The Nature and Role of Research and Development in Defence Preparedness

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IIM Delhi Chapter

The global perspective

- In the contemporary world, remote economic exploitation and capacity to affect the policies of the other nations has replaced physical occupation that was prevalent during 17th-20th centuries
- **Technology leadership** is the means and military might is a lever for remote economic exploitation
- Our national security strategy is to “Protect our national boundaries, economic interests and deter our potential adversaries against any adventurism”. DRDO empowers the nation by developing defence technologies
- Technology empowerment of the nation enhances its esteem in the comity of nations and also spurs a snowballing secondary and tertiary economic growth and employment generation
- As a nation we are trying to break in the league of influential nations and have no choice but to bridge the technology gap

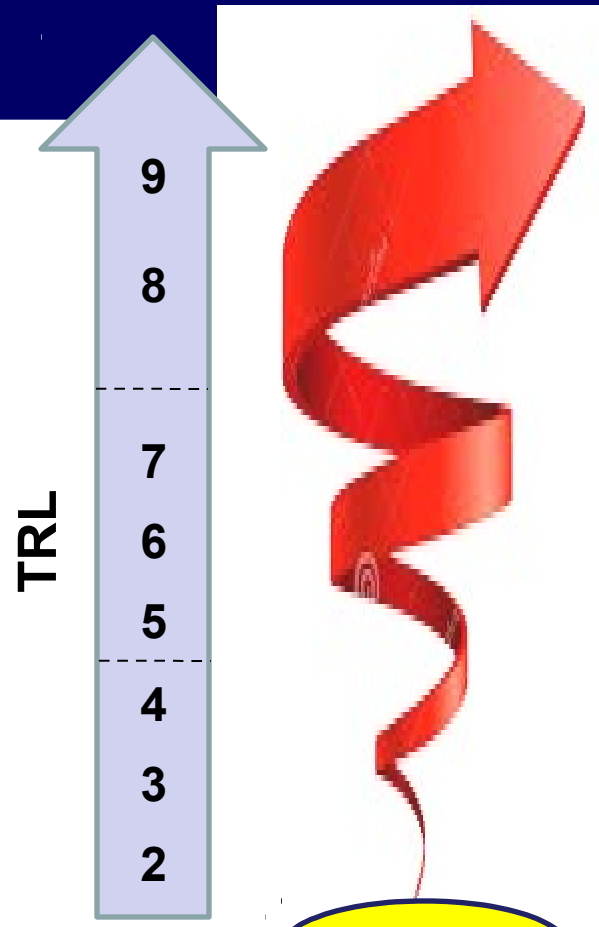
Our threats in near future

- Aggressive marketing by major holders of technology IPs
- Faster obsolescence
- Availability of technologies (The key limitation of ToT is that only production drawings are shared whereas equipment evolution to the contemporary design is the key)
- Limited industrial capacities
- Lack of expertise within the country
- Potential of premier Academic Institutions remains largely untapped due to policy limitations

Catch 22 for the country

- Services 15 year acquisition plan is called Long Term Integrated Perspective Plan (LTIPP), the present one covers the period 2012-2027
- DDR&D's LTTPP is in consonance with the LTIPP, for maximizing inductions of DRDO developed products.
- Services prepare the LTIPP based on their threat perception, operational directives and global visibility of systems as reported by Journals like Jane's Defence review, SIPRI, etc. This creates a catch 22 situation for DRDO. As Services project systems evolved and benchmarked elsewhere, DRDO mostly has to do the catch up
- DRDO can come out of it by showcasing customized novel indigenous systems to the Services based on technologies not reported elsewhere. Then the Services are likely to evolve their war doctrines on DRDO technologies

Defence R&D Leading to [illegible]n



System Development
- MM Projects
- JVs
- Collaborations

Technology Demonstration
- TD Projects
- JVs
- Collaborations/Consortiums

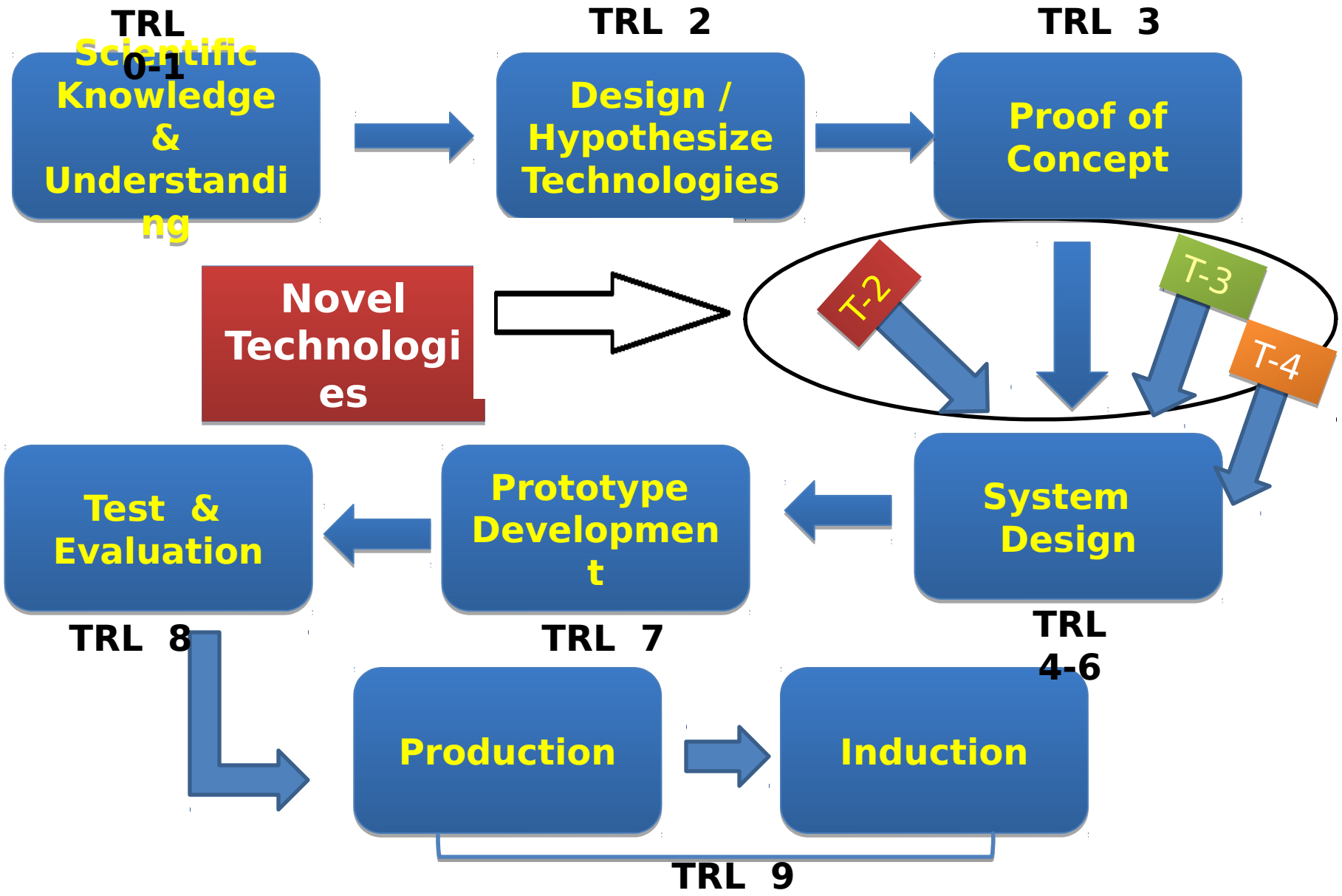
R&D
- S&T and IF Projects
- CARS
- Consortiums

