Engineers Conclave - 2017

Sep 14-16, 2017
CSIR-NAL, Bangalore

RECOMMENDATIONS

Organized by:

Indian National Academy of Engineering (INAE), New Delhi
Council of Scientific and Industrial Research (CSIR)

Coordinated by:

National Aerospace Laboratories (NAL)

Engineers Conclave - 2017

Sep 14-16, 2017
CSIR-NAL, Bangalore

RECOMMENDATIONS

Organized by:

Indian National Academy of Engineering (INAE), New Delhi
Council of Scientific and Industrial Research (CSIR)

Coordinated by:

National Aerospace Laboratories (NAL)

ENGINEERS CONCLAVE (EC2017)

Theme-I: Regional Air Connectivity
Theme-II: Digital Economy

Jointly Organized by Indian National Academy of Engineering (INAE) and Council of Scientific and Industrial Research (CSIR)

PROGRAMME

Venue: S R Valluri Auditorium, CSIR-NAL

14th September, 2017 - Day 1

0900 – 1000 hrs.	**Registration**
1000 – 1130 hrs.	**Inaugural Session**
1000 – 1005 hrs.	Lamp lighting / Invocation
1005 – 1015 hrs.	Welcome Address by Dr. Girish Sahni, Chair EC2017 and DG, CSIR, New Delhi
1015 – 1025 hrs.	Address by Dr. B N Suresh, President, INAE highlighting the Aim of the Conclave
1025 – 1045 hrs.	Address by the Chief Guest Dr V K Saraswat, Member, NITI Ayog
1045 – 1115hrs.	Keynote address by Prof Roddam Narasimha, Prof Emeritus at JNCAR, Bangalore & FNAE
1115 – 1120 hrs.	Vote of thanks by Mr Jitendra J Jadhav, Director, CSIR-NAL
1130 – 1200 hrs.	High Tea
1200 – 1300 hrs.	**Plenary Talk-1 on "Digital Economy – Challenges, opportunities, initiatives and way forward" by Mr. V. V. R Sastry, Ex Director, C-DOT**
1300 – 1330 hrs.	LUNCH
1330 – 1430 hrs.	**Inauguration and Visit to Techno Exhibition**

1430 – 1630 hrs	Parallel Technical Sessions	
	Theme 1	**Theme 2**
	Technical Session-I : ***Regional Air Connectivity: Policy/Regulatory issues/operators view points*** **Chairman: Dr V K Saraswat Member, NITI Ayog**	**Technical Session-I :** ***Infrastructure and Integration*** **Chairman: Ms Anandi Ramalingam, Director, Marketing, BEL**
	Topic 1: Regional Air Connectivity Policy & operational issues. **Speaker: Ms Vandana Aggarwal, Economic Advisor, Ministry of Civil Aviation** ***Topic 2:*** Operators viewpoints – **Speaker: Mr Pradeep Kumar, Director (Engg), Simm-Samm Airways** ***Topic 3:*** Cost benefit analysis of air connectivity vs high speed rail connectivity **Speaker: Prof Asim Tewari, IIT, Bombay** ***Topic 4:*** Operator View Points **Speaker: Mr CS Subbiah, CEO, Alliance Air**	***Topic 1:*** Technologies for back bone communication & Network Connectivity: telecommunication, computer networks. **Speaker: Dr Prakash, CDOT** ***Topic 2:*** Technologies for Identity: Registration, storage, Retrieval, Verification. **Speaker: Mr Pramod Varma, UIDAI** ***Topic 3:*** Manufacturing and Maintenance Systems. **Speaker: Mr R Manoharan, Reliance Jio** ***Topic 4:*** Technologies for Devices : Iris, Fingerprints, QR codes, Smart-cards, RFID **Speaker: Mr Srini Rajam, Ittiam**
1630 – 1700 hrs.	**TEA**	

1700 – 1830 hrs.	**Technical Session-II : <u>Airports/No frill Airports</u> Chairman: Dr Prahlada, Former VC, DIAT**	**Technical Session-II : <u>Financial Technologies</u> Chairman: Prof. Y Narahari, IISc**
	Topic 1: Building & Operation of no frill airports **Speaker: Mr S Bhaduri, ED, Engg ER, AAI** ***Topic 2:*** Making no frill airports commercially viable. **Speaker: Mr P S Nair, GMR Group, CEO, (Airports).** ***Topic 3:*** Autonomous Air Traffic Control systems at no frill airports. **Speaker:Mr Ritu Raj Tyagi, Director, SAAB India Technologies, Pvt. Ltd.**	***Topic 1:*** Smart-cards, Wallets and PoS Terminals **Speaker: Prof. Rajat Moona, IIT, Bhilai** ***Topic 2:*** Block chains and Cryptocurrencies. **Speaker: Prof Veni Madhavan, IISc** ***Topic 3:*** Signatures, Privacy protection **Speaker: Mr Sanjay Deshpande, Forty Two 42 labs**
1830 – 1900 hrs.	**Plenary Talk-2 on "IAF's requirements for transport Aircraft " by AVM B R Krishna, ACAS(Plans)**	
1900 – 2000 hrs	**Cultural Programme**	
2000 – 2100 hrs	**Dinner**	

