

Test and Evaluation/ Science and Technology (T&E/S&T) Program

**7th Annual Science & Engineering
Technology Conference
18-20 April 2006**

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T&E/S&T Program Background

- **Program started in FY 2002**

- Joint DDR&E/DOT&E initiative
- Transitioned to DTRMC in Feb 2005

- **Mission**

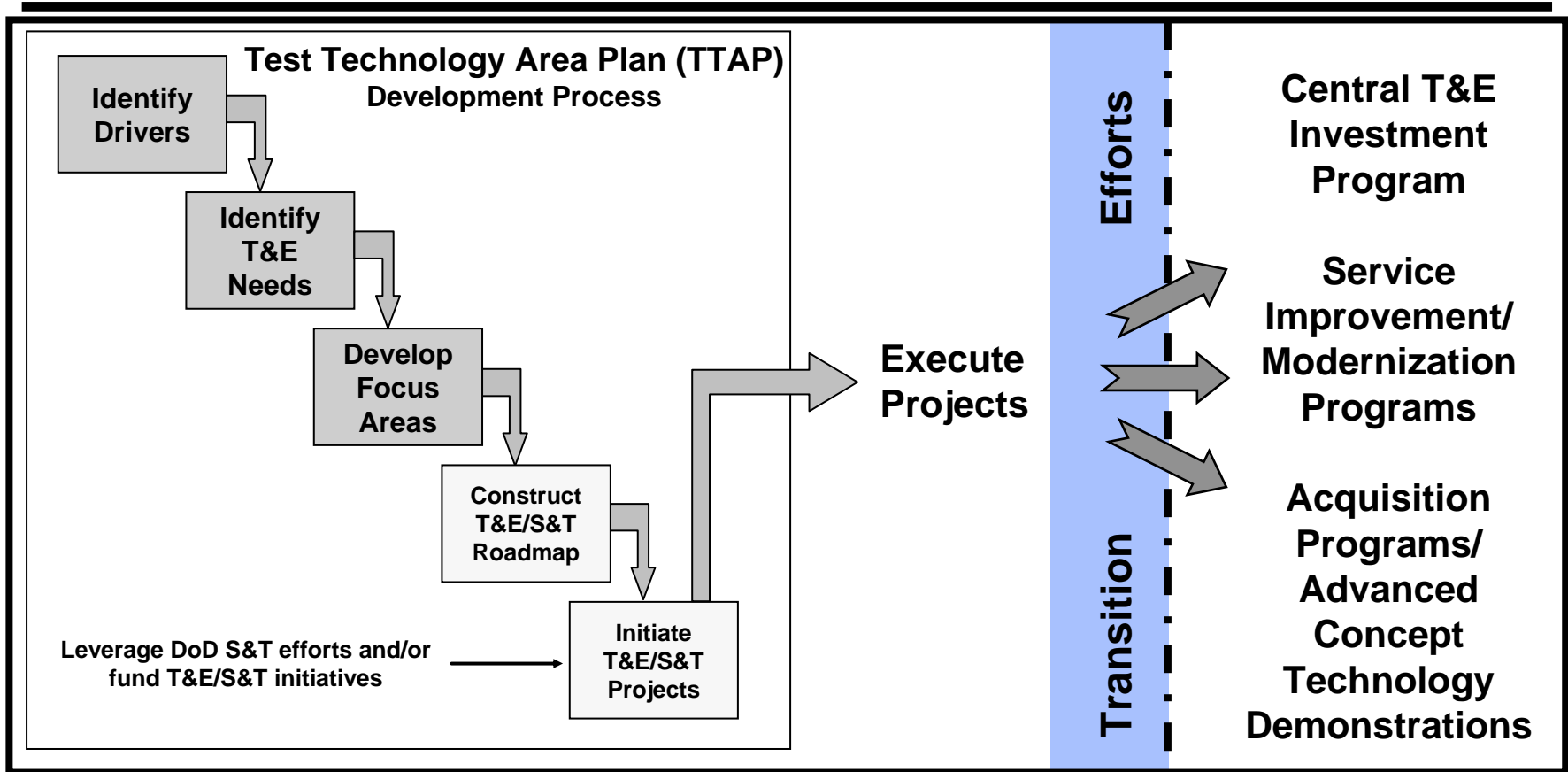
- Develop new technologies required to test and evaluate our transforming military capabilities
 - Includes any system that makes our warfighters more survivable and effective in combat
 - Lethal and non-lethal weapons
 - Intelligence, surveillance and reconnaissance
 - Information systems

