The topic engendered a wide variety of creative submissions from 46 states, Puerto Rico, the District of Columbia, and 17 other countries. Cash awards and certificates for first, second, and third place were awarded for each of three grade categories, and the winning stories are posted online at www.engineergirl.org/126417/2019-contest-winners. The 2020 writing contest, "Engineered for Learning," was launched in September.

EngineerGirl's newest program, the EngineerGirl Ambassadors launched in 2018, engages talented high school girls to serve as mentors and role models for younger girls. Ambassadors are selected based on their proposals to engage younger girls in engineering, and are brought together along with their local sponsors for training. In addition to support from engineering mentors and EngineerGirl staff, the ambassadors receive a \$250 minigrant to execute their projects. In the



first cohort, during the 2018–19 academic year, a high school student in Parkland, FL started an engineering club for up to 20 middle school girls that met weekly to work on design projects, 3D modeling, and career exploration. Another introduced the engineering design process and engineering challenges to at-risk elementary students in a one-on-one high school mentoring program, using engineering to help students understand the value of mistakes and cope with failure. A 9th grader led a push to engage Girl Scouts in the Los Angeles area in robotics programs: she organized the first of several planned expos for Girl Scouts and their leaders to learn about opportunities in STEM, and the expo resulted in 16 new Girl Scout robotics teams. And a student in Rhode Island organized an all-girls engineering club at her high school, trained the students to present engineering concepts to younger girls, and arranged for presentations in seven 5th grade classrooms to launch an after-school design club at the local middle school.

The second year of the EngineerGirl Ambassadors program began in fall 2019 with the selection of 16 ambassadors from 13 states and Puerto Rico. The students traveled with their sponsors or adult chaperones to the November 2019 SWE conference in Anaheim, where they received training in gender responsiveness, effective questioning and facilitation strategies, project management, and evaluation, among other events. Students also attended a webinar on choosing and designing high-quality STEM activities before the SWE meeting. These students are implementing their programs and communicating with EngineerGirl staff via monthly reports. More information about the 2019 Ambassadors is at www.engineergirl.org/115762/2019-ambassadors.

Initial reports from the Ambassadors program indicate that students find the experience rewarding and are inspired by the training provided to deliver high-quality engineering experiences for younger girls. Students and their sponsors provided video interviews at the end of the training in 2019, and those interviews will be used to promote the program in 2020. The first of the interview videos shows several ambassadors describing the value of the connections they made and can be seen on our Facebook page: <https://www.facebook.com/EngineerGirlNAE/videos/570939197005547/>.

We also received very positive responses to the writing contest from over 600 students and over 200 parents and teachers who responded to an online survey. Over 90 percent of respondents in each group gave the website a positive (4- or 5-star) review. In addition, 84 percent of the students who

responded said the website and/or contest changed their views or caused them to learn something about engineering. As we've seen in the past, boys (48 percent) were more likely than girls (39 percent) to say they would like to study engineering in college while girls (35 percent) were more likely than boys (26 percent) to say that the program caused them to consider an engineering career. Of the girls who responded 70 percent indicated that they were either likely or very likely to visit the website again, and 67 percent of all the students said they would tell their friends.

Sharing Exemplary Admissions Practices That Promote Diversity in Engineering

Despite longstanding calls to increase the numbers of women, African Americans, American Indians/Alaska Natives, Hispanics of any race, students from low-income families, and other underrepresented groups in undergraduate engineering education, most students are white or Asian males from upper-middle-class families. Admissions policies and criteria vary across institutions, and although research has led to evidence-based changes in criteria and policies that have improved the percentage of students from underrepresented and marginalized populations in engineering, effective practices are not widely known or adopted. Acceptance into engineering schools represents a clear threshold for all students and is thus the focus of this project.

Some institutions have become better at predicting student success in engineering majors based on high school performance or personal traits such as leadership skills or creativity, enabling students who would not normally be admitted to engineering programs to not only enroll but succeed. This project recognizes and promotes these effective practices and develops ideas for future research about ways to measure success in engineering education and to improve the system so that students from all backgrounds become interested in and enroll in engineering education.

Because the critical task of diversifying the US engineering workforce requires action and interventions throughout the engineering education and workforce system, especially at important transition points such as university admissions, with support from the National Science Foundation the NAE is engaging engineering deans and faculty, admissions staff, and researchers in relevant areas to highlight and encourage the diffusion of effective admissions practices that improve diversity in engineering education. This project will (1) provide national recognition to institutions that are effectively diversifying engineering education using admissions policies, (2) provide guidance to institutions that are developing or researching admissions policies to advance diversity but have not yet met with success, and (3) define directions for future research on both best practices in engineering admissions criteria, metrics, and policies and how those practices fit into the larger system of recruiting and retaining engineering students from all backgrounds.

In 2019 a committee appointed by the NAE president and chaired by NAE member Darryll Pines (University of Maryland) received 25 nominations for admissions programs or policies that are improving diversity in undergraduate engineering education and chose 8 of them as exemplary. The programs will be notified in early 2020 and representatives will attend an NAE-hosted spring 2020 workshop where information, expertise, mentoring, and facilitated discussions and collaboration will help attendees advance their work and develop effective plans for their own institutions. The workshop attendees will form the basis for a cohort of leaders and agents of change across the country. In addition, broad dissemination of both the workshop session videos and proceedings will enable deans, administrators, and others who did not attend the workshop to learn from the presentations and discussions.

Ultimately, the project will improve the way engineering schools evaluate the potential success of and accept applicants from all backgrounds and will disseminate best practices to support institutions as they diversify their engineering programs, which will benefit current and future engineers as well as the workforce and economy.

Collaborative Activities

Roundtable on Linking Academic Engineering Research and Defense Basic Science

To facilitate dialogue between the Department of Defense (DoD) and the academic engineering research community, the NAE, in conjunction with the Division on Engineering and Physical Sciences (DEPS) of the National Academies of Sciences, Engineering, and Medicine (NASEM), established the Roundtable on Linking Academic Engineering Research and Defense Basic Science (the “Deans’ Roundtable”), bringing together DoD leadership with US engineering deans and university vice presidents for research. The roundtable is funded by the Basic Research Office in the DoD Office of the Undersecretary of Defense for Research and Engineering.

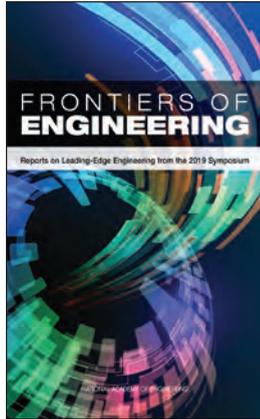
In 2019 the roundtable membership consisted of 28 deans (or interim deans) of engineering schools and 1 university vice president for research and was chaired by NAE member Al Pisano (University of California, San Diego). Other NAE members on the roundtable were Nadine Aubry (Northeastern University, until July 1), Margaret (Kathy) Banks (Texas A&M University), Craig Benson (University of Virginia), Robert (Bobby) Braun (University of Colorado Boulder), Emily Carter (University of California, Los Angeles, until July 1), Alex Gallimore (University of Michigan), Tsu-Jae King Liu (University of California, Berkeley), Vijay Kumar (University of Pennsylvania), Julio Ottino (Northwestern University), Guruswami (Ravi) Ravichandran (California Institute of Technology), Sharon Wood (University of Texas at Austin), and Yannis Yortsos (University of Southern California). NAE member Michael Griffin, Under Secretary of Defense for Research and Engineering, is an ex officio member of the roundtable.

The roundtable met March 15 to discuss strategic issues, ways to lower the mismatch between academic and DoD institutions, and ways to engage and build relationships. A subset of the roundtable (17 deans and 7 DoD attendees) met August 19 to explore issues in the current talent and technology pipeline, ways to help DoD more successfully engage students and faculty, and methods to help engineering schools build capacity for engagement, and to hear an overview of the Air Force Science and Technology Strategy. Another subset of the roundtable (10 deans and 15 DoD attendees) met December 10 to discuss strategies for successfully transitioning the results of basic research to the market.

In addition to facilitating information exchange between research university representatives and DoD leadership, the roundtable will recommend to DoD future workshops and/or consensus studies—to be separately funded and undertaken by separately appointed NASEM expert committees—designed, in part, to further improve the partnership between DoD and academia on topics of mutual importance. These proposed activities should aim to meet the department’s research goals of maintaining technological superiority, preventing technological surprise by adversaries, accelerating the pace of innovation, and training the high-tech defense workforce of the future. The roundtable does not produce publications.

Frontiers of Engineering

The Frontiers of Engineering (FOE) symposium series brings together emerging engineering leaders from industry, academia, and government laboratories to discuss pioneering technical work and leading-edge research in various engineering fields and industrial sectors. The goals of the symposia are to (1) introduce highly accomplished early-career engineers to each other and promote the establishment of contacts among the next generation of engineering leaders,



and (2) facilitate collaboration and the transfer of techniques and approaches across engineering fields in order to sustain and build US innovative capacity.

The annual US Frontiers of Engineering (US FOE) Symposium convenes approximately 100 engineers from across the country. There are also four bilateral programs: (1) German-American Frontiers of Engineering (GAFOE), in partnership with the Alexander von Humboldt Foundation; (2) Japan-America Frontiers of Engineering (JAFOE), in partnership with the Engineering Academy of Japan; (3) China-America Frontiers of Engineering (CAFOE), in partnership with the Chinese Academy of Engineering; and (4) EU-US Frontiers of Engineering (EU-US FOE), in partnership with the European Council of Applied Sciences, Technologies, and Engineering.

Four symposia were held in 2019. The GAFOE symposium, in March in Hamburg, featured sessions on AI and deep learning, biomedical optics, electromobility, and technologies for space exploration. The CAFOE symposium, hosted in March by Qualcomm in San Diego, offered sessions on neuroengineering for restoring human sensory and motor functions, smart cities, 5G wireless communication technology, and new materials. The US FOE meeting was hosted in September by Boeing in N. Charleston, South Carolina, with presentations on advanced manufacturing in the age of digital transformation, engineering the genome, self-driving cars, and blockchain technology; many of the papers were featured in the winter issue of *The Bridge*. At the EU-US FOE symposium, in November in Stockholm, sessions focused on 5G and IoT, smart manufacturing, materials engineering enabled by advances in imaging, and systems approaches to a clean environment.

The FOE program encourages continuing interaction among symposium participants through ongoing outreach activities. A proceedings volume of the US FOE, *Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2018 Symposium*, was published in February 2019. The FOE website (www.naefrontiers.org) includes a searchable database and directory of FOE alumni, a Latest News section that features alumni research breakthroughs, an FOE



community blog, an FOE Alumni Spotlight on participants' research and technical work, and programs, papers, and presentation slides from the FOE symposia. An FOE alumni newsletter is published twice a year.

The Grainger Foundation Frontiers of Engineering Grants enable further pursuit of new interdisciplinary research and technical work stimulated by the conference and support participants' continuing interactions. In 2019 these grants were awarded to two teams of individuals who attended the 2018 US FOE meeting. Andrew Detor (GE) and Corey Trobaugh (Cummins) received a grant for mechanical testing of an aluminum-cerium alloy with the potential to positively impact the transportation industry. Lee Bassett and Andrew Tsourkas, both at the University of Pennsylvania but in different departments, received a grant to engineer a new class of nanoparticles that can be programmed to interact in a biochemical environment in a targeted way. These agents could become diagnostics for disease, sensors to monitor treatment efficacy, and probes to study biochemical pathways and cellular dynamics in basic scientific research. For GAFOE participants the Alexander von Humboldt Foundation provides support for ongoing collaborations.

The following sponsors provided grants or in-kind support for the 2019 FOE symposia: The Grainger Foundation, Qualcomm, Boeing, National Science Foundation, Defense Advanced Research Projects Agency, Air Force Office of Scientific Research, DOD-ASDR&E Research Directorate-Laboratories Office, Microsoft Research, Amazon, Cummins Inc., and individual donors.

Armstrong Endowment for Young Engineers— Gilbreth Lectures

The Armstrong Endowment for Young Engineers—Gilbreth Lectures, a related but independent program, selects outstanding engineers from among FOE speakers to give presentations at the NAE national meeting.

In 2019 four speakers delivered Gilbreth lectures at the national meeting on February 7 in Irvine. Robert Gaunt (University of Pittsburgh) spoke on “Interfaces for Prosthetic Limb Control”; Leman Akoglu (Carnegie Mellon University; shown with NAE chair Gordon England and NAE president C. D.



Mote, Jr.) gave a presentation titled “Anomaly Mining: Detection and Beyond”; Stephen Nichols (Otis Elevator Company) described “Elevator Experience Technology Past, Present, and Future”; and Andrew Johnson (Jet Propulsion Laboratory) gave a talk on “Infusion of Vision Systems into Planetary Landers.”

2019 NATIONAL ACADEMY OF ENGINEERING AWARD WINNERS



2019 Fritz J. and Dolores H. Russ Prize

The Russ Prize is awarded in recognition of an outstanding achievement in bioengineering that improves the human condition. Presented biennially, the prize carries a \$500,000 cash award, an inscribed certificate, and a commemorative medallion.

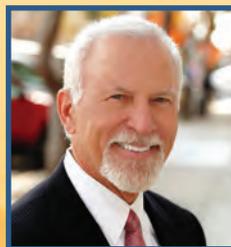
Julio C. Palmaz, Leonard Pinchuk, Richard A. Schatz, John B. Simpson, and Paul G. Yock *“for innovations in medical devices that enable minimally invasive angioplasty treatment of advanced coronary artery disease.”*



Julio C. Palmaz



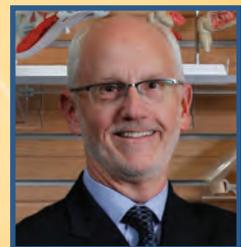
Leonard Pinchuk



Richard A. Schatz



John B. Simpson



Paul G. Yock



2019 Bernard M. Gordon Prize for Innovation in Engineering and Technology Education

The Gordon Prize for Innovation in Engineering and Technology Education honors technology educators whose innovative programs have strengthened the engineering workforce by cultivating students' leadership, creativity, and teamwork skills. The prize is presented annually and awards a cash prize of \$500,000, shared between the educator(s) and the educational institution, to support continuation of the award-winning program. The recipients also receive an inscribed certificate and a commemorative medallion.



Paul J. Benkeser



Joseph M. Le Doux



Wendy C. Newstetter

Paul J. Benkeser, Joseph M. Le Doux, and Wendy C. Newstetter *“for fusing problem-driven engineering education with learning science principles to create a pioneering program that develops leaders in biomedical engineering—Georgia Institute of Technology and Emory University.”*



2019 Simon Ramo Founders Award

The Simon Ramo Founders Award recognizes an outstanding US or foreign member whose professional, educational, and personal accomplishments exemplify the ideals and principles of the NAE. It is presented annually during the NAE annual meeting, and the recipient receives an inscribed certificate and a commemorative medal.



Cato T. Laurencin *“for fundamental, critical, and groundbreaking scientific advances in the engineering of tissues, guiding technology and science policy, and promoting diversity and excellence in science.”*

Cato T. Laurencin



2019 Arthur M. Bueche Award

The Bueche Award honors an engineer who has been actively involved in advancing US science and technology policy, promoting US technological development, and enhancing relations between industry, government, and universities. It is presented annually during the NAE annual meeting, and the recipient receives an inscribed certificate and a commemorative medal.



Roderic Ivan Pettigrew *“for leadership at the NIH and for academic and industrial convergence research and education, resulting in innovations that have improved global health care.”*

Roderic Ivan Pettigrew

2019 NEW MEMBERS AND FOREIGN MEMBERS

In February the NAE elected 86 new members and 17 foreign members, bringing the total US membership to 2,227 and the number of foreign members to 265. Election to the National Academy of Engineering is among the highest professional distinctions accorded to an engineer. Academy membership honors those who have made outstanding contributions to “engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature,” and to “the pioneering of new and developing fields of technology, making major advances in traditional fields of engineering, or developing/implementing innovative approaches to engineering education.”

A list of the newly elected members and foreign members follows, with their primary affiliation at the time of the induction ceremony on October 6, 2019.

NEW MEMBERS

Agonafer, Dereje

University of Texas at Arlington

Ahuja, Krishan K.

Georgia Tech Research Institute/
Georgia Institute of Technology

Aizenberg, Joanna

Harvard University

Antonsson, Erik K.

