RESEARCH PANELS UNDER ARMREB

1. High Energy Materials (HEM)

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Thrust Areas of Panel 'HEM'

A. **Synthesis of New Class of Materials**
- Strained poly-nitro-cyclic compounds (bicyclic, tricyclic, polycyclic).
- Poly-nitro aromatics & hetero aromatics.
- Compounds with mixed functional grounds (nitro, azido, nitro, amino).
- High temperature nitration.
- New high-energy binders and polymer materials.
- Photo-synthesis, laser induced and microwave initiated reactions.
- Nano materials for High Energy Systems.

B. **Propellants & Explosives**
- Propellants with high burning rates and explosives with low vulnerability.
- Pulse detonics engine.
- High combustion / detonation efficiency.
- Stability & aging aspects.
- Reusing and disposal of aged propellants and explosives.
- Techniques for safety and hazard investigations.
- Life prediction of propellants and explosives.
- Biodegradation of High Energy Materials.

C. **Physical Studies**
- Studies on composition of reagents and yield enhancement of new HEMs.
- Reproducibility of techniques and standardization.

D. **Modeling**
- Software development for explosives, propellants and pyrotechnics.
- Model studies to determine the efficiencies of systems and prediction methods

2. ***Materials for Armament Applications (MAA)***

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Thrust Areas of Panel 'MAA'

A. **Advanced Study of Materials**
   i. Behaviour at high strain rate
   ii. Low temperature impact properties
   iii. Mechanics of material behaviour

B. **Development of New Materials**
   i. Ultra high strength metallic materials
   ii. High impact properties at sub zero temperature

C. **Advanced Composites**
   i. Metal matrix composites
   ii. Polymer matrix composites

D. **Light Weight Materials**
   i. Special aluminum alloys
   ii. High strength low density alloys
   iii. Titanium alloy

E. **Nano Composites**

F. **Materials Processing Technologies**
   i. Power Metallurgy
   ii. Liquid Forging
   iii. Near Net Shape Forming

G. **Advanced Manufacturing processes**
   i. Filament winding for long barrels
   ii. Strip Lamination process for Rocket Motor Tubes
   iii. Flow Forming Techniques for Rocket Motor Tubes
   iv. Metal Injection Moulding

H. **Surface Engineering**
   i. Special Coating Technique
   ii. Tribological Processes

I. **Smart Materials, their use and Development**

J. **NDT of Materials**

3. Combustion Detonics and Shockwaves (CDSW)

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Thrust Areas of Panel 'CDSW'

- Initiation of Explosives
- Overdriven Detonation Waves
- Equation of State of Explosives
- Hazard Assessment, Sensitivity & Safety Related Responses
- Advanced & Novel Experimental Techniques
- Dynamic Shock Loading of Materials
- Blast Damages, Effects & Scaling
- Mechanical Properties of Explosives
- Micro Detonics
- Detonation in Gaseous Media
- Combustion studies

4. Armament Sensor & Electronics (ASE)

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Thrust Areas of Panel' ASE'

A. **Sensors**

i. RF Sensors based on CW, FMCW or pulsed system.
ii. IR Micro Wave & Millimetric Wave System
iii. Laser system for height sensing.
iv. System with inbuilt intelligence for target discrimination.
v. Incorporation of ECCM features.

B. **Power Source**
   i. Small size turbogenerator
   ii. Reserve batteries
   iii. Primary batteries

C. **Electro Mechanical Sensors**
   i. Seismic Sensors
   ii. Electro impulse generator
   iii. Acceleration sensors
   iv. High sensors

D. **Electro Potting Material**
   i. Silicon and Resins
   ii. Polyurathene foam
   iii. Study of electrical & mechanical properties during storage and high environment

E. **Wireless Technology**
   i. Remote setting of electronic timer
   ii. Remote activation and deactivation of electronic system.
   iii. Telemetry and guidance system

F. **Design Reliability**
   i. Reliability of single shot systems
   ii. Modeling and Simulation

G. **Signal Processing**
   i. Digital signal processing of real time systems.
   ii. Building intelligence into systems

H. **Motor Drive Electronics & Control**
   i. Simulation and modeling.
   ii. Automation

5. Armament Design, Mechanism & Ballistics (ADMB)

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Thrust Areas of Panel 'ADMB'