- **Goal**

- Transition emerging technologies into test capabilities in time to verify warfighting performance



T&E/S&T Program Process



■ Process used to identify focus areas
– 6 currently active



T&E/S&T Program

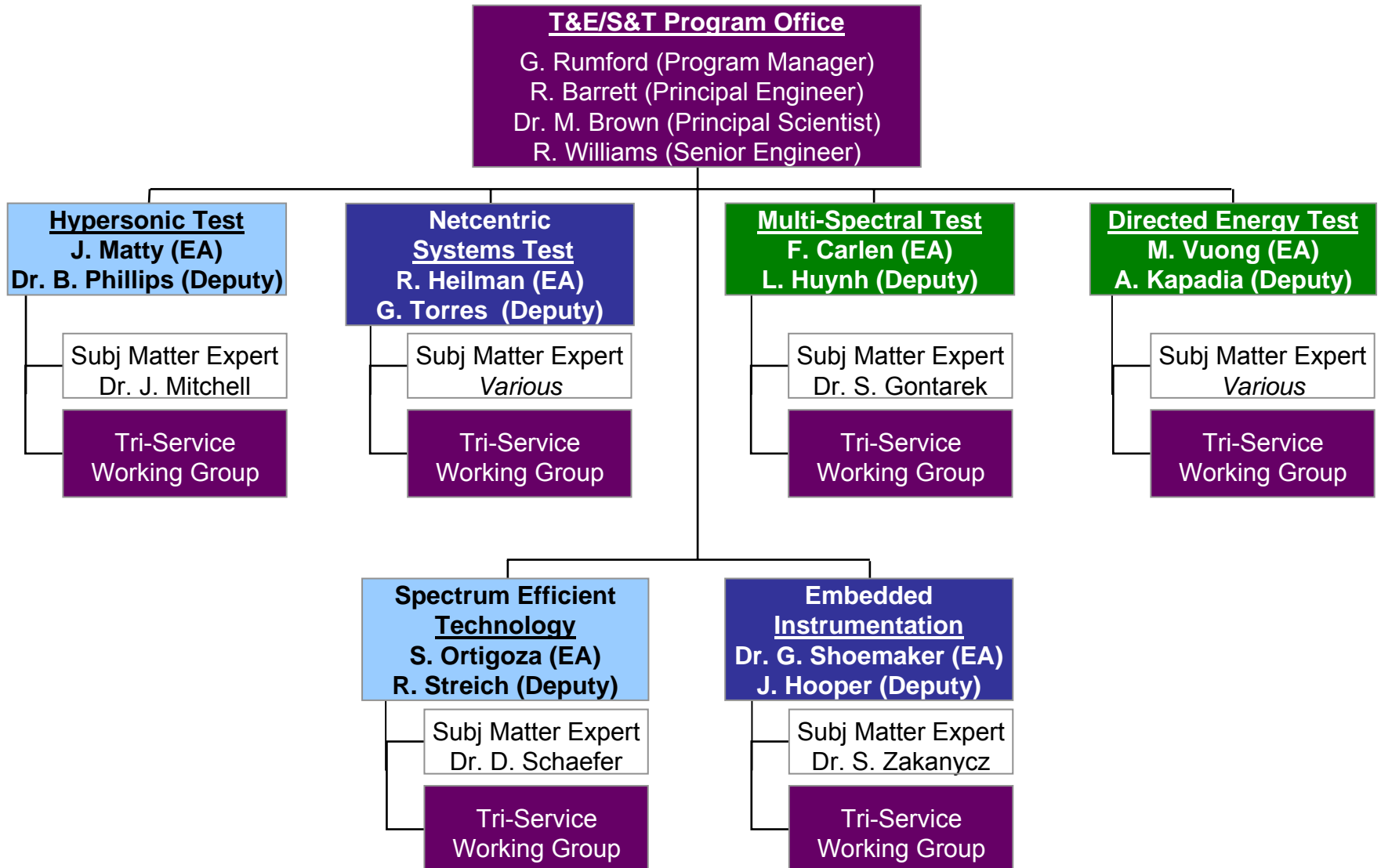
Active Focus Areas

Test Technologies for

- Emerging Warfighting Capabilities
 - Hypersonic Vehicles
 - Directed Energy Weapons
 - Multi-Spectral / Hyper-Spectral Sensors
 - Net-Centric Warfare Systems
- Enhanced Test Capabilities
 - Spectrum Efficient Technology
 - Embedded Instrumentation
- 65 projects active across focus areas