15th September, 2017 - Day 2

1000 – 1100 hrs.	**Plenary Talk-3 on" Evolution of Digital Space" by Dr Gulshan Rai, DG – CERT-In & National Cyber Security Coordinator**	
1100 – 1130 hrs.	**TEA**	
1130 – 1330 hrs.	**Technical Session-III: <u>Market and Top Level Requirements for new Gen Regional Aircraft</u> Chairman: Dr A R Upadhya, Former Director, CSIR-NAL**	**Technical Session-III: <u>User Interfaces and Services</u>**

	Topic 1: Market study **Speaker: Mr Nirmal Kumar Chandramouli, Pratt & Whitney, Canada** ***Topic 2:*** Top Level Requirements **Speaker: Gp Capt (Retd) RS Makker, Spicejet** ***Topic 3:*** Top Level Requirements **Speaker : Dr Kota Harinarayana & Mr Bhaskar Chakravarty, CSIR-NAL**	***Topic 1: Language Technologies*** **Speaker: Mr Mahesh Kulkarni, CDAC** ***Topic 2:*** Financial Inclusion related Technologies. **Speaker: Dr Sandeep Oberoi, TCS** ***Topic 3:*** Front-end, Back-end devices for citizen services. ***Topic 4:*** Data and Cloud Services. **Speaker: SBI**
1330 – 1430 hrs.	**LUNCH**	
1430 – 1630 hrs.	**Technical Session-IV :** **Technologies for a New Gen Regional Aircraft** **Chairman: Dr Girish Deodhare, PD & Director, ADA**	**Technical Session-IV :** **Cyber Security**
	Topic 1: Configuration and System definition for 70±20 passenger aircraft **Speaker : Mr Bhaskar Chakravarty & Dr Kota Harinarayana, CSIR-NAL** ***Topic 2:*** Gagan Development to meet CAT1 and above requirements. **Speaker : Mr Ramasubramaniam, Programme Director, Satellite Navigation, ISAC**	***Topic 1:*** Civilian, military networks, dual use technologies. **Speaker: Mr. Rakshit, CAIR, Bangalore** ***Topic 2:*** Data Analytics & Forensics **Speaker: Prof V Ravi, IDRBT**

	Topic 3: Enhanced Synthetic Vision. **Speaker : Mr Shantha Kumar, CSIR-NAL** ***Topic 4:***New Generation Turbo Prop engine for Regional Aircraft. **Speaker : Pratt & Whitney, Canada**	***Topic 3:*** Regulating Smart devices in restricted spaces. **Speaker: Prof Vinod Ganapathy, IISc** ***Topic 4:*** Communication systems and security. **Speaker: Prof UB Desai-IITH**
1630 – 1700 hrs.	**TEA**	
1700 – 1800 hrs.	**Technical Session-V:** **<u>Design for Maintenance</u>** **Chairman: Mr Sanjiv Shukla, Executive Director, AR & DC, HAL** ***Topic 1:*** Design for manufacture & Maintenance **Speaker: Mr Mohankrishnan K P, Mahindra Aerospace Pvt Ltd** ***Topic 2:*** Condition based maintenances **Speaker: Mr Luigi celmi, CEO, Lufthansa Technik Services, India** ***Topic 3:*** Structural Health Monitoring for Composites **Speaker : Dr Ramesh Sundaram, Head, ACD, CSIR-NAL**	**Technical Session-V:** **<u>Human Resources: Development, Employment and Empowerment</u>** **Chairman:** ***Topic 1:*** Decision making in changing, uncertain, technology driven times **Speaker: Prof. N Viswanadham-IISc** ***Topic 2:*** Innovation, Entrepreneurship, Employment. **Speaker: Dr. Ramesh Sundararaman-IIIT, Bangalore** ***Topic 3:*** Skills Development, Job Cadres. **Speaker:** ***Topic 4:*** **Speaker: Mr C S Rao**
1800-1900 hrs.	**- Plenary Talk-4 on "GST System Project: The Engineering Challenges" by Mr Prakash Kumar, CEO, GST, New Delhi**	

