Engineers Conclave - 2018

October 4-6, 2018
LDA, Lonavala

RECOMMENDATIONS

Jointly Organized by :

Indian National Academy of Engineering (INAE)
Larsen & Toubro (L&T)

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Engineers Conclave (EC 2018)

Jointly Organized by
Indian National Academy of Engineering (INAE)
Larsen & Toubro (L&T)

Theme-I: Defence Manufacturing in Industry
Theme-II: Engineering Challenges in Urban Infrastructure

Dates: 4th, 5th and 6th October 2018

PROGRAM SCHEDULE	
DAY-1: October 4, 2018	
0930 – 1030 hrs.	**Registration**
1030 – 1145 hrs.	**Inaugural Session** Dias: RRM, Secretary DP, Secretary R&D, Chair EC2018-SNS, President INAE, ED INAE
1030-1035 hrs.	• Welcome by **Prof. B.A. Damahe**, Convener, EC-2018
	• Lighting of Lamp
1035-1045 hrs.	• Presidential Address by **Dr. B.N. Suresh**, President, INAE
1045-1055 hrs.	• Address by **Mr. JD Patil,** Whole-time Director, and Senior Executive Vice President, L&T
1055-1110 hrs.	• Address by Chair, EC-2018: **Mr. S.N. Subrahmanyan**, CEO&MD, L&T
1110-1125 hrs.	• Guest of Honour: **Dr. Ajay Kumar,** Secretary Defence Production
1125-1140 hrs.	• Chief Guest: **Dr Subhash Bhamare**, Honourable Raksha Rajya Mantri
1140-1145 hrs.	• Vote of Thanks by **Brig. Rajan Minocha,** Executive Director, INAE

<table>
<tr><td>1145 – 1215 hrs.</td><td colspan="2">HIGH TEA – for Delegates
High Tea & Press Meet (by Invitation): Venue -
Invitees: Dr Subhash Bhamare, Dr BN Suresh, Dr Sanak Mishra, Mr. S N Subrahmanyan, J D Patil, Dr Kota Harinarayana, Prof Indranil Manna, Dr Punendu Ghosh, Dr Pradip, Mr MV Kotwal, Prof D Khakhar, Mr M Gowtama, Adm Dinesh Prabhakar, Mr Pravin Mehta, Adm A K Saxena, Dr S Guruprasad, Mr. S C Deshmukh, Amber Dubey, Mr. S M Vaidya, Col Shankar</td></tr>
<tr><td>1215-1300 hrs.</td><td>First Plenary Talk: Smart Cities :Bringing About Urban Revolution
Mr. Madhukar Srivastava, L&T, ECC</td><td rowspan="2">Luncheon Meeting with stake holders and policy makers
Topic: “Defence Production Policy 2018*: Converting Vision to Reality-What is needed to make it” under the Chatham House Rule**

Participants:
Chair: Dr Subhash Bhamare,
Hosts: Mr. S N Subrahmanyan, Mr. JD Patil
INAE: Dr BN Suresh, Dr Kota Harinarayana, Dr Sanak Mishra, Dr Pradip, Mr MV Kotwal

Invitees: Mr M Gowtama, Adm. Dinesh Prabhakar, Mr Pravin Mehta, Adm Saxena, Prof D Khakhar, Dr S Guruprasad, SC Deshmukh, Amber Dubey, Col Shankar, Mr. Rahul Gangal
Facilitator: AT Ramchandani. Rapporteur: Koustubh Phalnikar
* Defence Production Policy 2018 Vision: To make India among the top five countries in Aerospace & Defence Industries, with active participation of public & private sector, fulfilling the objectives of self-reliance as well as demand of friendly countries. Achieve a turnover of USD 25 Billion in Indian Defence Goods & Services by 2025 with investment of USD 10 Billion and create employment for over 2 million people ; achieve exports of USD 5 Billion by 2025 ; make India a global leader in Cyberspace & AI technologies
** When a meeting, or part thereof, is held under Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speakers(s), nor that of any other participants, may be revealed</td></tr>
<tr><td>300 – 1400 hrs.</td><td>LUNCH</td></tr>
<tr><td>1400 – 1600 hrs.</td><td colspan="2">Parallel Technical Session</td></tr>
</table>

Theme I: Defence Manufacturing in Industry Technical Session I on Subtheme I **Ecosystem Creation for Defence Manufacturing** **Session Chair: Mr. M V Kotwal, FNAE** Topic 1: International Models for Building Military Industrial Complex and Foreign Partnerships Keynote Speaker 1: **Rahul Gangal, Partner Roland Berger** Time: 1400-1430 hrs Topic 2: Creating a Tierised Industry Structure for Defence. Keynote Speaker 2: **AVM PK Srivastava , Former Dir Prodn BDL** Time: 1430-1500 hrs Topic 3: Defence Shipbuilding- An established ecosystem for Defence Manufacturing Keynote Speaker 3: **Adm A K Saxena, Director Shipbuilding MDL** Time: 1500-1530 hrs Topic 4: Challenges in Large Defence Indigenization Programs Keynote Speaker 4: **Adm Dinesh Prabhakar, Former DG ATV** Time: 1530-1600 hrs	**Theme II:** Engineering Challenges in Urban Infrastructure Technical Session I on Subtheme I **Challenge of Building Flyovers under 180 Days** **Session Chair: Mr. D K Sen, Whole Time Director & Sr EVP (L&T Infrastructure)** Topic1: Engineering Solutions - L&T Keynote Speaker 1: **Mr. P Niranjana, VP, L&T ECC** Time: 1400-1430 hrs Topic 2: Engineering Solutions – AFCON Case Keynote Speaker 2: **Mr. Srinivas Mantrala, Afcon** Time: 1430-1500 hrs Topic 3: Technology available for fast track construction Keynote Speaker 3**: Mr. Atul Bhobe, Consultant** Time: 1500-1530 hrs Topic 4: **"Implementation strategy for fast track urban project-Case study of 50 flyover project** Keynote Speaker 4**: Mr. P L Bongirwar** Time: 1530-1600 hrs
1600 – 1630 hrs.	**TEA**
1630 – 1830 hrs	**Parallel Technical Session** on the two themes identified
Theme I: Defence Manufacturing in Industry Technical Session II on Subtheme II: **Drivers to ensure "Design & Make in India": Boosting Industrial R&D in Defence** **Session Chair: Dr Kota Harinarayana, FNAE**	**Theme II:** Engineering Challenges in Urban Infrastructure Technical Session II on Subtheme II: **Technologies for Traffic Movement Including Synchronizing Traffic Signals** **Session Chair: Mr. Madhukar Srivastava, L&T, ECC**

Topic 1: DRDO-Industry Partnership Keynote Speaker 1: **Dr. S. Guruprasad, CC R&D** Time: 1630-1700 hrs Topic 2: Incentivizing R&D and Indigenous Technology Development in Defence Keynote Speaker 2: **Mr. Raghavan Muralidharan, Head R&D Tata Power SED** Time: 1700-1730 hrs Topic 3: R&D and Innovation in the Defence & Aerospace Industry Keynote Speaker 3: **Dr. Jagannath Nayak,** Outstanding **Standing Scientist & Director CHESS/ DRDO** Time: 1730-1800 hrs Topic 4: Shifts required in Defence R&D - A User Perspective Keynote Speaker 4: **Lt. Gen. P R Shankar, PVSM, AVSM, VSM (Retd.) Aerospace Department IIT Madras** Time: 1800-1830 hrs	Topic 1: How to reduce the commute time using technology at peak time Keynote Speaker 1: **Mr. Purushottam Chandra Kaushik, CSO L&T** Time: 1630-1700 hrs Topic 2: Current Traffic Challenges & proposed Solution - Analysis of DL Keynote Speaker 2: **Mr. Sridhar Jayaram, Pre Sale Head, L&T** Time: 1700-1730 hrs Topic 3: Providing traffic signal synchronization in city – (Nagpur Case Study) Keynote Speaker 3: **Mr. Vijay Kovvali, Director, IBI** Time: 1730-1800 hrs Topic 4: How to enable Green corridor for emergency vehicles and feasibility for implementation Keynote Speaker 4: **Mr. Santhosh Muzumdar, Tyco - INT** Time: 1800-1830 hrs
1830-1930 hrs	**Second Plenary Talk** **Plenary Speaker:** Swami Swatmananda, Chinmaya Mission Mumbai **Topic: Science, Technology & Spirituality**
1930-2130 hrs	**Cultural Program: Mallakhamb Demonstration by SSVM followed by Dinner**