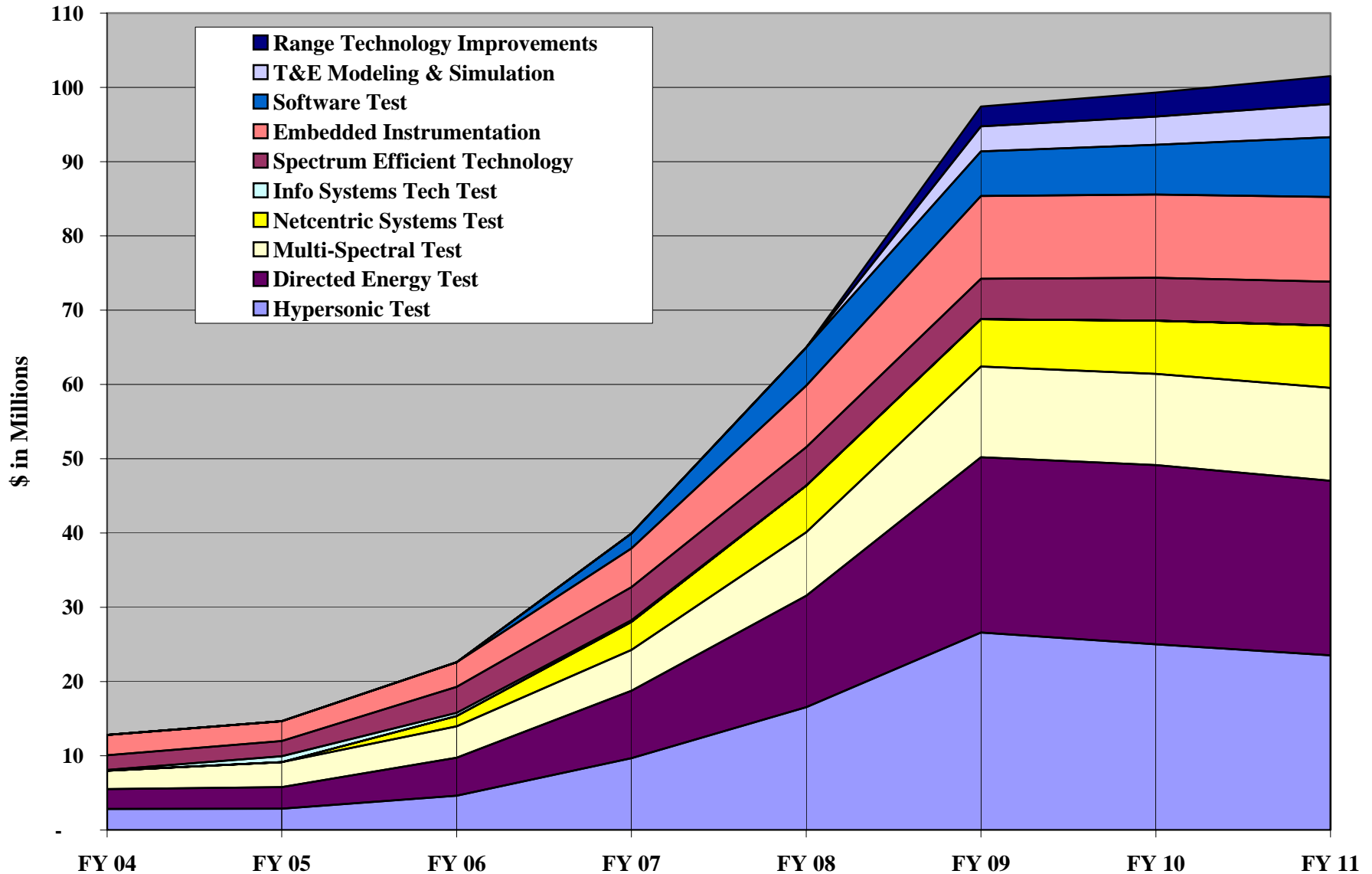


T&E/S&T Program Structure



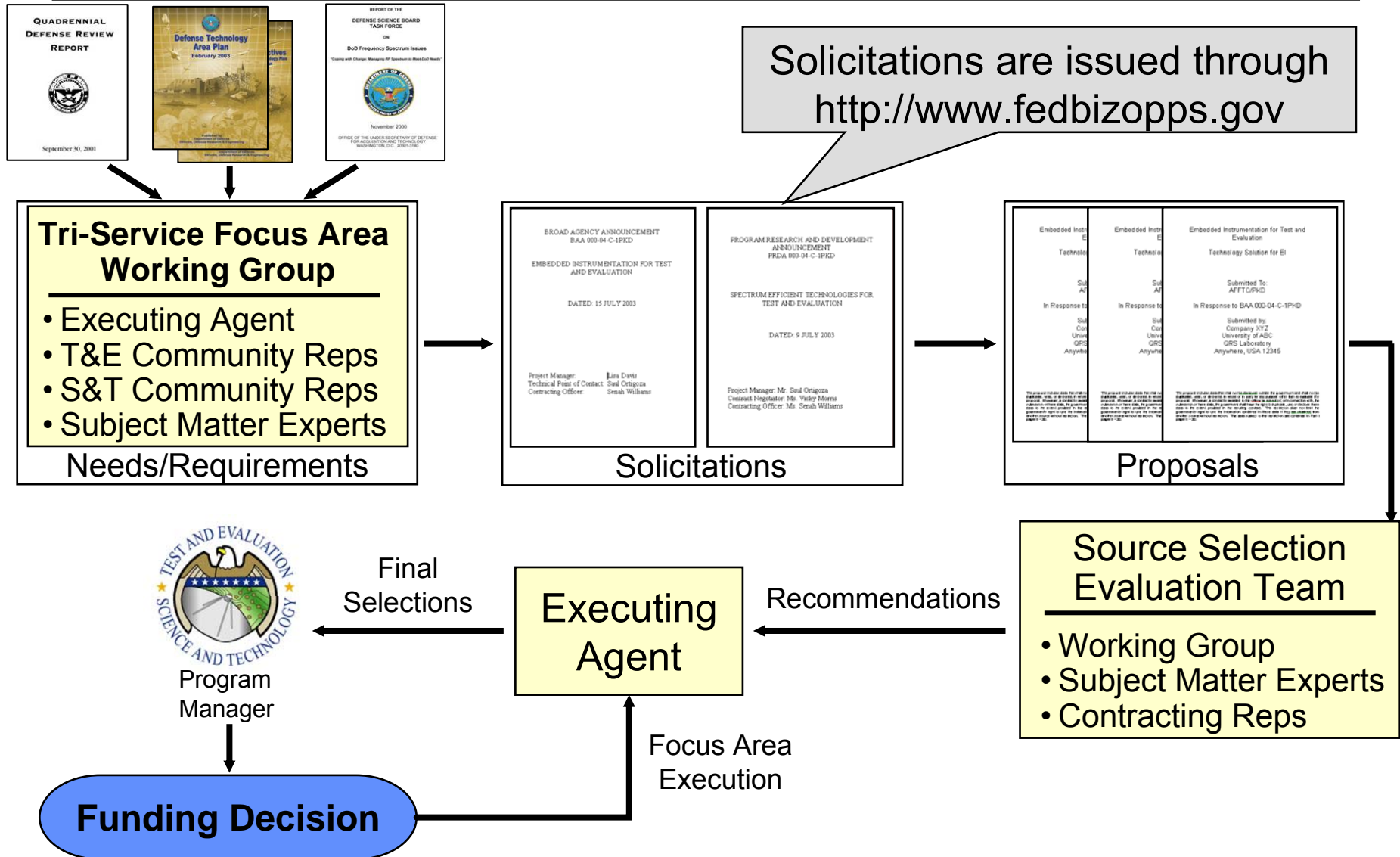


FY 2004 – 2011 Budget Projections





T&E/S&T Program Project Selection Process

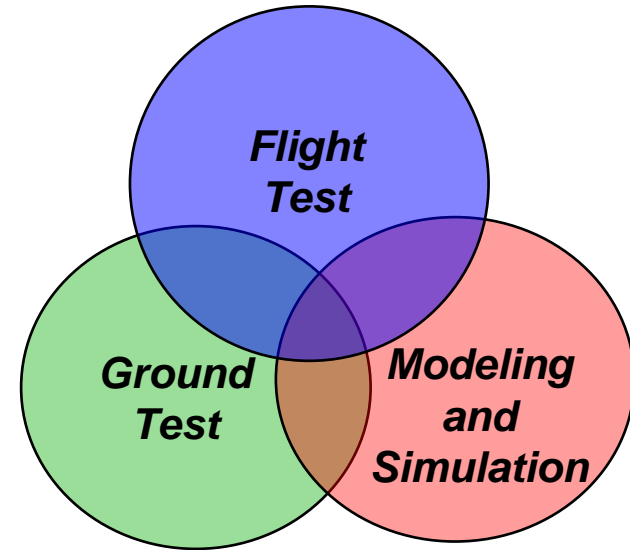




T&E/S&T Program

Hypersonic Test Focus Area

- **Hypersonic technology potential for rapid, long range targeting**
- **DoD hypersonic research efforts slated to transition technology to hypersonic weapon systems 2010+ timeframe**
 - National Aerospace Initiative
 - DARPA/Navy HyFly
 - Air Force Single Engine Demonstrator
- **Existing infrastructure inadequate to test envisioned systems**
 - Lead time away from meeting T&E needs
- **Need new T&E capabilities**
 - Ground test
 - Flight test