16th September, 2017 – Day 3

<table>
<tr><td>0930-1100 hrs.</td><td colspan="2">- Parallel Panel Discussion Session on Way Foreword</td></tr>
<tr><td></td><td>Theme – 1
Chair: Dr Kota Harinarayana
Mr Jitendra J Jadhav
Dr A R Upadhya
Dr Girish Deodhare
Mr Sanjiv Shukla
Mr Vineet Kumar</td><td>Theme – 2
Chair: Prof Veni Madhavan
Prof R K Shyamasundar,
Dr V Tyagi
Dr Ramesh Sundararaman</td></tr>
<tr><td></td><td>• Top Level Requirements
• Infrastructure issues.
• Cost / Timeframe and Strat for development.
• Technology Challenges.
• Strategy for development, production and product support.
• Recommendations on proposed course of action.</td><td>• Infrastructures.
• Financial Technologies.
• User Interfaces.
• Cyber Security.
• Human Resources
• Recommendations on proposed course of action.</td></tr>
<tr><td>1100–1130 hrs.</td><td colspan="2">TEA</td></tr>
<tr><td>1130-1215 hrs.</td><td colspan="2">Plenary Talk-5 on “Air Transportation in India – Challenges” by Prof Raghuram, Director, IIM, Bangalore</td></tr>
<tr><td>1215-1330 hrs.</td><td colspan="2">Valedictory Session

Chairman: Prof. Roddam Narasimha, Prof Emeritus at JNCAR, Bangalore & FNAE
• Introductory Remarks by President, INAE
• Summing up of Technical Sessions of two Themes by respective Coordinators.
• Valedictory Address by Session Chairman</td></tr>
<tr><td>1330 hrs onwards</td><td colspan="2">Lunch and dispersal</td></tr>
</table>

Engineers Conclave - 2017

Sep 14-16, 2017, CSIR-NAL, Bangalore

Recommendations

Theme I :
Regional Air Connectivity

Organized by:

Indian National Academy of Engineering (INAE),

Council of Scientific and Industrial Research (CSIR)

Coordinated by

National Aerospace Laboratories (NAL)

Summary of Deliberations

Inaugural Function

I Important points of key note address:

(a) The announcement of a new civil Aviation policy by government in 2016, was a landmark event in the history of Indian Aviation and aeronautics. Aviation addresses flying operations where as aeronautics addresses design, development and manufacture of aircraft and associated engines/ systems etc for those operations.

(b) Time is ripe for civil aeronautics to take off in India. A new civil aeronautics policy to support the civil aviation policy of 2016 would be a step forward and essential for growth of Indian economy.

(c) Order of 120 LCA Tejas, reduction of Rafale order, new civil aviation policy announced in 2016, government encouraging private industry's involvement in aircraft manufacture (Eg: Avro aircraft replacement assigned to private sector), 'Make in India' policy, Defence offset policy are initiatives enabling establishment of strong aviation/ aeronautics industry in the country.

(d) India is a country of shorter distances but large population density. 70% of civil air traffic routes in India are shorter than 800km. India is an ideal country for turbo prop aircraft. India is now the largest market for regional Turbo prop aircraft

(e) Existing Turbo Prop Aircraft are 2 to 21/2 decades old. Hence there is a pressing need for development of a new generation turbo prop aircraft. As India is a large market, has large talent pool , there is availability of advanced technologies (Thanks to Light combat aircraft programme), India is the right place to initiate development of a new generations, sub-100 Turbo Prop Aircraft. There is also demand for An-32 replacement for IAF. Due to demand from civil & Military customers in India, it is a cost effective proposition for development & production of a new generation Turbo Prop Aircraft in India.

(f) It is suggested that support be given by CSIR/DRDO for accelerated Technology development in areas such as new wings; also enable consortium of Private/ public sector industry and R&D institutions for undertaking development and production; invite global partnership leading to setting up a civil aeronautics ecosystem.

Chief Guest's Comments:

(i) Strongly supported

(a) Further development and operationalisation of SARAS aircraft variants for military and Civil customers.

(b) Taking up development of Sub 100 Turbo prop aircraft in India

Technical Session I

Regional Air Connectivity- Policy issues:

(i) Mrs Vandana Aggarwal, economic advisor, MoCA, presented the key aspects Civil Aviation Policy of 2016, operationalisation of the policy, issues/problems encountered & updates made in the policy to enable quicker operationalisation. She presented outcome of Round 1 of the bids and time lines for round 2 of bidding.

(ii) Mr Subbiah, CEO, Alliance Air and Mr Pradeep Kumar, Director of Simm-Samm Airways presented operators view points and suggested some improvements while supporting fully the new Aviation policy.

(iii) Prof Asim Tiwari presented the need for India to take the initiative to development a new Generation Regional Turbo Prop Aircraft and presented a comparative study between cost of establishing airport infrastructure for Airline operation vis-à-vis high speed rail infrastructure.