DAY-2: October 5, 2018

<table>
<tr><td>0930-1030 hrs.</td><td colspan="2">Plenary Speaker: Mr Jayant Patil, Member of Board, L&T
Topic: Policy Drivers & Enablers to Create a Vibrant National Defence Industrial Base</td></tr>
<tr><td>1030 – 1100 hrs.</td><td colspan="2">TEA</td></tr>
<tr><td>1100 – 1300 hrs.</td><td colspan="2">Parallel Technical Session</td></tr>
<tr><td colspan="2">Theme I: Defence Manufacturing in Industry
Technical Session III on Subtheme III:
Policy Interventions to Facilitate Public-Private- User Partnership
Session Chair: Dr Sanak Mishra, President Elect INAE

Topic 1: Public Private Collaboration to Facilitate Defence Industry Growth
Speaker 1: M Gowtama, CMD BEL
Time: 1100-1130 hrs

Topic 2: Policy enablers for Private Sector Participation
Speaker 2: RS Bhatia, CEO Kalyani Group, Defence
Time: 1130-1200 hrs
Topic 3: Role of Policy in boosting SME participation in Defence Production
Speaker 3: Mr. Harshvardhan Gune, DEMA
Time: 1200-1230 hrs
Topic:4 Overcoming Challenges in Public Private Partnership
Speaker 4: Vernon Noronha, Tata Motors (Defence)
Time: 1230-1300 hrs</td><td>Theme II: Engineering Challenges in Urban Infrastructure
Technical Session III on Subtheme III:
Technologies for rapid mass movement
Session Chair: Dr. Mangu Singh, FNAE & MD, DMRC

Topic 1: Future of Mass Movement - Concept 1
Speaker 1: Mr. Gaur Dattatreya, Head Digital Bosch
Time: 1100-1130 hrs
Topic 2: CBTC Technology for enhanced capacity of metro network
Speaker 2: Mr. Ravi Prakash Karcherla - Director Ground transportation, Thales
Time: 1200-1230 hrs</td></tr>
<tr><td>1300- 1400 hrs.</td><td colspan="2">LUNCH</td></tr>
</table>

1400- 1600 hrs.	**Parallel Technical Sessions**
Theme I: Defence Manufacturing in Industry Technical Session -IV on Sub-Theme IV: **Role of Talent and Skill Development** **Session Chair: Prof. D.V. Khakhar, Director IITB** Topic 1: Skill Building in Private Defence Industry Speaker 1: **Yogi Sriram, SVP CHR L&T** Time: 1400-1430 hrs Topic 2: Experience of Multifold increase in skill development for the Aerospace & Defence Industry Speaker 3: **P S Ramesh, Executive Director & Chief Operating Officer, Dynamatic Technologies Limited** Time: 1430-1500 hrs Topic 3: Role of Academia in generating highly skilled defence manpower Speaker 4: **Dr Amol Gokhale, IITB** Time: 1500-1530 hrs Topic4: Skill required for design development Speaker 4: **Mr. Gajanan Sadekar, Formerly VP, L&T** Time: 1530-1600 hrs	**Theme II:** Engineering Challenges in Urban Infrastructure Technical Session -IV on Sub-Theme IV: **Technologies for City Waste and Environment Management** **Session Chair: Mr. Devendra Mahajan, MD, Nagpur Smart City** Topic 1: Green City and Sustainable Infrastructure for a Better Tomorrow Speaker 1: **Mala Singh, Founder, Chairperson & MD PEC Solution Green Design** Time: 1400-1430 hrs Topic 2: Approaches & Technology Adoption in Solid Waste Management (Collection to Disposal) Speaker 2: **Mr. Sridhar Jayaram, Technical Architect, L&T** Time: 1430-1500 hrs Topic 3: Technologies for City Waste and **Environment Management**" in reducing carbon footprint Speaker 3: **Dr R R Sonde, EVP Thermax** Time: 1500-1530 hrs Topic 4: Steps to reduce Carbon Foot print reduction in city like Delhi Speaker 4: **Mr. Ajay Girotra, MD, AG Dauters** Time: 1530-1600 hrs
1600 – 1630 hrs.	**TEA**

1630 – 1830 hrs.	**Parallel Technical Sessions**
Theme I: Defence Manufacturing in Industry Technical Session V on Subtheme V: **Enabling International Collaboration in Defence Manufacturing** **Session Chair: Dr. Pradip, FNAE, Vice-President INAE** Topic 1: Creating Markets for Defence Exports Speaker 1: **Mukesh Bhargava, VP & Head International Business L&T Defence** Time: 1630-1700 hrs Topic 2: Defence Exports – SME Perspective Speaker 2: **Col Shankar, CEO Alpha Design Technologies** Time: 1730-1800 hrs Topic 3: Model for Successful International Defence Collaboration Speaker 3: **Mr. Patrick Philippart, Senior Manager, MBDA** Time: 1800-1830 hrs	**Theme II:** Engineering Challenges in Urban Infrastructure Technical Session V on Subtheme V **Connected Citizen: Digital Enablement of Services Offering** **Session Chair: Mr. Manojit Bose, CKO, Pune Smart City** Topic 1: Digital Concept for Citizen Benefit - Concept 1 Speaker 1: **Mr. Lokesh Lohiya, Industry Leader-Smart and Safe Cities, CISCO** Time: 1630-1700 hrs Topic 2: Digital Concept for Citizen Benefit - Concept 2 Speaker 2: **Mr. Anantha Sayana, Chief Digital Officer, L&T ECC** Time: 1700-1730 hrs Topic 3: Best practice Followed - Use cases Speaker 3: **Mr. Vikas Hooda, Smart City-Lead Architect, HPE** Time: 1730-1800 hrs

DAY-3: Oct 6, 2018

<table>
<tr><td>0915-1000 hrs</td><td colspan="2">Parallel Panel Discussion Session on the two themes identified</td></tr>
<tr><td colspan="2">Panel Discussion on Theme I: Defence Manufacturing in Industry

Session Coordinator:
Mr. A Ramchandani
Coordinator, Theme I

Panelists: Capt. Brijesh Kalra
Dr. Kota Harinaryana
Dr. Sanak Mishra
Prof. PK Mishra
Dr. Pradip</td><td>Panel Discussion on Theme II: Engineering Challenges in Urban Infrastructure

Session Coordinator:
1. Mr. K V Praveen, EVP & Head Road Runways & Elevated Corridor
2. Mr. Madhukar Srivastava, Coordinator, Theme II
Panelists: Dr. Mangu Singh
Mr. Devendra Mahajan
Mr. PK Guha</td></tr>
<tr><td>1000 - 1100 hrs.</td><td colspan="2">Future of Metro Transportation in India
Dr. Mangu Singh, Managing Director of Delhi Metro Rail Corporation</td></tr>
<tr><td>1100 – 1130 hrs.</td><td colspan="2">TEA</td></tr>
<tr><td>1130-1230 hrs.</td><td colspan="2">Valedictory Session to bring out the Recommendations for respective Themes
• Introductory Remarks by Dr. BN Suresh, President, INAE
• Summing up of Technical Sessions of two Themes by Mr. A Ramchandani, Coordinator, Theme I and Mr. K V Praveen, EVP & Head Road Runways & elevated corridor & Mr. Madhukar Srivastava, Coordinator, Theme II
• Valedictory Address by Chief Guest Dr. Rajagopala Chidambaram, Padma Vibhushan, Former Principal Scientific Advisor, Government of India</td></tr>
<tr><td>1230 hrs onwards</td><td colspan="2">Lunch and Dispersal</td></tr>
</table>

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Recommendations

Theme I :
Defence Manufacturing in Industry

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Summary of Deliberations

Inaugural Session

The Inaugural Session commenced with the lighting of the lamp and the Invocation which was followed by the Welcome Address by Mr. BA Damahe, Convener, EC-2018. The dignitaries on the dais then addressed the gathering. Dr BN Suresh, President, INAE delivered the Presidential Address during which he highlighted the mandate of the Academy along with the background and aim of the Conclave.