 - Modeling and Simulation
- **Supports T&E within DDR&E National Aerospace Initiative:**
 - High Speed/Hypersonics
 - Space Access
- **14 active projects**

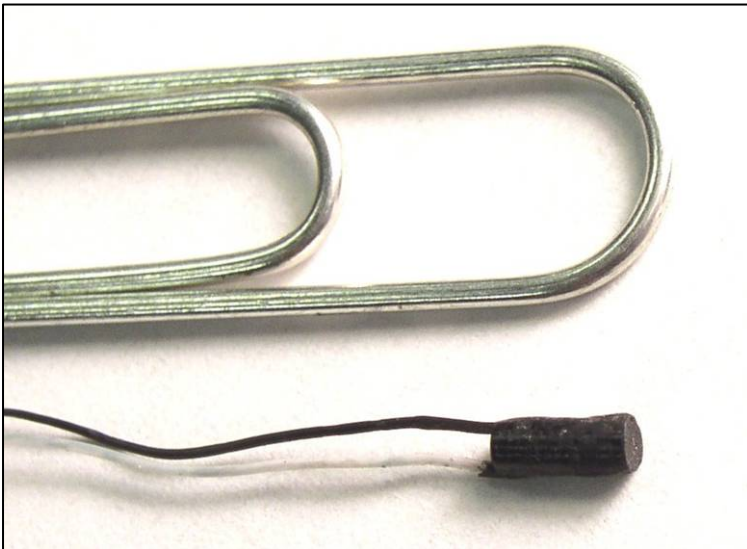




Heat Flux Sensor Development for Hypersonic Aerothermal Measurements –Hypersonic Test–

Developing miniaturized heat flux sensors with the following performance characteristics:

- Continuous operation at 700° F
- Calibration to 50 Btu/ft²-sec
- 0.0625 inches in diameter
- Compatible with embedding in Systems Under Test



0.0625 inch diameter heat flux sensor prototype

Calibration unit



Allows measurement of heat flux to support ground and flight testing of hypersonic vehicles



T&E/S&T Program

Directed Energy (DE) Test Focus Area

- **DE is revolutionary/transformational**
 - Focus has been on developing DE technologies, not how to test DE
 - Very little DE T&E legacy exists (infrastructure, methodology, expertise)
- **Need test technologies for:**
 - Survivable on-board instrumentation required to measure the DE beam on the target
 - Measuring the effects of DE on the target
 - Instrumentation that minimizes impacts on target performance and signature
 - Instrumentation to determine performance margins and reasons for success and failure
 - Evidence of the degree of hard kill and soft kill
 - Far field simulations in near field conditions
- **Supports T&E within DDR&E Initiative: Energy and Power Technologies**
 - Power sources for DE weapons
- **15 active projects**



