Networked Targeting Technology

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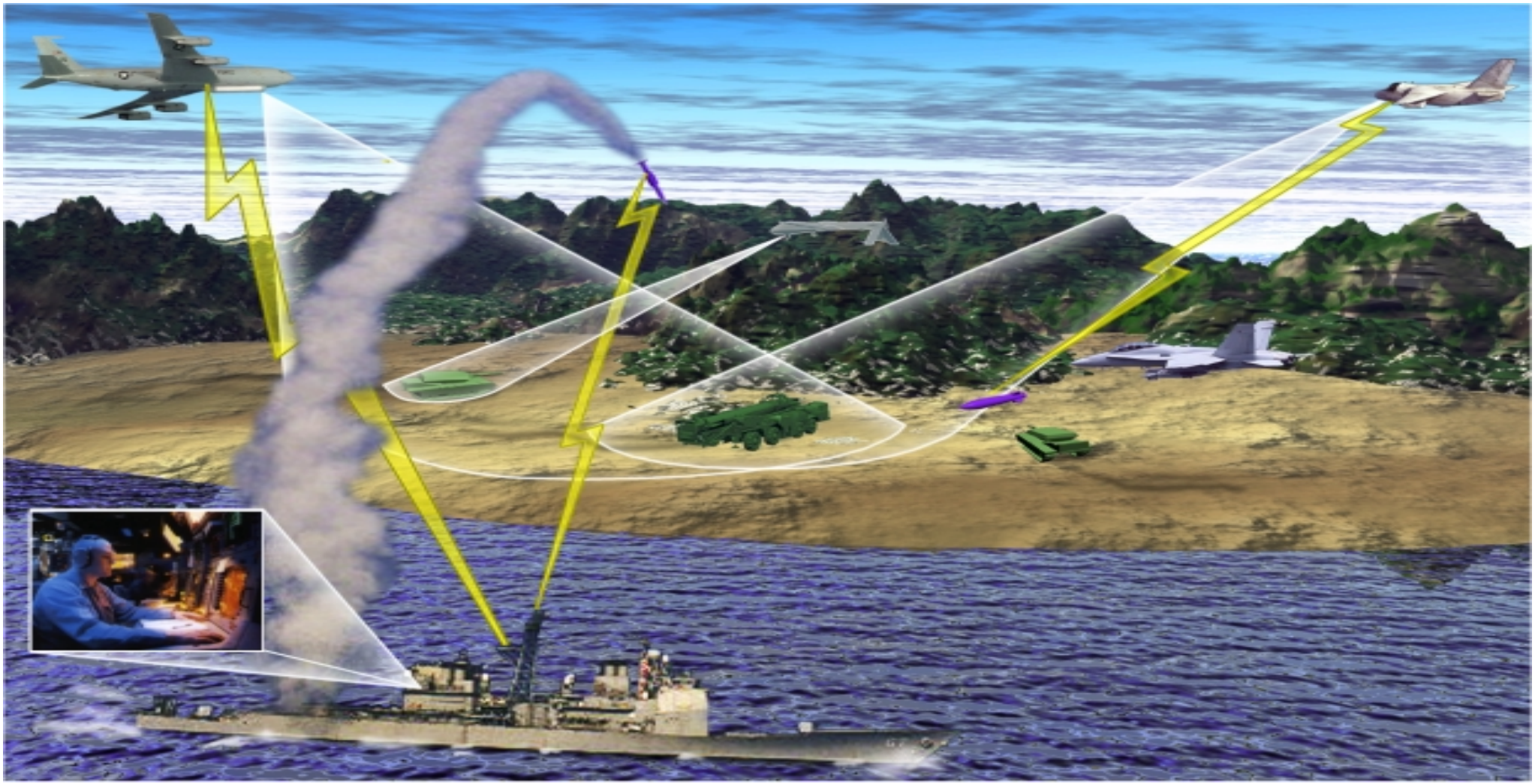

Stephen Welby
Special Projects Office

Next Generation Time Critical Targeting

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Future Battlespace Dominance *Requires* the Ability to Hold Opposing Forces at Risk:

- At Any Time
- In Any Weather
- Fixed, Stationary or Moving

Opponents Will Take Advantage of Delays or Shortcomings in US Quick Reaction Targeting Capabilities to Shelter Threat Systems

Examples:

- Use of mobility to protect threat surface-to-surface and surface-to-air missile systems
- Use of very short duration air defense emissions to avoid anti-radiation missile targeting