LTIPP SQRs ORs LTTPP Tech Forecasts World Scenarios

Modes of Projects
1. Mission Mode
2. Technology Demonstration
3. Science & Technology
4. Infrastructure & Facilities
5. Product Support
6. Mission Mode-User Trial

Partners
- Armed Forces
- CAPFs
- Academia
- Industries
- R&D institutions

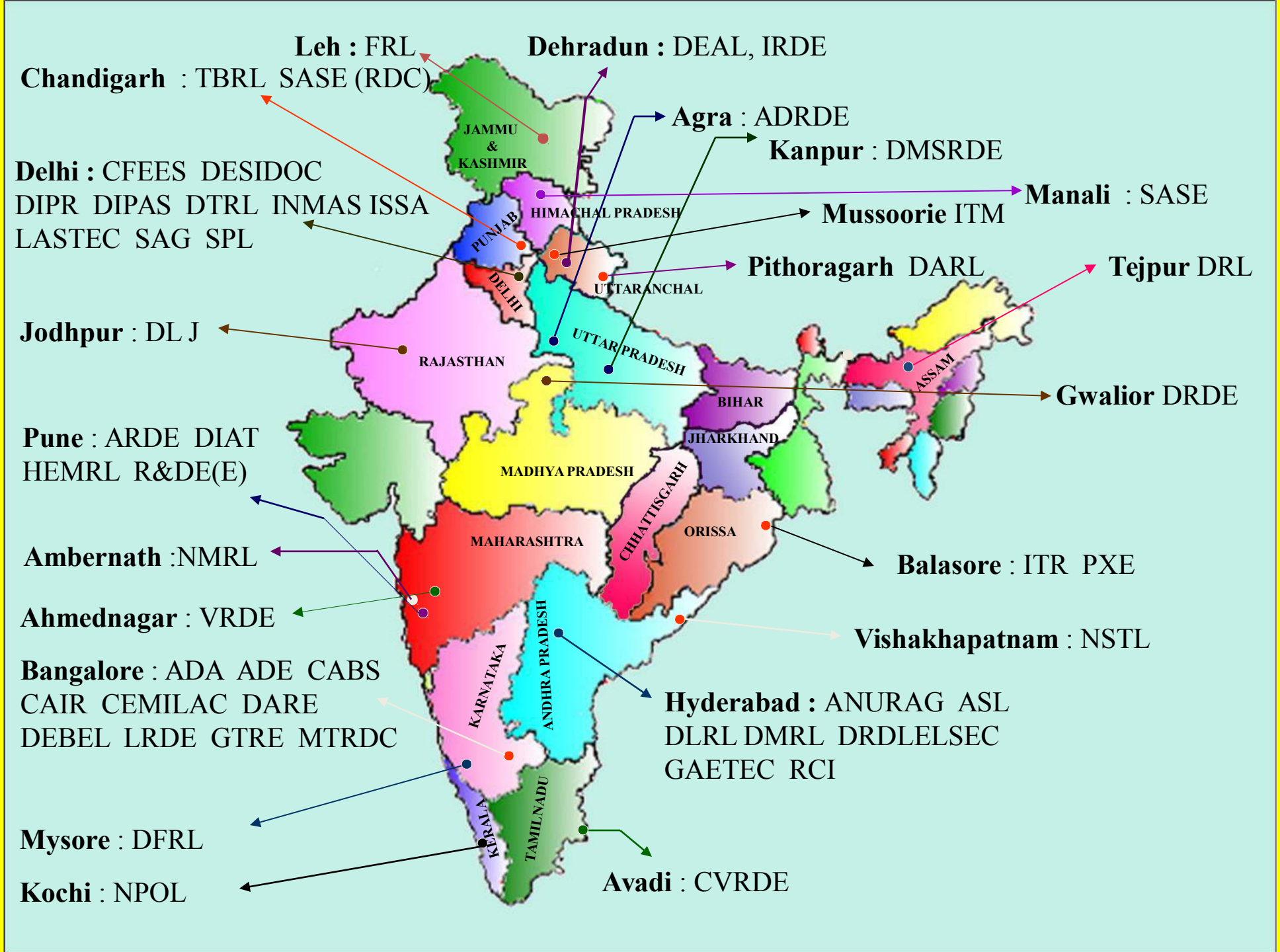
Steps in converting scientific knowledge to products for Induction