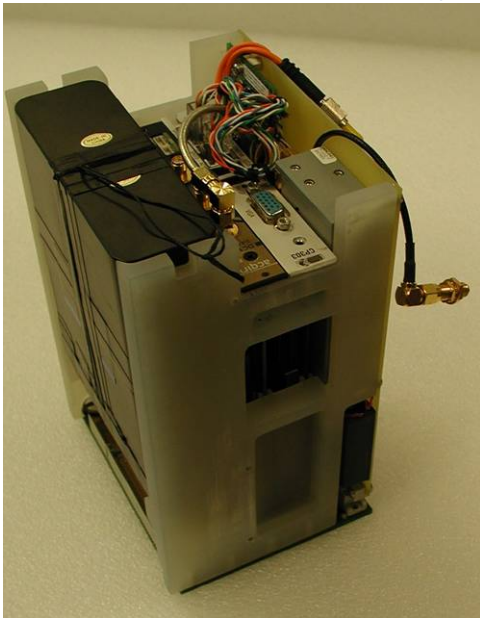


Directed Energy Data Acquisition Transformation

–Directed Energy Test–

- Developed a HPM hardened Compact Remote Data Acquisition System (CRDAQ) to replace analog Fiber Optic transmitters and oscilloscopes
 - Eliminates high-maintenance analog fiber optic links
 - 10-bit resolution increases dynamic range from 32 dB to over 40 dB
 - Automatic built-in calibration
 - 110 dB total dynamic range
 - Overall dimensions: 8.375" x 4.75" x 5.25"
- Developed simultaneous trigger and a breadboard 3-axis probe for HPM testing

CRDAQ Subassembly



Prototype CRDAQ



CRDAQ with open top



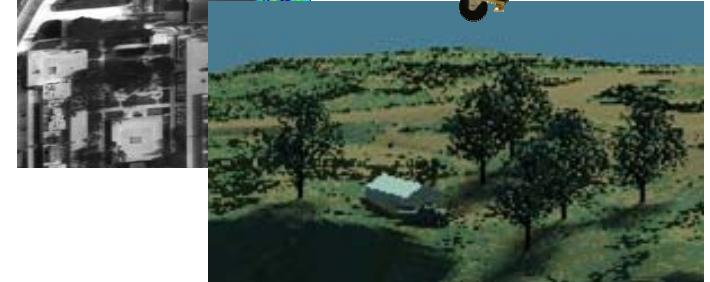
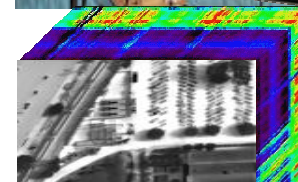
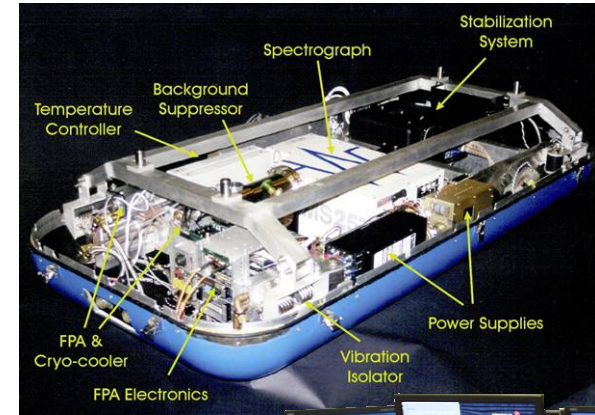
Enables T&E of High Power Microwave systems



T&E/S&T Program

Multi-spectral Test Focus Area

- **Next-generation focal plane array sensors and seekers will operate through RF, UV, visible, and IR bands**
 - Need affordable processors to create scenes for T&E
 - Presentation options require wide dynamic range, fast frame rates, and realism
 - Need performance metrics that are based on scientific analysis and describe system attributes in operational terms
- **Need an end-to-end multi-spectral test capability**
 - Robust, scalable, and affordable
- **Supports T&E within DDR&E Initiative: Surveillance and Knowledge Systems**
 - Sensors and unmanned vehicles
- **5 active projects**





Ultraviolet (UV) Light Emitting Diodes (LEDs) for T&E

–Multi-Spectral Test–

- **Conducting a technology assessment of deep UV LED sources against the developed requirements**
 - Transition results to CTEIP's Joint Mobile Infrared Countermeasures (IRCM) Testing Systems (JMITS) project