Systemix, Inc.

Axelrad, Penina

University of Colorado Boulder

Baker, Mary

ATA Engineering Inc.

Balta, Wayne S.

IBM Corporation

Barabino, Gilda A.

The City College of New York

Barrangou, Rodolphe

North Carolina State University

Barros, Ana P.

Duke University

Benioff, Marc R.

Salesforce

Bishop, David J.

Boston University

Biswas, Pratim

Washington University

Braatz, Richard D.

Massachusetts Institute of Technology

Broadbelt, Linda J.

Northwestern University

Chen, Wei

Northwestern University

Clark, Douglas S.

University of California, Berkeley

Conger, Harry M., IV

Freeport-McMoRan Inc.

Deisseroth, Karl

Stanford University and Howard Hughes
Medical Institute

Deligianni, Lili

Columbia University

Eccles, Thomas J.

Trident Maritime Systems, LLC

England, Paul

Microsoft Corporation

Erdemir, Ali

Argonne National Laboratory

Fascetti, Robert J.

Ford Motor Company

Gallimore, Alec D.

University of Michigan

Glotzer, Sharon C.

University of Michigan

Grejner-Brzezinska, Dorota A.

The Ohio State University

Halpern, Joseph Y.

Cornell University

Hassan, Yassin A.

Texas A&M University

Heritage, Jonathan P.

University of California, Davis

Hudson, Linda P.

The Cardea Group

Ingebritsen, Steven E.

US Geological Survey

Jordan, William C.

General Motors Research and Development
Center

Katz, Joseph

Johns Hopkins University

Khoshnevis, Behrokh

Contour Crafting Corporation

Kiesler, Sara

Carnegie Mellon University

Kircher, Charles A.

Kircher & Associates

Kiss, Robert D.

Sutro Biopharma, Inc.

Kogel, Jessica E.

National Institute for Occupational Safety and Health

Koon, John H.

John H. Koon & Associates

Kuehmann, Charles J.

SpaceX and Tesla Motors

Kumar, Anil

PPG Industries, Inc.

Lam, Monica S.

Stanford University

Lievense, Jefferson C.

Genomatica, Inc.

Lorenz, Robert D.*

University of Wisconsin-Madison

McCarthy, Kathryn A.

Canadian Nuclear Laboratories

McGill, Laura J.

Raytheon Missile Systems

McKinley, Gareth H.

Massachusetts Institute of Technology

Moghaddam, Mahta

University of Southern California

Mokhtari, Sasan

Open Access Technology International, Inc.

Morel, Thomas A.

Gamma Technologies, Inc.

Morris, Robert

Massachusetts Institute of Technology

Moyer, Mary Pat

INCELL Corporation LLC

Nunes, Sharon L.

IBM

O'Sullivan, Stephanie L.

Office of the Director of National Intelligence

Picard, Rosalind

Massachusetts Institute of Technology

Pines, Darryll J.

University of Maryland, College Park

Prather, Kimberly A.

University of California, San Diego

Reid, John

John Deere Company

Samuel, Clifford M.

Gilead Sciences, Inc.

San Martín, Alejandro M.

Jet Propulsion Laboratory

Sarter, Nadine B.

University of Michigan

Schuh, Christopher A.

Massachusetts Institute of Technology

Scott, Robert A.

Alcon Laboratories, Inc.

Seltzer, Margo I.

University of British Columbia

Semiatin, Sheldon L.

Air Force Research Laboratory

Shanahan, Patrick M.**Shoop, Barry L.**

The Cooper Union for the Advancement of Science & Art

Shyu, Heidi

Heidi Shyu Inc.

Sigur, Wanda A.

Lockheed Martin Corporation

Smith, Jane M.

US Army Corps of Engineers

Speer, John G.

Colorado School of Mines

Stanney, Kay M.

Design Interactive, Inc.

Stein, Robert M.***Stephens, Daniel B.**

Daniel B. Stephens & Associates, Inc.

Tabors, Richard D.

Tabors Caramanis Rudkevich

Tarokh, Vahid

Duke University

Thapar, Hemant K.

OmniTier

Tom, Jean W.

Bristol-Myers Squibb Company

Tomlin, Claire J.

University of California, Berkeley

Trolier-McKinstry, Susan E.

Pennsylvania State University

Tsividis, Yannis

Columbia University

*Deceased

Udren, Eric A.

Quanta Technology, LLC

Vaidyanathan, P.P.

California Institute of Technology

Wang, Christine A.

MIT Lincoln Laboratory

Wu, Margaret M.

ExxonMobil Research and

Engineering Company

NEW FOREIGN MEMBERS**Brignole, Esteban A.**

Universidad Nacional Sur/CONICET

PLAPIQUI

Cates, Michael E.

University of Cambridge

de Geus, Aart J.

Synopsis, Inc.

Dordain, Jean-Jacques

European Space Agency

Dyson, James

Dyson Technology

Jonah, Samuel E.

Jonah Capital

Laporte, Gilbert

HEC Montreal

Mair, Robert

University of Cambridge

Mazumdar-Shaw, Kiran

Biocon Limited

Murray, Christopher B.

University of Pennsylvania

Qu, Jiuhui

Chinese Academy of Sciences

Ramamoorthy, Mylavarapu

K L University, Vijayawada, Andhra

Rudnick, Hugh

Pontificia Universidad Católica de Chile

Sohrabpour, Saeed

Sharif University of Technology

Spaldin, Nicola

ETH Zürich

Stevens, Molly M.

Imperial College London

Zheludev, Nikolay I.

University of Southampton

NAE ANNIVERSARY MEMBERS

50 YEARS OR MORE

Members whose names are in bold celebrated their 50th year in 2019.

R. Byron Bird

Harold Brown*

John S. Foster, Jr.

Richard J. Grosh

William J. Hall

Hilliard W. Paige*

45 TO 49 YEARS

Members whose names are in bold celebrated their 45th year in 2019.

Robert Plunkett*

Calvin F. Quate*

Ivan E. Sutherland

Morris Tanenbaum

40 TO 44 YEARS

Members whose names are in bold celebrated their 40th year in 2019.

Egil Abrahamsen

H. Norman Abramson

Andreas Acrivos

Clarence R. Allen

Betsy Ancker-Johnson

Arthur G. Anderson

John G. Anderson

Alfredo H-S. Ang

Stephen D. Bechtel, Jr.

C. Gordon Bell

Daniel Berg

Donald C. Berkey*

Elwyn Berlekamp*

Andrew H. Bobeck

John E. Breen

William B. Bridges

Frederick P. Brooks, Jr.

Lloyd S. Cluff*

Fernando J. Corbato*

John F. Davidson*

Robert C. Dean, Jr.

Anthony J. DeMaria

Leo Esaki

Thomas E. Everhart

Joseph Feinstein

Steven J. Fennes

Merton C. Flemings

Douglas W. Fuerstenau

Yuan-Cheng B. Fung

Theodore V. Galambos

Robert G. Gallager

William J. Galloway

Richard L. Garwin

Welko E. Gasich

Ronald L. Geer

Ivar Giaever

Ralph E. Gomory

John B. Goodenough

Stephen E. Harris

Robert W. Hellwarth

Joseph M. Hendrie

Charles L. Hosler, Jr.

Michel Hug*

George W. Jeffs*

Paul C. Jennings

Bernard H. Kear

Jack L. Kerrebrock*

Herwig Kogelnik

William R. Lucas

Robert W. Lucky

John D. Mackenzie

Enrique A. Marcatili

Hans Mark

Robert D. Maurer

John S. Mayo

Perry L. McCarty

William J. McCune, Jr.

Ross E. McKinney

James D. Meindl

James K. Mitchell

Johannes Moe

Gordon E. Moore

James J. Morgan

C. Kumar N. Patel

Harold W. Paxton

Marc J. Pelegrin

John M. Prausnitz

Ronald F. Probststein

Leslie Earl Robertson

Theodore Stern

Daniel M. Tellep

Marshall P. Tulin*

Andrew J. Viterbi

John B. Wachtman, Jr.

William M. Webster

James Wei

Lloyd R. Welch

James G. Wenzel

Robert H. Wertheim

Amnon Yariv

35 TO 39 YEARS

Members whose names are in bold celebrated their 35th year in 2019.

Jan D. Achenbach

Mihran S. Agbabian

Dell K. Allen

William A. Anders

Arthur Ashkin

Norman R. Augustine

Seymour Baron

Lionel O. Barthold

Wallace B. Behnke

Arden L. Bement, Jr.

John G. Bollinger

Anil K. Chopra

John L. Cleasby

Robert C. Crooke

Jose B. Cruz, Jr.

James W. Dally

F. Paul de Mello

Daniel B. DeBra

Raymond F. Decker

Robert H. Dennard

Peter S. Eagleson

Charles A. Eckert

John V. Evans

G. David Forney, Jr.

Ralph S. Gens

Robert S. Hahn

*Deceased

Kent F. Hansen
Robert D. Hanson
 Kenneth E. Haughton
 Alfred J. Hendron, Jr.
 Cyril Hilsum
 David A. Hodges
 Edward E. Hood, Jr.
 John W. Hutchinson
 Irwin M. Jacobs
 Trevor O. Jones
Thomas Kailath
 C. Judson King
 Leonard Kleinrock
 Donald E. Knuth
 James N. Krebs
 Henry Kressel
Butler W. Lampson
 George Leitmann
John W. Leonard
Peter W. Likins
 Raymond C. Loehr
Dan Luss
 Charles J. McMahon, Jr.
Carver A. Mead
Robert Mehrabian
 Carl L. Monismith
 Norman A. Nadel
Hyla S. Napadensky
 Robin B. Nicholson
 Karl H. Norris
 J.R. Anthony Pearson
Thomas K. Perkins
 Karl S. Pister
 Lawrence R. Rabiner
Raj Reddy
Eli Reshotko
 James R. Rice
 Herbert H. Richardson
 Walter L. Robb
 Stanley T. Rolfe
 James F. Roth
 Irwin W. Sandberg
John H. Schmertmann
 William R. Schowalter
 John H. Seinfeld
 Charles V. Shank
Eugene D. Shchukin

John Brooks Slaughter
 George E. Smith
 Kenneth A. Smith
 Nickolas J. Themelis
 Kenneth Thompson
 Thomas A. Vanderslice
Sheldon Weinig
 Jasper A. Welch, Jr.
 John F. Welch, Jr.
 Albert R.C. Westwood
 Willis S. White, Jr.
 Gerald L. Wilson
 Theodore Y. Wu
 Takeo Yokobori
 Dante C. Youla
 Laurence R. Young
 Paul Zia

30 TO 34 YEARS

Members whose names are in bold celebrated their 30th year in 2019.

Richard C. Alkire
 Frances E. Allen
Frank F. Aplan
Ali S. Argon
 John A. Armstrong
 Bishnu S. Atal
David H. Auston
 William F. Ballhaus, Jr.
Robert G. Bea
George A. Bekey
 Alexis T. Bell
John A. Betti
Joel S. Birnbaum
 Kenneth A. Blenkarn
Geoffrey Boothroyd
 H. Kent Bowen
 Klaus D. Bowers
 Robert W. Brodersen
 Robert L. Byer
 William J. Carroll
John R. Casani
 John F. Cashen
 Ben H. Caudle*
 Herbert S. Cheng

Alfred Y. Cho
 Richard M. Christensen
 Jon F. Claerbout
Rodney J. Clifton
 Philip M. Condit
 Robert W. Conn
 Lynn A. Conway
Richard A. Conway
 Paul M. Cook
 Edward J. Cording
 Ernest L. Daman
 Morton M. Denn
Stephen W. Director
 James J. Duderstadt
 James M. Duncan
Russell D. Dupuis
 Lloyd A. Duscha
Robert J. Eaton
 James Economy
Charles Elachi
 Gerard W. Elverum
 Tony F.W. Embleton
 Richard E. Emmert
Thomas V. Falkie*
Frank F. Fang
 Edward A. Feigenbaum
Robert E. Fischell
 John W. Fisher
 Donald C. Fraser
Elsa M. Garmire
David B. Geselowitz
Jerome B. Gilbert
 Alastair M. Glass
 Richard J. Goldstein
 Mary L. Good*
 Joseph W. Goodman
 Arthur C. Gossard
Keith E. Gubbins
 Hermann K. Gummel
 Bacharuddin J. Habibie*
 Donald L. Hammond
Juris Hartmanis
Michael Hatzakis
 Siegfried S. Hecker
 Adam Heller
Robert J. Hermann
 Edward A. Hiler

*Deceased

Narain G. Hingorani
 Yu-Chi Ho
Lester A. Hoel
John E. Hopcroft
 William G. Howard, Jr.
 Lee A. Iacocca*
Izzat M. Idriss
 Anthony J. Iorillo
 Erich P. Ippen
 Robert B. Jansen
 Marvin E. Jensen
 James O. Jirsa
 Ellis L. Johnson
Gunther F. Joklik
 Frank D. Judge
 Robert E. Kahn
 Melvin F. Kanninen
 George E. Keller II*
 Makoto Kikuchi
 Albert S. Kobayashi
 Bernard L. Koff
 Louis J. Lanzerotti
 Ronald M. Latanision
 Kaye D. Lathrop
 Gerald D. Laubach
 L. Gary Leal
 James U. Lemke*
 Martin P. Lepselter
 Barbara H. Liskov
John D. Little
 Benjamin Y.H. Liu
Daniel P. Loucks
 John W. Lyons
 John B. MacChesney
 Albert Macovski
 Robert Malpas
 John L. Mason*
Robert F. Mast
Shiro Matsuoka
John C. McDonald
 Chiang C. Mei
 Richard C. Messinger
 Harold Mirels
James W. Mitchell
 Sanjoy K. Mitter
 Joe H. Mize
 Joel Moses

C. D. (Dan) Mote, Jr.
Roddam Narasimha
 Albert Narath
 George L. Nemhauser
 Robert M. Nerem
Arun N. Netravali
J. Nicholas Newman
 William D. Nix
Ronald P. Nordgren
 J. Tinsley Oden
 William G. Oldham
 Alan V. Oppenheim
 Morton B. Panish
 Frank L. Parker
 Ronald R. Parker
 Donald R. Paul
 J. Randolph Paulling
 Val P. Peline
 Donald E. Petersen
 George P. Peterson
 R. Byron Pipes
 John William Poduska, Sr.
 Michael Prats
 Robert A. Rapp
 Jerome G. Rivard
 Enders A. Robinson
 Ignacio Rodríguez-Iturbe
Ronald A. Rohrer
 Ronald E. Rosensweig
 Della M. Roy
Elbert L. Rutan
 Chih-Tang Sah
Alan Schriesheim
Frank J. Schuh
 Charles D. Scott
Laurence C. Seifert
 Eugene Sevin
 Don W. Shaw
Michael L. Shuler
 Leonard M. Silverman
 Merrill I. Skolnik
Henry I. Smith
James J. Solberg
 Ponisseril Somasundaran
 Ephraim M. Sparrow*
 William J. Spencer
 Fred I. Stalkup

Dale F. Stein
 Charles V. Sterling
Richard G. Strauch
 William D. Strecker
 Ben G. Streetman
 Chung L. Tang
 Byron D. Tapley
 Robert E. Tarjan
 David A. Thompson
Larry F. Thompson
Charles E. Till
 Neil E. Todreas
Jeffrey D. Ullman
 Walter G. Vincenti*
 Raymond Viskanta
 Daniel I.C. Wang
Kuo K. Wang
William J. Ward III
 Vern W. Weekman, Jr.
 Arthur W. Westerberg
 John A. White, Jr.
Robert M. White
 Sheila E. Widnall
 Janusz S. Wilczynski
 Forman A. Williams
 James C. Williams
 Edward L. Wilson
 Ward O. Winer
 John J. Wise
 Eugene Wong
Jerry M. Woodall
Israel J. Wygnanski
 Abe M. Zarem
 Jacob Ziv

25 TO 29 YEARS

Members whose names are in bold celebrated their 25th year in 2019.