A. **Mechanism**
   - Fin & Flap deployment & control mechanisms
   - In flight Para deployment & detachment mechanisms

- Dispensation & Ejection Mechanisms
- Fuzing & Safety Arming Mechanisms (Pyro as well as DC motor driven)
- Ballistic fairing opening mechanisms
- Aircraft weapon release and separation mechanisms
- Pilot safe ejection mechanisms
- Micro mechanisms for fuze & senor application
- Ammunition handling systems
- Auto feed mechanisms
- Recoil mechanisms
- Gas operated for weapon automation
- Servo control systems for alignment of guns

B. **Ballistics**

- Internal Ballistics (funs & Solid rocket motors)
- Launch dynamics & Intermediate ballistics
- External & Aero Ballistics
- Hydro/ Underwater ballistics
- Terminal ballistics
- Problems related to Ballistic Meteorology (surface & upper air measurements)
- Hypervelocity projectile in bore and external ballistics

C. **Armament Design**

- Noise suppressors and flash eliminators
- Reliability modeling & prediction for various mechanisms & systems
- EM propulsion – Hyper velocity gun & projectile design
- Systems for high pressure artillery guns
- Composite Sabot design
- Design of high L/D (>24) rocket systems
- Design of high L/D (>25) KE Penetrators

6. Safety and Test & Evaluation Panel (STE)

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Thrust Areas of Panel 'STE'

A. **Explosive Safety**

- Demilitarization Techniques, Disposal of Aged Propellants and Explosives
- Blast Structure Interaction
- Technologies and devices for blast mitigation
- Design of Protective/Containment Structures and Mobile Platforms against External Threat
- Safe Technologies for tracking of explosives/ammunitions
- Techniques for Safety and Hazard Investigation

B. **Fire Safety**

- Flame dynamics and suppression modeling
- Green materials and methodologies for fire suppression
- Fire protective coatings
- Multifunctional waterproof, breathable & CBRN resistant next generation fire protective suits
- Modeling of fabrics and fire protective suits for different fire environments
- Fire suppression chemicals
  - Clean fire extinguishants
  - Fluoro-surfactants and polymers
  - Evaluation of physico-chemical properties
  - Molecular modeling for design of fire extinguishing chemicals
  - Evaluation of atmospheric parameters like ODP, GWP, ALT
  - Toxicity evaluation of clean fire extinguishing agents
  - Analysis of thermal decomposition products of fire extinguishing chemicals
- High Performance fire retardant/resistant materials
- Self extinguishing materials
- Anti-freeze chemicals/agents
- Thermal behaviour of materials

C. **Environment Safety**

- Environment friendly Hazwaste disposal technologies
- Haz Chem management
- Eco-friendly Materials:
  - Molecular modeling & process development
- Atmospheric chemistry of hazardous species/chemical agents
  - Environmental modeling: fate and transport
- Safety management tools & techniques
- Biodegradation of High Energy Materials
- Risk and Hazard Analysis of all Hazardous Processes/Facilities

D. **Nano Safety**

- Safety regarding production, storage, transportation and handling of nanomaterials and devices
- Environmental modeling: fate and transport of nanomaterials

- Regulations regarding handling of nanomaterials and devices
- Risk assessment for nanomaterials
- Characterization of nanomaterials w.r.t. safety

E. **Test and Evaluation**

- Data Mining of measured parameters of Artillery Weapon Systems (Soft Computing Method)
- System Engineering Approach to Range Layout
- Advanced Modelling and Simulation Techniques for Virtual Artillery Firing Range
- Development of Lab Model for Gun/Tank System Simulation
- Reliability Model for Artillery Weapon Components
- Acoustic Signal Processing for projectile trajectory characterisation
- Shell Telemetry for test and evaluation of artillery projectile
- Fatigue characterisation of weapons system components
- Risk Assessment model for ammunition handling
- Virtual target by Optics/Laser Method
- High speed imaging analysis of projectile