Key Enabler: Robust Tactical Networks

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- Significant Investment Has Led to Widespread Planned Availability of Tactical Data Links
- This Investment Can Be Leveraged to Enable New **Rapid Reaction Targeting Concepts** Through the *Dynamic Synchronization* of *Sensors* and *Strike Weapons* Systems Across Large Areas over Tactical Networks
- Networked Targeting Offers Significant Advantages in *Precision* Over Traditional ISR and Traditional Stand-Alone Weapon Delivery Systems
- Networked Targeting Precision Supports:
  - Increased Lethality
  - Increased Effectiveness
  - Minimizes Collateral Damage
  - Minimizes Risk to US and Coalition Forces

The DARPA Special Projects Office is Aggressively Pursuing Networked Targeting

DARPA Special Projects Office
Networked Targeting Programs

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- **Affordable Moving Surface Target Engagement (AMSTE)**
  - Network Ground Moving Target Indication (GMTI) Sensors with Precision Weapons to Enable Precision, Stand-Off Engagement of Movers
  - Networked Targeting Permits:
    - Multi-Lateration of Stand-Off ISR and Strike GMTI Radars for Targeting Precision
    - Precision Tracking of Targets From Nomination through End Game with Targeting Updates to Weapons in Flight
    - Use of Low Cost GPS Guidance and Low Cost Seekers
- **Advanced Tactical Targeting Technology (AT3)**
  - Network Threat Warning Receivers to Enable Rapid, Precision Geolocation of Short-Dwell Emitters
  - Networked Targeting Permits:
    - Very Rapid Reaction Against Pop-Up Threats (seconds)
    - Extremely Precise Geolocation

The AMSTE Motivation

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- Technology Investments Have Enabled US Forces to Hold Fixed and Stationary Targets at Risk
- AMSTE Will Extend US Battlefield Dominance to Moving Threats
  - **Extend our capabilities to permit all weather engagement of vehicles on the move**
  - **Deny opponents the sanctuary of movement**

- Existing Technologies Provide the Basis for the *Affordable* Precision Targeting of Moving Surface Targets
  - **Planned GMTI sensors**
  - **Precision weapons**
  - **Communication networks**
  - **High performance processing**

AMSTE is a systems-of-systems approach, coupling capable sensors to precision weapons through robust sensor-to-sensor and sensor-to-weapon networks

AMSTE Focus

Special Projects Office

Target *moving* surface threats from long range and rapidly *engage* with precision, stand-off weapons

Key AMSTE Characteristics:

***All-Weather Engagement*:**	**Requires use of multi-laterated, geo-registered GMTI sensors**
***Targeting Focused*:**	**Requires ability to maintain threat track from nomination through engagement**
***Precision Engagement*:**	**Requires ability to provide fire control updates to weapons in flight**

AMSTE Technologies support a seamless moving target engagement from Nomination ➠ Track Maintenance ➠ Engagement

AMSTE Challenges

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Issues	Approach
• *Track Accuracy*	Networking of Standoff/Penetrating Sensors GMTI Radar Multilateration Advanced Tracking Algorithms Grid-locking and Geo-registration
• *Precision Endgame*	In-Flight Weapon Target Updates Weapon Data Links Precision Fire-Control Tracking Low-Cost Seekers
• *Track Maintenance*	Feature Aided Tracking
• *Affordability*	Maximize use of existing resources and minimize the need for new systems