Zhores I. Alferov*
 John L. Anderson
 Minoru S. (Sam) Araki
 Michael F. Ashby
 Donald W. Bahr
 B. Jayant Baliga
 Peter M. Banks

*Deceased

Craig R. Barrett
Forest Baskett

Leslie A. Benmark
Roger H. Beteille*
James R. Biard
David T. Blackstock
Richard E. Blahut
F. Peter Boer

David B. Bogy

Donald A. Brand
Robert K. Brayton

John D. Bredehoeft

Peter R. Bridenbaugh
Roger W. Brockett

Alec N. Broers

Alan C. Brown
Robert A. Brown
Keith A. Browning

Wilfried H. Brutsaert

Robert D. Burnham
James D. Callen
Renso L. Caporali
Kenneth E. Case

John J. Cassidy

Don B. Chaffin

Steve S. Chen
Harvey E. Cline
G. Wayne Clough

Joseph P. Colaco

James M. Coleman
Harry M. Conger
Richard W. Conway
Harry E. Cook*

Donald C. Cox

M. George Craford

Jerome J. Cuomo
David N. Cutler

Lance A. Davis

Stephen H. Davis

Carl R. de Boer
George E. Dieter
Frederick H. Dill
Steven D. Dorfman
Irwin Dorros*
Earl H. Dowell
Elisabeth M. Drake
E. Linn Draper, Jr.

Stephen W. Drew
T. Dixon Dudderar
Charles B. Duke*

Robert W. Dutton

Lewis S. (Lonnie) Edelheit

Fredric F. Ehrich
Jerald L. Ericksen
Charles Fairhurst

Odd M. Faltinsen

Eugene J. Fasullo

Leroy (Mike) M. Fingerson

Bruce A. Finlayson

Fred N. Finn

Essex E. Finney, Jr.

George M.C. Fisher

Marshall L. Fisher

William L. Fisher

Edith M. Flanigen

Woodie C. Flowers

Hans G. Forsberg

Alan B. Fowler
Judson C. French

L.B. Freund

William L. Friend
Samuel H. Fuller
B. John Garrick
C. William Gear
Thomas G. Giallorenzi

Elmer G. Gilbert*

George J. Gleghorn
W. Barney Gogarty
Ronald E. Goldsberry
Marvin E. Goldstein
Richard E. Goodman
Bernard M. Gordon
Susan L. Graham
Paul R. Gray

Sidney J. Green

Donald P. Greenberg

George I. Haddad

Delon Hampton
Howard R. Hart, Jr.
Henry J. Hatch
John L. Hennessy
John A. Herbst

George J. Hess

Arthur H. Heuer

George J. Hirasaki
Kaare Høeg

Seiuemon Inaba
James F. Jackson
David W. Johnson, Jr.
Donald L. Johnson

Anita K. Jones

Paul G. Kaminski

Frank E. Karasz
Frederick J. Karol
Richard M. Karp

John G. Kassakian

Donald B. Keck
Robert H. Kingston
Alexander M. Klibanov

Mark H. Kryder

David J. Kuck
Gerald L. Kulcinski
H.T. Kung

Charles R. Kurkjian

Richard T. Lahey, Jr.

James L. Lammie
Leslie B. Lamport
Robert S. Langer
Robert C. Lanphier III
Richard C. Larson
W. John Lee

Sidney Leibovich

Johanna M.H. Levelt Sengers

Norman N. Li

Robert H. Liebeck

James D. Livingston*

Robert W. MacCormack
Alexander MacLachlan
Thomas L. Magnanti
Thomas J. Malone
Anna M. Marabini
Robert C. Marini
Karl E. Martersteck
James F. Mathis
William C. Maurer
Adolf D. May
Eugene R. McGrath
James C. McGroddy
David G. Messerschmitt
Jan D. Miller
Keith K. Millheim

*Deceased

Linn F. Mollenauer
 James E. Monsees*
 L. David Montague
 Manfred Morari
 William B. Morgan
 Norbert R. Morgenstern
 Van C. Mow
 Richard S. Muller
 Earl M. Murman
 Venkatesh Narayanamurti
 John Neerhout, Jr.
 Stuart O. Nelson
 Shlomo P. Neuman
 Deborah J. Nightingale
 Tak H. Ning
 Robert M. Nowak
 John H. Nuckolls
 James G. O'Connor
 Thomas D. O'Rourke
 Bradford W. Parkinson
 David A. Patterson
 Irene C. Peden
Paul Penfield, Jr.
 Alan W. Pense
 Arno A. Penzias
 Stewart D. Personick
 Richard H. Petersen
 Arun G. Phadke
 Dennis J. Picard
 William F. Powers
Richard B. Priory
 Edwin P. Przybylowicz
Robert A. Pucel
 W. Harmon Ray
John R. Rice
 Ronald L. Rivest

Richard J. Robbins*
 Larry A. Roesner
 José M. Roesset
 Murray W. Rosenthal
 Donald E. Ross
 William B. Rouse
 Paul E. Rubbert
 Eli Ruckenstein
 William B. Russel
 T.W. Fraser Russell
 Gavriel Salvendy
 Maxine L. Savitz
Ronald W. Schafer
Jorg Schlaich
Gabriel Schmergel
Lanny D. Schmidt
Ronald V. Schmidt
 Albert B. Schultz
Jerome S. Schultz
 Robert J. Schultz
Lyle H. Schwartz
 Mischa Schwartz
 Norman R. Scott
 Charles L. Seitz
Robert J. Serafin
 F. Stan Settles
 Robert R. Shannon
 Hsieh W. Shen
Jeffrey J. Sirola
 Arnold H. Silver
 Richard W. Skaggs
 Helmut E. Sobieczky
George S. Springer
 Raymond S. Stata
 Hermann Statz
 Richard J. Stegemeier

Gunter Stein
 Richard S. Stein
Robert Stratton
 Yasuharu Suematsu
 John H. Sununu
George W. Sutton
James M. Symons
 Zehev Tadmor
 Richard A. Tapia
Valerian I. Tatarskii
 Robert L. Taylor
Shoichiro Toyoda
 Alvin W. Trivelpiece
 Rao R. Tummala
 G. Keith Turnbull
Gottfried Ungerboeck
 Irv Waaland
 C. Michael Walton
 Dianzuo Wang
 Hans-Juergen Warnecke*
 Watt W. Webb
 Robert J. Weimer
Richard M. White
 Sheldon M. Wiederhorn
 C. Grant Willson
 Niklaus Wirth
Savio L-Y. Woo
 Edgar S. Woolard, Jr.
 David A. Woolhiser
 Wm. A. Wulf
 Loring A. Wyllie, Jr.
 Henry T.Y. Yang
 A. Thomas Young
 John A. Young
 William D. Young
 Zhemin Zheng

*Deceased



A Message from NAE Vice President Corale Brierley

As the world continues to adapt and change, I am so grateful for the longstanding support and generosity of the National Academy of Engineering community. While much uncertainty lies ahead, there is also much to be hopeful and excited about—the NAE is more important now than ever before and moving forward will provide many opportunities to lead and inspire the nation.

I am pleased to report that more than 780 members, friends, and organizations invested over \$5.4 million in new cash, pledges, and planned gifts in 2019. You, our members and friends, play a vital role in enabling a dynamic and proactive NAE and ensuring that the engineers of tomorrow—today's girls and boys, young women and men—are engaged and equipped to take on the most pressing challenges facing our country and the world.

Private support derived from annual contributions from individuals, corporations, and foundations, and spendable income from endowments funded roughly 68% of the NAE's work in 2019. The NAE's EngineerGirl and Grand Challenges Scholars Program for developing engineering talent, Frontiers of Engineering for sustaining engineering excellence, and Center for Engineering Ethics and Society for ensuring the integrity of the profession—all thrive on funding from our members and friends.

This year as we recognize our Annual, Golden Bridge, Einstein, and Heritage Societies, we also announce the creation of three new societies recognizing cumulative giving: the Abraham Lincoln Society for donors who have invested \$1,000,000 or more; the Benjamin Franklin Society for donors who have invested \$500,000–\$999,999; and the Marie Curie Society for donors who have invested \$250,000–\$499,999.

Romig Challenge Update

In 2019 Al and Julie Romig established a \$100,000 giving challenge for NAE members elected since 2015. All first-time and upgraded gifts counted toward the challenge, allowing members to double the impact of their gift. Sixty-seven members qualified for the challenge, nearly 14% of the 481 members from the classes of 2015–19. Those members contributed a total of \$235,193.35 to the NAE.

Onward

Your ongoing philanthropic capital ensures a solid foundation from which to sustain important projects and spearhead inspiring new programs at the NAE. As the world continues to adapt to a new normal, the NAE will be on the front lines, helping to solve the complex challenges facing people and society today and in the coming decades. Thank you for all you do for engineering, people, and society.

A handwritten signature in blue ink that reads "Corale L. Brierley". The signature is fluid and cursive.

Corale L. Brierley

2019 HONOR ROLL OF DONORS

We greatly appreciate the generosity of our donors. Your contributions enhance the impact of the National Academy of Engineering's work and support its vital role as advisor to the nation. The NAE acknowledges contributions made as personal gifts or as gifts facilitated by the donor through a donor-advised fund, matching gift program, or family foundation.

LIFETIME GIVING SOCIETIES

We gratefully acknowledge the following members and friends who have made generous charitable lifetime contributions. Their collective, private philanthropy enhances the impact of the academies as advisor to the nation on matters of science, engineering, and medicine.

Recently, three new giving societies were approved, recognizing donors at \$250,000 and above, to show our donors appreciation in broader ways and to create more standardized stewardship practices allowing us to better steward our top-level donors.

THE ABRAHAM LINCOLN SOCIETY

In recognition of members and friends who have made lifetime contributions of \$1 million or more to the National Academy of Sciences, National Academy of Engineering, or National Academy of Medicine.

Boldfaced names are NAE members.

Bruce and Betty Alberts
Richard and Rita Atkinson
Norman R. Augustine
Craig and Barbara **Barrett**
Jordan* and Rhoda **Baruch**
Stephen D. Bechtel, Jr.
Arnold and Mabel **Beckman***
Leonard Blavatnik
Harry E. Bovay, Jr.*
Donald L. Bren
Harvey V. Fineberg and Mary E. Wilson
Bernard M. Gordon
Cecil H. Green*
Michael and Sheila Held*
William R. and Rosemary B. **Hewlett***

Ming and Eva **Hsieh**
Irwin and Joan **Jacobs**
Robert L. and Anne K. James
Kenneth A. Jonsson*
Fred Kavli*
Daniel E. Koshland, Jr.*
Tillie K. Lubin*
Whitney and Betty MacMillan
John F. McDonnell
George P. Mitchell*
The Ambrose Monell Foundation
Gordon and Betty **Moore**
Philip and Sima Needleman
Peter O'Donnell, Jr.
Robert* and Mayari **Pritzker**
Richard L. and Hinda G. Rosenthal*

Martine A. Rothblatt
Jack W. and Valerie Rowe
Fritz J. and Dolores H. Russ Prize
Fund of the Russ College of
Engineering and Technology at
Ohio University
Dame Jillian Sackler
Raymond* and Beverly Sackler
Bernard and Rhoda Sarnat*
Leonard D. Schaeffer
Sara Lee and Axel Schupf
James H. and Marilyn Simons
Anthony J. Yun and Kimberly A. Bazar

THE BENJAMIN FRANKLIN SOCIETY

In recognition of members and friends who have made lifetime contributions of \$500,000 to \$999,999 to the National Academy of Sciences, National Academy of Engineering, or National Academy of Medicine.

Boldfaced names are NAE members.

Rose-Marie and Jack R. Anderson*
John and Elizabeth **Armstrong**
Kenneth E. Behring
Gordon Bell
Elkan R.* and Gail F. Blout
Carson Family Charitable Trust
Charina Endowment Fund
Ralph J.* and Carol M. Cicerone
James McConnell Clark
Henry David*
Richard Evans*
Eugene Garfield Foundation
Theodore Geballe

Penny and **Bill George**, George
Family Foundation
Crista and Detlef Gloge
William T.* and Catherine
Morrison Golden
Alexander Hollaender*
Thomas V. Jones*
Cindy and **Jeong Kim**
Ralph and Claire **Landau***
Asta and **William W. Lang***
Ruben F.* and **Donna Mettler**
Dane* and Mary Louise **Miller**
Oliver E. and Gerda K. Nelson*

Gilbert S. Omenn and Martha A. Darling
Shela and **Kumar Patel**
William J. Rutter
Henry and Susan **Samueli**
Herbert A. and Dorothea P. Simon*
Raymond S. Stata
John and Janet **Swanson**
Roy and Diana Vagelos
Andrew and Erna* **Viterbi**
Alan M. Voorhees*
Anonymous (1)

*Deceased

THE MARIE CURIE SOCIETY

In recognition of members and friends who have made lifetime contributions of \$250,000 to \$499,999 to the National Academy of Sciences, National Academy of Engineering, or National Academy of Medicine. Boldfaced names are NAE members.

The Agouron Institute

W.O. Baker*

Warren L. Batts

Elwyn* and Jennifer **Berlekamp**

Daniel Branton

George* and Virginia **Bugliarello**

Clarence S. Coe*

Rosie and Stirling A. Colgate*

W. Dale and Jeanne C. **Compton***

Lance and Susan **Davis**

David and Miriam Donoho

Ruth and Victor Dzau

Dotty* and **Gordon England**

George and Christine Gloeckler

Jerome H.* and Barbara N.
Grossman

John O. Hallquist

John L. Hennessy

Chad and Ann **Holliday**

William R. Jackson*

Anita K. Jones

Mary and **Howard* Kehrl**

Kent Kresa

Robin K. and Rose M. **McGuire**

Janet and **Richard M.* Morrow**

Clayton Daniel and Patricia L.

Mote

Ralph S. O'Connor*

Kenneth H. Olsen*

Ann and **Michael Ramage**
Simon Ramo*

Anne and **Walt Robb**

Matthew L. Rogers and Swati
Mylavarapu

Stephen* and Anne Ryan

H.E. Simmons*

Judy Swanson

Marci and **James J. Truchard**

Ted Turner

Leslie L. Vadasz

Martha Vaughan*

Charles M.* and Rebecca M. **Vest**

Wm. A. Wulf

Anonymous (1)

THE EINSTEIN SOCIETY

In recognition of members and friends who have made lifetime contributions of \$100,000 to \$249,999 to the National Academy of Sciences, National Academy of Engineering, or National Academy of Medicine. Boldfaced names are NAE members.

John and Pat **Anderson**

Laura E. and John D. Arnold

Holt Ashley*

Nadine Aubry and John L. Batton

Francisco J. and Hana Ayala

William F. Ballhaus, Sr.*

David Baltimore

Thomas D.* and Janice H. **Barrow**

H.H. and Eleanor F. Barschall*

Donald and Joan Beall

Daniel and Frances **Berg**

Diane and Norman Bernstein

Bharati and **Murty Bhavaraju**

Chip and Belinda **Blankenship**

Erich Bloch*

Barry W. Boehm

Gopa and **Arindam Bose**

David G. Bradley

Lewis M. Branscomb

Sydney Brenner*

Malin Burnham

Ursula Burns and Lloyd Bean*

Chau-Chyun and Li-Li **Chen**

John and Assia **Cioffi**

Paul Citron and Margaret Carlson
Citron

A. James Clark*

G. Wayne Clough

Barry and Bobbi Coller

John D. Corbett*

Ross and Stephanie **Corotis**

Ruth David and Stan Dains

Roman W. DeSanctis

Robert* and Florence **Deutsch**

Nicholas M. Donofrio

Paul M. Doty*

Charles W. Duncan, Jr.

George and Maggie Eads

Robert and Cornelia **Eaton**

The Eletheria Foundation

James O. Ellis, Jr. and **Elisabeth**

Paté-Cornell

Emanuel and Peggy Epstein

Thomas E. Everhart

Peter Farrell

Michiko So* and Lawrence

Finegold

Tobie and **Daniel J.* Fink**

George and Ann **Fisher**

Delbert A. and Beverly C. Fisher

Robert C.* and Marilyn G. **Forney**

Harold K.* and Betty **Forsen**

Edward H. Frank and Sarah G.

Ratchye

William L. and Mary Kay **Friend**

Christopher Galvin

William H. and Melinda F. **Gates III**

Nan and **Chuck Geschke**

Jack and Linda Gill

Martin E. and Lucinda **Glicksman**

Avram Goldstein*

Robert W. Gore

Paul and Judy **Gray**

Corbin Gwaltney

Margaret A. Hamburg and Peter
F. Brown

William M. Haney III

Wesley L. Harris

George* and Daphne

Hatsopoulos

Jane E. Henney and Robert
Graham

Lyda Hill

Jane Hirsh

Michael W. Hunkapiller

Jennie S. Hwang

M. Blakeman Ingle

Richard B. Johnston, Jr.