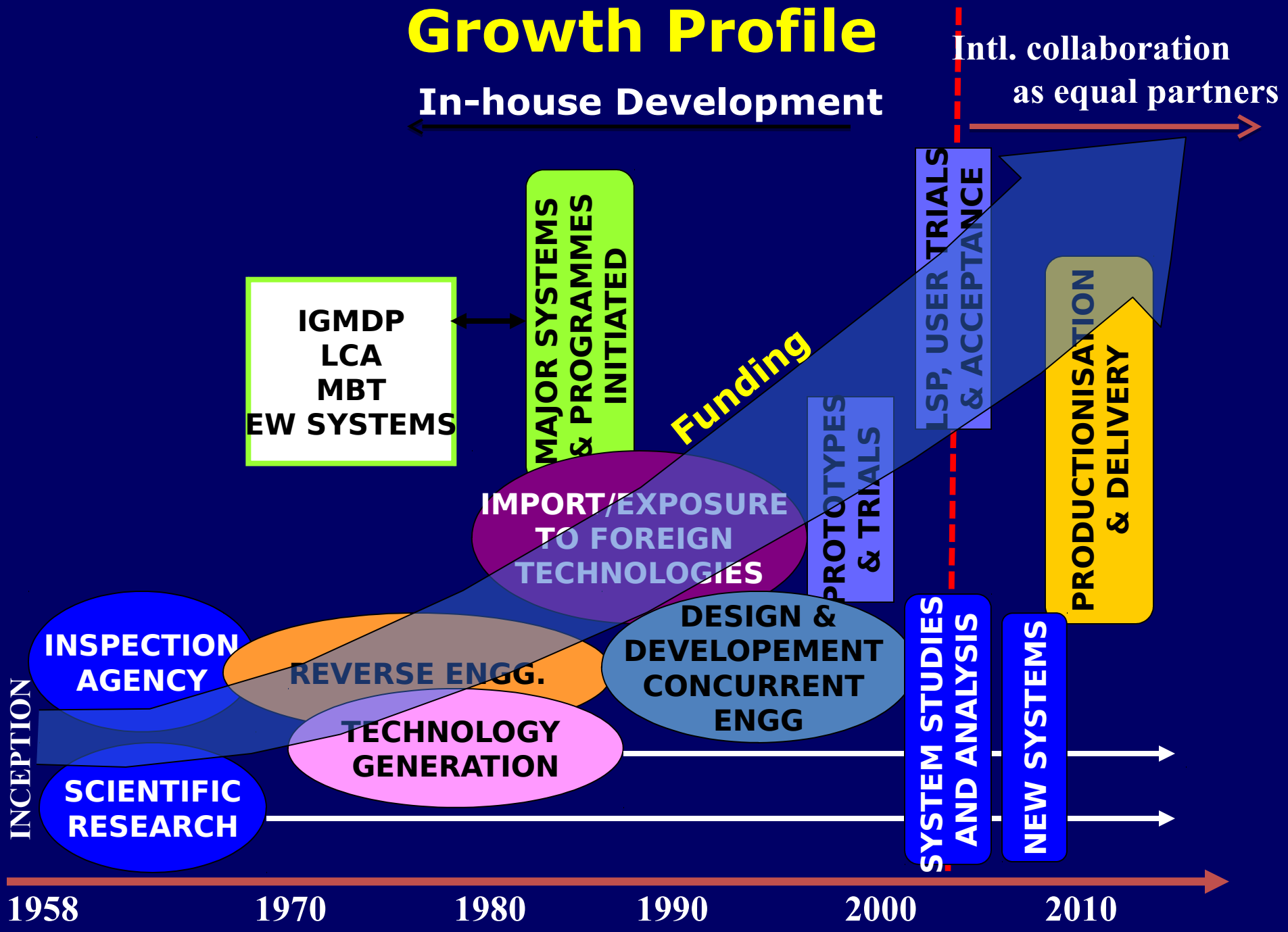
Department of Defence R&D Organisation

- **The largest R&D Organization in the Country (59 years old)**
- **Mandated to strengthen the Armed Forces**
- **Activities aligned with the National Defence Strategy**
- **Clustered into technological do**
- **Strong partnership with**
  - **over 150 academic institutions,**
  - **15 National S&T Agencies,**
  - **8 DPSUs, OFBs, PSUs and**
  - **nearly 800 private sector enterprises.**

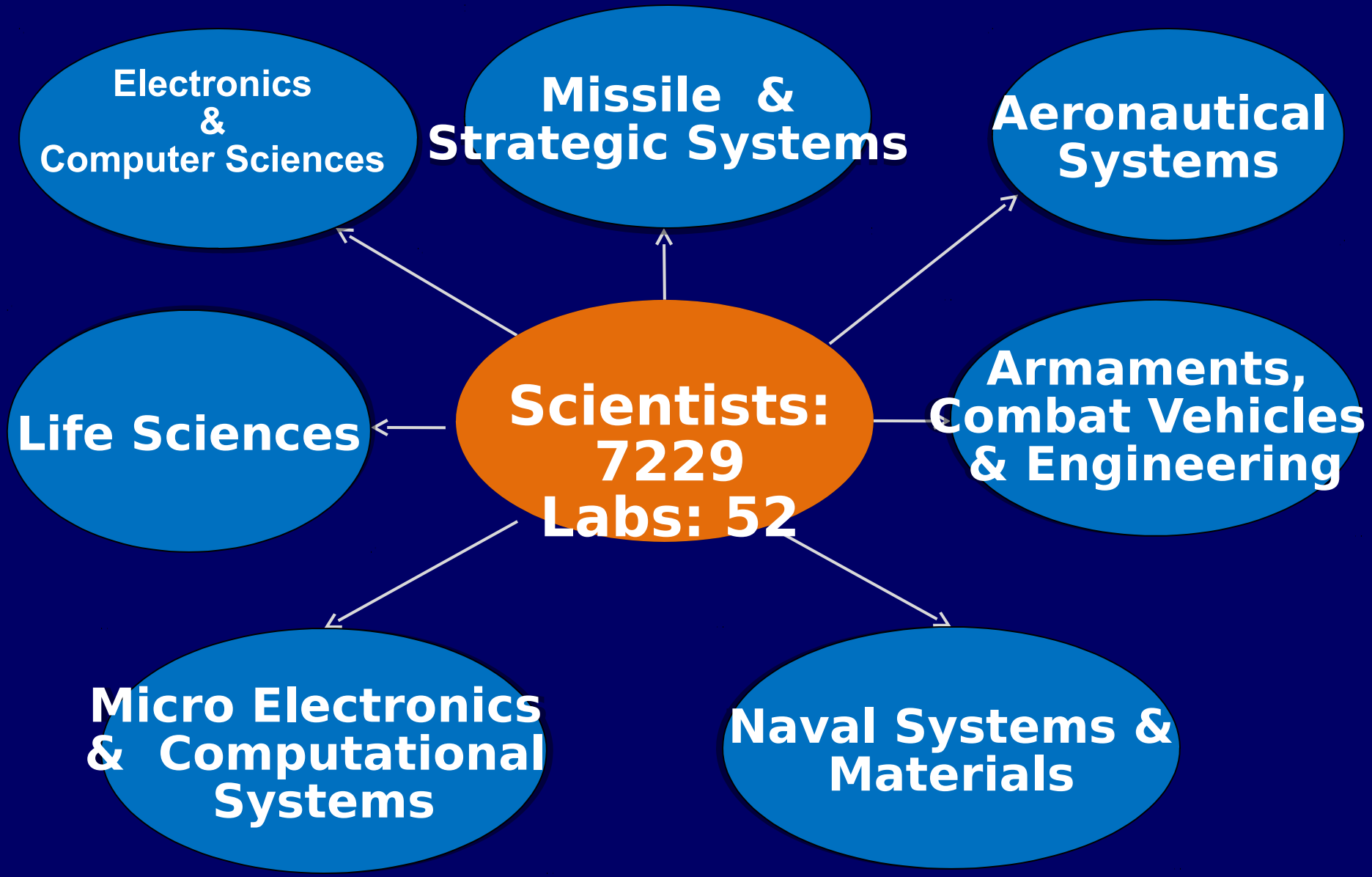
DRDO is the R&D back bone ADA, ATVP and many others are also there designated roles


Leh : FRL
Dehradun : DEAL, IRDE
Chandigarh : TBRL SASE (RDC)
Agra : ADRDE
Kanpur : DMSRDE
Delhi : CFEES DESIDOC
DIPR DIPAS DTRL INMAS ISSA
LASTEC SAG SPL
Manali : SASE
Mussoorie ITM
Pithoragarh DARL
Tejpur DRL
Jodhpur : DL J
Gwalior DRDE
Pune : ARDE DIAT
HEMRL R&DE(E)
Ambernath :NMRL
Balasore : ITR PXE
Ahmednagar : VRDE
Vishakhapatnam : NSTL
Bangalore : ADA ADE CABS
CAIR CEMILAC DARE
DEBEL LRDE GTRE MTRDC
Hyderabad : ANURAG ASL
DLRL DMRL DRDLELSEC
GAETEC RCI
Mysore : DFRL
Kochi : NPOL
Avadi : CVRDE
JAMMU & KASHMIR
HIMACHAL PRADESH
PUNJAB
DELHI
UTTARANCHAL
UTTAR PRADESH
RAJASTHAN
BIHAR
ASSAM
JHARKHAND
MADHYA PRADESH
CHHATTISGARH
ORISSA
MAHARASHTRA
KARNATAKA
ANDHRA PRADESH
KERALA
TAMILNADU