Technical Session II

No Frill Airports:

(i) Mr S Bhaduri, ED, AAI presented the concept of no frill airports, gradation of no frill airports as category 1, 2 and 3; cost of these categories of airports (50 crores, 65 crores and 75 crores), land request for these types of airports(50 acres, 75 acres and 100acres).He also presented the designs that enable establishment of no frill airport buildings in 6 months as against normal 24 months required for buildings at regular airports.

(ii) Mr P S Nair stated the need for additional land on city side for establishing tourism/ entertainment infrastructure at airports to make them commercially viable.

(iii) Mr Rituraj of SAAB stated that autonomous ATC systems are fully operational. He also presented the readiness of Enhanced vision system for operation in no frill airports. He emphasized the importance of these

technologies in making the low frill airports financially viable and operational in all weather conditions obviating the need for costly ATC infrastructure and ILS infrastructure.

Plenary Talk on "IAF's requirements for Transport Aircraft"

AVM Krishna, ACAS (plans) gave a presentation on types of transport Aircraft being deployed, recent acquisitions adding to heavy lift capability of IAF, operational challenges in operation of transport aircraft in difficult terrains specially at airports in Himalayan region. He emphasized the need for operation at very high altitudes and at semi prepared airstrips.

Technical Session III

Market & Top-level requirements for New Gen regional aircraft:

Market Study:

Mr Nirmalkumar Chandramouli, presented the latest market study done by P&W Canada with focus on Indian market. He stated that a market of 250 aircraft exists for regional Turbo prop aircraft in the next 10 years. He also showed that the market size could increase to 350 if the share of regional aircraft increases from present 7% to 15%. His study showed that there would be a global demand for 7000 Turbo prop aircraft in the next twenty years with market shifting to developing economies.

Top level requirements:

Two presentations were made on this subject.

- Gp Capt (retd) R S Makker of Spicejet presented his appreciation of top level requirements for a new generation regional Turbo prop aircraft.

Configuration	:	High wing, T-Tail, wing mounted engines
Fuselage	:	Design for Civil/Military
Payload	:	10 to 12 tons
Range	:	1000nm
Seating	:	70-90 pax
BFL	:	1300-1500m
Ceiling	:	25000-30000 ft

Cruise speed : 5-6 nm/minute

Noise level : FAR 36

Engine Power : 5000hp, FADEC, Composite propellers, Low SFC & Centralized diagnostics

Low Operating & Maintenance cost

Advanced Avionics with Enhanced Vision Systems

Test team: NFTC Model

- Dr Kota Harinarayana presented the feasibility study done earlier by CSIR-NAL on developing the next Gen Regional Turbo prop aircraft. He stated that extensive discussions were held with air line operators to arrive at the Top level requirements for a new gen regional aircraft. He mentioned that IIM, Bangalore had conducted primary market survey and he presented the outcome of this survey. He stated that many interactions were also held with international companies such as Airbus, Bombardier, ATR, Russian industry, Korean industry. He mentioned that discussions were held with IAF as regards their requirements. He presented the top level requirements for the new generation turbo prop aircraft with ATR-72 performance as the base.
    - Acquisition cost : 25% lower
    - Operating cost : 25% lower
    - Fuel Consumption : 20 to 25% lower
    - Maintenance cost : 25% lower
    - T.O & Landing from unequipped airfields
    - All weather operation
    - Emissions lower by 70%
    - Enhanced safety
    - Seating capacity : 70 / 90
    - Design Range : 2000km
    - Max cruise altitude : 30,000ft
    - Cruise speed : 550 – 600 kmph
    - Cargo capacity : Dedicated 1-ton capacity

Technical Session IV

Technologies for a new gen regional aircraft:

- Mr Bhaskar Chakravarty presented the feasibility study done earlier at CSIR_NAL on configuration & system design of a new generation regional turbo prop aircraft.

His presentation covered follow aspects:

- Work done to arrive at Top level requirements
- Technology levels of existing turbo prop aircraft being 2 to 2 ½ decades old and Need for new aircraft with advanced technologies.
- 50% of passengers world wide fly less than 800 km.
- Lack of new regional turbo prop aircraft development programmes in the world and the opportunity available to fill this window of opportunity
- Top level requirements
- Technology development work done at Engine OEMS and SFC improvements demonstrated.
- New technologies required to achieve the goals
- Technology work undertaken at CSIR-NAL in the area of

  Advanced Aerodynamics

  Advanced carbon composites

  Affordable fly by wire systems

  More electric systems

  IVHM/SHM Technologies

  Noise & Vibration control

He presented the configurations developed for both civil & military variants.