Trevor O. Jones

Thomas Kailath

Yuet Wai and Alvera Kan

John and Wilma **Kassakian**

Leon K. and Olga Kirchmayer*

Frederick A. Klingenstein

William I. Koch

Gail F. Koshland

Jill Howell Kramer

John W. Landis*

Janet and Barry Lang

Ming-wai Lau

Gerald and Doris **Laubach**

David M.* and Natalie **Lederman**

Bonnie Berger and **Frank**

Thomson Leighton

Thomas M. Leps*

Frances and **George Ligler**

*Deceased

R. Noel Longuemare, Jr.
Asad M., Gowhartaj, and Jamal
Madni
 Davis L. Masten and Christopher
 Ireland
Roger L. McCarthy
 Michael and Pat McGinnis
 William W. McGuire
 Burt* and Deedee McMurtry
 Marcia K. McNutt
 Rahul Mehta
 G. William* and Ariadna Miller
 Ronald D. Miller
 Stanley L. Miller*
Sanjit K. and Nandita **Mitra**
 Sharon and **Arthur Money**
 Joe and Glenna Moore
 David* and Lindsay Morgenthaler
Narayana and Sudha **Murty**
 Jaya and **Venky Narayanamurti**
 Ellen and **Philip Neches**
 Norman F. Ness
Ronald and Joan **Nordgren**
 Susan and **Franklin M. Orr, Jr.**

David Packard*
Charles and Doris **Pankow***
Larry* and Carol **Papay**
Jack S. Parker*
 Nirmala and **Arogyaswami J.**
Paulraj
 Edward E. Penhoet
Allen E.* and Marilynn **Puckett**
Richard F. and Terri W. **Rashid**
 Alexander Rich*
 Arthur D. Riggs
Ronald L. Rivest
 Julie and **Alton D. Romig, Jr.**
Henry M. Rowan*
Joseph E. and Anne P. **Rowe***
Jonathan J. Rubinstein
Maxine L. Savitz
 Walter Schlup*
 Wendy and **Eric Schmidt**
Richard P. Simmons
 Harold C. and Carol H. Sox
Robert F. and Lee S. **Sproull**
 Georges C. St. Laurent, Jr.
Arnold and Constance **Stancell**

Richard J. and Bobby Ann
Stegemeier
 Edward C. Stone
 F. William Studier
 Thomas and Marilyn Sutton
 Charlotte and **Morris Tanenbaum**
Peter and Vivian **Teets**
Hemant K. and Suniti **Thapar**
James M. Tien and Ellen S.
 Weston
Gary and Diane **Tooker**
 Katherine K. and **John J. Tracy**
John C. Wall
Robert and Joan **Wertheim**
Robert M.* and Mavis E. **White**
 John C. Whitehead*
 Jean D. Wilson
Ken Xie
 Tachi and Leslie Yamada
Adrian Zaccaria
Alejandro Zaffaroni*
 Peter Zandan
 Janet and Jerry Zucker
 Anonymous (3)

GOLDEN BRIDGE SOCIETY

In recognition of NAE members and friends who have made lifetime contributions totaling \$20,000 to \$99,999. Boldfaced names are NAE members.

\$75,000 to \$99,999

Paul F. Boulos
 Kristine L. Bueche
Josephine Cheng
 Priscilla and **Sunlin Chou***
Jeffrey Dean

Robert E. Kahn
Paul and Julie **Kaminski**
 Rita Vaughn and **Theodore C.***
Kennedy
Johanna M.H. Levelt Sengers

Jane and Norman N. Li
John Neerhout, Jr.
Roberto Padovani

\$50,000 to \$74,999

Jane K. and **William F. Ballhaus, Jr.**
Corbett Caudill
William Cavanaugh
Selim A. Chacour
 The Crown Family
Gerard W. Elverum
Louis V. Gerstner, Jr.
 Priscilla and **Paul E.* Gray**
 Kathryn S. and **Peter S. Kim**

Richard A. Meserve
James K. and Holly T. **Mitchell**
 Darla and **George E.* Mueller**
 Jane and **Alan R. Mulally**
Cherry A. Murray
 Cynthia J. and **Norman A*. Nadel**
Robert M. and Marilyn R. **Nerem**
 Cathy and **Paul S.* Peercy**
 Ellen and **George A.* Roberts**

Mendel Rosenblum and Diane
Greene
Linda S. Sanford
Leo John* and Joanne **Thomas**
David W. Thompson
Sheila E. Widnall
A. Thomas Young
Elias A. Zerhouni

\$20,000 to \$49,999

Andreas and Juana **Acrivos**
Rodney C. Adkins
Alice Merner Agogino
Clarence R. Allen
 Valerie and **William A. Anders**
John C. Angus
 Seta and **Diran Apelian**

Frances H. Arnold
 Ruth and **Ken Arnold**
 Kamla* and **Bishnu S. Atal**
Ken Austin*
 Clyde and Jeanette **Baker**
William F. Banholzer
David K. Barton

Becky and Tom **Bergman**
R. Byron Bird
 Diane and **Samuel W.* Bodman**
Mark T. Bohr
Rudolph Bonaparte
 Kathleen and **H. Kent Bowen**
Corale L. Brierley

*Deceased

- James A. Brierley
Lenore and Rob Briskman
Andrei Z. Broder
Rodney A. Brooks
Alan C. Brown
Andrew and Malaney L. Brown
Harold Brown*
Robert L. Byer
François J. Castaing
Sigrid and Vint Cerf
Joe H. and Doris W.L. Chow
Vinay and Uma Chowdhry
Joseph M. Colucci
Rosemary L. and Harry M.
Conger
Kay and Gary Cowger
Natalie W. Crawford
Malcolm R. Currie
Glen T. and Patricia B. Daigger
David and Susan Daniel
Pablo G. Debenedetti
Carl de Boor
Mary and Raymond Decker
Tom and Bettie Deen
Elisabeth M. Drake
E. Linn Draper, Jr.
James J. Duderstadt
Stephen N. Finger
Bruce and Pat Finlayson
Edith M. Flanigen
Samuel C. Florman
G. David Forney, Jr.
Douglas W. and Margaret P.
Fuerstenau
Elsa M. Garmire and Robert H.
Russell
Richard L. and Lois E. Garwin
Arthur and Helen Geoffrion
Paul H. Gilbert
Eduardo D. Glandt
Arthur L. and Vida F. Goldstein
Mary L. Good*
Joseph W. Goodman
Kathy and Albert G. Greenberg
Delon Hampton
Eli Harari
Janina and Siegfried Hecker
Robert and Darlene Hermann
David and Susan Hodges
Edward E. Hood, Jr.*
Lee Hood and Valerie Logan
Hood
Evelyn L. Hu and David L. Clarke
- J. Stuart Hunter
Ray R. Irani
Wilhelmina and Stephen Jaffe
Leah H. Jamieson
Edward G.* and Naomi Jefferson
George W. Jeffs*
Kristina M. Johnson
Frank and Pam Joklik
Howard* and Evelyn Jones
Eric W. and Karen F. Kaler
Min H. Kao
James R.* and Isabelle Katzer
Diana S. and Michael D. King
Albert S. and Elizabeth M.
Kobayashi
Robert M. and Pauline W.
Koerner
Demetrious Koutsoftas
James N. Krebs
Lester C.* and Joan M. Krogh
Ellen J. Kullman
Louis J. and M. Yvonne DeWolf
Lanzerotti
David C. Larbaestier
Cato and Cynthia Laurencin
Yoon-Woo Lee
Burn-Jeng Lin
Jack E. Little
Robert G. Loewy
Thomas* and Caroline Maddock
Thomas J. Malone
John C. Martin
James F. Mathis
Robert D. Maurer
Dan and Dalia* Maydan
James C. McGroddy
Kishor C. Mehta
James J. Mikulski
Susan M. and Richard B. Miles
Duncan T. Moore
Van and Barbara Mow
Matt O'Donnell
Claire L. Parkinson
Aliene and Thomas K. Perkins
Lee* and Bill Perry
Donald E. Petersen
Julia M. Phillips and John A.
Connor
Dennis J. Picard
Leonard and Diane Fineblum
Pinchuk
John W. and Susan M. Poduska
Henry H. Rachford, Jr.
- Srilatha and Prabhakar Raghavan
Joy and George Rathmann*
Buddy Ratner and Cheryl Cromer
Kenneth and Martha Reifsnider
Richard J.* and Bonnie B.
Robbins
Bernard I. Robertson
Mary Ann and Thomas Romesser
Howie Rosen and Susan Doherty
William B. and Priscilla Russel
Vinod K. Sahney
Steve* and Kathryn Sample
John M. Samuels, Jr.
Jerry Sanders III
Robert E.* and Mary L. Schafrik
Donna and Jan Schilling
Ronald V. Schmidt
Fred B. Schneider and Mimi
Bussan
William R. Schowalter
Martin B. and Beatrice E.*
Sherwin
Megan J. Smith
Alfred Z. Spector and Rhonda
G. Kost
David B. and Virginia H. Spencer
Henry E. Stone
Yongkui Sun
Gaye and Alan Taub
Rosemary and George
Tchobanglous
Daniel M. Tellep
Matthew V. Tirrell
James A. Trainham and Linda D.
Waters
John R. Treichler
Raymond Viskanta
Robert and Robyn Wagoner
David Walt and Michele May
Daniel I. Wang
Albert R.C. and Jeannie
Westwood
David and Tilly Whelan
Willis S. White, Jr.
George M. Whitesides
John J. Wise
Edgar S. Woolard, Jr.
Israel J. Wygnanski
Yannis C. Yortsos
William and Sherry Young
Teresa and Steve Zinkle
Anonymous (1)

*Deceased

HERITAGE SOCIETY

In recognition of members and friends who have included the National Academy of Sciences, National Academy of Engineering, or National Academy of Medicine in their estate plans or who have made some other type of planned gift to the Academies. Boldfaced names are NAE members.

Gene M.* and Marian **Amdahl**
Betsy Ancker-Johnson
John C. Angus
John and Elizabeth **Armstrong**
Norman R. Augustine
 Jack D. Barchas
Harrison H. and Catherine C. **Barrett**
 Stanley Baum
 Clyde J. Behney
 C. Elisabeth Belmont
Daniel and Frances **Berg**
 Paul Berg
 Elkan R.* and Gail F. Blout
 Enriqueta C. Bond
 Daniel Branton
 Robert and Lillian Brent
Corale L. Brierley
James A. Brierley
 Lenore and **Rob Briskman**
 Kristine L. Bueche
 Dorit Carmelli
 Peggy and Thomas Caskey
A. Ray Chamberlain
 Linda and Frank Chisari
 Rita K. Chow
Paul Citron and Margaret Carlson
 Citron
 John A. Clements
 D. Walter Cohen*
 Morrel H. Cohen
 Stanley N. Cohen
 Graham A. Colditz and Patti L.
 Cox
 Colleen Conway-Welch*
Ross and Stephanie **Corotis**
 Ellis and Betsy Cowling
 Barbara J. Culliton
Malcolm R. Currie
Glen T. and Patricia B. **Daigger**

David and Susan **Daniel**
 Peter N. Devreotes
Gerard W. Elverum
 Doty* and **Gordon England**
 Emanuel and Peggy Epstein
 Tobie and **Daniel J.* Fink**
Robert C.* and Marilyn G. **Forney**
William L. and Mary Kay **Friend**
Arthur and Helen **Geoffrion**
Paul H. Gilbert
Martin E. and Lucinda **Glicksman**
 George and Christine Gloeckler
 Christa and Detlef Gloge
Joseph W. Goodman
 Chushiro* and Yoshiko Hayashi
 John G. Hildebrand and Gail D.
 Burd
John R. Howell
 Nancy S. and Thomas S. Inui
 Richard B. Johnston, Jr.
Anita K. Jones
 Jerome Kagan
 Diana S. and **Michael D. King**
 Norma M. Lang
 Marigold Linton and Robert
 Barnhill
Daniel P. Loucks
 Ruth Watson Lubic
 R. Duncan* and Carolyn Scheer
 Luce
Thomas* and Caroline **Maddock**
Asad and Taj **Madni**
 Pat and Jim McLaughlin
 Jane Menken
 Sharon and **Arthur Money**
Van and Barbara **Mow**
 Guido Munch
 Mary O. Mundinger
 Philip and Sima Needleman
 Norman F. Ness

Ronald and Joan **Nordgren**
 Gilbert S. Omenn and Martha A.
 Darling
Bradford W. and Virginia W.
Parkinson
Zack T. Pate
 Neil and Barbara Pedersen
 Frank Press*
 James J. Reisa, Jr.
 Emanuel P. Rivers
Richard J.* and Bonnie B.
Robbins
 Eugene* and Ruth Roberts
 Julie and **Alton D. Romig, Jr.**
James F. Roth
 Esther and Lewis* Rowland
 Sheila A. Ryan
 Paul R. Schimmel
 Stuart F. Schlossman
 Rudi* and Sonja Schmid
Susan C. Scrimshaw
 Kenneth I. Shine
Arnold and Constance **Stancell**
 H. Eugene Stanley
 Rosemary A. Stevens
John and Janet **Swanson**
Esther Sans Takeuchi
 Paul* and Pamela Talalay
 Walter Unger
John C. Wall
 Patricia Bray-Ward and David C.
 Ward
Robert and Joan **Wertheim**
 Maw-Kuen Wu
Wm. A. Wulf
 Tilahun D. Yilma
 Michael and Leslee Zubkoff
 Anonymous (4)

*Deceased

ANNUAL GIVING SOCIETIES

The National Academy of Engineering gratefully acknowledges the following members and friends who made charitable contributions to the NAE, and NAE members who supported the Committee on Human Rights, a joint committee of the three academies, during 2019. The collective, private philanthropy of these individuals has a great impact on the NAE and its ability to be a national voice for engineering. We acknowledge contributions made as personal gifts or as gifts facilitated by the donor through a donor-advised fund, matching gift program, or family foundation.

Julie and Alton "Al" D. Romig, Jr. gave \$100,000 to fund a challenge for members elected since 2015. Members who participated in the Julie and Al Romig Challenge for the classes of 2015–2019 are noted with the ♦ symbol.

