THE ROLE OF ENGINEERS IN THE ARMED FORCES

WAYPOINTS

- Part I
  - Where it all began
  - Where We Are Today
- Part II
  - Engineering In The Three Services
    - Roles and Responsibilities
    - What they do
    - Challenges
- Part III
  - Contribution to the Nation

WAYPOINTS (CONTD)

- Part IV
  - Training
- Part V
  - General & Conclusion
- Part VI
  - Q & A

PART I

- Where it all began
- Where we are today

PART II

Engineering In The Indian Army

ENGINEERING IN THE INDIAN ARMY

- Corps of Engineers
- Corps of Electronic & Mechanical Engineers
- Corps of Signals

- Combat Engineers
- Military Engineering Services (MES)
- Border Roads Organisation

CORPS OF ENGINEERS

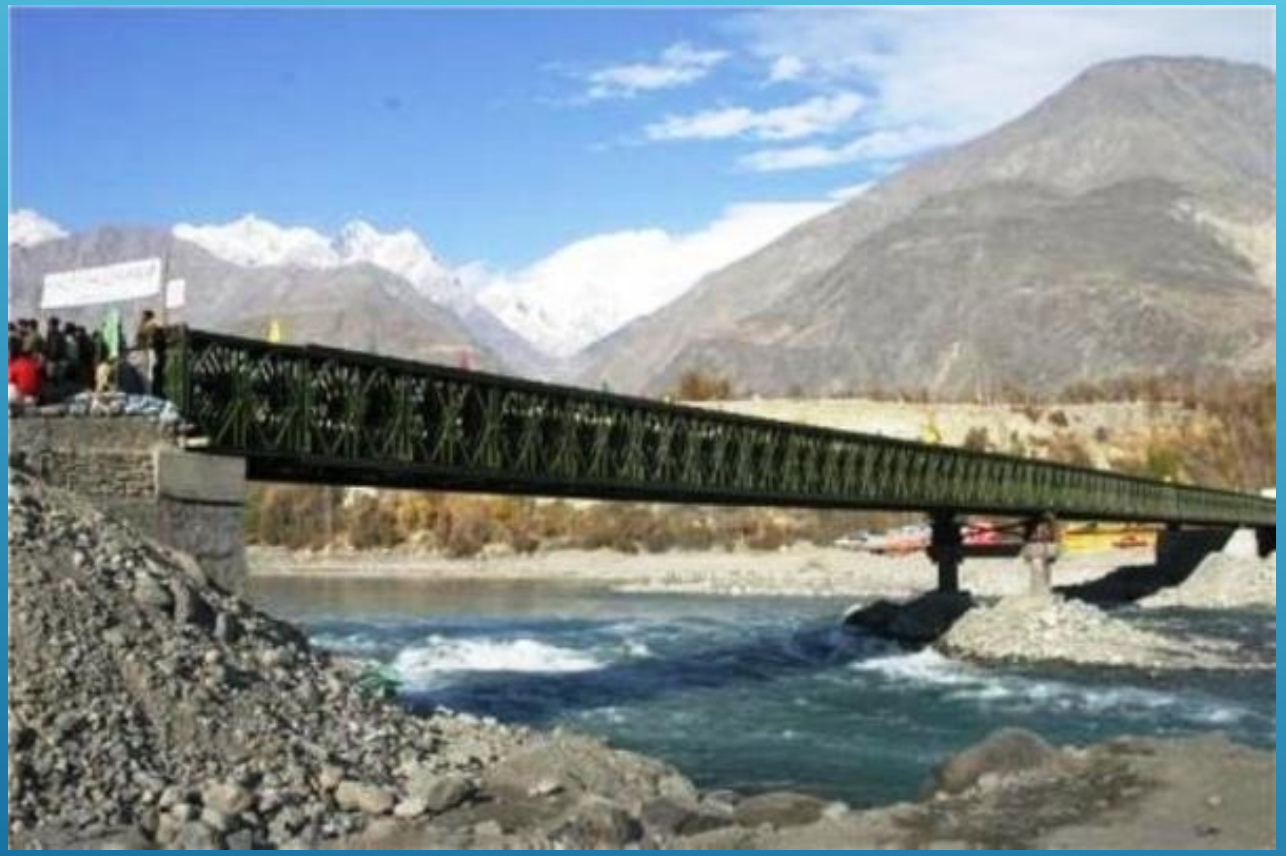
COMBAT ENGINEERS

- Provide mobility to own forces by constructing bridges, tracks and helipads;
- On the other hand the Corps denies the same to the enemy by creating obstacles such as laying mine-fields and demolition of bridges.
  - The Corps of Engineers is the first to move in and the last to exit

TYPES OF BRIDGES – PONTOON

Floating bridge made using floats or shallow bottom boats called pontoons.