AMSTE I Accomplishments

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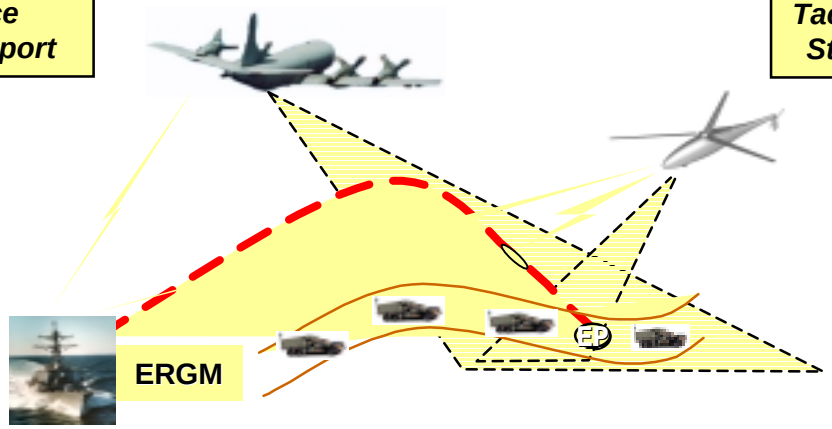
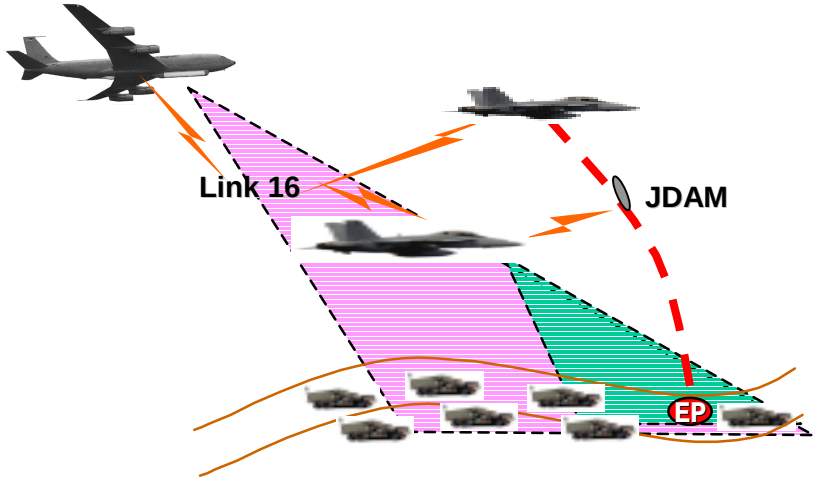
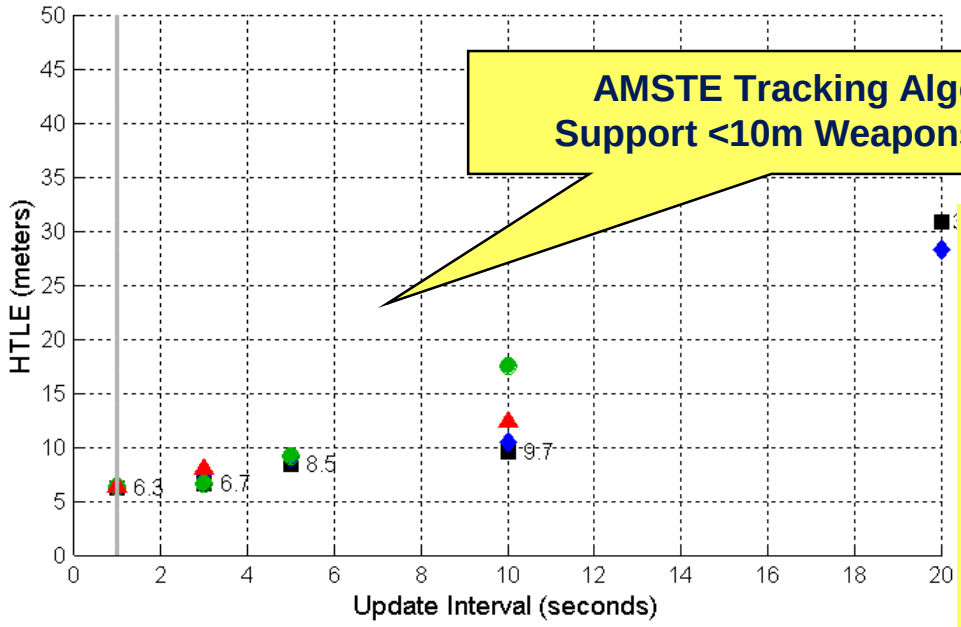
Surface Fire Support



Tactical Strike





AMSTE Tracking Algorithms Support <10m Weapons Delivery

AMSTE Phase I:

- **Investigated Weapons System Trades**
- **Developed and Tested Precision Fire Control Tracking Algorithms**
- **Collected Live and Simulated Multi-sensor GMTI data**

Findings Support Feasibility of AMSTE Concept and Establish Foundation for AMSTE II