CATALYST SOCIETY \$50,000+

Nadine Aubry and John L. Batton	Nirmala and Arogyaswami J. Paulraj	Marci and James J. Truchard
Ming and Eva Hsieh	Wendy and Eric Schmidt	Anonymous (1)
Jennie S. Hwang	Hemant K. and Suniti Thapar♦	Friend
Thomas M. Leps*	Katherine K. and John J. Tracy	John F. McDonnell
Robin K. and Rose M. McGuire		

ROSETTE SOCIETY \$25,000 to \$49,999

John and Pat Anderson	John O. Hallquist	Jonathan J. Rubinstein
Jeffrey Dean	Wesley L. Harris	Henry and Susan Samuelli
James O. Ellis, Jr. and Elisabeth Paté-Cornell	Richard F. and Terri W. Rashid	Anonymous (1)
Dotty* and Gordon England	Mendel Rosenblum and Diane Greene♦	

CHALLENGE SOCIETY \$10,000 to \$24,999

John and Elizabeth Armstrong	Nicholas M. Donofrio	Clayton Daniel and Patricia L. Mote
Gordon Bell	Gerard W. Elverum	Larry* and Carol Papay
Barry W. Boehm	Thomas E. Everhart	Cathy and Paul S.* Peercy
Gopa and Arindam Bose	Martin E. and Lucinda Glicksman	Julie and Alton D. Romig, Jr.
Paul F. Boulos	Robert W. Gore	John M. Samuels, Jr.
Chau-Chyun and Li-Li Chen	Paul and Judy Gray	Jerry Sanders III
Josephine Cheng	Michael W. Hunkapiller	Linda S. Sanford
Priscilla and Sunlin* Chou	Kristina M. Johnson	Richard J. Stegemeier
Joe H. and Doris W.L. Chow♦	Kent Kresa	James M. Tien and Ellen S. Weston
Joseph M. Colucci	David C. LARBalestier	Adrian Zaccaria
Glen T. and Patricia B. Daigger	Frances and George Ligler	
Ruth David and Stan Dains	Kiran Mazumdar-Shaw♦	
Lance and Susan Davis		

CHARTER SOCIETY \$1,000 to \$9,999

Linda M. Abriola	R. Lyndon Arscott	David K. Barton
Ilesanmi and Patience Adesida	Aziz I. Asphahani	Tamer Basar
Rodney C. Adkins	Amos A. Avidan	Steven Battel♦
Kyle T. Alfriend	Arthur B. Baggeroer	Arden L. Bement, Jr.
Montgomery and Ann Alger	Mary Baker♦	Craig and Karen Benson
Richard C. Alkire	William F. Baker	Daniel and Frances Berg
John C. Angus	Harrison H. and Catherine C. Barrett	Thomas and Becky Bergman
Frances H. Arnold	Lionel O. Barthold	Elwyn* and Jennifer Berlekamp
Ruth and Ken Arnold		Bharati and Murty Bhavaraju

♦Romig Challenge

*Deceased

- Mark and Kathy Board
 Mark T. Bohr
 Rudolph Bonaparte
 Anjan and Francy Bose
 Craig T. Bowman
 Frank Bowman
 Lewis M. Branscomb
 Corale L. Brierley
 James A. Brierley
 Andrei Z. Broder
 John H. Bruning
 George* and Virginia Bugliarello
 Antonio J. Busalacchi
 Wesley G. Bush♦
 Cleopatra Cabuz
 Stuart K. Card
 Robert P. Caren*
 François J. Castaing
 Corbett Caudill
 Selim A. Chacour
 Don B. Chaffin
 Weng C. Chew
 Dianne Chong♦
 Vinay and Uma Chowdhry
 James J. Coleman
 Harry E. Cook*
 Stuart L. Cooper
 Kay and Gary Cowger
 Magnus G. Craford
 Natalie W. Crawford
 Robert L. Crippen
 Steven L. and Karen L. Crouch
 David and Susan Daniel
 L. Berkley Davis
 Pablo G. Debenedetti
 Carl de Boor
 Tom and Bettie Deen
 Hariklia Deligianni♦
 George E. Dieter
 Stephen W. Director
 Ali H. Dogru
 Jean-Jacques Dordain♦
 Albert A. Dorman
 Fiona M. Doyle♦
 Elisabeth M. Drake
 E. Linn Draper, Jr.
 James J. Duderstadt
 Susan T. Dumais
 Richard E. Emmert
 Paul England♦
 John V. Evans
 Thomas V. Falkie*
 Peter Farrell
 Hans K. Fauske
 Robert E. Fenton
 Leroy (Mike) M. Fingerson
 Bruce and Pat Finlayson
 Edith M. Flanigen
- Samuel C. Florman
 Maria Flytzani-Stephanopoulos*
 G. David Forney, Jr.
 Robert C.* and Marilyn G. Forney
 Eric R. Fossum
 John S. Foster, Jr.
 Efi Foufoula-Georgiou
 Katharine G. Frase
 William L. and Mary Kay Friend
 Douglas W. and Margaret P.
 Fuerstenau
 Michimasa Fujino♦
 Alec D. Gallimore♦
 Elsa M. Garmire and Robert H.
 Russell
 Donald P. Gaver*
 Arthur Gelb
 Arthur and Helen Geoffrion
 Louis V. Gerstner, Jr.
 Nan and Chuck Geschke
 Paul H. Gilbert
 Eduardo D. Glandt
 Dan M. Goebel♦
 Arthur L. and Vida F. Goldstein
 Joseph W. Goodman
 David Goodyear
 Robert K. Grasselli*
 Kathy and Albert Greenberg
 Helen Greiner
 Hermann K. Gummel
 Eliyahou Harari
 James S. Harris, Jr.
 George* and Daphne
 Hatsopoulos
 Janina and Siegfried Hecker
 Joachim Heinzl
 John L. Hennessy
 Arthur H. Heuer
 Hugh D. Hibbitt
 Grace and Thom Hodgson
 Chad and Ann Holliday
 Urs Hölzle
 Edward E. Hood, Jr.*
 John R. Howell
 Jeffrey A. Hubbell
 J. Stuart Hunter
 Izzat M. Idriss
 Ray R. Irani
 Srinivasa H. Iyengar*
 Wilhelmina and Stephen Jaffe
 Anil K. Jain♦
 Leah H. Jamieson
 James O. Jirsa
 Barry C. Johnson
 David W. Johnson, Jr.
 Michael R. Johnson
 Frank and Pam Joklik
 Kahle/Austin Foundation
- Robert E. Kahn
 Paul and Julie Kaminski
 James R.* and Isabelle Katzer
 Michael C. Kavanaugh
 Leon M. Keer
 Mary and Howard* Kehrl
 Chaitan Khosla and Susi Ebert-
 Khosla
 Judson and Jeanne King
 Diana S. and Michael D. King
 James L. Kirtley
 Albert S. and Elizabeth M.
 Kobayashi
 Paul C. Kocher
 Charles E. Kolb*
 Jindrich Kopecek
 Demetrious Koutsoftas
 Philip T. Krein
 Derrick M. Kuzak
 Richard T. Lahey, Jr.
 Louis J. and M. Yvonne DeWolf
 Lanzerotti
 Ronald M. Latanision
 Edward D. Lazowska
 Lou-Chuang Lee
 Ronald K. Leonard
 Frederick J. Leonberger
 Dennis P. Lettenmaier
 Mark J. Levin
 Steven B. Lipner♦
 Helmut List
 Jack E. Little
 Robert G. Loewy
 Daniel P. Loucks
 J. David Lowell
 Lester L. Lyles
 William J. MacKnight
 Asad M., Gowhartaj, and Jamal
 Madni
 Thomas J. Malone
 Henrique S. Malvar
 W. Allen Marr
 David and Diane Matlock
 Gary S. May♦
 Jyoti and Aparajita Mazumder
 Roger L. McCarthy
 Larry V. McIntire
 Richard A. Meserve
 Robert M. Metcalfe
 R.K. Michel
 Susan M. and Richard B. Miles
 Richard K. and Beth Miller
 James K. and Holly T. Mitchell
 Piotr D. Moncarz♦
 Carl L. Monismith
 Duncan T. Moore
 Norman R. Morrow
 Edward and Stephanie Moses

♦Romig Challenge

*Deceased

- Dennis A. Muilenburg♦
 Jan and E. Phillip* Muntz
 Cherry A. Murray
 Omkaram Nalamasu♦
 Albert Narath
 David J. Nash
 Robert M. and Marilyn R. Nerem
 Paul and Dotty Nielsen
 William D. Nix
 Ronald and Joan Nordgren
 Matt O'Donnell
 Babatunde and Anna Ogunnaike
 Fran and Kwadwo Osseo-Asare
 Roberto Padovani
 Sorab Panday♦
 Bradford W. and Virginia W. Parkinson
 Claire L. Parkinson
 P. Hunter Peckham
 John H. Perepezko
 Aliene and Thomas K. Perkins
 Kurt E. Petersen
 Craig E. Philip
 Julia M. Phillips and John A. Connor
 Leonard and Diane Fineblum
 Pinchuk
 Darryll J. Pines♦
 James D. Plummer
 John W. and Susan M. Poduska
 Victor L. Poirier
 H. Vincent Poor
 Randall W. Poston♦
 Dana A. Powers♦
 William F. Powers
 William R. Pulleyblank
 Henry H. Rachford, Jr.
 Srilatha and Prabhakar Raghavan
 Buddy Ratner and Cheryl Cromer
 John F. Reid♦
 L. Rafael Reif
 Kenneth and Martha Reifsnider
 Gintaras V. Reklaitis
 Eli Reshotko
 Thomas J. Richardson
 Richard J.* and Bonnie B. Robbins
 Bernard I. Robertson
 Mary Ann and Thomas Romesser
- Murray W. Rosenthal
 Jonathan M. Rothberg
 Vinod K. Sahney
 Maxine L. Savitz
 Robert F. Sawyer
 Donna and Jan Schilling
 John H. Schertmann
 Ronald V. Schmidt
 Fred B. Schneider and Mimi Bussan
 Henry G. Schwartz, Jr.
 Lyle H. Schwartz
 Norman R. Scott
 Yang Shao-Horn♦
 Martin B. and Beatrice E.* Sherwin
 Heung-Yeung Shum♦
 Daniel P. Siewiorek
 Charles Simonyi
 Kumares C. Sinha
 Sarah Slaughter♦
 Debra and Alexander Slocum♦
 Alvy Ray Smith
 Robert F. and Lee S. Sproull
 Raymond S. Stata
 George L. Stegemeier
 Gunter Stein
 Dean E. Stephan
 Gregory Stephanopoulos
 Howard and Valerie Stone
 William D. Strecker
 Lisa T. Su♦
 Virginia and Carl Sulzberger♦
 Yongkui Sun
 John and Janet Swanson
 Gaye and Alan Taub
 Rosemary and George Tchobanglous
 Jerry D. Tersoff♦
 Rex W. Tillerson
 Matthew V. Tirrell
 Jean Tom♦
 James A. Trainham and Linda D. Waters
 John R. Treichler
 Richard H. Truly
 A. Galip Ulsoy
 David M. Van Wie♦
 Suzanne M. Vautrinot
- Charles M.* and Rebecca M. Vest
 Andrew and Erna* Viterbi
 Thomas H. and Dee M. Vonder Haar
 Robert and Robyn Wagoner
 John C. Wall
 David Walt and Michele May
 Kuo K. Wang
 Darsh T. Wasan
 Sheldon Weinig
 Robert and Joan Wertheim
 Willis S. White, Jr.
 Sharon L. Wood
 Dennis A. Woodford♦
 Edgar S. Woolard, Jr.
 Margaret M. Wu♦
 Israel J. Wygnanski
 Beverly and Loring Wyllie
 William W-G. Yeh
 Paul G. Yock
 Yannis C. Yortsos
 William and Sherry Young
 Elias A. Zerhouni
 Teresa and Steve Zinkle
 Ben T. Zinn
 Mary Lou and Mark D. Zoback
 Charles F. Zukoski
 Anonymous (2)
- Friends**
 Stephan Biller
 Carol Born
 Kristine L. Bueche
 Linda Caren
 Jennifer Curtis
 Donald A. Edwards
 Joan R. Finnie
 Marjorie R. Friedlander
 Frances Gaver
 Eva-Maria Hauck-Grasselli
 Kay Hood
 Joan Hulburt
 Ruth Iyengar
 Curtis Jones
 Guru Madhavan
 Janice F. Muntz
 Bonnie B. Robbins
 Rhoda A.M. Weisz
 Toby Wolf

♦Romig Challenge

*Deceased

Foundations, Corporations, and Other Organizations

In recognition of foundations, corporations, or other organizations that made gifts or grants to support the National Academy of Engineering in 2019.

Alliance of Automobile Manufacturers, Inc.	Leps Family Trust
Amazon.com, Inc.	Microsoft Corporation
AmazonSmile Foundation	The Gordon and Betty Moore Foundation
Applied Materials Charity Custodial Account	Morgan Stanley Smith Barney Global Impact Funding Trust, Inc.
The AYCO Charitable Foundation	National Christian Foundation
Bank of America Charitable Gift Fund	National Christian Foundation Houston
Battelle	The Ohio University Foundation
Bell Family Foundation	Oracle Corporation
Benevity Community Impact Fund	Orcas Island Community Foundation
Bentley Systems, Inc.	Palo Hills Foundation
Berwind Corporation	Pfizer Foundation Matching Gifts Program
BMO Charitable Fund Program	Pfizer, Inc.
Branscomb Family Foundation	The Pittsburgh Foundation
Bristol-Myers Squibb Company	PJM Interconnection
Bristol-Myers Squibb Foundation	The T. Rowe Price Program for Charitable Giving
Card Family Foundation, Inc.	Princeton Area Community Foundation, Inc.
Castaing Family Foundation	Qualcomm, Inc.
Chevron Matching Employee Funds	Rothberg Institute
A. James Clark and Alice B. Clark Foundation	Henry M. Rowan Family Foundation, Inc.
Combined Jewish Philanthropies	B. Don and Becky Russell Charitable Foundation
Commerce Trust Company	Saint Louis Community Foundation
Cummins, Inc.	Samueli Foundation
Dassault Systèmes	Tawny & Jerry Sanders Charitable Foundation
Digital Water Works	Schmidt Futures
Albert and Joan Dorman Family Foundation	Schwab Charitable Fund
Fidelity Charitable Gift Fund	Shell Oil Company Foundation Educational Matching Gift Program
Forney Family Foundation	Siegel & Friend Foundation
GE Foundation	Silicon Valley Community Foundation
General Electric Company	TIAA-CREF
Goldman Sachs Philanthropy Fund	Tien Family Foundation
Gratis Foundation	Tillerson Foundation
Greater Horizons	Transamerica Life Insurance Company
Houston Jewish Community Foundation	The US Charitable Gift Trust
Hsieh Family Foundation	Vanguard Charitable Endowment Program
Innovative Catalytic Solution, LLC	Wells Fargo Advisors, LLC
Jewish Community Foundation San Diego	The Woolard Family Foundation
W.M. Keck Foundation	Zerhouni Family Charitable Foundation, Inc.
The William R. Kenan Institute at NC State University	Anonymous (2)
The Kern Family Foundation	

We have made every effort to list donors accurately and according to their wishes. If we have made an error, please accept our apologies and contact the Office of Development at 202.334.2431 or giving@nae.edu so we can correct our records.





RSM US LLP

Independent Auditor's Report

Board of Trustees
National Academy of Engineering Fund

Report on the Financial Statements

We have audited the accompanying financial statements of National Academy of Engineering Fund (the Fund), which comprise the statement of financial position as of December 31, 2019, the related statements of activities, functional expenses and cash flows for the year then ended, and the related notes to the financial statements.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of the Fund as of December 31, 2019, and the changes in its net assets and its cash flows for the year then ended in accordance with accounting principles generally accepted in the United States of America.

THE POWER OF BEING UNDERSTOOD
AUDIT | TAX | CONSULTING

RMS US LLP is the U.S. member firm of RSM International, a global network of independent audit, tax, and consulting firms. Visit rsmus.com/aboutus for more information regarding RSM US LLP and RSM International.

NATIONAL ACADEMY OF ENGINEERING FUND

December 31, 2019 and 2018

Report on Summarized Comparative Information

We have previously audited the Fund's 2018 financial statements, and we expressed an unmodified opinion on those audited financial statements in our report dated June 10, 2019. In our opinion, the summarized comparative information presented herein as of and for the year ended December 31, is consistent, in all material respects, with the audited financial statements from which it has been derived.

RSM VS LLP

Washington, D.C.
June 16, 2020

National Academy of Engineering Fund Statement of Financial Position

December 31, 2019
(With Comparative Totals for 2018)

	2019	2018
Assets		
Current assets:		
Cash and cash equivalents	\$ 690,104	\$ 394,649
Contributions receivable	92,962	285,215
Prepaid expenses	18,123	30,106
Short-term investments (Note 4)	1,936,749	3,490,338
Redemptions receivable	2,716,330	1,702,586
Investment draw receivable	1,035,970	966,178
Promises to give (Note 3)	1,038,800	674,009
Total current assets	7,529,038	7,543,081
Non-current assets:		
Promises to give – long-term portion, net (Note 3)	1,978,242	1,312,685
Beneficial interest in split-interest agreements (Note 4 and 5)	984,168	531,495
Investments (Note 4)	74,256,758	66,160,571
Total non-current assets	77,219,168	68,004,751
Total assets	\$ 84,748,206	\$ 75,547,832
Liabilities and Net Assets		
Current liabilities:		
Accounts payable – due to National Academy of Sciences (Note 7)	\$ 2,419,987	\$ 878,251
Commitments (Note 4)		
Net assets:		
Without donor restrictions	30,782,656	27,819,432
With donor restrictions (Notes 5 and 6)	51,545,563	46,850,149
Total net assets	82,328,219	74,669,581
Total liabilities and net assets	\$ 84,748,206	\$ 75,547,832

See notes to financial statements.