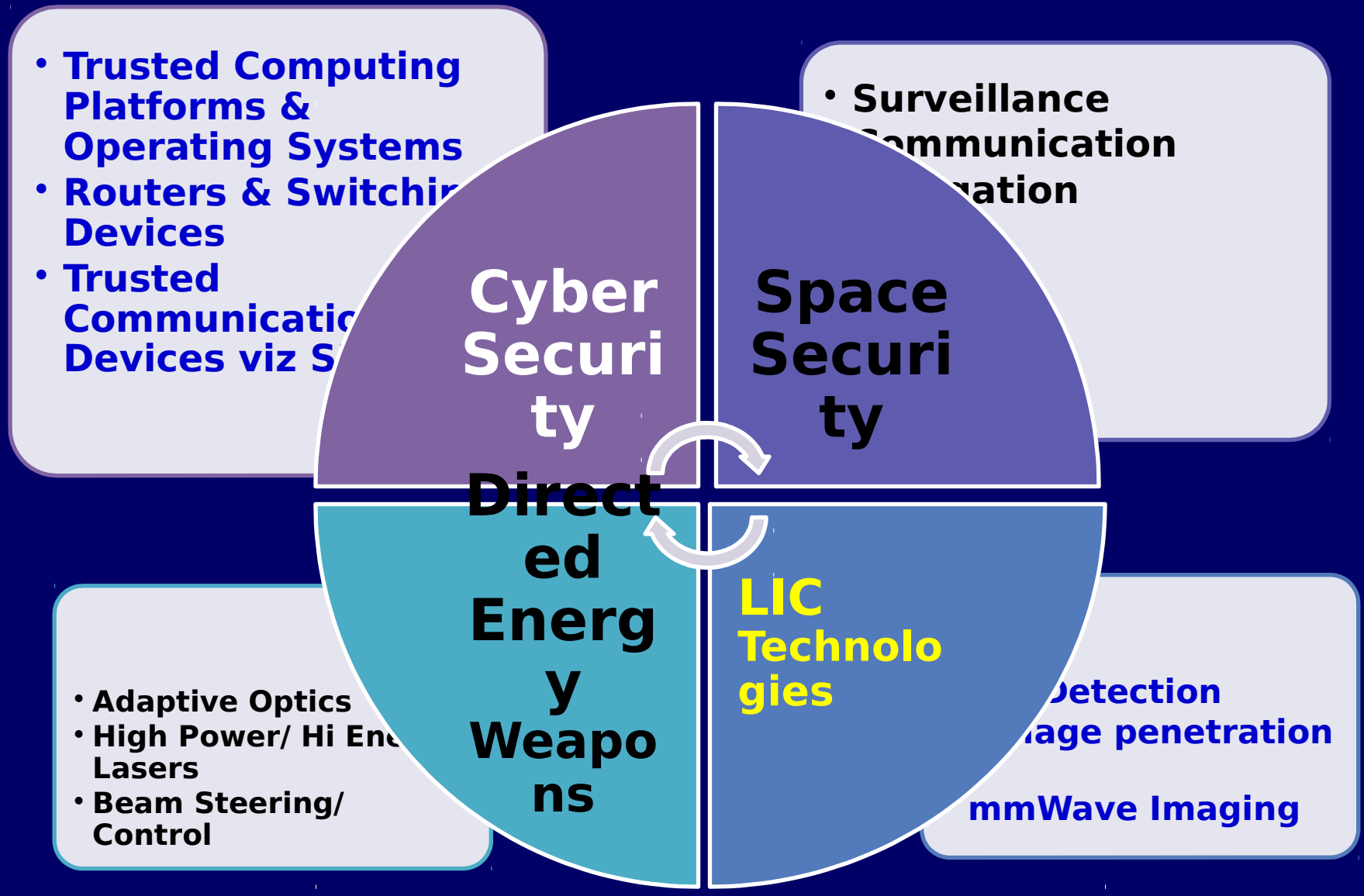
Growth Profile



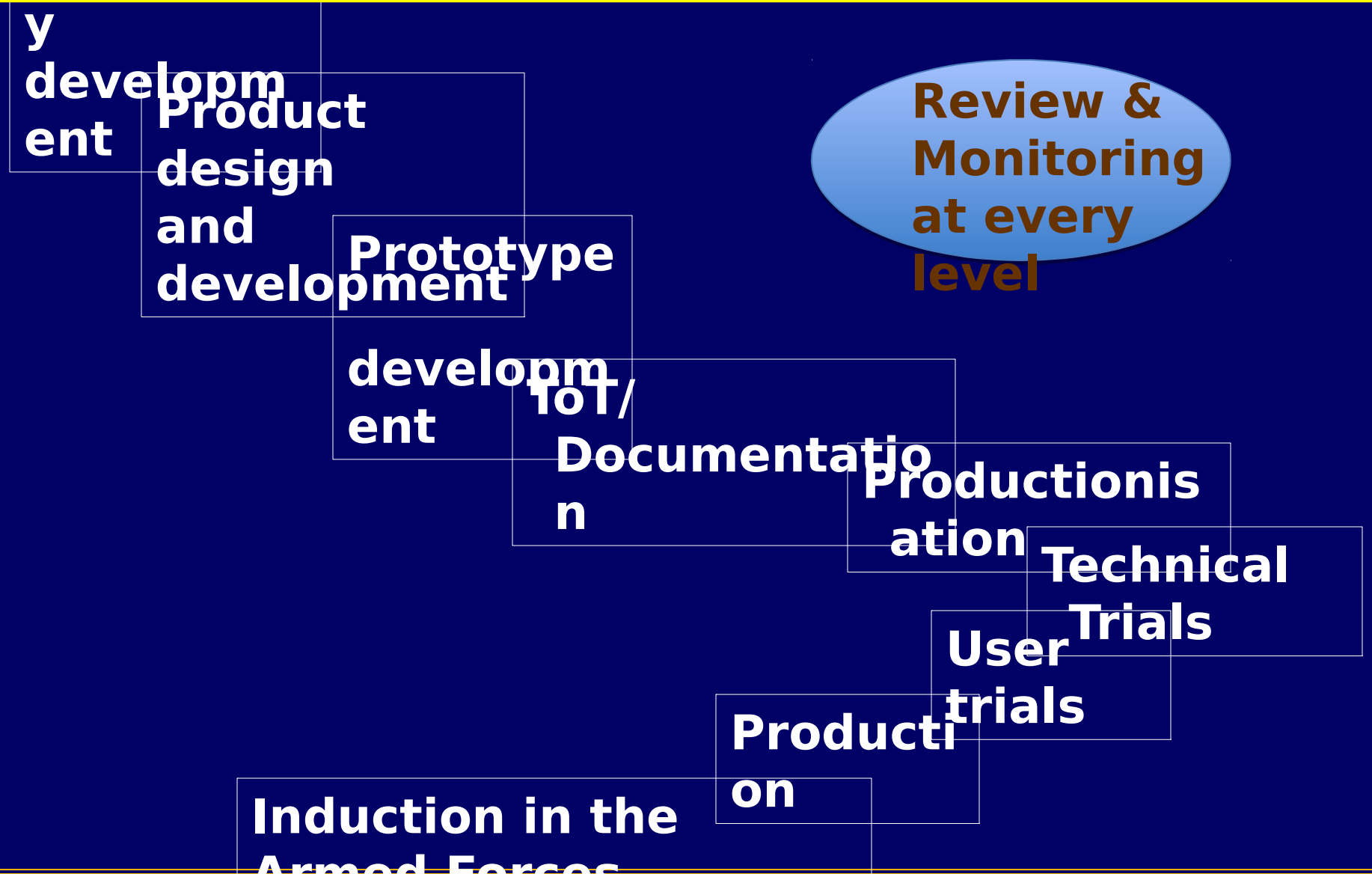
DRDO: Technology Spectrum



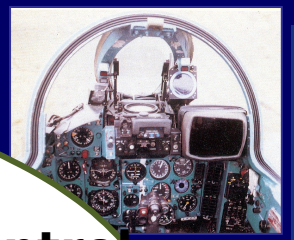
New Technology Initiatives



DRDO: Product Realisation Model



Aeronautics



Systems

- Airborne Early Warning & Control Systems (AEW&C)
- Light Combat Aircraft - Tejas
- UAVs- Lakshya, Rustom- I & II
- Electronic warfare systems
- Aerostats

technologies Developed

- ght control laws for unstable aircraft
- by wire digital flight control system
- en architecture mission avionics
- mposite structure
- State-of-the-art avionics for combat aircraft