- Mr Rama Subramanian, programme director, ISAC gave an over view of GAGAN system developed by ISRO in partnership with AAI. He stated that the system, is fully operational and can provide CAT1 level of landing capabilities without any ILS facility.

- Mr Shanta Kumar, Scientist, CSIR-NAL, presented the work done at CSIR-NAL in developing integrated enhanced synthetic vision systems and how these systems could enable all weather operation of aircraft in unequipped airfields.

- Mr Nirmal Kumar chandramouli presented the technology work done at P&W Canada for new Turbo prop engines of 5000-8000shp and stated that reduction of SFC to the extent of 13-15% vis a vis P&W 150 engine could be demonstrated . He mentioned that new engines could be certified in 48 months after go ahead.

The session demonstrated that aircraft Technologies required to achieve the Top Level requirement are available.

Technical Session V

Design for Maintenance:

- Mr Mohan Krishnan of Mahindra Aerospace showed the maintenance features & design for manufacturing features of their Air Van aircraft.

- Mr Luigi Celmi of Lufthansa Tech showed the benefits of condition based maintenance Technology, the work done in their company and tangible benefits demonstrated.

- Dr Ramesh Sundaram showcased the extensive work done at CSIR-NAL in developing & demonstrating the benefits of structural health monitoring Technologies and how this Technology could enable reduction of maintenance effort required.

This session showed the benefits of new technologies (CBM, SHM etc) in reducing the maintenance cost.

Plenary Talk on "Air transportation in India-Challenges"

The fifth plenary talk was given by Prof Raghuram, Director, IIM, Bangalore on "Air transportation in India-Challenges". He clearly brought out the issues, challenges and how the new civil aviation policy of 2016 with proper implementation could enable growth of domestic civil aviation.

Panel Discussions & Valedictory Session

Summary of the suggestions and action points:

- India has emerged as the biggest market for regional turbo prop aircraft thanks to new civil aviation policy and UDAAN programme.
- Thanks to LCA and SARAS projects, a large number of private industries have entered aircraft industry leading to enhanced aviation ecosystem in India.
- There was a total convergence that India should launch development of a new generation regional turboprop aircraft.
- It was suggested that base line capacity could be 90 seats with a 70 seat variant.
- Civil and military requirements need to be harmonised and maximum commonality between these two variants should be achieved.
- Whether it should be 4 abreast or 5 abreast was debated. It was felt that based on military pay load requirement, this issue could be finalised.
- It was recommended that design and development should be fully funded by the Government.
- Major issues are identification of an international partner and industrial partner as these are vital for timely development, certification , marketing and production.
- It was suggested that CSIR-NAL should undertake project definition phase and identification of international partner and other development and production/ industrial partners should be done during this phase. Funds required for this phase of activity should be provided by CSIR on priority.
- A special purpose vehicle needs to be created to undertake full scale development.
- It was noted that commitment of 80-100 aircraft would be needed for private sector to invest in the project.
- A detailed market study by a reputed agency such as KPMG
- PWC need to be undertaken to assess the Indian and global market.

- **Not undertaking the project is not an option. India must undertake this project with due sense of urgency**.

- A national civil aeronautics policy that addresses development and production of transport aircraft to supplement the civil aviation policy of 2016 is essential and should be formulated by Government.

RECOMMENDATIONS

Theme I: Regional Air Connectivity

- India has emerged as the biggest market for regional turbo prop aircraft thanks to new civil aviation policy of 2016 and UDAN programme.

- Thanks to LCA and SARAS projects, a large number of private industries have entered aircraft industry leading to enhanced aviation ecosystem in India.

- There was a total convergence that India should launch development of a new generation regional turboprop aircraft.

- It was suggested that base line capacity could be 90 seats with a 70 seat variant.

- Civil and military requirements need to be harmonised and maximum commonality between these two variants should be achieved.

- Whether it should be 4 abreast or 5 abreast was debated. It was felt that based on military pay load requirement, this issue could be finalised.

- It was recommended that design and development should be fully funded by the Government.

- Major issues are identification of an international partner and industrial partner as these are vital for timely development, certification, marketing and production.

- It was suggested that CSIR-NAL should undertake project definition phase. Identification of international partner and other development and production/ industrial partners should be done during this phase. Funds required for this phase of activity should be provided by CSIR on priority.

- A special purpose vehicle needs to be created to undertake full scale development.

- It was noted that commitment of 80-100 aircraft would be needed for private sector to invest in the project.

- A detailed market study by a reputed agency such as KPMG/PWC need to be undertaken to assess the Indian and global market.

- Not undertaking the project is not an option. India must undertake this project with due sense of urgency.

- A national civil aeronautics policy that addresses development and production of transport aircraft to supplement the civil aviation policy of 2016, is essential and should be formulated by Government.