AMSTE Program Schedule and Milestones

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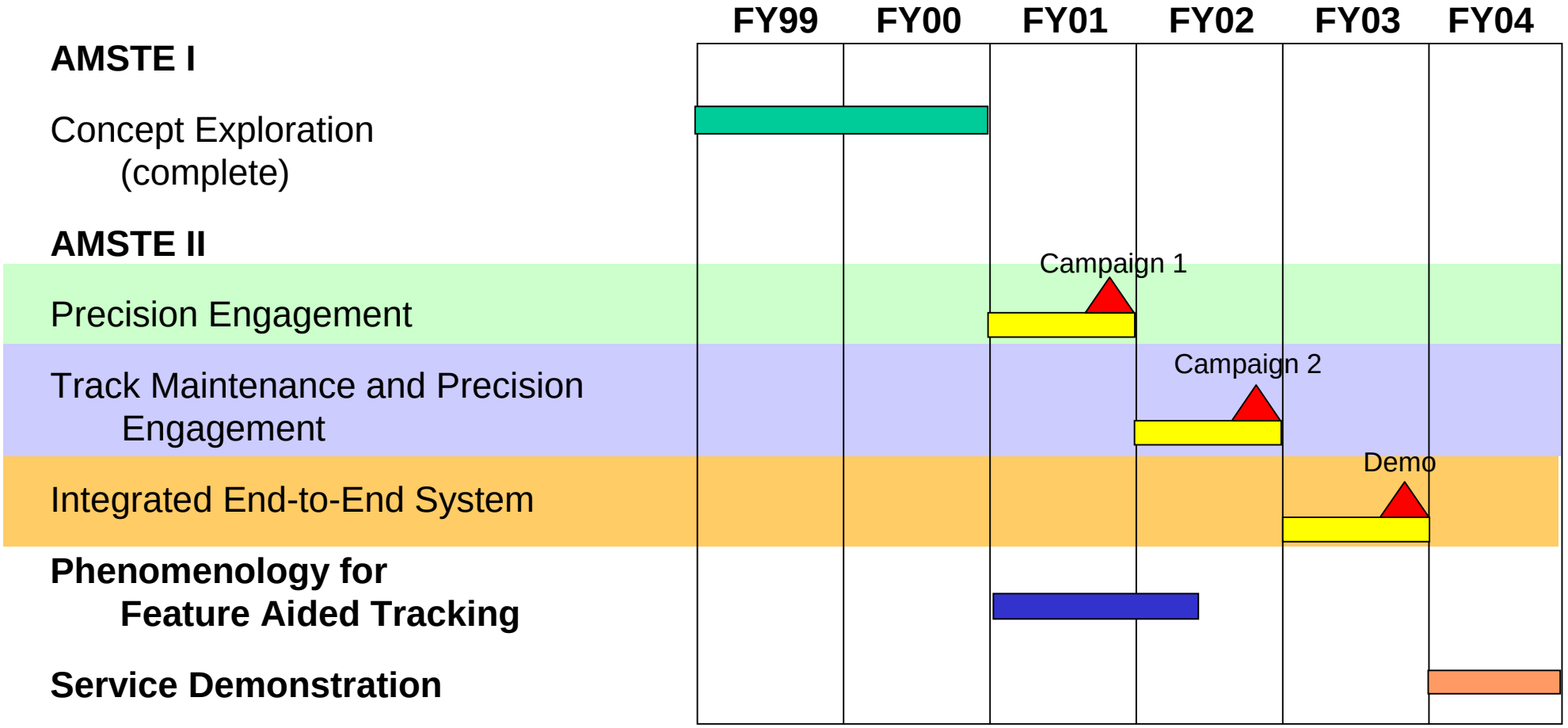

AMSTE II will use an Integrated, System-of-Systems Approach to Demonstrate an Affordable Moving Surface Target Engagement Solution

Advanced Tactical Targeting Technology (AT3)