TYPES OF BRIDGES - BAILEY



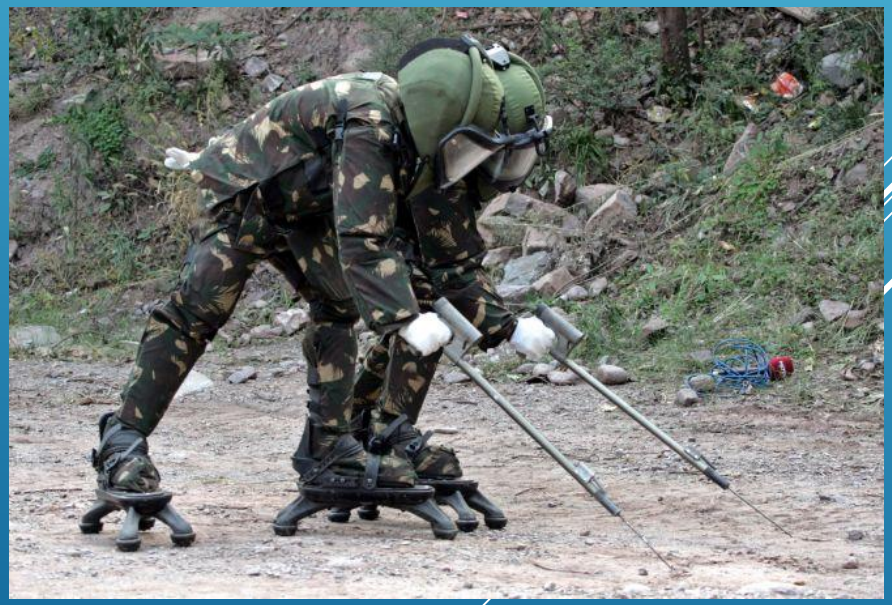
Bridge Between Dras and Suru Rivers, Ladakh, built 1982. Highest in the world.

TYPES OF BRIDGES – BAILEY BRIDGE

Elphinstone Road Station – Rail Over Bridge, Constructed in 40 days

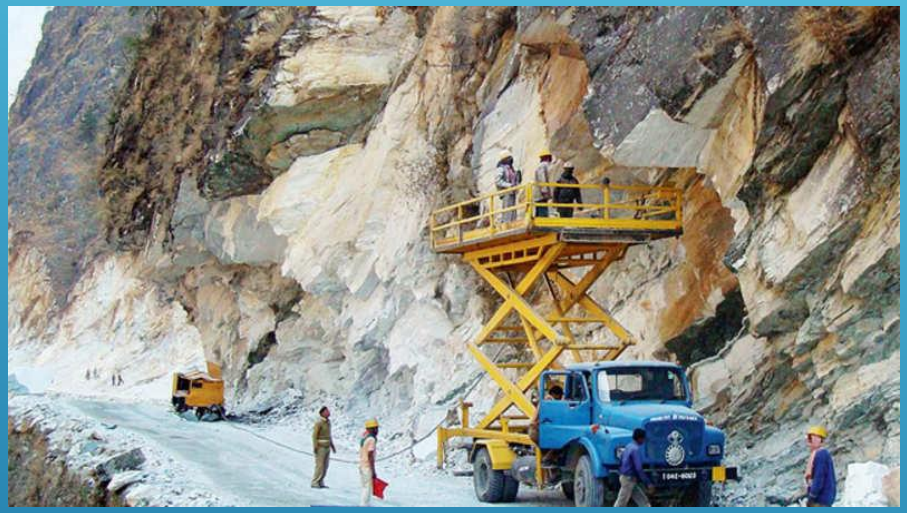
MINE LAYING & CLEARANCE

- Mines are laid to prevent forces from advancing
  - Need to be cleared before own forces can move
  - Own mines need to be cleared after a conflict



CONSTRUCTION OF HELIPADS, TRACKS

BORDER ROADS ORGANISATION



ELECTRONICS & MECHANICAL ENGINEERS (EME)

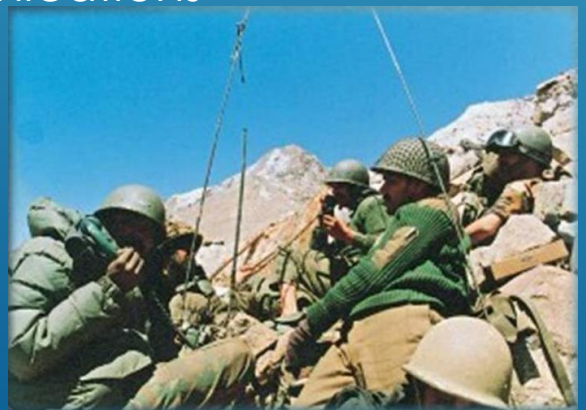
- Recovery & Repair of all army vehicles, aircraft, radio and other electronic equipment through:
  - Field Workshops
  - Zone Workshops
  - Advance Base Workshops
  - Army Base Workshop