Engineers Conclave - 2017

Sep 14-16, 2017, CSIR-NAL, Bangalore

Recommendations

Theme II :
Digital Economy

Organized by:

Indian National Academy of Engineering (INAE),
and
Council of Scientific and Industrial Research (CSIR)

Coordinated by

National Aerospace Laboratories (NAL)

Summary of Deliberations

In the current global networked world of the information age many new factors influence societies and economies. The rapidly advancing Indian society has a tremendous capacity for assimilation of modern socio-economic processes and related technological changes. Some of these enable and enhance democratic processes, financial inclusion, demographic dividends, fiscal growth, human resource development, and the rich socio linguistic diversities.

Realizing the power of Digital Economy, GOI has given a big push for all enabling systems. Technology evolution plays a big role in nation building with associated risks. While digital economy is a great enabler, a carefully orchestrated implementation is necessary. This calls for safety and security measures together with capability to cope with and mitigate deliberate attempts to undermine the stability of the country in different forms affecting banking services, citizen services, health care services and critical infrastructures.

A close examination and analysis of these facets is in the interest of many concerned such as policy makers, planners, implementers, executives and citizens. INAE conducts its flagship program, Engineers Conclave, every year. For the year 2017, EC-2017, INAE has selected for the theme II “Digital Economy” essentially addressing the scientific, technology and policy issues.

The Conclave was organized, during 14-16 September, 2017, at NAL, Bangalore. The deliberations were conducted in five structured thematic sessions. Salient issues in each theme were addressed by four or five specialists, as lead speakers, with a summary by a moderator as the session chairman. The issues examined included, the present status of, policies, development, manufacturing, institutional mechanisms, human resources, budgets, and linkages. In the final sixth session, a Panel Discussion was held to consolidate actionable ideas in the contest of the earlier expert deliberations.

In the closing, joint valedictory session, chaired by Prof. R. Narasimha, the co-ordinating Chairmen of the two themes of EC 2017 presented summaries including action points and recommendations on behalf of INAE.

This report highlights findings of the Conclave and suggests specific measures policy and technological interventions to ensure that digital economy does boost the growth of the country and mitigate the adverse effects on the economy.

In the following sections, a brief note on the scope of issues discussed under each theme is summarized. Then, in the final section we present a set of recommendations for consideration by the Government and other related agencies.

Technical Session I

Infrastructures and Integration:

Various agencies, such as planners, developers and implementers, technology support system providers, regulators, users, all need to have a harmonious connectivity, in the form of both electronic and human media, in the robust digital economy. Many constituents of the system are in place in many independent forms and modes of operation. Strengthening of these and integration of these is required. For example, one facet of the digital economy is centered around citizen identity and is addressed by multiple means, namely, Aadhaar, PAN, Voter ID, Ration Card, Passport and Driving License. This is being handled by various systems and agencies of the government, supported by private enterprises.

Some aspects of infrastructures are well addressed like availability of fiber network, associated connecting/switching hardware and software. However, almost all the hardware is imported and many of these come with associated risk of communication of sensitive data without knowledge of the service providers.

There is a need to address hardware manufacturing and integration of procedures and processes in a mission mode, in a government and private partnership mode.

Technical Session II

Financial Technologies:

A natural major driver of the digital economy is the vast enterprise of financial systems, technologies and institutions. A strong nudge is given by major policies such as GST, adoption of information and digital technologies in governance. Tied to these are the national imperatives of financial inclusion and overall fiscal health in both macro and micro economic sectors. Newer forms of financial products and systems such as payment banks, value added services, micro-finance schemes, group insurance schemes, deposits and loans, all mediated by mobile telephone and computer communication media bring to the fore newer engineering and technological issues. New enterprise digital technologies such as blockchains and cryptocurrencies have many e-governance applications. However, they need to be accompanied by requirements of new policy and technology interventions by the state for a reliable and secure usage.

The focus of the government on e-governance has given a big push to the adoption of digital financial technologies, however, we are still far away from developed countries. While Indian Railways was a pioneer in adopting on-line reservations and recent push towards e-payment has led to many new initiatives, this area needs continuous R&D on aspects of services and security.

Cryptocurrency is emerging as a new technology allowing complete fluidity of flow of currency. This has advantages of free flow, no middle men, and no commission. It is based on sound principles of blockchains. However, the same advantage of individual convenience of universal fluidity comes against the national security interest. This may lead to easier acts of economic offences. Generating cryptocurrency like bitcoin is an enormous power consuming exercise.

Technical Session III

User Interfaces and Services

The measurement of success of the national mission oriented programme of digital economy will be based on many tangible parameters as GDP growth, ratio of market, capitalization to GNP, investments, ROI, employment generation, productivity growth. Success may also be measured with respect to some intangible parameters such as user acceptance, convenience and satisfaction, reduction in the deleterious aspects of corruption and inefficiency. Technological inputs that influence these include computing and communication devices, networks, software systems, front end point of sale or transaction terminals, storage systems and software interfaces.