During the address by Mr. JD Patil, Whole-time Director (Defence Business) & Sr. Executive Vice-President, L&T, shared the history and major verticals of L&T Defence Production with respect to Theme I of the Conclave. Thereafter, Mr. SN Subrahmanyan, CEO & MD, L&T and Chair, EC-2018 addressed the audience and emphasized on the aspects of Information Modelling with respect to Urban Infrastructure. He cited various examples wherein L&T has taken initiative of incorporating various tools of Information Modelling.

The Guest of Honour Dr. Ajay Kumar, Secretary Defence Production appreciated the importance of the two themes of the Conclave which are of national importance. He briefed the gathering on Defence Procurement Policy with special emphasis on the ease of procurement and import/export of Defence equipment.

Dr. Subhash Bhamare, Hon'ble Raksha Rajya Mantri, Chief Guest emphasized the importance of the Defence Manufacturing in Industry with respect to the relevance of being self-reliant in Defence, as a major initiative towards Make in India Campaign and Nation's security. Since a number of dignitaries and senior luminaries in the fields of Defence Manufacturing participated in the two-day event, he also recommended the forwarding of the actionable recommendations to his Ministry for consideration.

Executive Summary of Luncheon Meeting to discuss "**Defence Production Policy 2018: Converting Vision to Reality-what is needed to make it?" under the Chatham House Rule**

There were discussions on requirement to look at Short, Mid and Long Term aspects of driving defence growth. Short term aspects would involve converting Buy Global to Buy & Make Indian, Mid Term aspects would involve more and more programs to be categorized in Buy & Make and Make 2, whereas Long Term approach would involve Strategic partnerships as well as technology development through Make 1. It was felt that Strategic Partnership was an essential element to make the targeted numbers of the Defence Production Policy 2018 a reality. Need was felt to shorten lifecycle of programs from 15 years to 5-7 years.

The need of handholding between government and industry was brought out. The need for creation of a defence industrial ecosystem was discussed. It was felt that if private

sector joined hands with the government, timely delivery was possible. Participants felt that private sector needed to be treated as a national asset and be encouraged to supply defence goods & services as an alternate to imports (as in the long run cost of domestic procurement would be a fraction of cost of imports) with the added benefit that money would stay within the country.

The forum felt that Secretary DP should have accountability for contribution of the private sector defence industry. Similarly, since investment in DRDO is made through national resources, DRDO should be accountable for indigenization efficiency. It was felt that an independent audit of capacity in Indian industry should be carried out, in order to balance the loading on different entities. Wasteful creation of capacities at a national level should be avoided.

The Strategic Submarine program was cited as a great example of a successful indigenization program. Profits made by private industry indicated efficiency, and hence it was felt that profits should be viewed positively. Reinvestment of profit was also seen as a driver for technology growth.

There was also a strong recommendation to retain Tax Incentives on industrial R&D for Defence. The need to avoid the same R&D teams working on basic research as well as final product development was expressed. It was felt that industry should come in at an early stage of R&D of DRDO, so that final productionization would be quicker.

It was felt that too many agencies were involved in the Defence Procurement Process decision making, resulting in a very complicated process. Need was felt to give a longer tenure of 5 years for personnel in procurement departments before rotating them.

The need to nurture talent and focus on skill development was discussed so that crucial knowhow was not lost. On the manpower skill development front, it was felt that the present ecosystem was not allowing engineers to become systems engineers and they ended up being detailing engineers. The need to build capabilities in system engineering was emphasized.

Two ways in which concepts of space industry could be deployed in defence industry were discussed, namely arrangement of finance approval right at the inception level of the project, and steering away from L1 process. Changing from purely L1 based model, to a model where quality and technology were also given weightage in the evaluation process was debated.

It was pointed out that 80% of innovation comes from SMEs and startups and hence they needed to be encouraged. The inability of private industry to work in consortiums was highlighted in the discussions. It was suggested that the technology developed by bigger private players could be infused in to startups. Satellite manufacturing was cited as a good example of consortium approach. Need for enabling funding for start-ups in Defence Industry through Government, Venture Capital Funds and large public & private industry was discussed.

Participants felt that external technical & procurement consultancy was not presently encouraged by the Defence Ministry. Use of such consultants could professionalise the entire procurement process and add value in contractual, legal matters as well as in Price Discovery.

Participants concluded that INAE can provide a platform for further debate and enable close synergy between academia, industry, government and funding agencies.

Technical Session I

Subtheme I : Ecosystem Creation for Defence Manufacturing

Topic 1: International Models for Building Military Industrial Complex and Foreign Collaboration - Keynote Speaker 1: Rahul Gangal, Partner Roland Berger

The talk covered five key megatrends which are shaping how military industrial complexes are coming up, namely Shortening technology cycles and shift of balance of power eastward, Tierisation Disruption, Strengthening of Home market relevance, New Technology led disruption and Shift from Global Strategy to Campaign/Country Strategy. He bought out the five clear implications for military-industrial complexes that were emerging:

Military-Industrial complexes globally are a result of Government collaboration with Industry and academia; in the initial phases of the evolution of the Military-industrial complexes, most roles overlap between stakeholders. Collaboration between stakeholders in needed across value chain (design, manufacturing, supply chain development and sustainment. The government's key charge is in ensuring provision of commons infrastructure, higher level infrastructure & financing support.

OEM participation is a non-negotiable. There are no known examples of post-cold war military-industrial complexes where local industry has exclusively built a complete manufacturing ecosystem. Smart money lies in ensuring that OEM participation in the local value chain is encouraged but with conditionality around local retention of IP, creation of local jobs and local downstream supplier base.

It is impossible to think of a military-industrial complex without 'home country' orders as the primary core, exports can augment the core but not build long term viable businesses on their own (at platform level). Military-industrial complexes are required usually to be centred around an/some platfomist OEM(s). Creation of platformists or even tier 1s in most categories of the aerospace and defence business is unviable unless supported by home market order-book. Eventually in a monopsonistic home environment the presence or absence of home market orders are make or break for the OEM and for the surrounding military-industrial complex.

At an ecosystem level, sustained availability of talent is a key enabler. Private industry can supplement government efforts in building a talent pool but the central role in this is usually that of academia funded by the government. Building a sustainable talent pipeline is critical and non-negotiable. The onus of this resides primarily with the academia and the government. The responsibility to ensure that the scale brought in by the government and academia efforts is fine-tuned in terms of skills resides with the Industry.

Most countries are broadly defining the focus of their emerging Military-Industrial complexes - the better the definition of boundary conditions, the greater is the

demonstrated success of the initiatives. Definition of boundary conditions is usually key to ensuring focus. The definition need not be in terms of focus product categories but can be in terms of value chain play as well. For example, Israel has decided to focus on sub-systems and not on platforms, Saudi Arabia is now aggressively pushing the development of a local military-industrial complex on specific pre-determined directions (APCs, Aero-engines, Missile systems etc.)