ELECTRONICS & MECHANICAL ENGINEERS (EME)

- Design, Development, Trials and Induction of new equipment
- Indigenisation of foreign equipment
- Technical advice to units

CORPS OF SIGNALS

- Communications
  - Between static & mobile forces for Voice, Data, Fax through digital, automated, secure network using:
    - Microwave radio
    - Optical Fibre cable
    - Satellite & Millimetre wave Communication Eqpt
  - Satellite Communications in the mountains
  - Strategic Broadband Satellite Network
  - Computer Data Networks
  - Static Peace Communications



CORPS OF SIGNALS

- Electronic Warfare
- Computer Emergency Response Team
- Data Centre
- Network For Spectrum
- Strategic Alliance between Signals
- and BSNL

AIR FORCE ENGINEERS

MAINTENANCE ORGANISATION

- Maintenance Command
  - Responsible for repair of nearly 40 different types and variants of Fighters, Transports, Ground Attack Aircraft, Trainers, Helicopters and others
  - In addition – Missiles, Ground Radars, Communication Eqpt, Radio & Nav Aids, GCA, EW Eqpt and more

AIR FORCE ENGINEERING

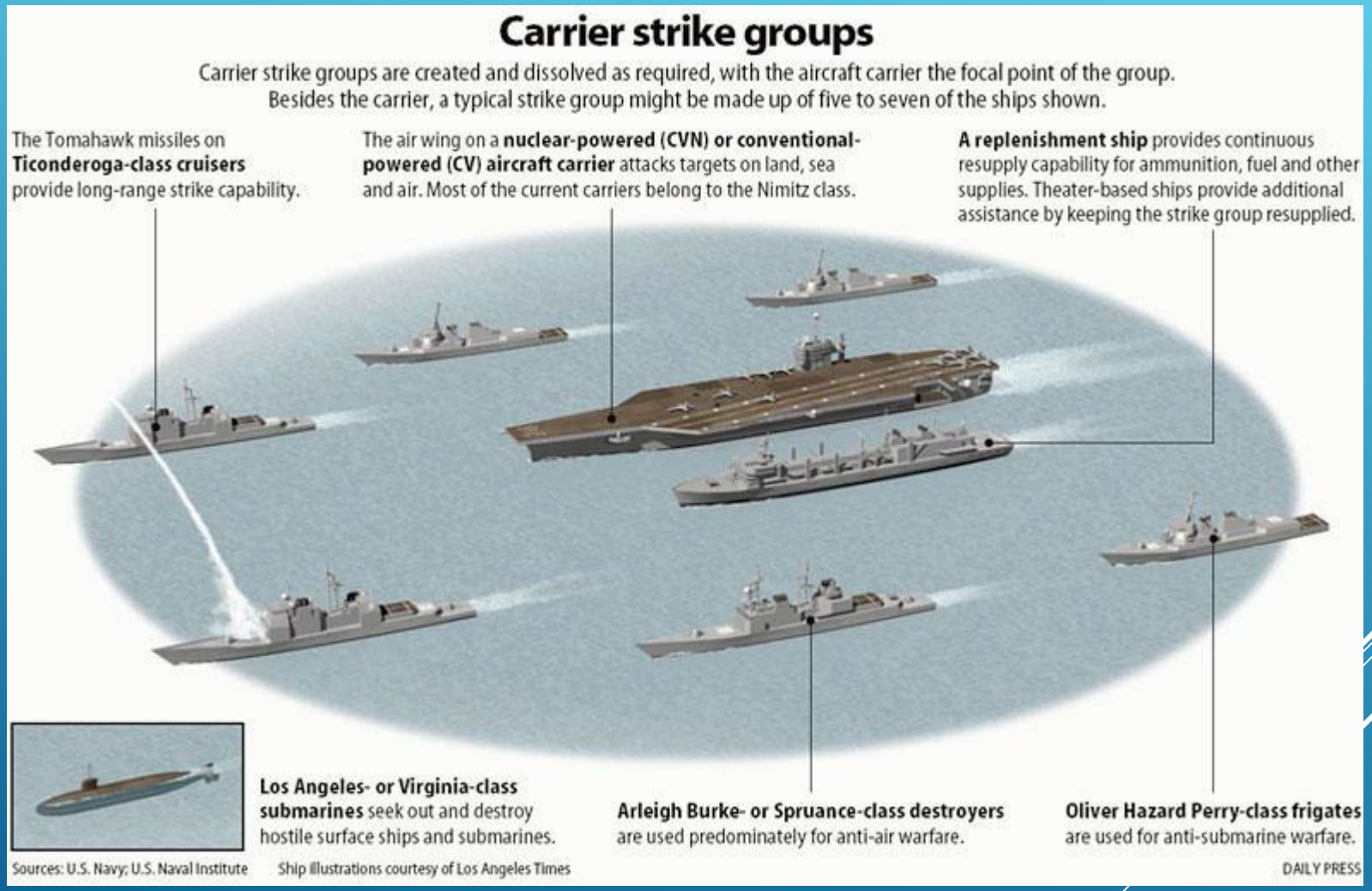
- Repair carried out at Base Repair Depots (BRD) across India
  - Besides smaller front line repair units and specialized repair units
- Branches
  - Air Engineering (Mechanical)
    - Engines, Airframes, Other mech systems
  - Air Engineering (Electrical)
    - Avionics, Ground Electronics
    - Ground Radar, Missile Systems