Being part of the global system and Indian IT industry serving the global market, interfaces are being adopted from global standards and are well in place. However, services are specific to each society and country needs to focus on these aspects.

Some services are global in nature. Taxi systems, such as, Uber, Ola are examples of global service solutions. There is a need for equivalent indigenous service providers with indigenous software/hardware and addressing the last-mile connectivity problems.

Technical Session IV

Cyber Security

Cyber security, guaranteeing the protection of information in storage and transitory communication, covers digital content handled in databases, operating systems, computer communication protocols and networks and end point devices. The broad goals are the same across the many interest groups, dealing with this subject in government, academia and industry. However, the methodologies and modes of functioning of the different agencies entail variations in the specific systemic goals. The consequent technological implications are many and complex.

The cyber security software in different domains are largely imported and are being used with little understanding. Unfortunately, there is hardly any Indian product, though many Indian companies are contributing to the technology as part of MNCs.

The country needs a thorough revamping of the cyber security systems. We have not encountered serious threats in the past and the thousands of cyber attacks on various targets have been viewed as mere irritations. It is to be noted that tens of thousands of experts are being trained by other countries and what we see on day to day basis is only a field testing exercise of their tools and capabilities. A major cyber attack may have paralyzing effect on the Indian economy.

Technical Session V

Human Resources: Development, Employment And Empowerment

Large scale, nation wide adoption and deployment of the many constituent modules of the digital economy has direct and indirect effects on the human resource capital of the country. The effects on growth are catalytic and boot strapping in nature. The design, production, marketing, and life cycle support of the technological inputs call for directed man power development activities.; Manpower with different levels of educational and training attainments need to be generated. Also spin-off employment generation avenues for a large segment of the digitally empowered population in new manufacturing and service industries need to be addressed.

India has a large force of software engineers and lead companies like TCS, INFOSYS, WIPRO etc., are providing digital services to not only many Indian Government Agencies and private sector but have world-wide presence occupying a top place in the world as a computer/digital economy support system. However, this has been confined to a governance and service sector. There is practically no human resource in (i) cyber security and related science and engineering (ii) basic research in related areas of computer science like algorithms, cryptography, digital communication, AI, robotics etc. The time has come for building a general workforce as well as specially skilled engineers and scientists in specific fields.

Panel Discussion

The thematic sessions had been devoted to a detailed analysis of technical, technological, and related socio economic issues. The analysis and discussions provided a clear view of the entire landscape of interactions among the issues. In the Panel Discussion session an integration of the major ideas and specific suggestions were consolidated into actionable recommendations.

RECOMMENDATIONS

Theme II: Digital Economy

Following recommendations emerge from the Engineers Conclave regarding "Digital Economy" to effectively happen in India.

Infrastructure and Integration

- GoI should intervene in manufacturing digital electronic equipment, such as, switches, routers, sensors, transducers and end-user devices (POS terminals), in India. This intervention could be in the form of mission mode programs that may be anchored by NITI Aayog and in cooperation with MeitY, DST, DOS/ISRO and other scientific institutions. Private companies have to pitch in seriously and the mission mode program has to find ways and means to support private manufacturing on the lines of mobile phone manufacturing.

- It is known that GoI has tried to set up a silicon foundry in the country with not much of success. However, silicone foundry with 10nm or 7 nm is still very relevant for creating infrastructure in the country. Fabless manufacturing as a concept is not adequate as it has isolated the country from evolution in technology in areas like GaAs, GaN2 and new initiatives like Graphene, etc.

- India needs special efforts towards hardware and software integration and that in turn requires involvement in developing standards, protocols and interfaces. Today, there are very few mechanisms or institutions that address these issues at the national level. Individual companies/start-ups put incremental efforts. A more institutional effort is needed, perhaps under the MeitY by creating a body responsible for this.

Financial Technologies

- Thanks to the visionary initiatives of TCS, WIPRO and INFOSYS, Indian adoption of digital financial technologies has been satisfactory. However, these are primarily based on imported tools and protocols, which sometimes is a cause for worry in terms of security and large outflow of money for basic tools and modules. Not much professional grade open source tools are used and some in use are also vulnerable.

  There is a need for an institution that serves as a research cum advisory role, on all emerging topics of financial technologies, such as blockchains, digital

lockers. This could be in PPP mode, but concentrating on providing long term support to financial services in a seamless but secure manner.