Topic 2: Creating a Tierised Industry Structure for Defence - Keynote Speaker 2: AVM P.K. Srivastava, Former Director, Production, BDL

The talk brought out how market forces are not capable of establishing robust aerospace ecosystem. Government intervention & investments are deemed necessities.

The following recommendations were made:

- Formation of National Aeronautics Commission
- Regulatory Body to Segment Indian Industry
- Ecosystem based on Tier-ised Structure
- HAL to play leadership role, Focus on Final Assembly, Testing and Interface with User
- Ecosystem will spawn right up to MSME segment. Proposes participation of 720 Tier-ised Companies as against random 250+ Companies.
- Large Indian Private Cos with proven Track record to emerge Tier I, drive downstream Value Chain
- Mentoring of MSME sector i.e. Private-Private-Partnership
- Government to infuse initial investment, develop mechanism to retrieve as component of the price of the product

Topic 3: Defence Shipbuilding- An established ecosystem for Defence Manufacturing - Keynote Speaker 3: Adm A K Saxena, Director Shipbuilding, MDL

The talk brought out the pertinent need to build an ecosystem for Naval Ship Building, highlighting that the future requirement for Indian Navy was pegged at 200 ships by year 2027 and for the Indian Coast Guard at 200 ships by 2023.

The following recommendations were made

- Incorporation of advance ship building techniques using Robotics, Artificial Intelligence etc.
- Optimal utilisation of shipyard facilities by sharing of resources such as dry docks, wet basins etc.

- Colleges/Institutes to be set up for dedicated training on shipbuilding (for both blue & white collared personnel)
- New Design Houses to be set up through a Joint Ventures between shipyards(Public & Private)
- Dedicated department for R&D under DRDO for Shipbuilding
- Adequate funding for R&D in shipbuilding
- Schemes to engage System and Equipment manufacturers in R&D
    - Development of new technologies should be delinked from warship projects
    - Only after the technologies mature, it should be implemented in new designs
- For developing vendor base:
    - Financial support - Soft loans with easy repayment
    - Tax incentives
    - Single window clearances
- Facilitating access to funds for construction of ships. Setting up of a Marine Fund/scheme or specialized Marine Financing Institution to support domestic shipbuilding.
- To stimulate FDI, measures such as cutting corporate taxes or tax holiday, provide tax incentive etc.
- Licensing process for Defence industries to be liberalized. Negative list of items should be very small
- Declare Shipbuilding as 'Priority' or 'Strategic' Industry with fiscal incentives

Topic 4: Challenges in Large Defence Indigenization Programs - Keynote Speaker 4: Adm Dinesh Prabhakar, Former DG ATV

The talk by Adm Prabhakar brought out major challenges in large defence indigenisation programs in India and they are listed below:

1. The first challenge is the development and retention of expertise both for design as well as construction.
2. The quality is of paramount importance and this needs to be reinforced at every stage of production. Close overseeing of construction is essential to maintain quality as well as timelines, but this responsibility has to be of an enabler rather than a bottleneck.

3. Vendor development should be done with care. One has to realise that any no commercial organization exists due to patriotism. They are there to make profit and they need to be allowed to make justified profit. Once the order is placed one has to ensure that the vendor succeeds.
4. One needs to be liberal in getting TOT wherever feasible. It helps in the long run.
5. Once an equipment or system has been imported, all possible efforts should be made to ensure that it is not imported again. Of course, one has to respect the laws concerning IPR.
6. With Program extending over decades, obsolescence management has no easy answers. Through-life support is also very important, which is another reason to nurture vendors and sustain them through repeat orders.
7. The Project Management is extremely important. There has to be serious attempt to carry all concerned agencies along. It is essential to understand the difficulties on the ground and mitigate all road blocks. The Project Monitoring has to be for all aspects of the Program. It has to be very detailed and at very frequent intervals. The lessons learnt from mistakes need to be analysed thoroughly and benefits must be ploughed back.
8. There is no need to look abroad for everything. The capability existing within the country is required to be developed. There is a need to build upon and nurture this capability.

Technical Session II

Subtheme II Drivers to ensure "Design & Make in India": Boosting Industrial R&D in Defence

Topic 1: DRDO-Industry Partnership- Keynote Speaker 1: Dr. S. Guruprasad, CC R&D

The talk brought out various aspects of DRDO partnerships in the emerging ecosystem. Different Industry Engagement models were presented such as Development Partner, Consortium, Concurrent Engineering, Joint Venture, Joint Development (Indian as well as Foreign), LSP, GOCO and ToT. The talk highlighted that the need of the hour was to have synergy among all stake holders to make India self-reliant with indigenous technologies.

Topic 2: Incentivizing R&D and Indigenous Technology Development in Defence- Keynote Speaker 2: Mr. Raghavan Muralidharan, Head R&D Tata Power SED

The talk brought out the impact of technologies such as Artificial Intelligence, Machine Learning, Cyber Security and advancements in development of All Digital Howitzers. New Defence Industry Models such as Lead Systems Integrator/System of Systems Manager, Public-Private Partnership with Mission based procurement and Capability based services & component suppliers were discussed.

Topic 3: Future Warfare Technologies : India's Readiness- Keynote Speaker 3: Dr Jagannath Nayak, Director, Centre for High Energy Systems & Sciences (CHESS)

Topic 4: Shifts required in Defence R&D- A User Perspective- Keynote Speaker 4: Lt Gen P R Shankar, PVSM, AVSM, VSM (Retd.) Aerospace Department IIT Madras

The talk highlighted that technology owned is cheap, whereas technology bought is costly. It emphasized that India needed to invest in Defence R&D if it had to be a power of reckoning. The following recommendations were made for Industry:

- Investment in R&D and establishing research centers collectively
- Creating think tanks
- Project/Product based research
- Process knowledge research
- Research and expertise in established fields
- Vertical specialization of dual use technology
- Partnering with Research/Academic Institutions to achieve cost reduction of research
- Working with sister organizations for cross flow of technology and research
- Communicate capabilities effectively
- Research Road Map formulation

Technical Session III

Subtheme III Drivers to ensure "Design & Make in India": Boosting Industrial R&D in Defence

Topic 1: Public Private Collaboration to Facilitate Defence Industry Growth - Speaker 1: M Gowtama, CMD BEL

Public Private Collaboration: Public Private Collaboration is an excellent strategy to develop a strong indigenous defence base and help India to build a strong self-reliant

defence industry. Significant competencies are available with the Indian Public sector and the Private sector and the focus should be on the collaborative efforts complimenting the public sector / private sector capabilities. Public Private Collaboration model can be effectively deployed for R&D and implementation of complex turnkey Systems and System of Systems. A strong Industry – academia collaboration to work on very futuristic technology with funding from the Industry will enable development of cutting edge technologies. Government is also actively engaging with the industry/Industry associations for exchange of ideas and views to create a conducive environment for the industry.

Efforts of BEL: BEL recognizes Public Private Collaboration as an inevitable part of its Business strategy to achieve cost benefits and also complement the strengths of Public and Private sector to build a strong industrial base. BEL has engaged large private sector companies as partners through PPP model for executing turnkey projects partnering with OEMs. The indigenous design development and manufacturing of Akash Missile System is a great success story and one of the best examples of successful Public Private Partnership model in India in defence. More than 90% of the total inputs are sourced within India with many sub-systems sourced from the Indian Private Industry. Akash is now being explored for export opportunities also.

BEL has been taking several initiatives to strengthen the partnership with Indian industry like long term outsourcing and vendor development policy, online vendor registration and e-procurement, nomination of nodal officers specifically for outsourcing and vendor development opening up of BEL's test facilities to the Industry etc. BEL extends support to start-ups by relaxing the eligibility criteria and has extended preference to IDDM products, in its Procurement policy. BEL has also adopted an innovative Collaborative R&D process to further augment its R&D efforts for addressing technological gap and indigenization with the involvement of academia, private industry including MSMEs and Startups etc.

