

Raytheon Environmental Sensors Web Branch 2009

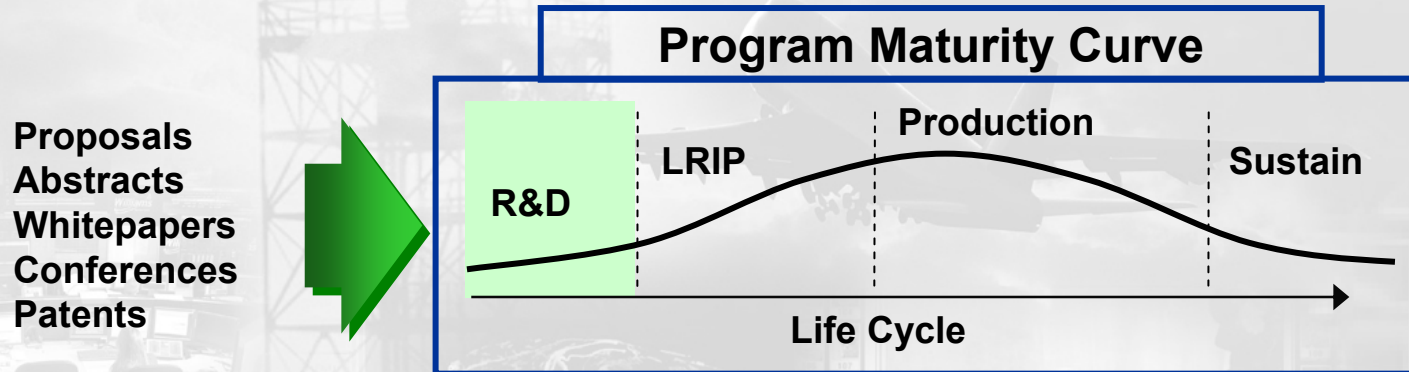
Vice President Advanced Technology Programs

24 September 2009



Advanced Technology Programs

Vision: To Lay the Technical Foundation and Relationships for Future Growth



■ Technology Program Capture and Execution (6.1, 6.2, 6.3)

- Basic research, applied research, and Advanced Technology demonstrations to support new & existing Raytheon business thrusts
- 100+ active technology programs
- Sizes range from <\$10K to over \$50M

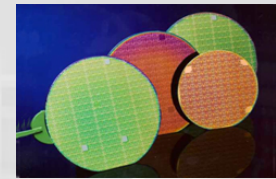
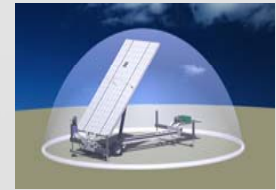
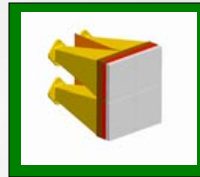
■ Leading the Raytheon IDS push into adjacent markets

- Nuclear Detection
- Explosives Detection
- Cargo Security
- Environmental Sensing
- Chemical / Biological Detection
- Software Tools

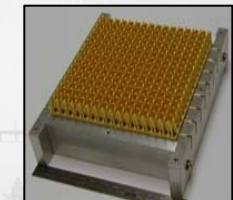
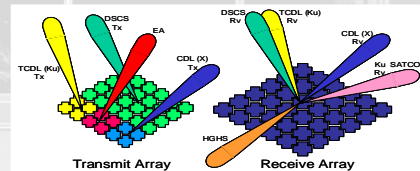
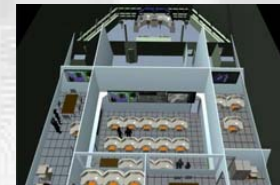
Technology Capture Focus Areas