User Interfaces and services

- The User interfaces have been emerging with technology growth and Indian IT companies just follow these to be of use and service to users across the globe. Though India employs more than a million engineers in the IT service sector, the R&D efforts in development of standards and interfaces, for end-use devices, is practically nil. We have a large number of (more than 1000) institutions for training the man power, but, there is no research on such tools for development and validation.

- Artificial Intelligence (AI) is emerging as a game changer in services and, IOT and AI together is likely to be revolutionary in the next 5 to 10 years.

  GOI/MeitY/HRD must create an institution of Advanced Research in AI in cooperation with core expertise institutions. The use of AI will be application specific though some common tools may apply. Many services like banking, railways, airlines, remote sensing, metro, civic systems, law enforcement systems, city traffic management, medical, hospital, health-care etc, will have AI embedded. Hence this sector needs urgent attention.

- The application of digital technology in government, citizen services is fragmented and isolated project based. The e governance tools are being developed for each state separately in isolation. GoI needs an overseeing mechanism so that advantage of developing tools for a progressive state is easily available to another not so developed state by reusing the same tools and expertise.

- AI based Digital services is the future in each and every sector and there are important segments of society still not served: for example, basis trade skills of carpentry, smithy, gold smith, electrical, mechanical works, in the unorganized sector, and many even in the organized sector. An integrated transportation system that integrates Uber/Ola type of taxi service to metro and bus systems. There are many such convenient mobility services related to hospitals, public systems that need such integrated services offering good end-point connectivity.

GOI Must Set Up A Mechanism as a Directorate Under the Digital India Program

- Cyber Security

- Cyber security has emerged as most potent and 5^{th} dimension of warfare, after Army, Air Force Navy and Space. Efforts put up by the country in this direction are little and disperse.

In fact, cyber security needs to be created as a separate department either under Ministry of Defence or Ministry of MeitY (see recommendation, para 6). India needs an army of researchers addressing various aspects of cyber security of the order of 5 to 10 thousand, working in tandem . In fact, the number of engineers working on cyber security related research and development, in China, exceeds 50,000.

- Indian laws do not permit any serious R&D in cyber warfare while defence and offence in any wars are two facets of same coin. There is a need to look at cyber security laws in the context of R&D. Including technologies such as viruses, malware injection, denial-of-service etc.

- The existing data protection laws need to be augmented to cater to the requirements of global business needs, particularly with respect to the stringent European laws.

- Modernizing the copyright rules, simplifying the consumer protection laws are all needed to enable the digital commerce harmonious trading in the digital economy.

- Human Resources

  While India has 2nd largest number of engineers (next only to China) working on computer applications and related, India lacks basic R&D base in developing digital technologies. However, it is envisaged that this can happen if the job opportunities are created in these basic areas. If initiatives are put in place as suggested above, the vibrant education system will quickly respond to human resources need.

- Transforming MeitY into a science department

- MeitY should be transformed into a science ministry like DST or MoES, with a scientist as Secretary to the ministry.

- The ministry should have 4 distinct directorate (1 to 4 as above) and may have more as per need.

- There is a lot of expertise in autonomous bodies of the MeitY like C-DAC, SAMEER. Some of these should be converted into centers of excellence as regular GoI staff with clearly defined mandate.

- The reconstitution of the DIETY may incorporate suggestions above for creating expert groups/divisions/directorate.

- INAE may assist GoI in such a restructuring with its vast expert pool.

INDIAN NATIONAL ACADEMY OF ENGINEERING

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 & technology and the related sciences for their application to solving problems of national importance. INAE is an autonomous institution partly supported by grant-in-aid from the Department of Science & Technology, Government of India. Among other activities, one of the important objectives of the Academy is to assist the Government from time to time in providing inputs related to engineering interventions for formulating national policies. INAE has established mechanisms in place for interacting with Government bodies such as DST, Niti Aayog and Office of PSA to seek inputs and work on thrust areas of the Government related to engineering and technology. 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.

INAE had taken an initiative of organizing an annual mega event of engineers as "Engineers Conclave" starting from the year 2013, which is being organized jointly with major engineering institutions, essentially to provide a platform for all engineers/scientists to deliberate and address major engineering challenges and opportunities of vital engineering concern to the country. Each conclave has two themes, one specific to the host department and other specific to some social problem where engineering intervention is desired. These two issues are focused from point of view of finding engineering solutions and specific recommendations are formulated for action by the concerned government department and industry.

For more details, please visit INAE website www.inae.in

Indian National Academy of Engineering
Unit No 604-609, SPAZE, I-Tech Park, 6th Floor, Tower A, Sector 49,
Sohna Road, Gurgaon 122018
Phone: 0124-4239480 Fax: 0124-4239481
email: inaehq@inae.in, website : www.inae.in

Designed and Printed at : Pratibha Printers Pvt. Ltd., New Delhi ; 9811100619