Way Forward: The Indian industry needs to develop a robust system, policies & procedures and security controls in place to interact and engage various stake holders for carrying out research, design and development, manufacturing and implementation of defence projects in a collaborative manner. The industry should focus on setting up world class platform level infrastructure and optimum capacities for design, development, manufacturing, testing, evaluation and offering life cycle support. The industry need to create a strong eco-system built on trust and mutual understanding for success of the Public Private collaboration Model in India.

Topic 2: Policy enablers for Private Sector Participation- Speaker 2: Col. R.S. Bhatia, President & CEO, Bharat Forge, Defence & Aerospace

The talk stressed on the importance of Make in India initiative. It brought out that whereas there had been industries which had shown breakout growth, defence manufacturing sector had failed to inspire in spite of being a sector of strategic

importance. It was also a matter of concern that India had been ranked the world's largest importer of weapons for the 10th straight year by well-known think tank Stockholm International Peace Research Institute. The step by step approach followed by Bharat Force in building the Defence and Aerospace business was presented, consisting of

- Establishing the organization : Focus on cost, quality and processes
- Leveraging the domestic market and building export orientation : Building world class facilities, gaining market leadership, scaling up and innovating
- Building a global company : Exports and Acquisitions
- Transforming in to a global engineering products company: de-risk business model by diversification

The importance of getting the correct combination of Vision, Capability, Incentives, Resources and Action plan to achieve transformation was highlighted.

Topic 3: Role of Policy in boosting SME participation in Defence Production- Speaker 3: Mr. Harshvardhan Gune, DEMA

The talk brought out the difficulties and hurdles faced by SMEs in Defence Production, namely :

- Strict Statutory requirements
- Lack of awareness
- Financial Constraints
- Organization structure (Engineering, Business Dev resources)
- Low volumes High Technology
- Working Capital
- Complex Purchasing Procedures
- Long gestation times
- R&D cost
- Infrastructure
- Specific Raw materials/MOQ
- No/Limited access Government organizations/DPSU's/End User's requirements

The talk highlighted that creating a competitive, innovative and robust defence industry inevitably mandates the creation of a structured roadmap that leverages on India's growing private industry and a gradually spreading SME base. Further it was discussed how Defence Policy 2018 blueprint aims at involving start-ups, SME's in the technology

development, conducting regular outreach programs, encouraging private investments and coming up with appropriate policies to energise the smaller enterprises for defence manufacturing. In conclusion, it was pointed out that the success of the policy will rest firmly on the proper execution and full participation of the Indian SME sector.

Topic 4 : Overcoming Challenges in Public Private Partnership- Speaker 4: Vernon Noronha, Tata Motors (Defence)

The talk highlighted challenges and strategies to address them in four types of Public Private partnership models, namely Product Co-Development, Manufacturing and Transfer of Technology for products already developed, Upgrades and Repowering, and Maintenance-Repair-Overhaul through GOCO Model (Government Owned Contractor Operated).

With respect to Product Co-Development partnerships, the following challenges, along with the way forward for each was presented:

- Long Development Cycle : Create a wide portfolio of products so that at any given time, one or the other product is in production
- Every program is unique leading to frequent platform modification: Platform strategy necessitates a system of system approach rather than individual system development approach.
- Private industry is required to invest in the initial phase with no clarity on lifetime business potential : Government to provide funding for development under “Make” Programs
- Managing aggregate supplies over the project lifecycle: Partnership approach rather than transactional approach between SOSI and the MSMEs.

For technology partnerships, it was suggested that OFB can form a “Joint Development Center” with Private Industry with the Design & Development responsibility to be offloaded to private industry, whereas Validation and Testing responsibility would rest with OFB.

With respect to Manufacturing and ToT partnerships, the following challenges, along with the way forward for each was presented:

- ToT agreements pertain to base model which leads to reluctance to upgrade: OEM to be made responsible throughout Lifecycle for continuous upgrades so that the product remains relevant throughout its lifecycle.
- Cost discovery/price settlement for upgrades is an extremely lengthy process: The upgrades must form part of the principle agreement with a cap on price.

With respect to Upgrades and Repowering, the following challenges, along with the way forward for each was presented:

- Long project cycle which can lead to obsolescence setting in before it is put to practice: Government to cut down on development cycle and award “low volume initial quantities” to keep supply chain alive
- Local players fronting foreign OEMs without much track record and infrastructure: Such players can be identified and eliminated early in the trial phase.

With respect to MRO partnerships, the following challenges, along with the way forward for each was presented:

- Manpower Management- Predominantly civilians and highly unionized : Alternate employment opportunity can be offered, or VRS
- Terms and conditions for supply of material from OFs and DPSUs: Long term agreements or ROFR
- Hand holding during transfer of responsibility : Limited period well defined
- Organization- parallel hierarchies, freedom of work : Should be left to OEMs
- Management of existing residual inventory with ABWs and Ordnance : To be written down and passed on to the OEMs
- Plant Machinery and Infrastructure Maintenance and up-gradation : OEM to pay for the same through mutually agreeable service contract.

Technical Session IV

Subtheme IV: Role of Talent and Skill Development

Topic 1: Skill Building in Private Defence Industry- Keynote Speaker 1: Mr. Yogi Sriram, SVP, CHR, L&T

The talk described the top 10 skills to be relevant in the age of Industry 4.0, namely

- Complex Problem Solving
- Critical Thinking
- Creativity
- People Management
- Coordinating with Others
- Emotional Intelligence
- Judgment and Decision Making
- Service Orientation

- Negotiation
- Cognitive Flexibility

Some of the means that could be used to attract the best talent from Campus pool were shared, such as

- Catch them Young at college campuses
- Leverage Social Media to evangelise the charm of joining Defence sector
- Collaborate with NCC to evangelise the charm of joining defence sector
- Conduct Industrial visits for College students
- Innovation through sharing of live technical problems with students
- Controlled student visits to Defence establishments
- Tie Up with Armed forces for selection of students

The importance of custom designed programs in partnership with leading institutes like IITs, IIMs, NITs to develop future defence professionals and equip them with project management competencies was also highlighted. Examples of contribution by nations such as Germany and USA, in skill building of Defence Industry were shared.

Topic 2: Experience of Multi-fold increase in skill development for the Aerospace & Defence Industry- Keynote Speaker 2: Mr. P. S. Ramesh, Executive Director & Chief Operating Officer, Dynamatic Technologies Limited

The talk brought out the challenges faced in the area of skill development for Aerospace Industry, how the same were overcome by establishing a skill development center. The following learnings were shared by the speaker:

- Teach the **Art of Unlearning**
- The learning be **validated & documented**
- Customer's **Engineering is sacrosanct**
- The teaching should be **imparting experience** not information
- The teaching should **impart confidence in the trainee** to take up aerospace job

Topic 3: Role of Academia in generating highly skilled defence manpower- Keynote Speaker 3: Dr Amol Gokhale, IITB

The talk highlighted various routes for academia to contribute to the military industrial complex:

- Generating IP

- Launching ventures
- Solving problems
- Improving product quality and reliability
- Aiding technology assimilation

The AMRC, Sheffield Model as well as the proposed I3M model (NITI initiative) were also presented. It was also pointed out that a philosophical shift among academia in engineering institutions is taking place, which is making them look outward with the realization that engineering is an applied science and industry is where knowledge is applied.

Topic 4: Design and Its Evolution Towards Skill Development- Keynote Speaker 4: Mr Gajanan Sadekar, Former Vice President, L&T

The talk focussed on how design had to be approached with a plan for purpose and functionality. Design Thinking as a process for preparation of practical & creative plan to achieve the desired purpose was discussed.