Focus Areas

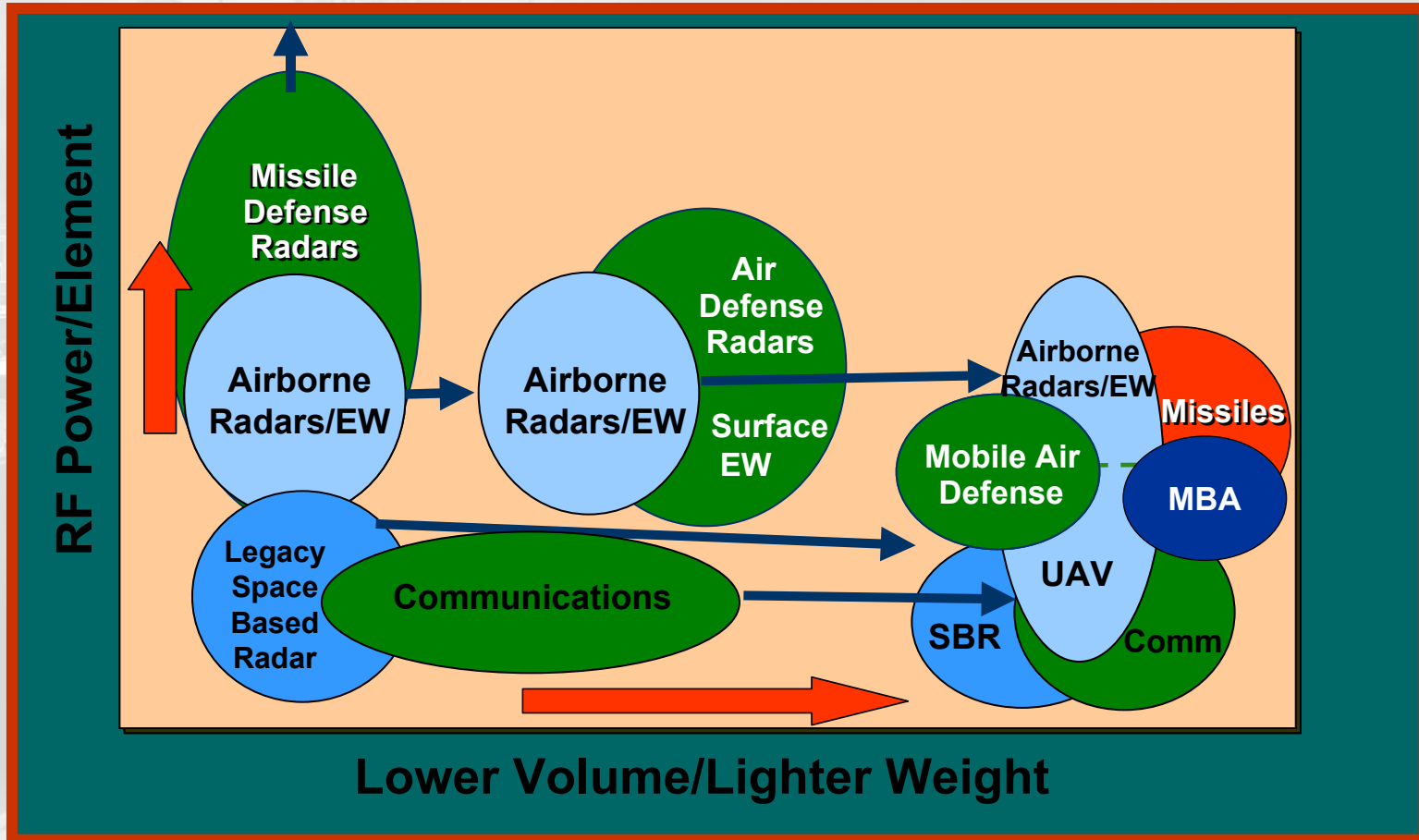
- RF Systems
- RF Components
- Maritime Systems
- Homeland Security
- Microelectronics
- Electro-Optic Systems
- Software Systems
- Advanced Manufacturing
- Environmental Systems Integration
- Advanced Materials
- Power Systems and Robotics
- Acoustics and Dynamics
-



- Rapid response to customer needs
- Dedicated support from Contracts, Integrated Supply Chain
- Experienced Program and Capture managers