AIR FORCE ENGINEERING

NAVAL ENGINEERING

NAVAL BATTLEFIELD SCENARIO

SCENARIO (CONTD)



COMMUNICATION & COORDINATION

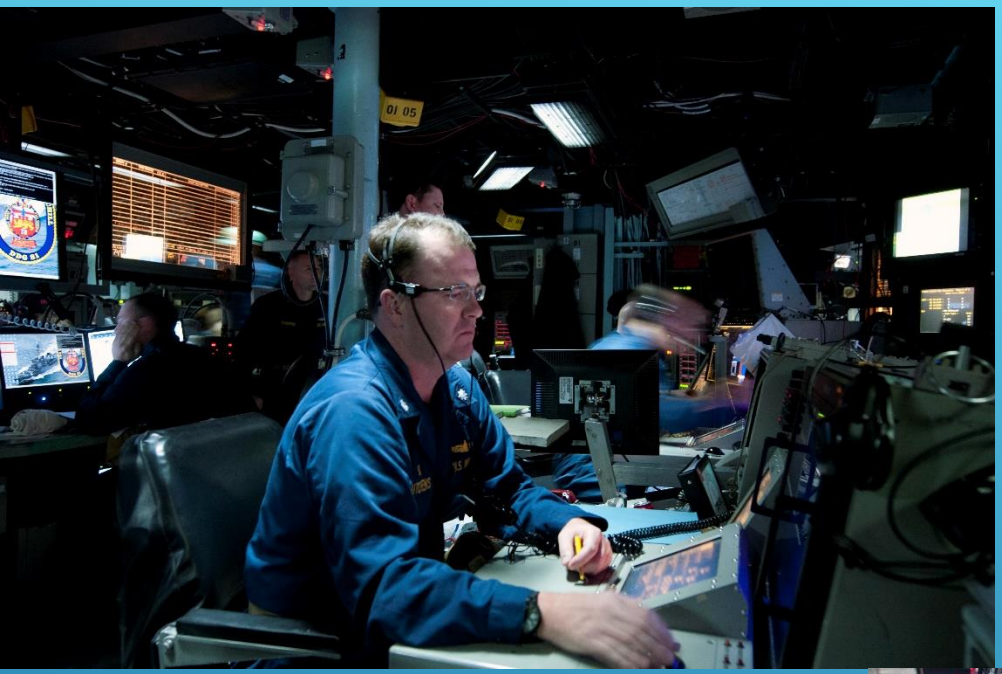

COSPAS-SARSAT
INMARSAT
CES
LUT
RCC
EPIRB
SAR forces
SART
COAST
NETWORKS
DSC-NBDP-RT
CRS
MSI
AREA A3
AREA A2
AREA A1

TOTAL SHIP COMMUNICATIONS SYSTEMS

- Fully Integrated, Centrally Managed
- External, Internal, Security Certified
- Mission Critical Secret, TEMPEST Secure Voice System
- Independent Multi-level Security and Payload Type GIGE Networks