The different stages in Design Thinking Process were highlighted, namely

- Define
- Research
- Ideate
- Prototype
- Choose
- Implement
- Learn

Technical Session V

Subtheme V: Enabling International Collaboration in Defence Manufacturing

Topic 1: Creating Markets for Defence Exports- Keynote Speaker 1: Mukesh Bhargava, VP & Head International Business L&T Defence

The talk gave an overview of the Indian defence scenario, India's import scenario, Government initiatives to boost defence manufacturing and exports.

The challenges for defence exports were highlighted as under:

- Nomination of G-to-G & LoC related exports opportunities only to DPSUs

- ToT:
  FOEMs are to willing to provide ToT, but release of ToT is with Government approvals
- Government Licensing Issue:
  Due to absence of specific guidelines with regards to ToT arrangements in the DPP, OEMs tend to place enormous prices and restrictive licensing terms in ToT arrangements with IPAs. Mandatory ToT requirements to be stated in RfPs.
- Level Playing Field:
  To achieve the stated objective of self-reliance and to ensure a level playing field exists between OEM's and IPAs, DPP should mandate a min Indigenous Content (IC) and seek ToT for critical tech. as a min qualifying criteria.
- Validity: MoD Export Authorisation validity (02 years) should be extended for contract duration to avoid multiple extensions.
- Change in Item Details: Any changes in part /component details mentioned in Export Authorisation during execution, requires amendment & re-application of the authorisation.
- This requires additional time & efforts. Minor changes in details should not warrant re-authorisation.
- Importing & Re-exporting of items for repair & rework under warranty obligation: IOP is required to re-obtain Export Authorisation for re - exporting components imported for repair/rework.
- IOP should be permitted to re-export the part/component for repair quoting earlier Export authorisation.
- EUC format for Parts & Components: The EUC format for parts & components requires FOEMs to share details of EU which FOEMs are unable to do as they are bound with confidentiality obligation from the Users.
- This poses challenges in the process of integration of IOPs in the global supply chain of the FOEM through offset contracts.

The following recommendations were made:

- Promote co-development and co-production projects to create new avenues for offsets and promote export to third country
- Promote skill development, (in Aerospace specifically) to create efficiencies for offsets execution and potential for exports
- Develop infrastructure as Offsets thus creating a D&A manufacturing hub in India for SE Asia and MENA Region – targeted regions for Exports

- Leverage new policy provisions to:
    - Identify outcome based Offset projects
    - Identify suitable partner from industry for ToT under B&M(G)
- Revise policy to encourage cooperation between Indo-US firms to enable them to share technical data and facilitate smoother offset delivery – post 2+2 initiative
- Speed up licensing to US companies exporting products technology to India to facilitate offsets execution
- More than one US Co. be permitted to partner with Indian companies to enhance potential offset avenues
- USG to cut down the time for awarding the DSP-5, TAA, MLA approvals for short listed partners to speed up offset process
- Encourage formation of JVs/ Consortiums with Indian companies to enable potential to participate in B&M(I) Projects and for liquidation of Offsets obligations & promote exports

Topic 2: Model for Successful International Defence Collaboration- Keynote Speaker 3: Mr. Patrick Philippart, Commercial Operations Director, MBDA

The talk highlighted the following enablers for successful international collaboration on defence

- **Political vision, Defence vision**
    - Political initiatives
    - Indigenous Defence Plan
    - Defence endowment budget (segmented, time-wise, with platforms…)
    - National Security Plan (including terrorism, cyber-attack, …)
    - Industrial policy, Offset as a leverage
    - Incentivized initiatives (Financials, Tax,)
    - Bilateral relations, International Organisation initiatives
- **Stability**
    - Political
    - Regulations, including Financials
    - Defence Procurement Policy

- **Industrial Landscape**
    - Capabilities, growth potential
    - Ecosystem, Corridors
    - State owned vs. Private sector

The following conclusions were presented:

- A successful International Defence Collaboration is coming from reciprocal commitment
- In this reciprocal commitment, the Local Industry shall attract technology and knowhow from his OEM Partner and generate employment, education partnership in a Campus like this one
- In turn, the Government shall support this growth in releasing Make in India RFPs and signing contracts with Indian Companies at a reasonable pace, and facilitating the administrative regulations
- The Government and the Administration shall rely on the Local Industry to determine how to develop the Collaboration in an appropriate manner, providing guidance but less rules
- The Indian Industry is best placed to determine what is good for their Long Term Development and therefore for India
- A successful International Defence Collaboration will request a reciprocal commitment between the Government and the Administration on one side, and the Indian Industry on the other

RECOMMENDATIONS

1) **We need to decide where we want to position ourselves in the value chain : System / Platform Integrator, Tier 1**
    - If we want to play at Platform Integrator level then support in home market is crucial
    - Platforms need to be ordered on Indian OEMs
    - Successful implementation of Strategic Partnership and Make I are imperatives
2) **Market forces are not alone capable of establishing robust aerospace ecosystem**
    - Government intervention & investments are deemed necessities.
3) **Ecosystem based on Tier-ised Structure**
    - Manufacturing clusters already set up to be exploited in a greater way to enable start-ups and MSMEs
    - Testing infrastructure to be enhanced and made available
    - Defence Innovation Fund schemes to be implemented
    - Mentoring of MSME sector i.e. Private-Private-Partnership
    - This requires percolation of legal and techno-commercial skills down to tier 2/3 firms
4) **Planning Technology and R&D Orientation**
    - Investment to enable incorporation of advance manufacturing techniques using Robotics, Artificial Intelligence, 3D printing, etc.
    - Investment in Laser technologies for Directed Energy Weapons
    - Product co-development in P-P model
    - Incentives for private industry investment in Defence R&D
5) **Building a sustainable talent pipeline is critical and non-negotiable**
    - The onus of this resides primarily with the academia and the government.
    - The responsibility to ensure that the scale brought in by the government and academia efforts is fine-tuned in terms of skills resides with the Industry.
    - System Engineering to be a key part of the curriculum
    - Collaborative training institutes like the one set up by Dynamatics for aero structure manufacturing to be set up

- Colleges/Institutes to be set up for dedicated training on aerospace, defence, shipbuilding

6) For Successful Public Private Collaboration in Indian Defence

- Indian industry need a robust system, policies & procedures and security controls to interact and engage various stake holders for carrying out R&D, manufacturing and implementation of complex defence projects.
- Industry need setting up of world class platform level infrastructure and optimum capacities for design, development, manufacturing, testing & life cycle support.
- Industry should create complementary strengths and avoid duplication.
- The industry need to create a strong eco-system built on trust and mutual understanding for success of the Public Private Collaboration Model in India.

7) Short Term Stimulants

- Public Procurement Policy in DPP
- Faster Acquisition Cycles
- Buy Global to Make-in-India
- QA/QC Self Certification
- Efficient obsolescence management

8) Mid-term Measures

- Strategic Partnership Model
- IDDM & Make-II Programs
- Categorization and AoN approval in favour of Indian Industry
- Exports to Friendly Countries via LOC (Look East-Act East)

9) Long Term Measures

- Push for 'Make' Programs
- Defence corridors and testing infrastructure
- Industry specialists in Decision Making Bodies
- Restructure acquisition branch in to specialist cadre
- Funding of Targeted Industry in R&D

Engineers Conclave - 2018

October 4-6, 2018
LDA, Lonavala

Recommendations

Theme II :
Engineering Challenges in Urban Infrastructure

Jointly Organized by :

Indian National Academy of Engineering (INAE)
Larsen & Toubro (L&T)

Summary of Deliberations

There were 5 sub-themes under theme-2

1. Challenges of building Flyovers under 180 days
2. Technologies for traffic movement including synchronizing traffic signals
3. Technologies for rapid mass movement
4. Technologies for city waste & environment management
5. Connected citizen: Digital Enablement of services offering

As we all understand, today there are series of challenges almost in all facet of life, viz. Pollution, population, drinking water, sanitation, energy, mobility and transport, solid waste management, environmental degradation and many more such infrastructural issues still remain unaddressed.