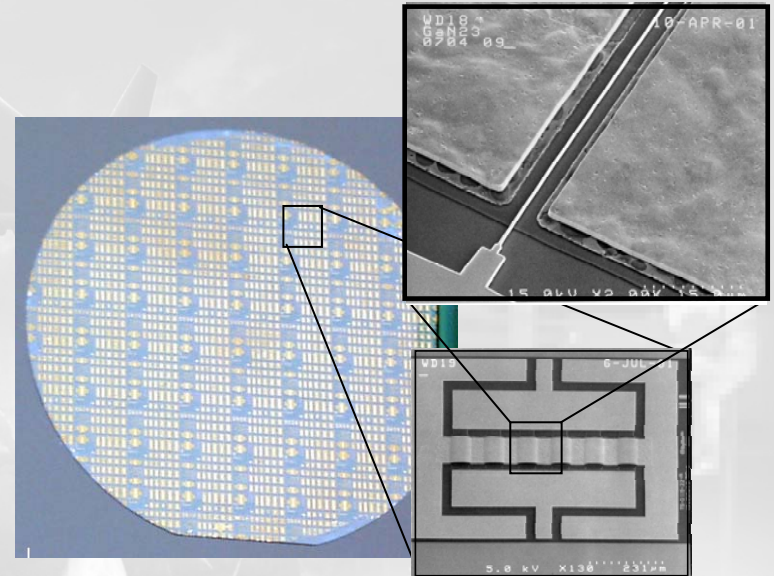
Mission Needs Drive the RF Sensor Technology



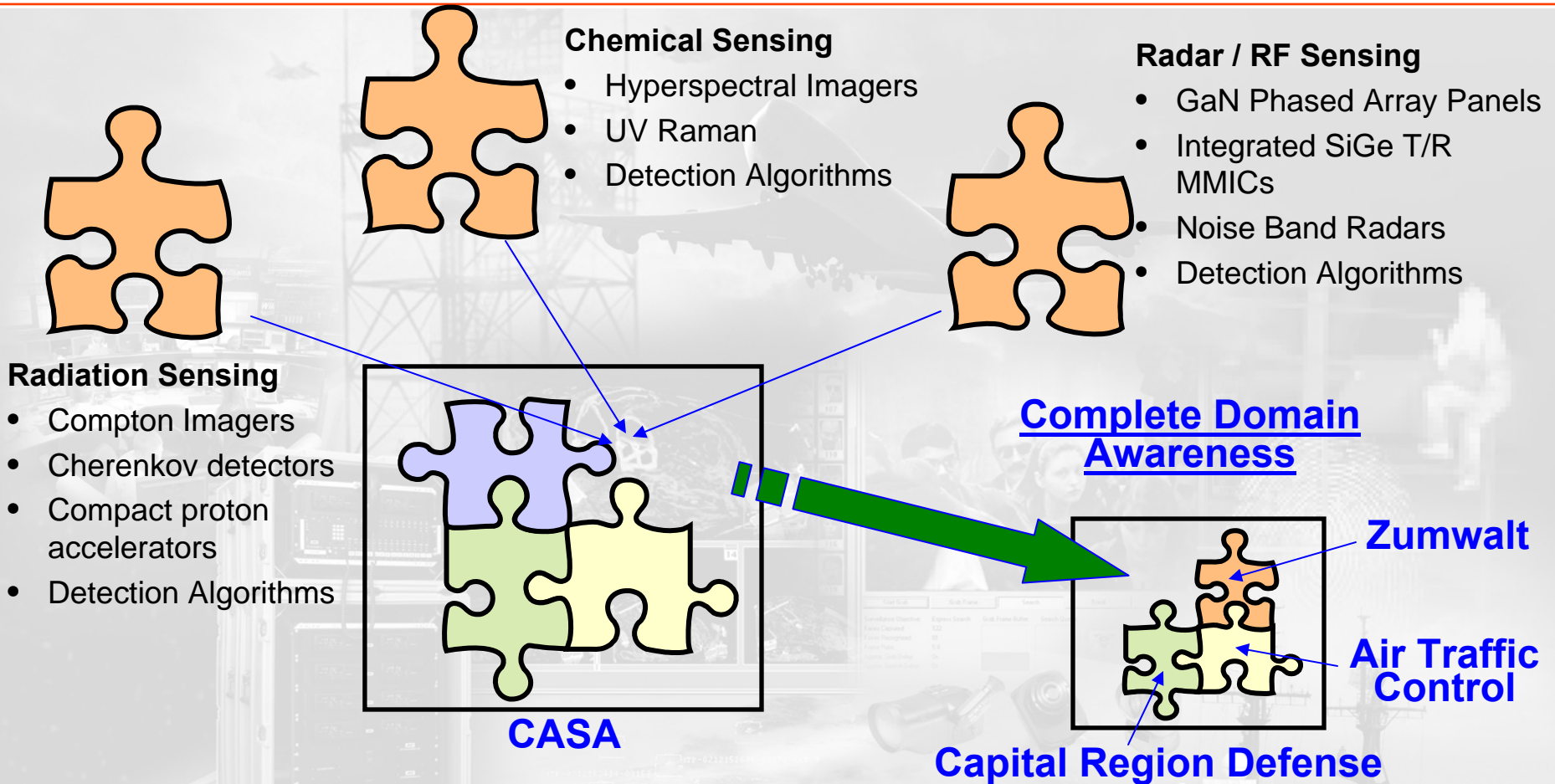
- Technology advancement is enabling higher RF power and smaller size

