

# **Innovative Concepts and Special Focus Projects**



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## Innovative Concepts and Special Focus Projects

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### ■ Description:

- This Research Area solicits innovative concepts and special-focus projects that can provide game-changing solutions to increase the performance and reduce the cost of the future BMDS.
- This year, the Research Area emphasizes new sensor strategies to detect and track ballistic missiles, although its mission spans the full spectrum of BMDS future capabilities.
- Ideas solicited include high performance and revolutionary advanced sensor approaches such as Type II Strained Layer Superlattice (SLS) and other III-V materials, smart focal plane arrays, and associated read-out integrated circuits.



# Develop and Demonstrate High Performance Infrared Focal Plane Arrays with Advanced Quantum Structures

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- **Topic Objective:** Develop next-generation high-performance infrared (IR) focal plane arrays (FPAs) by exploring advanced quantum structures and utilizing innovations in nano-engineering.
- **Support/Integration:** All programs that need high-performance IRFPAs, e.g., PTSS, SM3 ABL, air-borne missile defense. Two/Three-letter support: DV, SM3, DEE, TH, AL.
- **Technology Description:** Focus on high risk/ high reward innovative approaches that are not covered by other programs, due to risk factors, budget constraint, and timing. More specifically, develop non MBE growth techniques on alternative substrates that may offer better uniformity and large format, broaden the scope for etching chemical and passivant selection that offers a stable mechanism to eliminate leakages, search for novel dry-etching and passivation protocol that leads to higher detectivity .
- **Benefits:**
  - Best sensor performance – early detection, complete coverage, comprehensive discrimination , large system trade space, and smaller constellation size for lower BMD system cost.
  - Increase detectivity 9X → increase range 3X, earlier detection and more time for discrimination, maneuver, and kill ; Decrease constellation size.
  - Increase format 2X → increase footprint 2X, or increase spatial resolution 2X.
  - Increase operating temperature by 20K → decrease weight and power.
  - Add multiple spectral bands → realization of spectral discrimination capability.



# Smart Infrared Focal Plane Arrays and Advanced Electronics

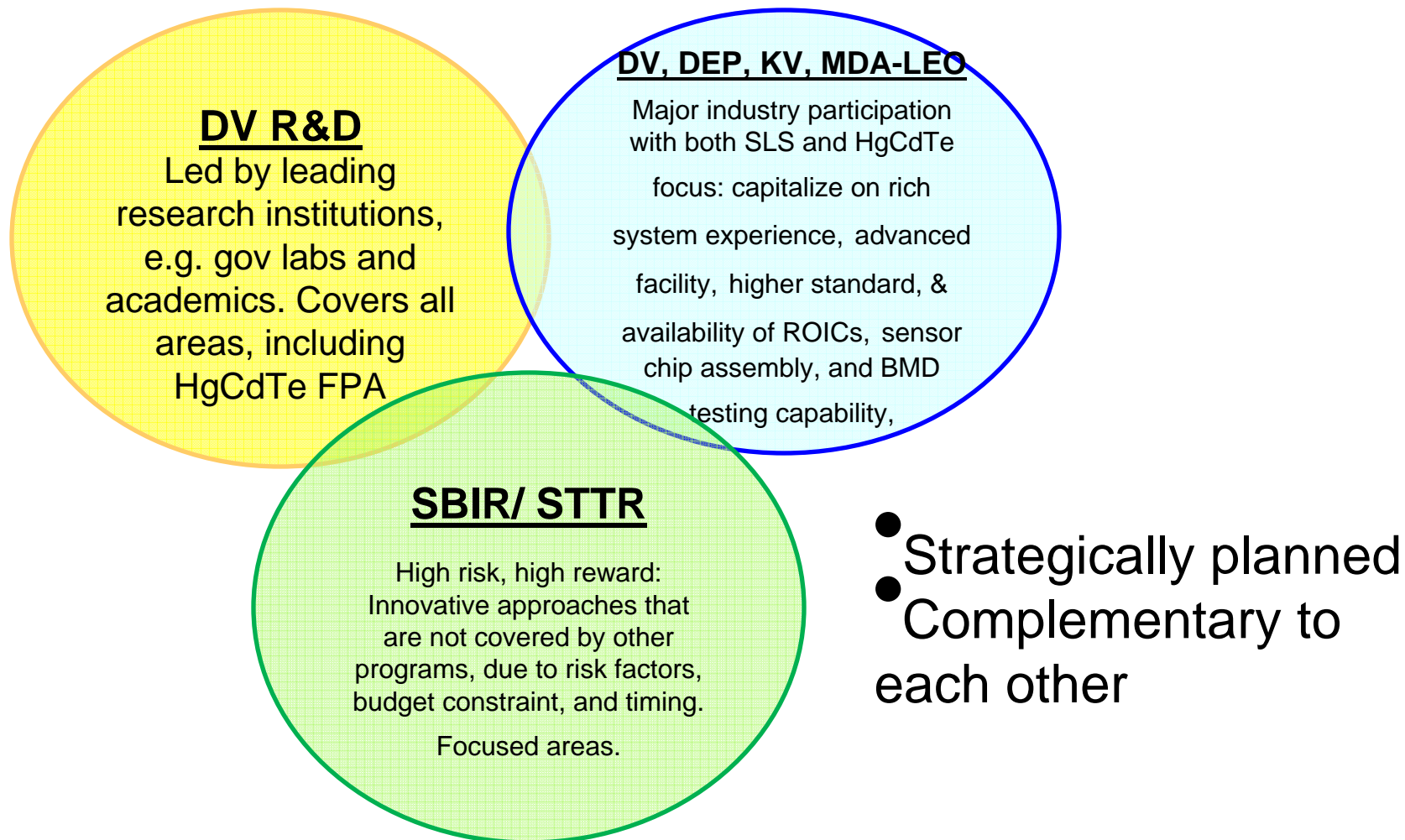
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- **Topic Objective:** Develop and demonstrate advanced read out integrated circuits (ROIC) for smart infrared focal plane array that can operate robustly under ballistic missile defense environment. Explore innovative ideas in ROIC and detector structures to mitigate all adverse space radiation effects.
- **Support/Integration:** All programs that need high-performance IRFPAs that can overcome adverse effect due to radiations in permanent or transient space environment, e.g. PTSS, SM3, THAAD. Two/Three-letter support: DV, SM3, TH, AL, PTSS.
- **Technology Description:**
  - Understand the phenomenology of radiation effect on IRFPA performance, including newly developed devices that lack prior knowledge.
  - Devise mitigation strategy and techniques that address all aspects of an IRFPA, including smart device architecture, substrate and detector materials, ROIC, and on-chip and off-chip signal processing.
- **Benefits:**
  - Robust infrared sensor performance under long-term and transient adverse radiation environment.



## How Do These SBIR Topics Fit the Overall MDA Programs



- DV R&D cutting edge research & development, theoretical modeling, feasibility study, single-device demonstration.
- FastFPA: substantial performance improvement, system-level technology demonstration, hardware-in-the-loop (HWIL) testing.
- SBIR/STTR: alternative approach, e.g. MOCVD material growth. Supplementary to other programs, e.g., rad-hard issues.



## Example: Next-generation IRFPA Development Roadmap, Task Breakdown, and the Role of SBIR