This has aggravated due to huge migration from rural to urban areas and is continuing. According to statistics published by Census 2011 around 31.16% population are in urban and It is forecasted that it may rise to 40.76% of India's population would be there by 2030.

There is a huge impact on urban infrastructure and as such there is impetus required to expand, enhance and align urban infrastructure to meet this shift.

The Government is taking a lot of measures to improve the infrastructure and one of the initiative is to bring technological innovation and digital enablement to bring improvement in efficiency & effectiveness of Governance as well as citizen connects to Government

"A smart sustainable city (SSC) is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects."

Smart Cities have been a focal point of improving the quality of life in our cities and ensuring citizen safety. This has been achieved to good effect and a number of cities have been adopting ICT interventions with increasing investments being pooled in by state and central governments.

The capital expenditure can be considered as a sunk cost but the operational expenses can be paid for by the projects themselves.

We wish to create a smart city model wherein the city can leverage its assets to generate the money required to run these projects

There are four facets of such impacts -

- Governance Impact
- Social Impact

- Spatial Impact
- Economic Impact

Smart city is a city which can manage its resources (natural and human) efficiently and effectively in order to achieve high livability, comfortable and sustainable development.

AND to achieve the goals, ICT as an enabler is a necessity

Most City still focus on ICT and don't put strong priorities for other enablers (people, process, information management)

A carefully planned city will attract investments, create jobs, have strong infrastructure, and most importantly, up the standard of living of its citizens. Going ahead, the contribution of cities to India's GDP will only increase

The transformation to smarter cities will require

- Innovation in planning,
- Management, and operations.

Cities must get smarter to address an array of **emerging urbanization challenges**,

The number of cities worldwide pursuing smarter transformation is growing rapidly.

However, these efforts face many **political, socioeconomic, and technical hurdles**.

Changing the status quo is always difficult for city administrators, and smarter city initiatives often require extensive coordination, sponsorship, and support across multiple functional silos.

The need to visibly demonstrate a continuous return on investment also presents a challenge.

The technical obstacles will center on achieving system interoperability, ensuring security and privacy, accommodating a proliferation of sensors and devices, and adopting a new closed-loop human-computer interaction paradigm.

The program will have to be scalable, sustainable and futuristic

We had eminent speakers in days, who expressed their views around various key aspects of urban infrastructure development needs and given their recommendation, which is summarized here below-

1. Technologies for traffic movement including synchronizing traffic signals
2. Technologies for rapid mass movement
3. Technologies for city waste & environment management
4. Connected citizen: Digital Enablement of services offering

Key takeaway from Engineers Conclave: Engineering challenges in Urban Infrastructure

The mix of speakers from industry, research, Academics, consultant total 22 delegates participated, discussed and expressed their views around various key aspects of urban infrastructure development needs and given their recommendation, which is summarized here below:

Current smart city challenges are:

1. Retrofitting existing legacy city infrastructure to make it smart
2. Financing smart cities
3. Availability of master plan or city development plan
4. Financial sustainability of ULBs (Urban Local bodies)
5. Technical constraints of ULBs (Urban Local bodies)
6. Three-tier governance
7. Providing clearances in a timely manner
8. Dealing with a multivendor environment
9. Capacity building programs

The transformation to smarter cities will require:

- The solution Concepts we are implementing shall be taken forward for future be scalable, sustainable and futuristic and which benefits the citizens and society
- The change to be done in policies which ease the business and enables for timely completion
- Innovation in planning, Management and operations.

However, these efforts face many political, socioeconomic, and technical hurdles. Changing the status quo is always difficult for city administrators, and smarter city initiatives often require extensive coordination, sponsorship, and support across multiple functional silos. The need to visibly demonstrate a continuous return on investment also presents a challenge.

The technical obstacles will center on achieving system interoperability, ensuring security and privacy, accommodating a proliferation of sensors and devices, and adopting a new closed-loop human-computer interaction paradigm.

Technical Session I:

Challenge of Building Flyovers under 180 Days

As India is going through urbanization at a rapid pace, we are facing new challenges to decongest our cities. Elevated corridors will play a very important role to decongest our existing cities.

The scope of the discussion was to build a typical flyover of length 1000 mtr. The scope covers only the construction at site.

In order to Build Flyovers under 180 days, following recommendation emerged through the discussion at Engineering Conclave:

1. More Time on the Drawing Board

   We need to spend more time planning during pre-construction phase. DPR preparation should capture ROW availability, Utility mapping & Environmental issues, types of foundations, Substructure and Superstructure. If not addressed properly during preconstruction phase, these issues contribute to disproportionate delays in alignment and design finalization.

2. Better Project Preparation

   ROW and environmental issues should be addressed before commencing the execution at site.

   Utility shifting is the major hurdle towards execution of urban infrastructure projects. It is recommended that project authorities should do the mapping and relocation of utilities through a separate utility package.

   As in various cities, infrastructure projects are being carried out for many decades, Pile foundation capacity can be estimated through past experiences. Currently contractor cant proceed with the foundation works unless Pile load testing is done, which takes more than a month. If we allow contractor to proceed with the execution with an undertaking of additional pile to be installed if desired strength is not achieved, it will save a lot of time at site.
   If the projects are given notice to proceed once all the necessary approvals are obtained, it will remove uncertainties to a great extent, reducing construction duration on site minimizing inconvenience to road users.

3. Bid Selection Process

   Currently we practice a two stage process prequalification followed by award to L1. In this case bidder doesn't take in to account the past delivery records of the contractors.

It is recommended to consider Hybrid System i.e, giving weightage to technical qualification, technical solution and price to select a contractor. This would be a robust system for faster project delivery.

4. Standardization & Usage of New Technology

   Flyovers can be constructed at high pace if we change our approach to FACTORY MODE.

   Wherein Standardization will be the key. Standardization of spans, piers, piercap, deck slab will ensure that designs are already in place before the commencement of bid process. It will also provide better quality than in-situ approach. More off-site pre-casting would minimize public inconvenience, reduce noise and dust pollution and increase pace of construction. Also a standard design in a specific city would give it a character.

   A standard design for a standard span is currently practiced by Railways for ROBs (RDSO approved designs).

   Also Client should be open to accept new technologies followed in developed countries. New technologies such as monopole, single row piles, Hybrid Composite Beams should be explored.

5. Creating A Sustainable Business Ecosystem for Contractors Improving Contract Conditions

   It is observed that generally the construction Contracts are one sided favoring clients and putting undue risk on contractors. It is suggested that risks be managed by the entities who are better / suitably placed to mitigate them. Also a faster dispute resolution mechanism will ensure a sustainable working environment for the contractors to implement the project.

   Improving Cash Flows

   Currently the infrastructure segment is facing liquidity crunch. Various contract conditions require contractor to lock greater working capital in the business. This limits the capacity of conytractor to execute big projects simultaneously.

   It is suggested to revise the billing schedule as per actual Cash flow. Also providing Interest free mobilisation advance up to 15% of contract value will enhance liquidity in sector which will in turn accelerate project implementation.

Technical Session II:

Technologies for traffic movement including synchronizing traffic signals

Objective was to achieve to have "reduced commute time, improve the traffic signal synchronization, enable green corridor for emergency vehicles", and other traffic challenges. During peak traveling 7 Kms may take 1 hr while it shall take around 15 min.