Gallium Nitride (GaN) is a Revolutionary RF Technology

- GaN enables high RF transmit power per radar element
 - Order of magnitude increase in power density
 - Improved efficiency
 - Less expensive \$/Watt compared to GaAs
- Higher Voltage Operation
 - Simplified Power Distribution
 - Increased Power System Efficiency
- Commercial applications for cellular base station amplifiers, power supply devices and solid state blue diode lasers for optical data storage



The Sensor Challenge



- **Future Systems → Multiple Threats, Multiple Domains, Multiple Sensors**
- **Pieces of a Larger Puzzle(s) vs. Individual Stove Pipe Technologies**

OpenAIR™ Partner Oriented Business Model

- Develop Enabling Subject Matter Expertise, Sensors and Algorithms
- Develop the Winning Teams to go from R&D to Production
 - Universities + National Labs + Small Businesses + Raytheon

<u>Challenges</u>	<u>Subject Matter Expertise</u>	<u>Sensors, Algorithms & Systems</u>	<u>Collaborative Partners (Partial)</u>
Sensitivity, Bandwidth, Range	Efficient HPA (GaN) Low Cost, High Volume SiGe Advanced Thermal Management Panel Arrays Robust LNA, A/Ds and DDS Chemical Detection	Wideband Solid State Arrays Light Weight Large Apertures High Power T/R modules Integrated, Digital T/R MMICs Hyperspectral Imaging UV Raman Systems THz Systems	U Mass McGill Oklahoma University Colorado State University of Rhode Island Penn State University MIT
Clutter Rejection, Interference Mitigation	High Speed DDS & converters Low Noise sources Digital Arrays Digital Beam forming Adaptive Signal Processing Target Behaviors	Super Resolution Algorithms Intelligent Agents Multiple Hypothesis Tracking Meteorological Detection Algorithms Storm Morphology Explosive Residue Transfers	Los Alamos National Laboratory Oak Ridge National Laboratory Sandia
Resource Management	Meteorological Command & control Multiple Beams (Digital Beam forming) Dense Netted Sensors Data Links Open Architectures Sensor & Data Fusion Distributed Storage Energy Balancing	Resource Planning / Optimization Algorithm SWARM Simulation Environment	Bubble Technologies Radiation Monitoring Devices Physical Sciences Intelligent Optics Systems VAISALA Vieux & Associates Micro-Ant Inc.
Prediction, Warning, Response	Meteorological Detection Algorithms Weather Mapping Lower to Storm-troposphere Geo-Spatial Integration Rapid Response Systems	DIB/DCGS PSDS2	IBM IMI HP

New Partners = New Sensors, Expanded Capabilities, Expanded Markets