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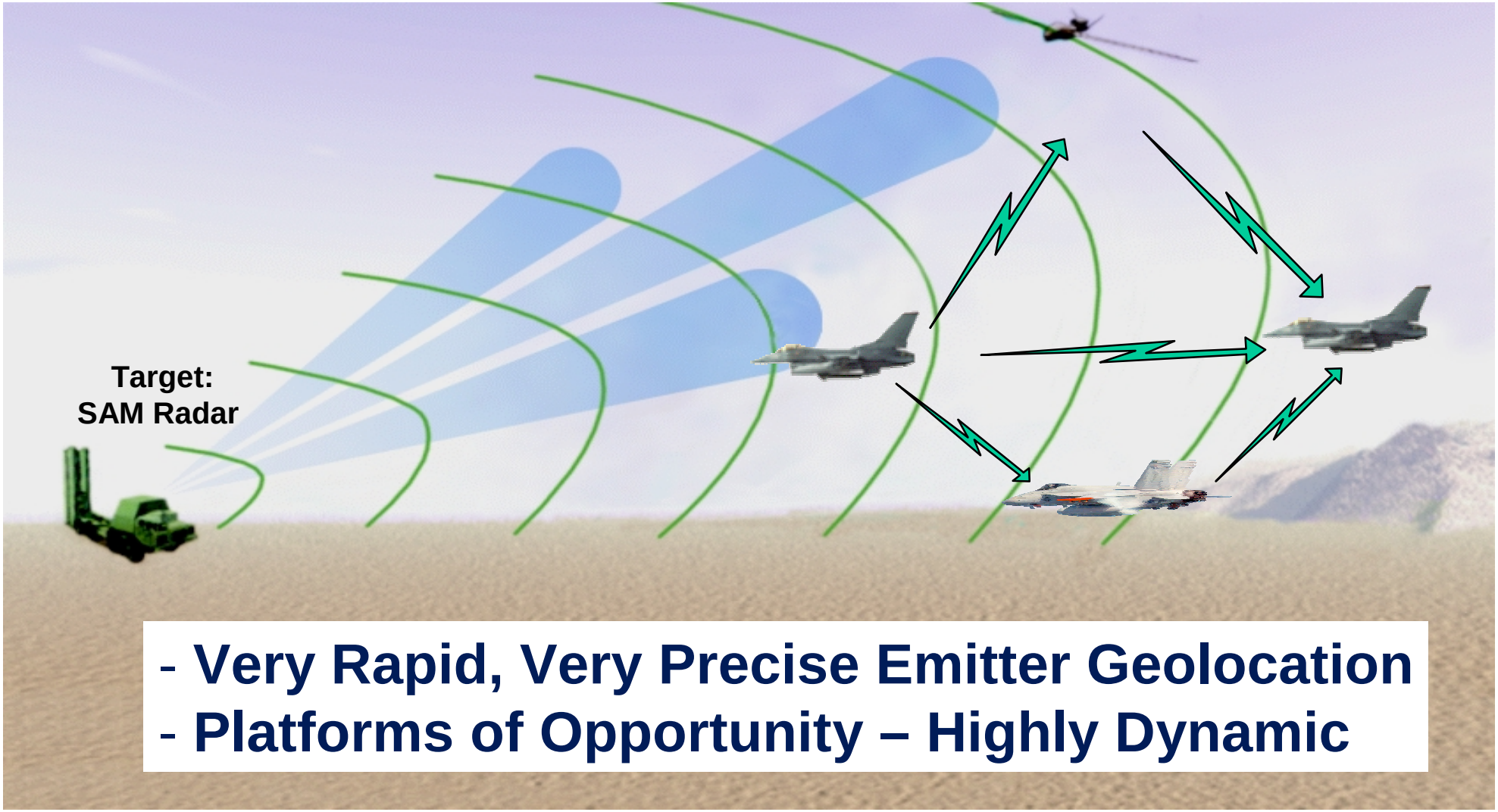

- Very Rapid, Very Precise Emitter Geolocation
- Platforms of Opportunity – Highly Dynamic

AT3 Challenges

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Issues

- *Exploit Threat Sidelobe Emissions*
- *Common Pulse, Ambiguity Resolution, Geolocation*
- *Network Management, Collector Cueing, Traffic Load Reduction*
- *Multipath, RF Agility, etc.*

Approach

- Affordable, High Performance Digital Receiver
- Exploit Correlations within Pulse Trains and Between Collector Platforms
  - Coherent vs. Non-coherent
- 7-D Precise Registration of Battle Space
- Network Simulation/Analysis Traffic Management/Data Compression
- Novel, Transparent Tactical Network Approaches
- Leading Edge, Inter-Collector Multipath Decorrelation, Digital Receiver Flexibility, Other