Indian Missile Showcase

SSM

Prithvi I

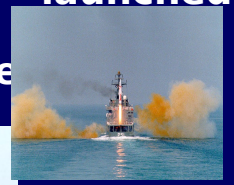
SSM

Prithvi II

Cruise Missile

Brahmos

Ship launched



Dhanush

IRBM

Agni 1

IRBM

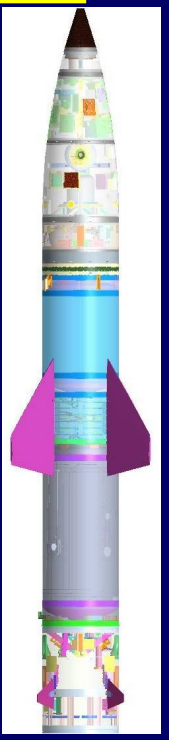
Agni 2

IRBM

Agni 3

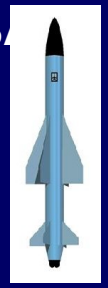
IRBM

Agni 5



PAD

LR SA



LR SAM

AAM

Astra

MR SAM

Akash

Anti Tank

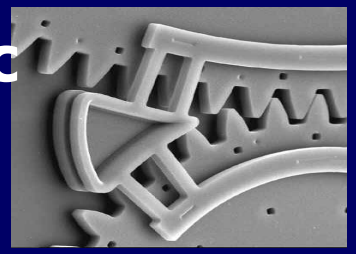
NAG 4 km

Technologies Established:

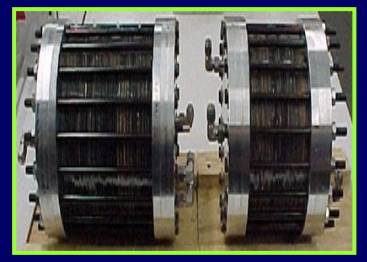
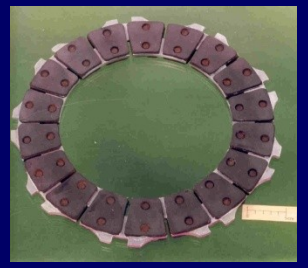
- Re-entry Vehicle Structure
- Twin engine liquid propulsion
- Pre-fragmented & Submunition Warhead
- Stabilization & Launch from Moving Platform

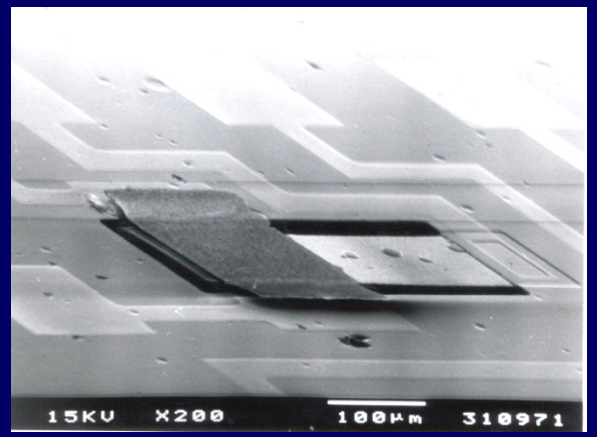
Material Sciences

- Conventional Metallic Alloys
- Metal, Ceramic, Polymer Matrix Composites
- Electronic & Photonic Materials
- Smart Materials
- Nanotubes
- Stealth Materials







Electronic Systems

- EW Systems- Samyukta,Sangraha, Divya Drishti
- Radars – BFSR, Revati, Aslesha, Rajendra, WLR
- Command Control & Comm. Systems;
- MMW Components & SATcom systems;
- Night Vision & electro optical instruments
- High power laser sources

ologies Developed

- High accuracy direction finding
- High power jamming
- High accuracy multi-channel receivers
- Network centric information fusion
- Multi beam & Slotted Wave guide antenna

COMBAT VEHICLES & ARMAMENTS

Pinaka MBRL

MBT Arjun

Bridging System

Armoured Ambulance

AERV

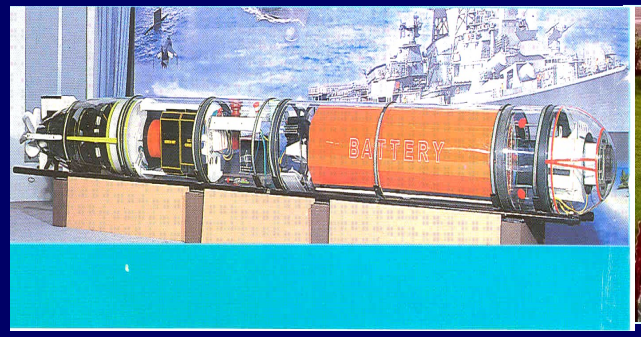
INSAS family

BLT –T72

Technologies Established

* Composite Armour
* Hydro-gas suspension
* Autofrettaged Gun barrels
* Integrated Fire Control System
* Flow formed rocket motor
* FRP launch tube

Naval Systems



SONAR TECHNOLOGIES

- Transducer Array
- State-of-art Signal processing techniques for target classification
- MEMS based Hydrophone

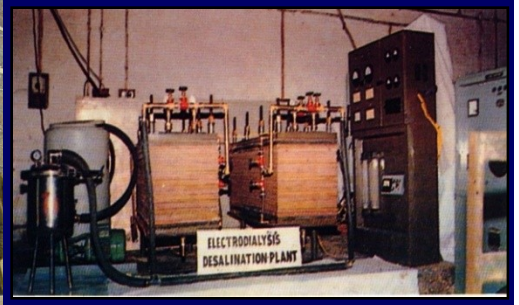
Underwater sensors and weapons; special materials and fleet support system, oceanographic studies

Torpedo Technologies

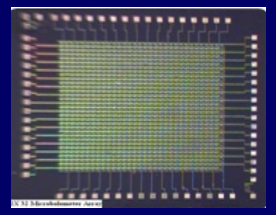
- Torpedo Propulsion Battery
- State-of-the-Art Homing System
- On-Board Computers & FCS

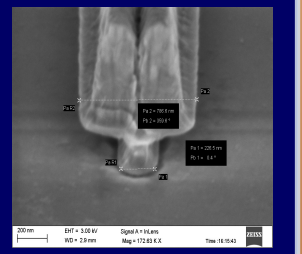
Life Sciences – The Man behind the Machine

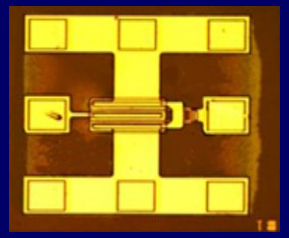
- Performance Enhancement
- Selection
- Training
- Health
- Protection
- Clothing
- Nutrition