National Academy of Engineering Fund Statement of Activities

Year Ended December 31, 2019
(With Comparative Totals for 2018)

	Without Donor Restrictions	With Donor Restrictions	Total	2018 Total
Support and revenue:				
Contributions (Note 1)	\$ 1,512,358	\$ 3,267,350	\$ 4,779,708	\$ 4,520,188
Investment income (loss), net (Note 4)	4,067,779	5,746,454	9,814,233	(1,315,435)
Change in beneficial interests in split-interest agreements	-	204,486	204,486	(208,215)
Membership dues	334,700	-	334,700	244,000
Registration fees	203,615	-	203,615	265,065
Miscellaneous revenue	654,698	-	654,698	5,469
Net assets released from restrictions:				
Satisfaction of program restrictions	4,311,444	(4,311,444)	-	-
Satisfaction of time restrictions	211,432	(211,432)	-	-
Total support and revenue	11,296,026	4,695,414	15,991,440	3,511,072
Expenses:				
Program services:				
Programs	3,497,458	-	3,497,458	3,306,785
Awards	1,429,591	-	1,429,591	1,384,684
Member programs	531,593	-	531,593	470,852
Support for NRC and NAS	307,033	-	307,033	295,289
	5,765,675	-	5,765,675	5,457,610
Support services:				
Management and operations	1,419,128	-	1,419,128	1,214,181
Fundraising	1,147,999	-	1,147,999	1,244,451
	2,567,127	-	2,567,127	2,458,632
Total expenses	8,332,802	-	8,332,802	7,916,242
Change in net assets	2,963,224	4,695,414	7,658,638	(4,405,170)
Net assets:				
Beginning	27,819,432	46,850,149	74,669,581	79,074,751
Ending	\$ 30,782,656	\$ 51,545,563	\$ 82,328,219	\$ 74,669,581

See notes to financial statements.

National Academy of Engineering Fund
Statement of Functional Expenses

Year Ended December 31, 2019
(With Comparative Totals for 2018)

	2019										2018	
	Program Services					Support Services					Total	Total
	Programs	Awards	Member Programs	Support for NRC and NAS	Total Programs	Management and Operations	Fundraising	Total	Total			
Direct reimbursements to NAE	\$ 3,161,911	\$ -	\$ 531,593	\$ -	\$ 3,693,504	\$ -	\$ -	\$ -	\$ 3,693,504	\$ 3,348,769		
Grant awards	-	1,429,591	-	-	1,429,591	-	-	-	1,429,591	1,384,684		
NRC and NAS support	-	-	-	307,033	307,033	-	-	-	307,033	295,289		
Income taxes	-	-	-	-	-	6,484	-	-	6,484	21,028		
Credit card fees	-	-	-	-	-	17,539	-	-	17,539	14,477		
Other expenses	-	-	-	-	-	2,772	-	-	2,772	4,157		
	3,161,911	1,429,591	531,593	307,033	5,430,128	26,795	-	-	5,456,923	5,068,404		
Allocated costs from NAS	-	-	-	-	-	282,592	1,147,999	-	1,430,591	1,549,036		
Allocated overhead from NAS	335,547	-	-	-	335,547	1,109,741	-	-	1,445,288	1,298,802		
	\$ 3,497,458	\$ 1,429,591	\$ 531,593	\$ 307,033	\$ 5,765,675	\$ 1,419,128	\$ 1,147,999	\$ 8,332,802	\$ 7,916,242			

See notes to financial statements.

National Academy of Engineering Fund Statement of Cash Flows

Year Ended December 31, 2019
(With Comparative Totals for 2018)

	2019	2018
Cash flows from operating activities:		
Change in net assets	\$ 7,658,638	\$ (4,405,170)
Adjustments to reconcile change in net assets to net cash used in operating activities:		
Net unrealized and realized (gain) loss on investments	(9,493,392)	1,537,879
Unrealized (gain) loss on split-interest agreements	(204,486)	208,215
Increase (decrease) in discount on promises to give	9,311	(37,508)
Contributions restricted to investment in perpetuity	(242,528)	(111,500)
Changes in assets and liabilities:		
(Increase) decrease in:		
Contributions receivable	192,253	(168,811)
Promises to give	(1,039,659)	2,026,248
Beneficial interest in split-interest agreements	(248,187)	(244,294)
Prepaid expenses	11,983	(9,631)
Increase (decrease) in:		
Accounts payable – National Academy of Sciences	1,541,736	(3,666)
Net cash used in operating activities	(1,814,331)	(1,208,238)
Cash flows from investing activities:		
Proceeds from sale of investments	40,600,268	36,347,494
Purchases of investments	(37,649,474)	(34,284,008)
Redemptions receivable	(1,013,744)	(1,365,268)
Investment draw in transit	(69,792)	49,129
Net cash provided by investing activities	1,867,258	747,347
Cash flows from financing activities:		
Contributions restricted to investment in perpetuity	242,528	111,500
Net cash provided by financing activities	242,528	111,500
Net increase (decrease) in cash and cash equivalents	295,455	(349,391)
Cash and cash equivalents:		
Beginning	394,649	744,040
Ending	\$ 690,104	\$ 394,649
Supplemental disclosure of cash flow information:		
Cash paid for taxes	\$ 5,090	\$ 29,930

See notes to financial statements.

Note 1. Nature of Activities and Significant Accounting Policies

Nature of activities: National Academy of Engineering Fund (the Fund) is an independent nonprofit organization established by National Academy of Engineering (NAE) to collect and disburse funds for accomplishing the goals of NAE. NAE operates within the charter and framework of the National Academy of Sciences (NAS), which accounts for NAE's expenses. The operating expenditures of NAE are accounted for by offices of NAS and are offset by reimbursement from funds received from the Fund and from contracts and grants administered by NAS. The net expenditures of NAE are paid by the Fund to balance accounts with NAS.

A summary of the Fund's significant accounting policies follows:

Basis of accounting: The Fund's financial statements are prepared using the accrual basis of accounting in accordance with the generally accepted accounting principles in the United States of America (U.S. GAAP), whereby unconditional support is recognized when notification of the contribution is received, revenue is recognized when earned and expenses are recognized when incurred.

Basis of presentation: The Fund follows the Not-for-Profit Entities Topic of the Financial Accounting Standards Board (FASB) Accounting Standards Codification (the Codification). Under this Topic, the Fund is required to report the information regarding its financial position and activities according to two classes of net assets: net assets without donor restrictions and net assets with donor restrictions. The two classes of net assets are as follows:

Net assets without donor restrictions: Undesignated net assets represent funds that are available for the support of the Fund's operations and not subject to donor restrictions.

Net assets with donor restrictions: Net assets subject to donor imposed restrictions. Some donor-imposed restrictions are temporary in nature, such as those that will be met by the passage of time or other purposes specified by the donor. Donor-imposed restrictions are released when a restriction expires, that is, when the stipulated time has elapsed, when the stipulated purpose for which the restriction was restricted has been fulfilled or both. Some donor restrictions stipulate that resources be maintained in a perpetual nature as endowment funds, but permit the Fund to expend income generated in accordance with provisions of the agreement.

Endowments with donor restrictions consist of the following:

John A. Armstrong Endowment for Young Engineers supports programs aimed at engaging engineers at a younger age in the activities of NAE and provides an opportunity to identify potential nominees from industry for membership in NAE.

Norman R. Augustine Senior Scholar supports an outstanding member of industry or another field working as an advisor and assistant to the President of NAE in the management and execution of NAE's programmatic activities.

Capital Preservation Fund provides income for the general operations of the NAE. The endowments require the principal be maintained in perpetuity.

A. James Clark Endowment for Inspiring Women Engineers provides support to expand EngineerGirl, a flagship program of the NAE.

Note 1. Nature of Activities and Significant Accounting Policies (Continued)

Charles Stark Draper Prize for Engineering provides an annual prize in honor and memory of Charles Stark Draper. It is the Fund's intention to use the investment earnings of the endowment to cover the expenses incurred in connection with administration of the prize and in providing the honorarium awarded with the prize.

Bernard M. Gordon Prize for Innovation in Engineering and Technology Education provides an annual prize in honor of Bernard M. Gordon for innovation in engineering and technology education. It is the Fund's intention to use the investment earnings of the endowment to cover the expenses incurred in connection with administration of the prize and in providing the honorarium awarded with the prize.

J. Herbert Hollomon Fellow Fund provides income to support the J. Herbert Hollomon Fellow. The endowment requires the principal be maintained in perpetuity.

Thomas V. Jones Industry Scholar supports fellowships for recently retired corporate executives to assist with strategy and management of program activities in NAE and the National Research Council (NRC).

Simon Ramo Founders Award supports the "Simon Ramo Founders Award" in honor and memory of Simon Ramo, founding member of the NAE on the occasion of NAE's 50th Anniversary and Ramo's 100th Birthday. It is presented each year at the annual meeting. The endowment requires the principal be maintained in perpetuity.

Hans Reisner Fund provides income for the general operations of the NAE. The endowments require the principal be maintained in perpetuity.

Wm. A. Wulf Initiative for Engineering Excellence, named after Bill Wulf, NAE member and former NAE president, provides NAE's presidents with unrestricted funding allowing them to address the most pressing issues before the engineering community and the nation at any given time.

Cash and cash equivalents: For purposes of reporting cash flows, the Fund considers all investments purchased with an original maturity of three months or less to be cash equivalents, except for the cash in the investment portfolio, which will be reinvested on a long-term basis and which are reported with investments.

Contributions receivable: Contributions receivable include contributions collected near or at year-end by NAS for the Fund but not yet received by the Fund as of December 31, 2019.

Short-term investments: These investments consist of money market accounts and certificate of deposits with maturities less than one year that are used to fund normal operations of the Fund. The money market accounts and certificate of deposits are not publicly traded and are therefore held at cost.

Redemptions receivable: These receivables are redemptions from the Fund's alternative investments that were not received as of year-end.

Investment draw receivable: The Fund is eligible to draw 5% from one of its investment funds annually. This transfer crosses fiscal years and is recorded as a receivable until the cash is received by the Fund.

Note 1. Nature of Activities and Significant Accounting Policies (Continued)

Promises to give: Unconditional promises to give are recognized as support and receivables in the period the promises are received. Unconditional promises to give that are expected to be collected within one year are recorded at their net realizable value. Unconditional promises to give that are expected to be collected in future years are recorded at the present value of their estimated future cash flows. The discounts on those amounts are computed using rates commensurate with the risk involved applicable to the year in which the promises are received. The discount rates used range from 1.45% to 2.76% for the year ended December 31, 2019. Amortization of the discounts is included in contribution revenue. Based on management's evaluation of the collectability of receivables, there is no provision for doubtful promises to give at December 31, 2019. Conditional promises to give are not included as support until the conditions are substantially met.

Beneficial interest in split-interest agreements: Charitable gift annuity agreements are classified as a beneficial interest in split-interest agreements in the statements of financial position. The Fund has been notified that it was designated as the remainder beneficiary for several charitable remainder trusts. The Fund has an agreement with NAS, where NAS, rather than the Fund, serves as the trustee of the assets for all. The Fund has recorded an asset and contribution revenue equal to the present value of the remainder interest.

The remainder interest was determined by using the fair market value of trust assets, less the estimated distributions by NAS to the income beneficiary over the Trust term. Upon termination of an annuity, the remainder interest in the asset is available for use by the Fund as donor restricted or without donor restrictions in accordance with the donor's designation. On an annual basis, the Fund re-measures the value of the asset using current assumptions. Any change in such value is recorded as a change in value of split-interest agreements included within investment (loss) income on the statement of activities.

Investments: Investments are carried at fair market value, as discussed in Note 4. Investment income (loss) is included in the change in net assets without donor restrictions unless the income is restricted by donor or law.

Financial risk: The Fund maintains its cash and cash equivalents and short-term investments in bank deposit accounts which, at times, may exceed federally insured limits. The Fund has not experienced any losses in such accounts. The Fund believes it is not exposed to any significant credit risk on cash.

The Fund invests in professionally managed portfolios that contain corporate bonds, equity and fixed income mutual funds, common shares of publicly traded companies, exchange traded funds, certificates of deposit, hedge funds, fund of funds, a limited partnership and private equity funds. Such investments are exposed to various risks such as interest rate, market and credit risk. Due to the level of risk associated with such investments and the level of uncertainty related to change in the value of such investments, it is at least reasonably possible that changes in risks in the near term would materially affect investment balances and the amounts reported in the financial statements.

Support and revenue: The Fund reports gifts of cash and other assets as donor-restricted support if they are received with donor stipulations that limit the use of the donated assets. When a donor restriction expires, (that is, when a stipulated time restriction ends or purpose restriction is accomplished) net assets with donor restrictions are reclassified to net assets without donor restrictions and reported in the statement of activities as net assets released from restrictions. Gifts of cash and other assets without donor restrictions are recorded in revenue, gains and other support when received or in the period in which such amounts are estimable. Membership dues are recognized as a contribution in the year it is received. Revenues from special events (registrations) are recognized at the time the event occurs.

National Academy of Engineering Fund

Notes to Financial Statements (continued)

Note 1. Nature of Activities and Significant Accounting Policies (Continued)

Allocation of expenses: The costs of providing various programs and other activities have been summarized on a functional basis in the statement of activities. Accordingly, certain costs have been allocated among the programs and supporting services benefited. The staff performing the NAE operational activities listed below are funded by the Fund but are employees of NAS. NAS offices account for all operating expenditures including salaries, payroll taxes and benefits, information technology, travel occupancy and depreciation. Costs incurred by NAE program or supporting activities are specifically identified or allocated by NAS on an appropriate basis among the Academies.

NAEF's programs and supporting services are as follows:

Programs: Programs that address relevant issues in the engineering field including, but not limited to: Engineering Education, Research and Practice; The Engineering Workforce; Diversity in Engineering; Engineering Ethics and Society; Public Understanding of Engineering; and Manufacturing, Design and Innovation.

Awards: NAE presents seven awards: the Bernard M. Gordon Prize, the Charles Stark Draper Prize for Engineering, the Fritz J. and Dolores H. Russ Prize, the Arthur M. Bueche Award, the Simon Ramo Founders Award, the Gibbs Brothers Medal, and the J.C. Hunsaker Award in Aeronautical Engineering. Activities include soliciting nominations, selection of the recipients, and announcement of the recipients and presentation of the prizes.

Member programs: Organization and administration of the Annual Meeting and publication of NAE Memorial Tributes.

Support for NRC and NAS: Contributions to joint activities of the National Academies, including, but not limited to, the NAS/NAE/National Academy of Medicine (NAM) Committees on Human Rights and Women in Science, Engineering and Medicine, the African American History Program, and Community Service Projects.

Operations: Includes the functions necessary to provide an adequate working environment, provide coordination and articulation of the Fund's programs, secure proper administrative function of the Board of Trustees, maintain competent legal services for program administration and manage the financial and budgetary responsibilities of the Fund.

Fundraising: Provides the structure necessary to encourage and secure private financial support from individuals, foundations and corporations.

Income taxes: The Fund is incorporated under the District of Columbia Non-Profit Corporation Act and is exempt from income taxes under Section 501(c)(3) of the Internal Revenue Code. In addition, the Fund has been determined by the Internal Revenue Service not to be a private foundation. The Fund is required to remit income taxes to the federal government and the District of Columbia for unrelated business income. For the year ended December 31, 2019, there was unrelated business income tax of \$4,615.

Note 1. Nature of Activities and Significant Accounting Policies (Continued)

The Fund complies with the accounting standard on accounting for uncertainty in income taxes, which addresses the determination of whether tax benefits claimed or expected to be claimed on a tax return should be recorded in the financial statements. Under this guidance, the Fund may recognize the tax benefit from an uncertain tax position; only if it is more likely than not that the tax position will be sustained on examination by taxing authorities, based on the technical merits of the position. The tax benefits recognized in the financial statements from such a position are measured based on the largest benefit that has a greater than 50% likelihood of being realized upon settlement. The guidance on accounting for uncertainty in income taxes also addresses de-recognition, classification, interest and penalties on income taxes and accounting in interim periods. The Fund had no such positions recorded in the financial statements at December 31, 2019. Generally, the Fund is no longer subject to U.S. federal income tax positions by tax authorities for years before 2016.

Use of estimates: In preparing financial statements in conformity with U.S. GAAP, management is required to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the financial statements and revenue and expenses during the reporting period. The most significant assumptions relate to the realization of pledges receivable and the fair value measurement of investments. Actual results could differ from those estimates.