- Few solutions, recommendations emerged during discussion
    - Use of technologies like machine learning, Artificial intelligence
    - ATCS (Adaptive Traffic control System) and ITMS (Intelligence Traffic Management System)
    - New infrastructure called Green Corridor for emergency vehicle
    - Improving the ecosystem and bringing political will to get the logical and optimized width of the road. This requires stringent policy & its enforcement
    - Improve the traffic signal synchronization, using technology
    - To have 'Traffic Engineers' rather than a police to plan for traffic flow management.
- Metrics for smart mobility – Public transport usage (% of trip share), Number of buses, non-motorized vehicles (NMT), Average traffic speed to be monitored regularly and make available to everyone.
- For making Green Corridor, we can have adaptive traffic management→ Vehicle detector sensors, traffic signal controller, communication network, traffic control system, application software. Some of the innovative ideas like "Fast tags" for emergency vehicles etc.
- Leveraging AI (Artificial Intelligence) for synchronizing traffic movement – Analyse the use of design features, determine the impact of temporary events and special programming, traffic density analytics, toll gate automation etc..
- Analyze the city requirements (like population, space available, environmental solutions etc..) and integrate into zones and implement centralized solution for each zone.
- Recommendation for Implementation
    - ROI could be less than 2 years when seen with other benefits
    - Special funding to manage high initial cost

- Minimizes inconvenience to other commuters→ Can use existing networking infrastructure
- Integration with existing signals with technology, Platform & applications
- Leveraging AI (Artificial Intelligence) for synchronizing traffic movement
- ATCS (Adaptive Traffic control System) and ITMS (Intelligence Traffic Management System)
- To have 'Traffic Engineers' rather than a police to plan for traffic flow management.

Technical Session III:

Technologies for rapid mass movement

With a rapid expansion of urban areas one of the major challenge could be "how mobility for mass movement?"

1. The effective solution could be the implementation of the
   - Connected mobility- Electrified, Connected & Automated
   - Shared transport - Collaborate, co create, software driven
   - Hybrid Electric Cars and Battery operated cars
   - The sensors, intelligence & connected medium to be brought into an integrated platform.
   - Technologies like radar to interface two trains/metro such that the information is passed to the drivers before hitting vehicles.
2. Major shift in citizens behavior
   - From "Vehicle as the central object" to "Connected, Inter-modal transportation services"
   - Rapid transport systems for smart mobility
3. CBTC (Communication Based Train Control) systems to improve efficiency and time
   a. Currently it is 'fixed block' or 'moving block'
   b. Cost effectiveness and safe
   c. Technological advancement for Data communication to achieve safety & efficiency in operations

Technical Session IV:

Technologies for city waste & environment management

- Green Building
    - All the smart buildings should also include the green concepts in it which will reduce the carbon foot print & betterment of the living index.
    - Rain water harvesting must for every building
    - Environment friendly policies like banning plastic bags, mandating renewable energy sources, Waste re-cycling
- Solid Waste Management
    - GIS enabled maps,
    - RFID tags and sensors based technologies
    - Attendance at field for solid waste management's etc.
    - Proper scheduling & routing will increase efficiency in usage of fuels at the production stage itself. (Nagpur smart city use case)
- Encourage renewable energy (SPV based solution)
    - It is effective efficient and environment friendly
    - Not so reliable in long cold climatic situations, thus battery capacity to be increased
- Alternate solution for energy for Communication need
    - Zigbees & LORA network should be enabled city wide
    - As an alternate or complement to cellular networks in tracking smart devices
- solid/liquid waste conversion for ENGERGY-
    - One of the technology recommended by one of the speakers is converting the solid/liquid waste into diesel+jet fuels+CNG+Ammonia
    - The innovative technology was from "LANGENBURG" presented by "AG Dauters". It is based on forward & reverse Engineering and Plasma Gasification

Technical Session V:

Connected citizen: Digital Enablement of services offering

- Understanding pulse of citizen need and adoptability for such change

    - Security
    - Services- such as eGovernance, Land revenue and municipal services
    - Life quality improvement- Smart transport, stand Connected, and ease of movement
    - Virtual citizen services
    - eHealth Centres and eEducation
    - eKiosk - Enabling of government services reachable to every citizens in single platform
    - Liveability Index improvement
- Technology enablement
    - Edge analytics – Green corridor for ambulance, emergency vehicles, VIP corridor
    - Citizen Identity to be addressed
        - High resilient communication networks (ZigBee, LORA, WiFi, GPRS) for various applications
    - City Wide surveillance for ensuring the safety & security
    - AI (Artificial Intelligence) based Video Analytics for surveillance, Traffic and SWM services
- Solution to understand city requirement – citizen's engagement, transparency in public data usage, procurement awareness, vendors & partners trust.
- Always Connected
    - Communicate, commute, co-create

RECOMMENDATIONS

Govt to come with the policy on the following area

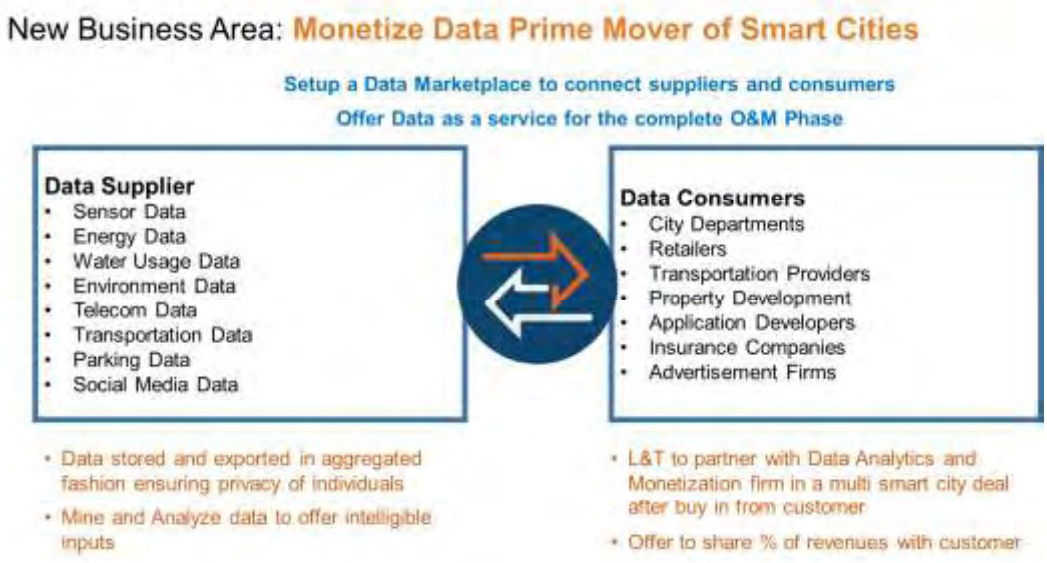
1. Integrated solid waste management with GIS enabled AI based services linked to garbage driven energy production
2. Adaptive traffic management system along with AI based surveillance and ITMS
3. Citizen centric application mandating the uses for critical registrations like birth, marriage, death & any property transaction. The application shall be GIS based and by exploiting the technology such as block chain especially for revenue record transactions
4. The mandate for all the smart city should be minimum smart infra towards wifi, green energy, water & electricity management system based on SCADA linked with the single integrated command control system
5. Rapid mass traffic systems with unified payment system linking the credentials of individual systems
6. Mandate of deployment of kiosks for e-governance & govt citizen connects inline with ATM

Implementer's Perspective

Recommendation to make these Urban Smart Infrastructure project successful, effective and impact full-

- Min 9 month Go -Live
    - High Risks/issues if less than 9 months on Complex projects
- Max 5 years O&M
    - O&M should not be more than 5 years including warranty period due to technology obsolescence
- Nodal Agency
    - Appoint single window to expedite permits, etc.
- Payment milestones
    - Recommend 90% of CAPEX receivable progressively till Go Live
    - More stringent terms reduces participation by leading players in bids.
- Cloud
    - Deploy on cloud first, within 45 days (don’t wait for data center)
    - Allows for more time for testing, training, and validation.

- Integrations
    - Lack of detail on systems to integrate creates scope issues upon implementation
    - Owners of these systems do not participate in integrations: budgets, staffing.
- Governance
    - Inter-departmental co-ordination
    - Citizen Engagement
- Technology
    - Open & Scalable Architecture / Understanding the existing System



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Notes

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

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