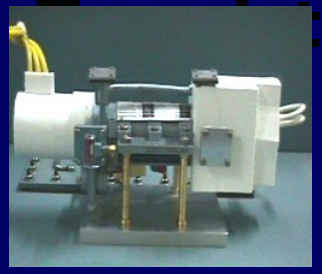
Micro Electronics & Devices

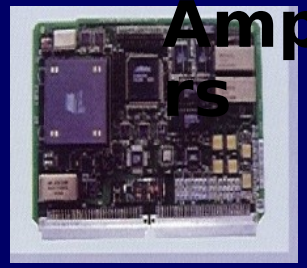






Solid State	Microwave	Microelectronics
• 32 X 32 Bolometer • Laser Diode Array • GaN HEMT	• High Power Traveling-Wave Tube • MPM • Microwave Amplifiers	• ASICs & SoC • Embedded Systems • MEMS





DRDO Technologies & Systems for LIC Operations

Combat Arms & Ammunition

- LMGs & Sub-machine carbines
- Grenades
- Plastic bullets/explosives
- Mines & Demolition devices
- Laser Dazzlers

Protection Systems

- Encryption & secure Comm.
- Bullet Proof Jackets& Vehicles
- B&C Agent protection
- Portable Jammers
- Stealth & Camouflage

Detection & Surveilla

- UAVs & Aerostats
- Radars and Surveillance systems
- Secure VHF & Satellite Communication
- Thermal Imaging, NV Sighting Devices
- Remotely Operated vehicles/robots

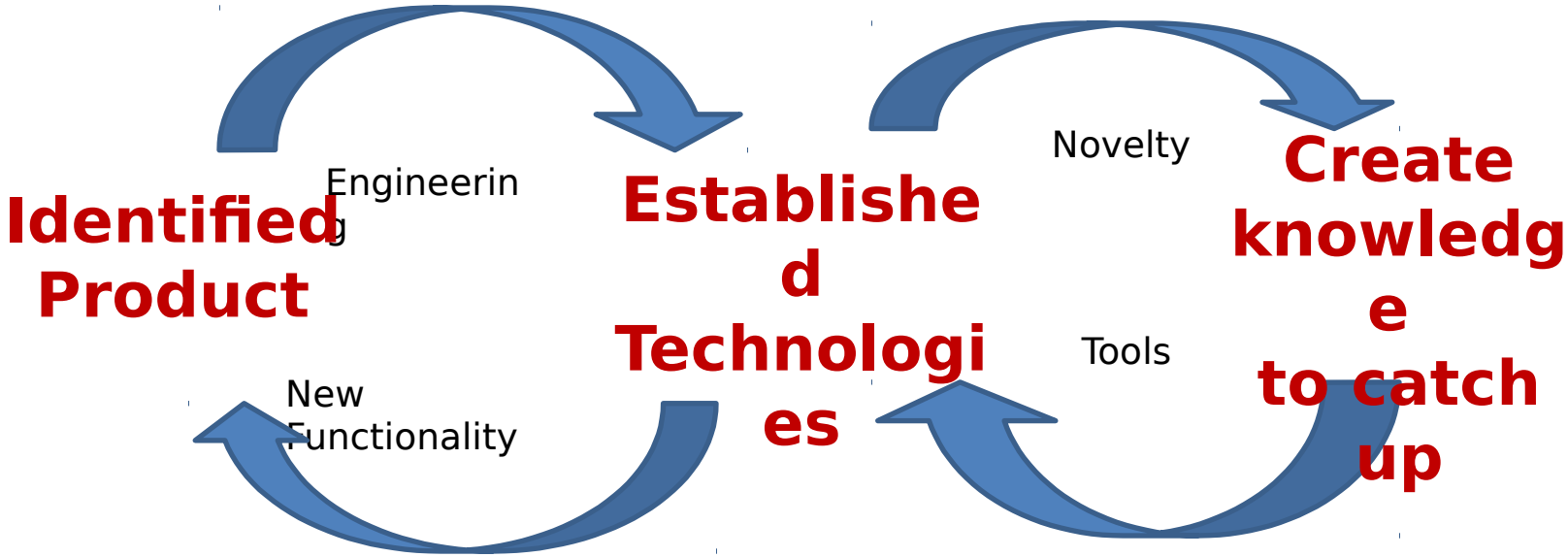
Support Systems

- Simulation & Modell…
- Combat Stress Behaviour
- Snow & Avalanche Studies
- Multi insect Repellant
- MRE & Survival Ration

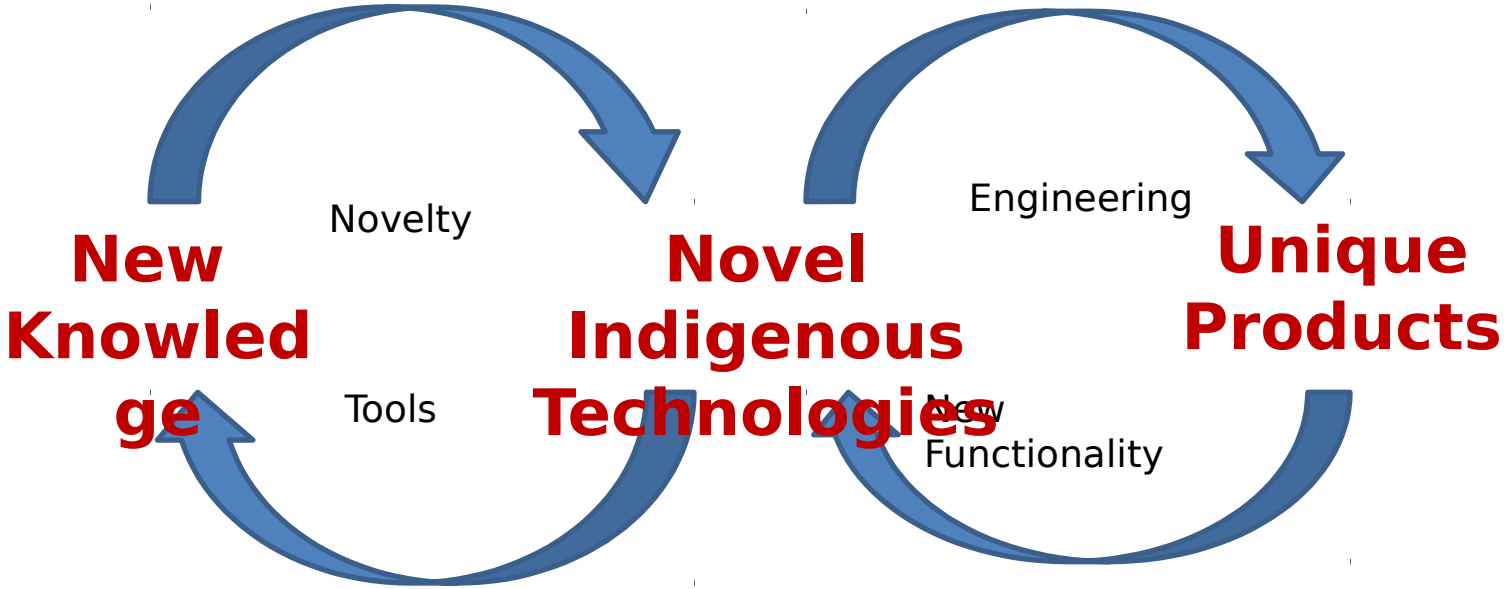
Projected Resources in LTTPP

Cluster	**Fund**	**Human Resources**
Naval	XXXXCr	DRDS: 151 DRTC: 117
Materials	3115 Cr	DRDS: 380
Total (For DRDO including all Clusters)	180043 Cr	DRDS: 7389 DRTC: 4217