LEONARDO DRS

Rockwell Collins



NAVY TECHNICAL BRANCHES

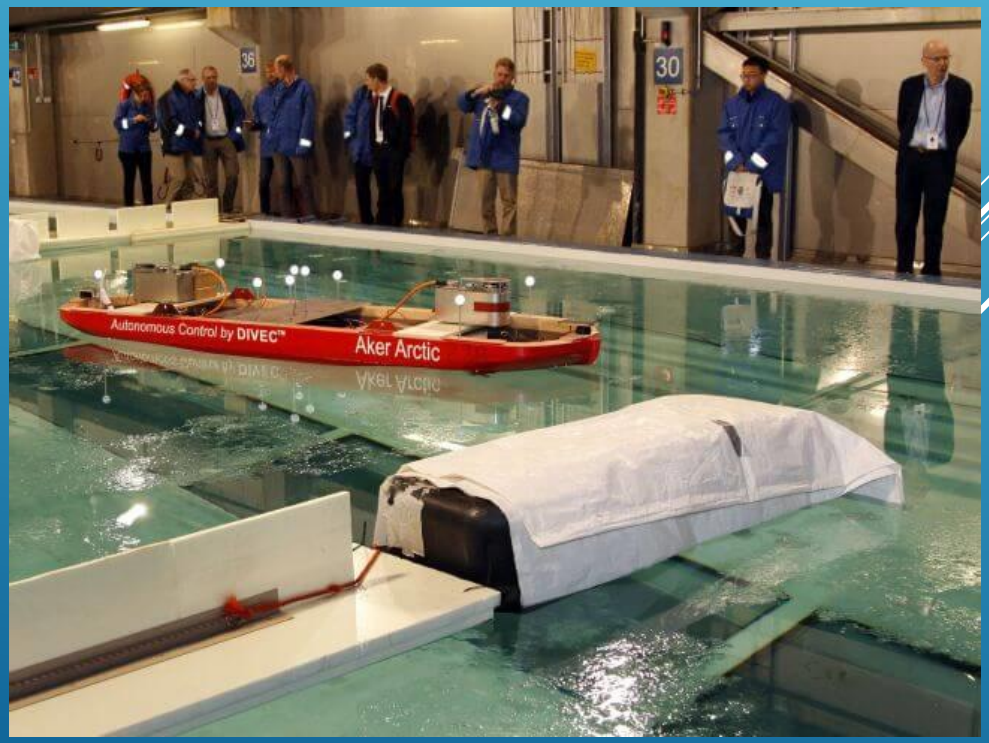
- Marine Engineering (E)
  - Main propulsion – Steam, Diesels & Gas Turbines
  - Power Generation (Prime Movers)
  - Air Conditioning & Refrigeration
  - Auxilliary Machinery
  - Stability, Fire Fighting and Damage Control

NAVY TECHNICAL BRANCHES

- Electrical & Electronics Engineering (L)
  - Power Generation and Distribution
  - Communications and Nav Aids
  - All Sensors – Radars, Sonars, Electronic warfare
  - Weapons – Missiles, Rockets, Torpedos, Guns and their associated systems

NAVY TECHNICAL BRANCHES

- Naval Construction (NC)
  - Ship Design and ship building
  - Hull Integrity
  - Docking of ships



REPAIR & MAINTENANCE

- First Line – On Board, by Ships' Crew
- Second Line – In Harbour, by Ships' Staff and / or Fleet Maintenance Staff & Dockyard
- Third Line – By Dockyard
- Fourth Line – By Dockyard / Manufacturer

PART III

Contribution To The Nation

MAJ RR RANE, PARAM VIR CHAKRA (CORPS OF ENGRS)

- 1948 – Indo Pak Conflict, Naushera Sector, J&K
- Then Lt Rane was attached to 4th Dogra Battalion for mine clearance
- 08 Apr 1948 –
  - Commenced mine clearance
  - Enemy opened up with gunfire and mortar
  - Two members of his team were killed and he was wounded
  - Despite this, he cleared the minefield by evening
  - But road ahead was still dangerous

MAJ RR RANE (CONTD)

- 08 Apr 48 (Night)
  - Worked through the night to make a safe passage for tanks
- 09 Apr 48
  - Continued working with surviving men for 12 straight hours
  - Cleared further mines and roadblocks
- 10 Apr 48
  - Cleared blockages for own forces to advance, amidst minefields
  - Enemy fire from higher positions
  - Rane brought a tank to take cover and continued clearing
- 11 Apr 48
  - Team worked for 17 hours continuously to enable Indian Army to advance

Maj RR Rane

Courage and Commitment

Param Vir Chakra

COMMODORE (DR) A PAULRAJ, NAVY

- 1966 - Joined the Indian Navy
- 1972 – Made improvements to Sonar 170 B, then in service
- 1977 to 83 – Designed advanced sonar APSOH, which was a quantum jump in technology and electronics. Its variants are still in service
- Founded three national level research labs:
  - Center for Artificial Intelligence & Robotics, DRDO
  - Central Research Laboratory, Bharat Electronics
  - Centre for Development of Advanced Computing (CDAC), Dept of Electronics

COMMODORE (DR) A PAULRAJ (CONTD)

- 1992 – Invented the idea of MIMO
  - Boosts data rates by creating parallel data streams
  - Technology standardized for wireless LANs, 3G mobile phone networks, and 4G mobile phone networks and is now in widespread commercial use