Comparative financial information: The financial statements include certain prior year summarized comparative information in total but not by net asset class or function. Such information does not include sufficient detail to constitute a presentation in conformity with U.S. GAAP. Accordingly, such information should be read in conjunction with the Fund's financial statements for the year ended December 31, 2018, from which the summarized information was derived.

Adopted accounting pronouncement: In June 2018, the FASB issued Accounting Standards Update (ASU) 2018-08, *Clarifying the Scope and the Accounting Guidance for Contributions Received and Contributions Made (Topic 958)* to clarify the accounting guidance for contributions received and contributions made. The amendments provide assistance to entities in (1) evaluating whether transactions should be accounted for as contributions (nonreciprocal transactions) within the scope of Topic 958, Not-for-Profit Entities, or as exchange (reciprocal) transactions subject to other guidance and (2) determining whether a contribution is conditional. Differences in these conclusions affect the timing of revenue recognized. Unconditional contributions are recognized immediately and classified as either net assets with donor restrictions or net assets without donor restrictions. Conditional contributions received are accounted for as a liability or are unrecognized initially, that is, until the barriers to entitlement are overcome, at which point the transaction is recognized as unconditional and classified as either net assets with restrictions or net assets without restrictions. The Fund adopted this guidance on a modified prospective method as a resource recipient and resource provider effective for the year ended December 31, 2019. The adoption of this guidance had no impact on the statements of financial position or the statements of activities.

Pending accounting pronouncements: In August 2018, the FASB issued ASU 2018-13, *Fair Value Measurement (Topic 820): Disclosure Framework – Changes to the Disclosure Requirements for Fair Value Measurement*. The amendments in this update modify the requirement of disclosures on fair value measurements in Topic 820. The amendments remove the requirement to make certain disclosures and modify certain disclosures for Level 3 fair value measurements. The amendments in this update are effective for all entities for fiscal years beginning after December 15, 2019. The Fund is currently evaluating the impact this ASU will have on the financial statements.

National Academy of Engineering Fund

Notes to Financial Statements (continued)

Note 1. Nature of Activities and Significant Accounting Policies (Continued)

Subsequent events: The Fund evaluated subsequent events through June 16, 2020, which is the date the financial statements were available to be issued.

Subsequent to year-end 2019, the World Health Organization declared the novel coronavirus (COVID-19) outbreak a public health emergency. There have been mandates from international, federal, state and local authorities requiring forced closures of various schools, businesses and other facilities and organizations. These forced closures could negatively impact NAEF's revenue. Management is continually monitoring the potential impact of COVID-19 and will review and adjust planned expenditures should there be a significant impact on revenues.

Note 2. Liquidity and Availability of Financial Assets

Financial assets available for general expenditure, that is, without donor or other restrictions limiting their use, within one year of the statement of financial position date, comprise the following:

Cash and cash equivalents	\$ 690,104
Investment draw receivable	1,035,970
Contributions receivable	92,962
Promises to give	3,082,600
Redemptions receivable	2,716,330
Beneficial interest in split-interest agreements	984,168
Investments	<u>76,193,507</u>
Total financial assets available	84,795,641
Promises to give scheduled to be collected in more than one year	(408,800)
Beneficial interests in split-interest agreements	(984,168)
Donor-imposed restrictions subject to spending policy	(38,094,468)
Donor-imposed restrictions for specific purposes	(11,925,790)
Redemptions re-invested into illiquid investments	<u>(2,716,330)</u>
Total financial assets available to meet cash needs for general expenditures within one year	<u><u>\$ 30,666,085</u></u>

The Fund receives substantial donor restricted gifts to establish endowments that will exist in perpetuity and contributions with donor time and purpose restrictions. The income generated from donor-restricted endowments may be donor restricted or unrestricted as to use. In addition, the Fund receives support without donor restrictions for purpose, which are classified as donor restricted gifts subject to the passage of time.

Investment income without donor restrictions, contributions without donor restrictions and contributions with donor restrictions for use in current activities and programs are considered to be available to meet cash needs for general expenditures. General expenditures include management and operations, fundraising and program expenses expected to be paid in the subsequent year. Annual operations are defined as activities occurring during, and included in the budget for, a fiscal year.

Total financial assets available to meet cash needs for general expenditures within one year includes long-term investments that are not donor restricted. Although these long-term investments are available for use, the Fund does not intend to spend from these long-term investments for general expenditures unless necessary.

National Academy of Engineering Fund
Notes to Financial Statements (continued)

Note 2. Liquidity and Availability of Financial Assets (Continued)

The Fund manages its cash available to meet general expenditures following three guiding principles:

- Operating within a prudent range of financial soundness and stability,
- Maintaining a sufficient level of asset liquidity through the use of short-term investments and
- Monitoring and maintaining long-term investments in accordance with its long-term investment strategy.

Note 3. Promises to Give

Promises to give are unconditional and are estimated to be fully collectible as follows at December 31, 2019:

	2019		
	With Donor Restrictions		
	Time Restricted	Purpose Restricted	Total
Unconditional promises to give	\$ 558,100	\$ 2,524,500	\$ 3,082,600
Less unamortized discount	(16,963)	(48,595)	(65,558)
	<u>\$ 541,137</u>	<u>\$ 2,475,905</u>	<u>\$ 3,017,042</u>
Amounts due in:			
Less than one year	\$ 149,300	\$ 889,500	\$ 1,038,800
One to five years	408,800	1,635,000	2,043,800
	<u>\$ 558,100</u>	<u>\$ 2,524,500</u>	<u>\$ 3,082,600</u>

Note 4. Investments

Investments consist of the following at December 31, 2019:

Cash and money market*	\$ 1,366,779
Money market fund	1,391,377
Equity securities	8,214,150
Mutual funds	13,262,460
Certificates of deposit	2,506,006
Exchange traded funds	7,292,708
Alternative investments	42,160,027
	<u>76,193,507</u>
Less short-term investments	1,936,749
	<u>\$ 74,256,758</u>

*Cash and money market accounts held at cost.

National Academy of Engineering Fund

Notes to Financial Statements (continued)

Note 4. Investments (Continued)

Investment income for the period consists of the following for the year ended December 31, 2019:

Interest and dividends	\$ 744,637
Net realized and unrealized gain on investments	9,493,392
Investment management fees	<u>(423,796)</u>
	<u>\$ 9,814,233</u>

The Fair Value Measurement Topic of the Codification defines fair value as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. The Fund utilizes valuation techniques to maximize the use of observable inputs and minimize the use of unobservable inputs. Assets and liabilities recorded at fair value are categorized within the fair value hierarchy based upon the level of judgment associated with the inputs used to measure their value. The fair value hierarchy gives the highest priority to quoted prices in active markets for identical assets or liabilities (Level 1) and the lowest priority to unobservable inputs (Level 3). Inputs are broadly defined as assumptions market participants would use in pricing an asset or liability. The three levels of the fair value hierarchy are described below:

- Level 1:** Valuations based on unadjusted quoted prices in active markets for identical assets or liabilities that the reporting entity has the ability to access at the measurement date. The types of investments included in Level 1 include listed equities and listed derivatives. As required by the guidance provided by the Codification, the Fund does not adjust the quoted price for these investments, even in situations where the Fund holds a large position and a sale could reasonably impact the quoted price.
- Level 2:** Valuations based on inputs other than quoted prices within Level 1 that are observable for the asset or liability, either directly or indirectly and fair value is determined through the use of models or other valuation methodologies. Investments which are generally included in this category include corporate bonds and loans, less liquid and restricted equity securities and certain over-the-counter derivatives. A significant adjustment to a Level 2 input could result in the Level 2 measurement becoming a Level 3 measurement.
- Level 3:** Valuations based on inputs that are unobservable for the asset or liability and include situations where there is little, if any, market activity for the asset or liability. The inputs into the determination of fair value are based upon the best information in the circumstances and may require significant management judgment or estimation.

All transfers between fair value hierarchy levels are recognized by the Fund at the end of each reporting period. In certain cases, the inputs used to measure fair value may fall into different levels of the fair value hierarchy. In such cases, an investment's level within the fair value hierarchy is based on the lowest level of input that is significant to the fair value measurement. The Fund's assessment of the significance of a particular input to the fair value measurement in its entirety requires judgment and considers factors specific to the investment. The inputs or methodology used for valuing financial instruments are not necessarily an indication of the risks associated with investing in those instruments.

The following is a description of the valuation methodologies used for assets measured at fair value.

Mutual funds, equity securities, money market funds and exchange traded funds are publicly traded on the exchanges and therefore are considered Level 1 items.

National Academy of Engineering Fund

Notes to Financial Statements (continued)

Note 4. Investments (Continued)

Certificate of deposits contain inputs other than quotes prices in active markets and therefore are considered Level 2 items.

Beneficial interests in split-interest agreements held by others are measured at the present value of future cash flows considering the estimated return on the invested assets during the expected term of the agreements, the contractual payment obligations under the agreement and a discount rate commensurate with the risks involved. Split-interest agreements held by others are classified as Level 3 within the fair value hierarchy

Investments and other assets measured at fair value on a recurring basis are as follows at December 31, 2019:

	2019			
	Total	Level 1	Level 2	Level 3
Investments:				
Mutual funds:				
Large blend	\$ 5,516,465	\$ 5,516,465	\$ -	\$ -
Emerging markets	1,326,274	1,326,274	-	-
Nontraditional bond	4,046,299	4,046,299	-	-
Intermediate term bond	1,181,866	1,181,866	-	-
Real estate bond	799,009	799,009	-	-
World bond fund	392,547	392,547	-	-
	<u>13,262,460</u>	<u>13,262,460</u>	-	-
Equity securities:				
Consumer goods	1,687,007	1,687,007	-	-
Technology	1,690,894	1,690,894	-	-
Financial	1,471,996	1,471,996	-	-
Healthcare	1,039,633	1,039,633	-	-
Industrial goods	1,009,499	1,009,499	-	-
Services	511,981	511,981	-	-
Energy	206,287	206,287	-	-
Basic materials	330,388	330,388	-	-
Real estate	266,465	266,465	-	-
	<u>8,214,150</u>	<u>8,214,150</u>	-	-
Exchange traded funds:				
Energy limited partnership	1,213,371	1,213,371	-	-
Large growth	2,024,462	2,024,462	-	-
Large blend	646,515	646,515	-	-
Small growth	1,866,814	1,866,814	-	-
Small blend	1,541,546	1,541,546	-	-
	<u>7,292,708</u>	<u>7,292,708</u>	-	-
Certificates of deposit	2,506,006	-	2,506,006	-
Money market funds	1,391,377	1,391,377	-	-
	<u>32,666,701</u>	<u>30,160,695</u>	<u>2,506,006</u>	<u>-</u>
Total investments held at fair value				
Beneficial interest in split-interest agreements	984,168	-	-	984,168
Total assets held at fair value	<u>\$ 33,650,869</u>	<u>\$ 30,160,695</u>	<u>\$ 2,506,006</u>	<u>\$ 984,168</u>
Total investments:				
Held at fair value	\$ 32,666,701			
Held at net asset value (NAV) (a)	42,160,027			
Held at cost	1,366,779			
	<u>\$ 76,193,507</u>			

National Academy of Engineering Fund
Notes to Financial Statements (continued)

Note 4. Investments (Continued)

(a) In accordance with Codification Topic 820-10, certain investments that are measured at fair value using the net asset value (NAV) per share (or its equivalent) practical expedient have not been classified in the fair value hierarchy. The fair value amounts presented in this table are intended to permit reconciliation of the fair value hierarchy to the amounts presented in the statement of financial position.

The table below sets forth a summary of changes in fair value of the Fund's Level 3 assets, the beneficial interests in split-interest agreements, for the year ended December 31, 2019:

	Split-Interest Agreements
Balance, beginning of year	\$ 531,495
New split-interest agreement gifts	248,187
Change in value of split-interest agreements	204,486
Balance, end of year	<u>\$ 984,168</u>

The table below presents additional information for the Fund's investments as of December 31, 2019, whose fair value is estimated using the NAV per share (or equivalent) practical expedient and presents the nature and risk of assets with fair values estimated using NAV.

	Fair Value at December 31, 2019	Unfunded Commitment	Redemption Frequency	Redemption Notice Period
Fund of funds – Multi-strategies (a)	\$ 24,122,948	\$ 2,000,000	Quarterly – annually	60 days-five years
Fund of funds – Multi-strategies, multi-vehicles (b)	2,149,703	-	Monthly – annually, or upon dissolution of the fund	30-125 days
Fund of funds – Multi-strategies, credit (c)	1,499,372	-	Quarterly and after lock-up period	90 days
Hedge funds – Long equity (d)	4,615,534	-	Quarterly and after lock-up period	30 days- five years
Limited partnership (e)	957,469	2,537,907	Upon dissolution of the partnership	None
Private equity – Multiple strategies (f)	6,373,598	1,675,000	Upon liquidation of the fund	None
Private equity – Single strategy (g)	2,441,403	1,485,256	Upon dissolution of the partnership	None
Total	<u>\$ 42,160,027</u>	<u>\$ 7,698,163</u>		

Note 4. Investments (Continued)

- (a) This category includes investments in funds of hedge funds that use multiple strategies to obtain total returns on a leveraged basis. The funds invest in a broad range of equity instruments, including international, domestic and private equity. The funds also invest in fixed income and alternative asset classes. The fund's portfolio is designed to achieve equity-like returns at fixed income risk levels. The funds are subject to an initial two-year lock up and are limited to annual redemptions thereafter. Withdrawals require a minimum 60 days' notice and are subject to specific considerations as outlined in the Limited Partnership Agreement.
- (b) This category includes investments in a multi-strategy, multi-vehicle hedge fund with the objective of maximizing long-term, risk adjusted returns and capital appreciation. The funds have investments in multiple investees which trade in various financial instruments such as, but not limited to, domestic and international securities, fixed income debt, government securities, real estate investment trusts and derivatives. 89% of the investments in this category are available for redemption monthly, 4% of the investments are available for redemption quarterly and 7% of the investments are available for redemption upon dissolution. Notice periods range from 30 to 125 days' notice. Shares are redeemable at their NAV as of the end of the respective month, quarter and year or at the time of dissolution.
- (c) The primary objective of this category is to achieve long-term capital appreciation through structured credit investments opportunities which include investments in residential mortgage-backed securities, commercial mortgage-backed securities, asset-backed securities, collateralized loan obligations and collateralized debt obligations. This fund invests primarily in the U.S. and European markets. Funds in this category are available for redemption quarterly after an initial three-year lock-up period. Withdrawals require a 90-day notice.
- (d) Investment funds in this strategy invest primarily in publicly-traded common stocks but its investments may, at times, include positions in publicly-traded, domestic or foreign common stocks, stock warrants and rights. The Fund's investments may include investment in small capitalization companies as well as mature companies. Investments in this category are available for redemption quarterly after an initial lock up period.
- (e) This category includes investment in a limited partnership who invests in private equity funds engaged in venture capital, buyouts and growth capital, international private equity and other private equity investments. The Fund may receive distributions-in-kind from the partnership investments representing securities of the partnership investments' underlying portfolio companies. These investments can never be redeemed with the funds. Instead, the nature of the investments in these categories is that distributions are received through the liquidation of the underlying assets of the funds. As of December 31, 2019, it is probable that the investments in these categories will be liquidated at an amount different from the NAV of the Fund's ownership interest in partners' capital. Investments in the underlying funds are reported at their estimated fair value, as determined in good faith by the fund manager. Fair value is based on the information provided by the respective general partner of each of the underlying funds, including audited financial statements, which reflects the fund's share of the fair value of the net assets of the respective underlying fund and any other relevant factors determined by the fund manager. The fund has applied the fair value guidance for measuring its investments in the underlying funds, using the practical expedient. As such, the Fund fair values its investments using the underlying funds' NAV without any further adjustments. The value reported by the Fund is the value of its ownership share.