Present top down approach for LTIPP requirements



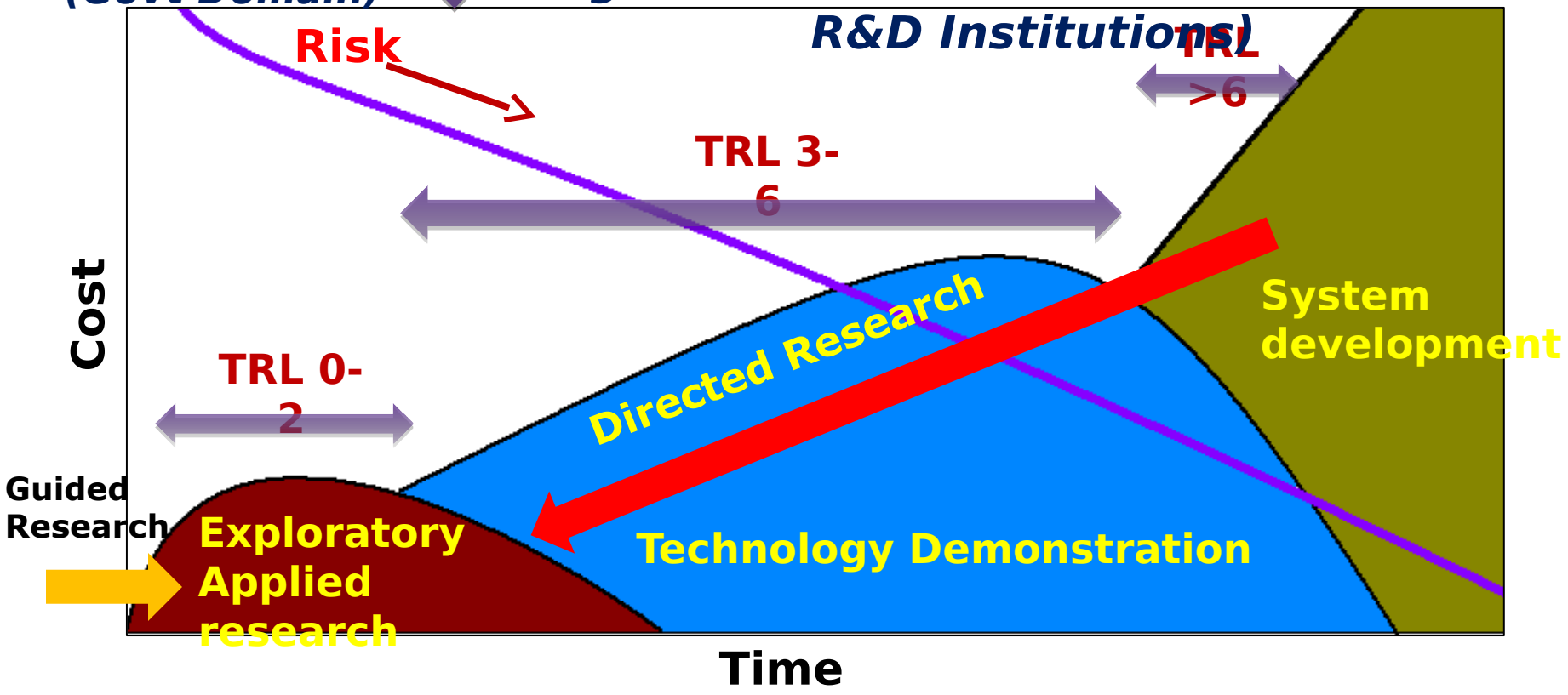
Proposed bottoms up approach beyond LTIPP/2027



Evolving contours of collaborative R&D

Need to create appropriate eco-system (Govt Domain)

Collaboration on need basis to reduce time from concept to induction (Originates from DGs and Lab Directors of R&D Institutions)



Phases of high-end technology development

TECHNOLOGY MANAGEMENT

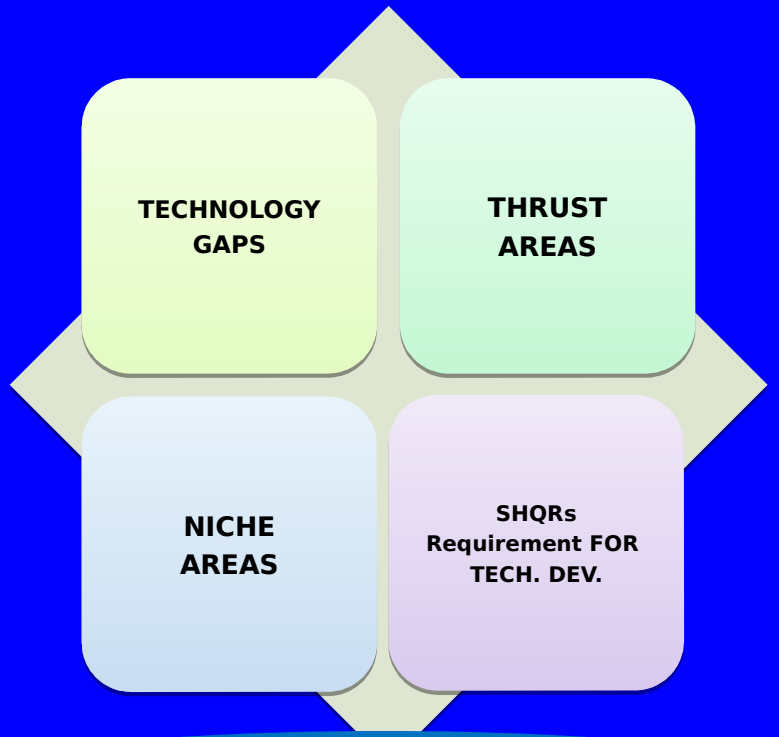
ACADEMIA & RESEARCH INSTITUTES

INDUSTRY

- Directed Research Centers
- Research Boards (NRB,ARMREB, LSRB & AR&DB
- Extra Mural Research & IPR
- Contract for Acquisition of Research Services (CARS)
- Technology Development Fund (TDF) Scheme
- IMPRINT Programme
- UAY (Ucchtar Avishkar Yojna)

LTIPP (USER SHQrs)

LTTPP (DRDO)



Advancement on Technologies

READINESS FOR MISSION MODE PROJECTS & TECHNOLOGY DEVEVELOPMENT WITH INDUSTRIES

ABOUT THE PROGRAMMME

Technology Development Fund (TDF) Scheme has been established to promote Self-Reliance in Defence Technology as part of Make-in-India Initiative.

Vision

Development of Defence and Dual use Technologies

To create an ***eco-system for enhancing cutting edge technology capability by inculcating R&D culture in Industry*** for building indigenous state-of-art systems for defence applications.

ELIGIBILITY

Public and Private Sector Industry ***Especially MSMEs*** that may work in collaboration with the ***academia or research Institutions*** to carry out innovation, research and development

INDIAN LAWS

The Industry has to be owned and controlled by ***Indian Citizen Industry with Excess of 49%*** foreign investment will not be considered

Requirements
ARMY, NAVY AIRFORCE, DDP & DRDO

Industry registration

Launching of Projects and Seeking Proposals

Registrations till date on TDF Web-portal

Industries	1630
Individual Experts	514
Academia	299

VALID REQUIREMENTS RECEIVED TILL DATE (31)

ARMY	AIR FORCE	NAVY	DRDO
12	8	5	6

Execution under TDF

Valid requirement	Projects sanctioned	Projects Under Sanction	DPR Stage	AoN Stage	Feasibility Studies
31	3(4)	4	1	17	6

SCOPE OF THE PROJECTS TO BE FUNDED

A

- Products having **potential use** for the Tri-Services
- Components / assemblies whose **technologies doesn't exist with the Indian industry** and /or need ; Significant improvement /Up-gradation

B

- Further **developments in existing products / process / application**
- **Upgrades** in terms of reduced material consumption

C

- Improved functioning, improved quality etc. **resulting in overall cost reduction**.
- Technology readiness level up-gradation from **TRL-3** onwards to realization of products as per Tri-Services requirements.