AWARDS

- 2018 Chinese Friendship Award, Govt. of P.R. China
- 2018 Inductee, National Inventors Hall of Fame, USPTO
- 2015 Foreign Member, Chinese Academy of Engineering, CAE
- 2015 Overseas Fellow, Indian National Science Academy, INSA
- 2014 **Marconi Prize and Fellowship**
- 2014 Foreign Fellow, Indian Academy of Sciences, IAS
- 2011 **IEEE Alexander Graham Bell Medal**
- 2011 Foreign Fellow, National Academy of Sciences India, NASI
- 2010 Fellow, American Association for Advancement of Sciences, AAAS
- 2010 **Padma Bhushan**
- 2008 Foreign Member, Royal Swedish Academy of Engineering Sciences, IVA
- 2007 Foreign Fellow, The World Academy of Sciences (TWAS)
- 2006 Member, US National Academy of Engineering, USNAE
- 2003 IEEE SP Society Technical Achievement Award
- 1998 Fellow, Indian National Academy of Engineering, INAE
- 1996 IEEE SPS Distinguished Lectureship
- 1990 Fellow, IEEE
- 1990 Fellow, Institution of Engineers, India
- 1987 Fellow, Institution of Electronics and Telecom. Engineers, India
- 1985 **Scientist of the Year** (Awarded by Government of India)
- 1983 **Ati Vishist Seva Medal** (National Award, Military - India) [Citation] [APSOH]
- 1982 VASVIK Gold Medal (Industry Innovation - India)
- 1974 **V.K. Jain Memorial Gold Medal** (Navy Award - India)
- 1974 **Vishist Seva Medal** (National Award, Military - India) [Citation]
- 1973 Chief of Naval Staff Medal (Navy Award - India)

CAPT NS MOHAN RAM, NAVY

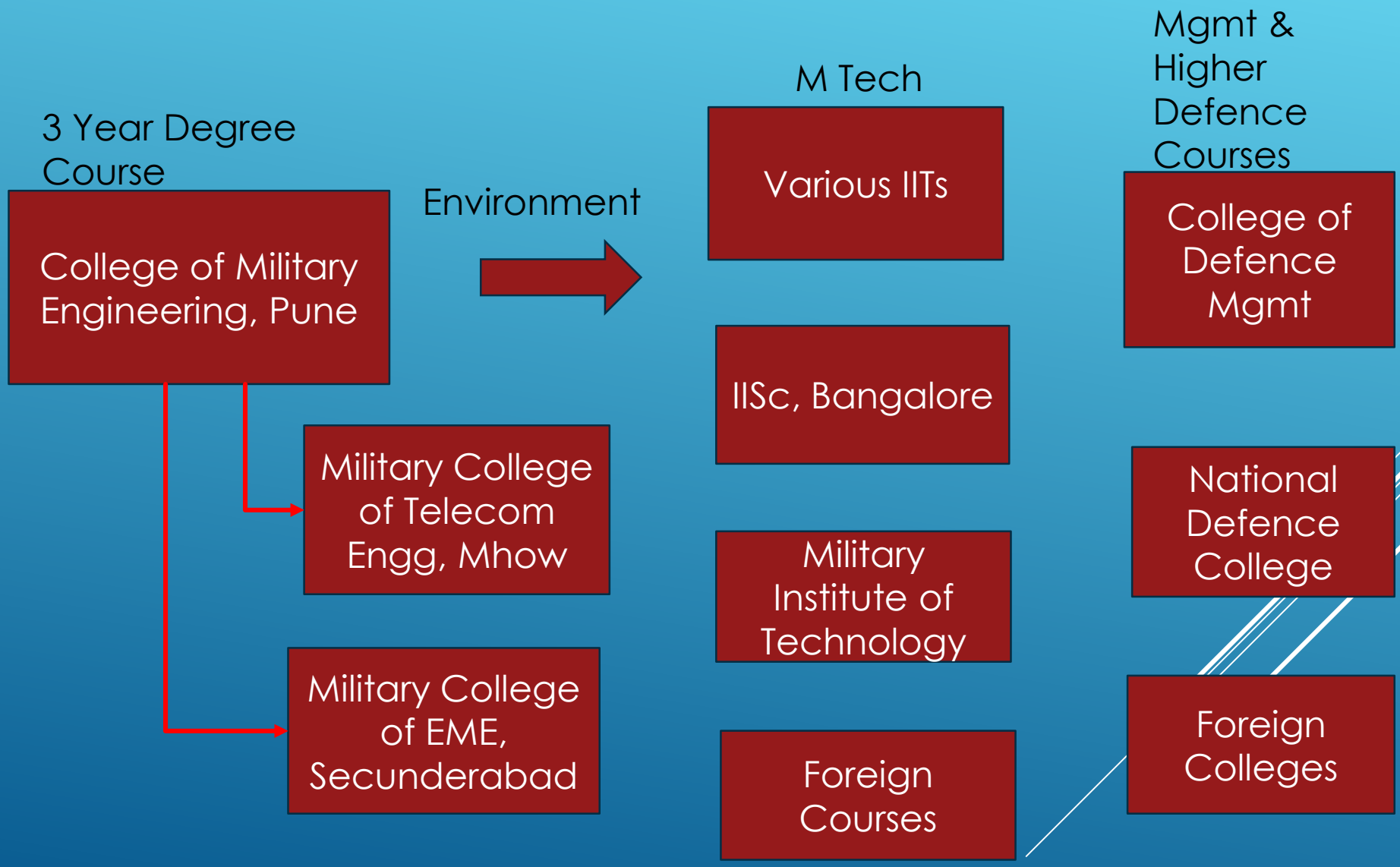
- Built India's First Modern Missile Frigate
  - INS Godavari