Note 4. Investments (Continued)

- (f) This category includes investments in private equity, venture capital and distressed securities and other non-traditional categories on a global basis. The other fund makes indirect investments in emerging private markets including private equity and distressed securities. These investments can never be redeemed with the funds. Instead, the nature of the investments in these categories is that distributions are received through the liquidation of the underlying assets of the funds. As of December 31, 2019, it is probable that the investments in these categories will be liquidated at an amount different from the NAV of the Fund's ownership interest in partners' capital. Investments in the underlying funds are reported at their estimated fair value, as determined in good faith by the fund manager. Fair value is based on the information provided by the respective general partner of each of the underlying funds, including audited financial statements, which reflects the fund's share of the fair value of the net assets of the respective underlying fund and any other relevant factors determined by the fund manager. The Fund has applied the fair value guidance for measuring its investments in the underlying funds, using the practical expedient. As such, the Fund's fair values its investments using the underlying funds' NAV without any further adjustments. The value reported by the Fund is the value of its ownership share
- (g) The Fund invests in private equity companies that provide infrastructure. The Fund seeks investments that have a desirable risk return profile, which will deliver, in aggregate, a gross target internal rate of return of 12% to 15% with prudent leverage. The leverage strategy primarily revolves around the following principles: structure debt capital to investment grade standards whenever possible; develop matching debt duration profiles to respective assets' cash flow profiles; and avoid floating interest rate exposure, either through the use of fixed rate debt or interest hedging activities. These investments can never be redeemed with the funds. Instead, the nature of the investments in these categories is that distributions are received through the liquidation of the underlying assets of the fund. As of December 31, 2019, it is probable that the investments in these categories will be liquidated at an amount different from the NAV of the Fund's ownership interest in partners' capital. Investments in the underlying funds are reported at their estimated fair value, as determined in good faith by the fund manager. Fair value is based on the information provided by the respective general partner of each of the underlying funds, including audited financial statements, which reflects the fund's share of the fair value of the net assets of the respective underlying fund and any other relevant factors determined by the fund manager. The fund has applied the fair value guidance for measuring its investments in the underlying funds, using the NAV practical expedient. As such, the fund fair values its investments using the underlying funds' NAV without any further adjustments. The value reported by the Fund is the value of its ownership share.

National Academy of Engineering Fund

Notes to Financial Statements (continued)

Note 5. Net Assets With Donor Restrictions

Net assets with donor restrictions consist of the following at December 31, 2019:

	Balance, December 31, 2019
Endowments:	
Subject to spending policy and/or appropriation:	
Bernard M. Gordon Prize for Innovation in Engineering and Technology Education	\$ 13,373,324
Charles Stark Draper Prize for Engineering	10,135,421
Wm. A. Wulf Initiative for Engineering Excellence	4,880,170
Capital Preservation	4,008,690
Norman R. Augustine Senior Scholar	1,354,948
John A. Armstrong Endowment for Young Engineers*	1,114,224
A. James Clark Endowment for Inspiring Women Engineers	1,009,074
J. Herbert Hollomon Fellow	813,465
Thomas V. Jones Industry Scholar	676,620
Simon Ramo Founders Award	682,072
Hans Reisner	46,460
	<u>38,094,468</u>
Subject to expenditure for a specified purpose:	
Charles M. Vest President's Opportunity	6,132,620
Engineer Girl	2,570,212
General Reserves*	994,471
President's Initiatives	963,136
Grainger	844,108
Urban Infrastructure	341,482
Public Understanding	310,416
Global Grand Challenges Summit	192,265
NAE Empowerment	154,010
Frontiers of Engineering	100,670
Guiding Implement of K-12 Engineering Education	69,533
Link Engineering Samueli	62,177
Chevron Link Engineering	45,063
Noise Policy Development	37,730
Engineering Health Care Delivery	37,628
Engineering Ethics Center	31,587
US/German American	20,017
Technology and Environment	1,096
STEM Tech Literacy	804
Sustaining Link Engineering	363
MVA – Adaptability Workshop	276
Moore President Discretionary	179
Engineering Education & Research	107
US/India Frontiers	8
	<u>12,909,958</u>
Subject to the passage of time:	
Promises to give	541,137
	<u>541,137</u>
	<u>\$ 51,545,563</u>

*Net assets related to the beneficial interest in split interest agreements of \$941,424 and \$42,734 are included in the general reserve and John A. Armstrong Endowment for Young Engineers, respectively.

Note 6. Endowments

Interpretation of relevant law: The Fund has interpreted the District of Columbia-enacted version of the Uniform Prudent Management of Institutional Funds Act (UPMIFA) as requiring the Fund, absent explicit donor stipulations to the contrary, to act in good faith and with the care that an ordinarily prudent person in a like position would exercise under similar circumstances in making determinations to appropriate or accumulate endowment funds, taking into account both its obligation to preserve the value of the endowment and its obligation to use the endowment to achieve the purposes for which it was donated. As required by U.S. GAAP, net assets associated with endowment funds are classified and reported based on the existence or absence of donor-imposed restrictions as net assets with donor restrictions and net assets without donor restrictions, respectively. The Fund's endowment consists of net assets with donor restrictions and accordingly, endowment earnings and principal amounts are classified as net assets with donor restrictions. Principal amounts include: (a) the original value of gifts donated to the permanent endowment, (b) the original value of subsequent gifts to the permanent endowment and (c) accumulations to the permanent endowment made in accordance with the direction of the applicable donor gift instrument at the time the accumulation is added to the fund. In accordance with UPMIFA, the Fund considers the following factors in making a determination to appropriate or accumulate donor-restricted endowment funds:

- (1) The duration and preservation of the endowment fund
- (2) The purposes of the institution and the endowment fund
- (3) General economic conditions
- (4) The possible effect of inflation or deflation
- (5) The expected total return from income and the appreciation of investments
- (6) Other resources of the institution
- (7) The investment policy of the institution

Return objective and risk parameters: The Fund has adopted an investment policy for the endowment fund. This investment program is based on growing the endowment fund to provide financial stability for the Fund in perpetuity. The Fund's ability to tolerate risk and volatility should be consistent with that of a conservative growth portfolio, with investments made in companies that demonstrate consistent growth over time. Asset allocations are developed in accordance with this long-term, conservative growth strategy.

Spending policy: The Fund will appropriate for expenditure in its annual budget up to 5% of the earnings plus an additional 1% to use in contingency under special financing circumstances for a maximum of 6% of the average of the 12 previous quarterly valuations of the participating funds. There may be times when the Fund may opt not to take the spending rate, but rather to reinvest some or all of the annual income. Expenditures are made in accordance with donor stipulations.

Fair value: The fair value of assets associated with donor-restricted endowment funds may fall below the level that UPMIFA requires to retain as a fund of perpetual duration. As of December 31, 2019, funds with an original gift value of \$13,438,250 were underwater by \$64,926 in net assets with donor restrictions. Accumulated losses are the result of investment losses and releases in accordance with donor stipulations. Future market gains and additional gifts by the donor will be used to restore this reduction in net assets.

National Academy of Engineering Fund
Notes to Financial Statements (continued)

Note 6. Endowments (Continued)

The following illustrates endowment net asset composition by type of fund at December 31, 2019:

	Original Gift	Accumulated Gains (Losses)	Total
Donor-restricted endowment funds:			
Underwater	\$ 13,438,250	\$ (64,926)	\$ 13,373,324
Other	17,868,900	6,852,244	24,721,144
Total funds	<u>\$ 31,307,150</u>	<u>\$ 6,787,318</u>	<u>\$ 38,094,468</u>

Changes in endowment net assets for the year ended December 31, 2019, are as follows:

Endowment net assets, beginning of year	\$ 33,304,611
Total investment return, net	4,808,041
Amounts appropriated for expenditure	(1,140,712)
Contributions	<u>1,122,528</u>
Endowment net assets, end of year	<u>\$ 38,094,468</u>

Note 7. Related Party Transactions

The National Academies Corporation: The National Academies Corporation (TNAC) is a nonprofit corporation that was incorporated in January 1986 for the purpose of constructing and maintaining a study and conference facility, the Arnold and Mabel Beckman Center, in Irvine, California, to expand and support the general scope of program activities of NAS, NAE, NAM and NRC. TNAC is organized as a tax-exempt supporting organization for NAS and the Fund. The Board of Directors and officers of TNAC include certain officers of the Fund. The Fund had no transactions with TNAC for the year ended December 31, 2019.

National Academy of Sciences: The Fund reimburses NAS by making periodic payments based on NAE's estimated expenditures for the year. The Fund also receives contributions through NAS. This resulted in a payable to NAS at December 31, 2019, of \$2,419,987. Payments made to NAS by the Fund for its allocated portion of the expenditures, including occupancy costs, shared jointly by NAS, NAE and NAM were \$1,430,591 for the year ended December 31, 2019.

Officers

Terms expire June 30 of the year shown in parentheses.

Chair

Gordon R. England (2020)
Chair, PFP Cybersecurity; Former
President, General Dynamics Fort
Worth Aircraft Company (later
Lockheed Corporation)

President

John L. Anderson (2025)
President, National Academy of
Engineering

Immediate Past President

C. D. (Dan) Mote, Jr. (2020)
President Emeritus, National
Academy of Engineering

Vice President

Corale L. Brierley (2022)
Principal, Brierley Consulting,
LLC

Home Secretary

Julia M. Phillips (2020)
Retired Vice President and Chief
Technology Officer, Sandia
National Laboratories

Foreign Secretary

Ruth A. David (2019)
Retired President and CEO,
Analytic Services Inc.

James M. Tien (2023)
Distinguished Professor and Dean
Emeritus, College of Engineering,
University of Miami

Treasurer

Martin B. Sherwin (2021)
Retired Vice President, W.R.
Grace & Co.

Councillors

John L. Anderson (2019)
Distinguished Professor of
Chemical Engineering, Illinois
Institute of Technology

Nadine Aubry (2021)
Provost and Senior Vice President,
Tufts University

Josephine Cheng (2022)
Entrepreneur; Retired Vice
President, International Business
Machines Corporation

David E. Daniel (2019)
President Emeritus, University of
Texas at Dallas

James O. Ellis, Jr. (2022)
US Navy (retired); Annenberg
Distinguished Visiting Fellow,
Hoover Institution, Stanford
University

Katharine G. Frase (2020)
Retired Vice President, Education
Business Development,
International Business Machines
Corporation

Wesley L. Harris (2021)
Charles Stark Draper Professor
of Aeronautics and Astronautics,
Massachusetts Institute of
Technology

Edward D. Lazowska (2021)
Bill & Melinda Gates Chair, Paul
G. Allen School of Computer
Science & Engineering, University
of Washington

Frances S. Ligler (2020)
Lampe Distinguished Professor of
Biomedical Engineering, NC State
University and UNC-Chapel Hill;
Retired Senior Scientist, Naval
Research Lab

Robin K. McGuire (2022)
Senior Principal, Lettiss
Consultants International, Inc.

H. Vincent Poor (2020)
Michael Henry Strater University
Professor, Princeton University

C. Paul Robinson (2019)
President Emeritus, Sandia
National Laboratories

Howard B. Rosen (2021)
Independent Consultant

Alan I. Taub (2022)
Professor of Materials Science
and Engineering, University of
Michigan; Retired Vice President,
Global R&D, General Motors
Company

Yannis C. Yortsos (2020)
Dean, Viterbi School of
Engineering, University of
Southern California

Ex officio:

Marcia McNutt (2022)
President, National Academy
of Sciences

Staff

Office of the President

C. D. Mote, Jr., *President (through June)*
John L. Anderson, *President (from July)*
Kelli Zingler, *Assistant to the President*
Sierra Hall, *Office Assistant*

Executive Office

Alton D. Romig, Jr., *Executive Officer*
Lance A. Davis, *Senior Advisor*
Jatryce Jackson, *Executive Assistant*
Pamela Lankowski, *Council Administrator*

Finance Office

Joan Zaorski, *Director, Finance and Administration*
Barbara Boyd, *Financial and Administrative Associate*
Raymond Hart, *Senior Accountant*
Mary Kuttruff, *Financial Officer*

Membership Office

Michaela Curran, *Director*
Kim Case, *Senior Membership Associate (from February)*
Caryn Cochran, *Membership Associate*
Kim Garcia, *Election Manager*
Kim Middleton, *Senior Membership Associate (from February)*
Ervin Pinckney, *Senior Membership Assistant*

Program Office

Guru Madhavan, *Norman R. Augustine Senior Scholar and Director (from February)*
Carl-Gustav Anderson, *Associate Program Officer (through November)*
Randy M. Atkins, *Senior Public/Media Relations Officer*
Rosalyn W. Berne, *Director, Center for Engineering Ethics and Society*
Elizabeth Cady, *Senior Program Officer*

Soumya Chappidi, *College Intern (summer)*
Cameron H. Fletcher, *Senior Editor Penelope Gibbs, Administrative and Financial Associate*
Brandon Green, *Communications/Media Specialist*
Kassandra Grimes, *Christine Mirzayan Science and Technology Policy Graduate Fellow (winter) and College Intern (from April)*
Michael Holzer, *Senior Program Assistant*
Sherri Hunter, *Meetings Coordinator*
Janet Hunziker, *Director, Frontiers of Engineering*
Kenan P. Jarboe, *Senior Program Officer, Manufacturing, Design, and Innovation (through September)*
Maribeth Keitz, *Web Communications Manager*
Mary Kuttruff, *Financial Officer*
Mary Mathias, *Associate Program Officer*
Rebecca Monteleone, *Christine Mirzayan Science and Technology Policy Graduate Fellow (winter)*
Greg W. Pearson, *Scholar, K-12 Engineering Education and Public Understanding of Engineering*
Simil L. Raghavan, *Senior Program Officer, EngineerGirl Program*
B.L. (Rama) Ramakrishna, *Director, Grand Challenges Scholars Program*
Sudhir (Sid) Shenoy, *College Intern (summer)*
Darul West, *Program Coordinator*
Deborah M. Young, *Program Officer, Awards*

Development Office

Radka Z. Nebesky, *NAE Senior Director*
Lauren Bartolozzi, *NAE Associate Director*
Elana Lippa, *Director of Planned Giving*

NAE Publications

NAE publications are available from the National Academies Press (NAP), either for purchase or as free downloadable PDFs, at www.nap.edu or 800-624-6242, or from the National Academies Bookstore, 500 Fifth Street NW, Washington, DC.

Publications from 2019

(in alphabetical order):

Engineering Societies' Activities in Helping to Align the Needs and Goals of Industry and Academia: Proceedings of a Workshop – In Brief

Frontiers of Engineering: Reports on Leading-Edge Engineering from the 2018 Symposium

Privacy and Security in the 21st Century: Who Knows and Who Controls? Proceedings of a Forum

Science and Engineering for Grades 6–12: Investigation and Design at the Center (NAE-NRC)

The Third Global Grand Challenges Summit: Engineering for the Future – Summary

In addition, *The Bridge* addressed the following topics in 2019:

Technologies for Aging (spring)

Engineering for Disaster Resilience (summer)

Cybersecurity (fall)

Frontiers of Engineering (winter)

The quarterly is available from the NAE Program Office or online at www.nae.edu/thebridge.

The National Academy of Sciences was established in 1863 by an Act of Congress, signed by President Lincoln, as a private, nongovernmental institution to advise the nation on issues related to science and technology. Members are elected by their peers for outstanding contributions to research. Dr. Marcia McNutt is president.

The National Academy of Engineering was established in 1964 under the charter of the National Academy of Sciences to bring the practices of engineering to advising the nation. Members are elected by their peers for extraordinary contributions to engineering. Dr. C.D. Mote, Jr. was president through June 30; Dr. John L. Anderson began his term as president on July 1.

The National Academy of Medicine (formerly the Institute of Medicine) was established in 1970 under the charter of the National Academy of Sciences to advise the nation on medical and health issues. Members are elected by their peers for distinguished contributions to medicine and health. Dr. Victor J. Dzau is president.

The three Academies work together as the National Academies of Sciences, Engineering, and Medicine to provide independent, objective analysis and advice to the nation and conduct other activities to solve complex problems and inform public policy decisions. The Academies also encourage education and research, recognize outstanding contributions to knowledge, and increase public understanding in matters of science, engineering, and medicine.

Learn more about the National Academies of Sciences, Engineering, and Medicine at www.national-academies.org.

Photo Credits:

Earthrise: Courtesy of William A. Anders (NAE), NASA/AP, Dec. 24, 1968

Page 14: Courtesy of the Royal Swedish Academy of Engineering Sciences

Page 15: Courtesy of Kenneth Fisher, Cabrillo High School



NATIONAL ACADEMY OF ENGINEERING

500 Fifth Street NW
Washington, DC 20001

www.nae.edu

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

The nation turns to the National Academies of Sciences, Engineering, and Medicine for independent, objective advice on issues that affect people's lives worldwide.

www.national-academies.org