AT3 Phase I

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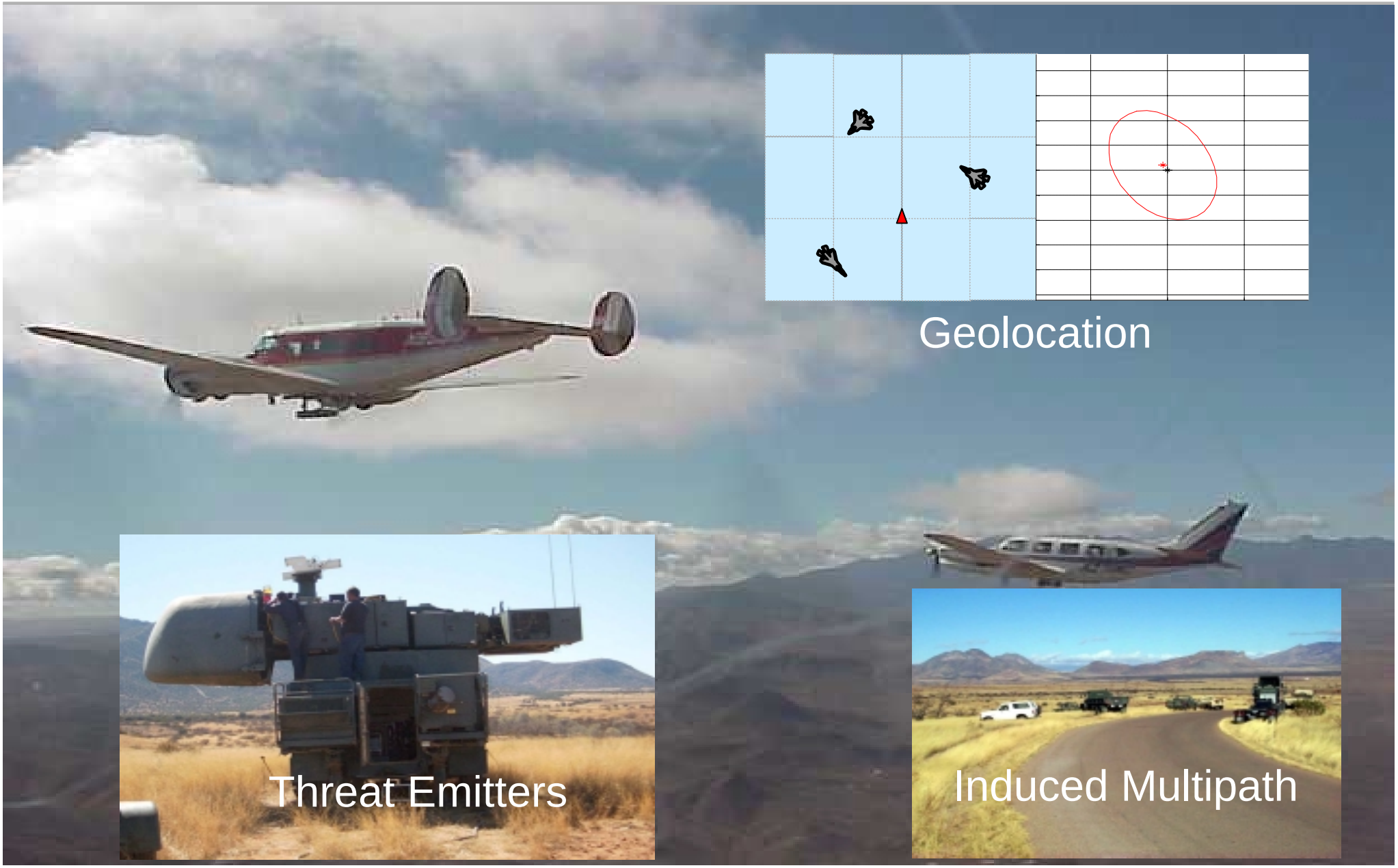

Status

- Raytheon (Tucson, AZ) Proceeding to FY02 Data Collection and Real Time Flight Demonstration

Opportunity

- Innovative Multi-Ship Algorithm Development
  - Dense Pulse De-interleaving
  - Highly Agile Emitters
  - Coherent Techniques
  - Polarization Exploitation, etc.

- Explore Trade Space in Non-Real Time Environment

Tactical Networking Technology Opportunities

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- Networked Targeting Can Be Limited By Tactical Network Capacity, Latency and Rigidity
  - The Need:
    - Increased bandwidth and on-the-fly reconfigurability
    - Very low latency data transfer
    - Advanced network planning/management
    - Compatibility with legacy systems

- New Applications for Tactical Networking Concepts
  - Synchronization of Strike and Sensor Assets for Real-Time Battle Damage Assessment

DARPA Special Projects Office
Networked Targeting Programs

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- DARPA SPO Is Aggressively Pursuing The Networked Targeting Paradigm Through Advanced Applications Such as AMSTE and AT3
- Near Term Experimentation with Networked Targeting Must Involve Both Technologists and Users
  - Co-development of Advanced System Concepts and Supporting Tactics, Training and Procedures is Critical to Successful Transition of Networked Targeting Approaches
- Networked Targeting Approach Offers Promise In Many Other Mission Areas by Realizing Tighter Coupling Between Sensors and Shooters