And went on to design the TVS Scooty!

PART IV

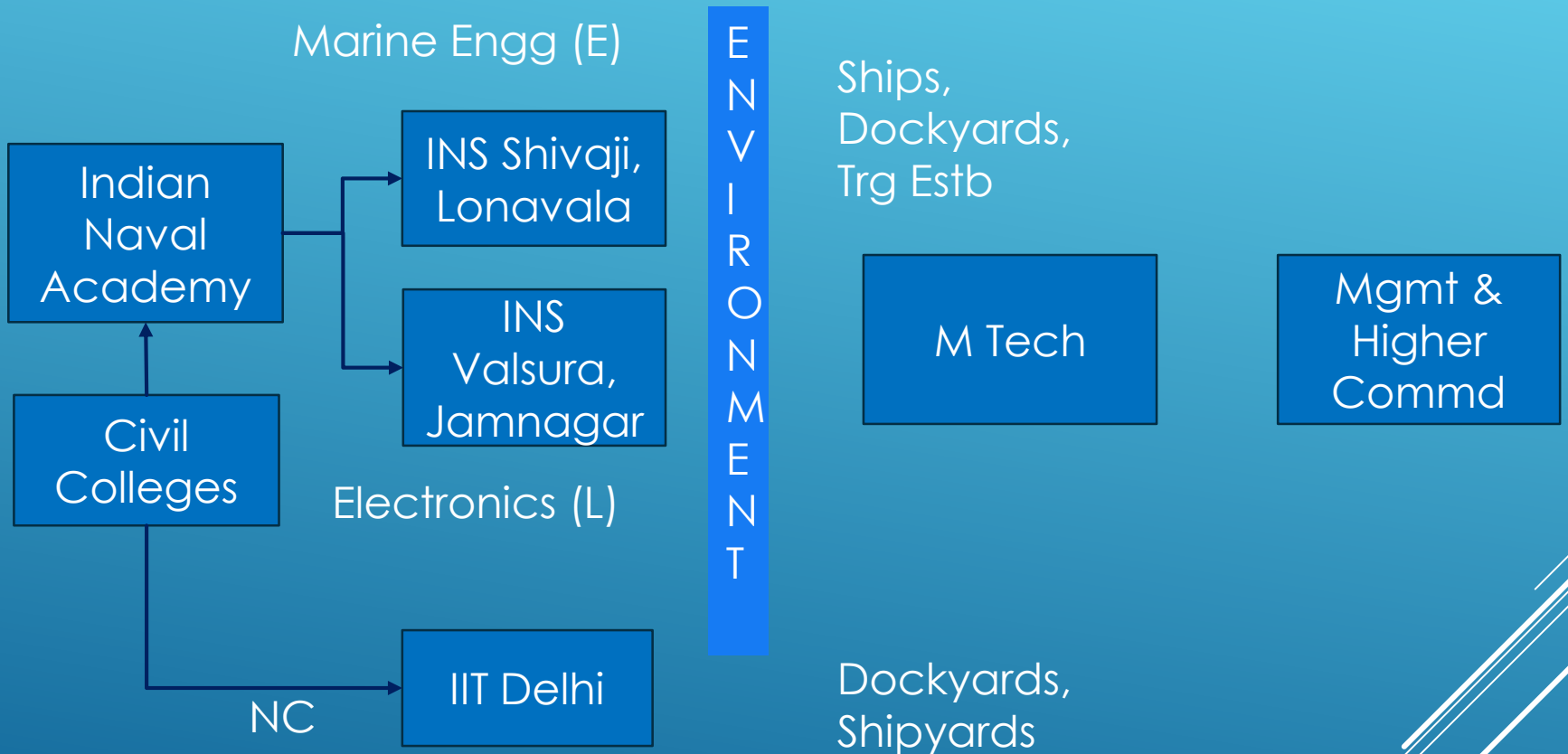
Training

TRAINING: ARMY – ENGINEERS, EME AND SIGNALS



TRAINING – AIR FORCE (AE M&L)