D

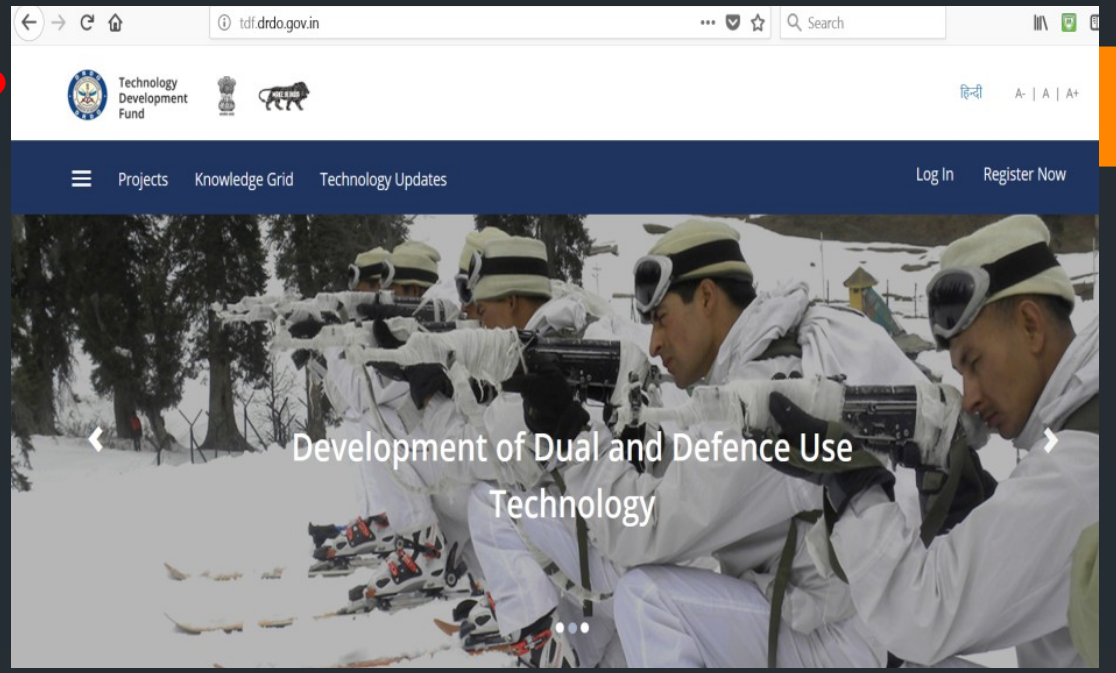
- Development of **futuristic technologies / innovative products** having defence application or **dual use technology**

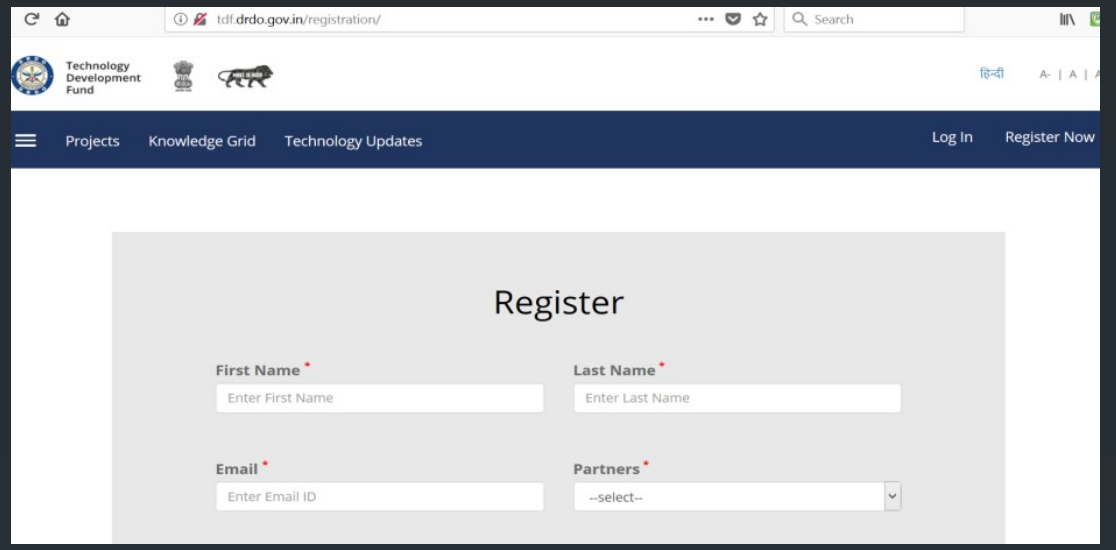
How to apply for TDF projects ?

visit at : https://tdf.drdo.gov.in

- Developers / Industry can submit the proposal against the requirement only after registration, therefore they are advised to Create Account
- ***Requirements for inviting EoIs can been seen as;***
  - Ongoing Projects
  - Closed projects
  - Upcoming projects
  - Feasibility Study

- Accordingly within time frame Industry can submit their proposal





IMPRINT – Programme

(DRDO is one of the participating Department)

Signatories of the MOU for IMPRINT

CENTRAL MINISTRIES

Sl No	Name of Ministry
1	Human Resource Development
2	AYUSH
3	Drinking Water and Sanitation
4	Earth Science
5	Environment, Forests and Climate Change
6	Health and Family Welfare
7	New and Renewable Energy
8	Power
9	Railways
10	Road Transport and Highways
11	Rural Development
12	Steel
13	Textiles
14	Urban Development

CENTRAL GOVERNMENT DEPARTMENTS

Sl No	Name of Department
1	Atomic Energy
2	Biotechnology
3	Defence Research and Development Organization
4	Electronics and Information Technology
5	Heavy Industries
6	Indian Council of Medical Research
7	Industrial Policy and Promotion
8	Pharmaceuticals
9	Science and Technology
10	Scientific and Industrial Research
11	Space

Mandate of IMPRINT

AIM: INCLUSIVE GROWTH AND SELF RELIANCE

- Translation of knowledge into viable technology
- Identify major engineering challenges in 10 domains
- Domain > Themes > Targets > Topics (with 100 variants)
- Million challenges for billion minds (by crowd sourcing)
- Industry participation highly encouraged not mandatory
- Product/process ready for demonstration or deployment

Million Challenges, Billion Minds

Ten Technology Domains of IMPRINT

Living world


Healthcare Technology


Sustainable habitat (urban/rural) design


Energy Security

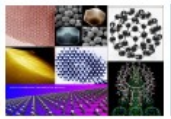

Water and River Systems


Environment and Climate Change

Materials world


Manufacturing Technology


Defense and Security


Nano-Science and Technology


Advanced Materials


Computer Science and ICT

Acknowledgement

Secretary DDR&D

Arjun Kumar , Addl. Director DDR&D

Thanks

JAI HIND