TRAINING: NAVY (E, L & NC)



ARMY (For Graduate Engineers)

- University Entry Scheme (Unmarried Male B.E/ B.Tech Graduates)
- Technical Graduates Course (As above)
- Short Service Commission (Men and Women)

HOW TO JOIN

University Entry Scheme

Vacancies Per Course	60 (As Notified) (Once a Year)
Notification Published in Employment News and leading Daily news Paper	Notified by Directorate General Recruiting / AG Branch in Jun/Jul
Eligibility Criteria	
Age	18 to 24 years
Qualification	Pre Final year students of Notified Engineering Streams
Marital Status	Un Married
How to Apply	Apply online on Official website of DG Rtg www.joinindianarmy.nic.in as Notified in the Notification.
Likely SSB Date	Nov to Feb
Date Commencement of Training	Jul
Training Academy	IMA, Dehradun
Duration of Training	One Year

TGC (Engineers)

Vacancies Per Course	60 (As Notified) (Twice a Year)
Notification Published in Employment News and leading Daily news Paper	Notified by Directorate General Recruiting / AG Branch in Mar/Apr and Sep/Oct.
Eligibility Criteria	
Age	20 to 27 years
Qualification	BE / B Tech in notified streams of Engineering
Marital Status	Un Married
How to Apply	Apply online on Official website of DG Rtg www.joinindianarmy.nic.in as Notified in the Notification.
Likely SSB Date	Mar / Apr and Sep / Oct
Date Commencement of Training	Jan and Jul
Training Academy	IMA, Dehradun
Duration of Training	One Year

Short Service Commission Tech

Vacancies Per Course	100 (As Notified) (Twice a year)
Notification Published in Employment News and leading Daily news Paper	Notified by Directorate General Recruiting / AG Branch in Jun / Jul and Dec/Jan
Eligibility Criteria	
Age between	20 to 27 years
Qualification	Engineering Degree in notified stream
Marital Status	Un Married
How to Apply	Apply online on Official website of DG Rtg www.joinindianarmy.nic.in as Notified in the Notification.
Likely SSB Date	Dec-Jan and Jun-Jul
Date Commencement of Training	Apr and Oct
Training Academy	OTA, Chennai
Duration of Training	49 Weeks

AIR FORCE

- Combined Defence Services Exam (UPSC)
  - Permanent Commission
  - Direct Entry (Men)
  - 20 to 24 Years
- University Entry
  - Men, Permanent Commission
  - 20 to 26 years
- NCC Entry
  - C Certificate holders
  - Men, Permanent Commission
- Engineering Degree as per requirements

NAVY

Type of Entry	Unmarried Men / Women	Age Limit	Educational Qualification
Short Service Commission (GS)	Men	19 – 25	B.E/ B.Tech in any discipline with minimum 60% .
Short Service Commission (Submarine-Engineering)	Men	19 ½ – 25	BE / BTech in Mechanical with minimum 60% marks.
Naval Architect (SSC)	Men & Women	21 – 25	BE/B.Tech in Naval Architecture / Mech/Civil/ Aeronautics / Metallurgical /Aerospace Engg with 60% marks.
Naval Architect University Entry Scheme (SSC)	Men & Women	19 – 24	BE/B.Tech in Naval Architecture / Mech/Civil/ Aeronautical / Metallurgical / Aerospace Engg / B.Arch with 60% marks
Special Naval Architect Entry Scheme (SNAES)	Men & Women	21 – 25	BE/B.Tech in Naval Architecture with 60% marks (campus rectuitment)

NAVY

Electrical Branch University Entry Scheme (SSC)	Men	19.5 - 25(Pre-Final year) 19 – 24(Final year	Final Year and Pre-final year students of Electrical, Electronics, Power Engg, Instrumentation and Control, Electronics & Instrumentation, Electronics & Communication, Instrumentation and Control, Control System, Power Electronics, Computer Science Engg, Instrumentation, with minimum 60% upto VI th Semester.
Short Service Commission (Submarine)	Men	19½ – 25	BE / BTech in Electrical/Electronics/Control Engg/ Telecommunication Engg with 60% marks
Graduate Special Entry Scheme (GSES) Indian Naval Academy, Ezhimala (Through UPSC)	Men	19 – 22	BE or B.Sc (Physics & Maths)

CONCLUSION

Q & A