UV-LED



Test Rig

UV Output



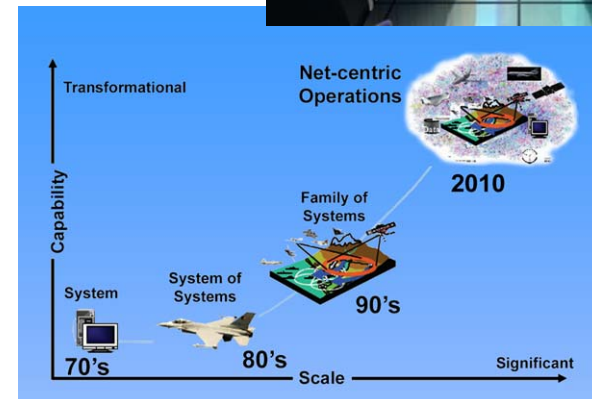
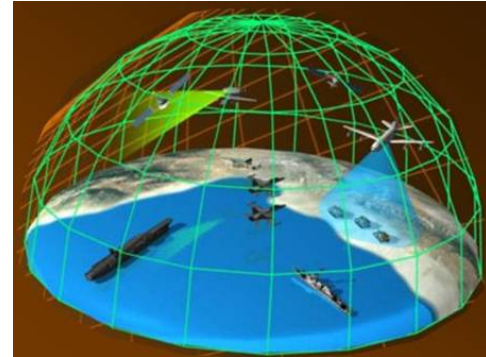
Provides an ultraviolet source to support T&E of Infrared Counter Measures



T&E/S&T Program

Netcentric Systems Test Focus Area

- **Information systems are a “force multiplier” in U.S. military operations**
 - Command & Control
 - Operational Pictures/Intelligence, Surveillance & Reconnaissance (ISR)
- **Emerging, powerful information systems technologies—drive toward network centric warfare**
 - Information Assurance (IA) to protect computer networks, information, and information systems
 - Seamless, secure, self-organizing, self-healing, tactical and global communications networks
- **Need non-intrusive, network centric test technologies**
 - Assess performance of networks of networks with multiplayer simultaneous activities
 - Evaluate the effectiveness of IA
 - Assess information/knowledge management
 - Test the functions of decision making systems, including the actions of intelligent agents
- **Supports T&E within DDR&E Initiative:**
 - Surveillance and Knowledge Systems
- **2 active projects**

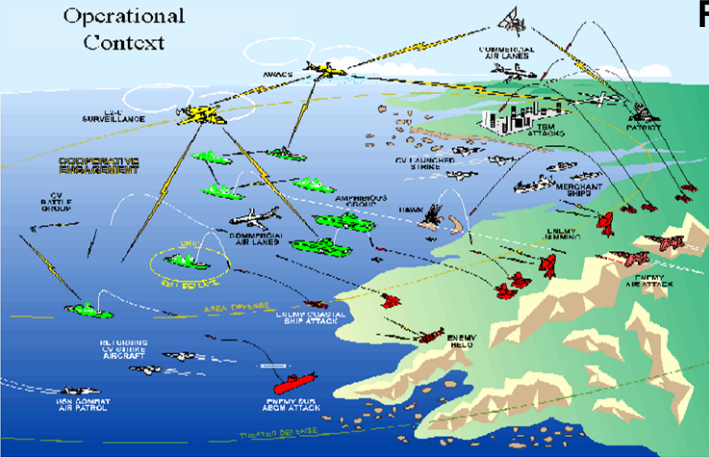




Tactical-Report Generation Test Bed –Netcentric Systems Test–

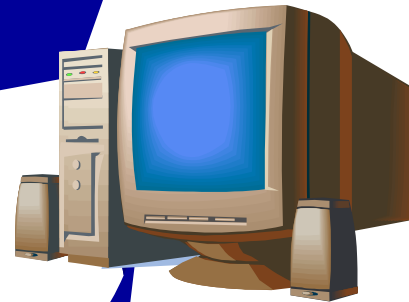
Record Real-World
Event Messages

Operational
Context



Generate Baseline
Choreographed Event
“Fill in the Blanks”

Inject Ambiguity and
Uncertainty



Provide Realistic
Test Input



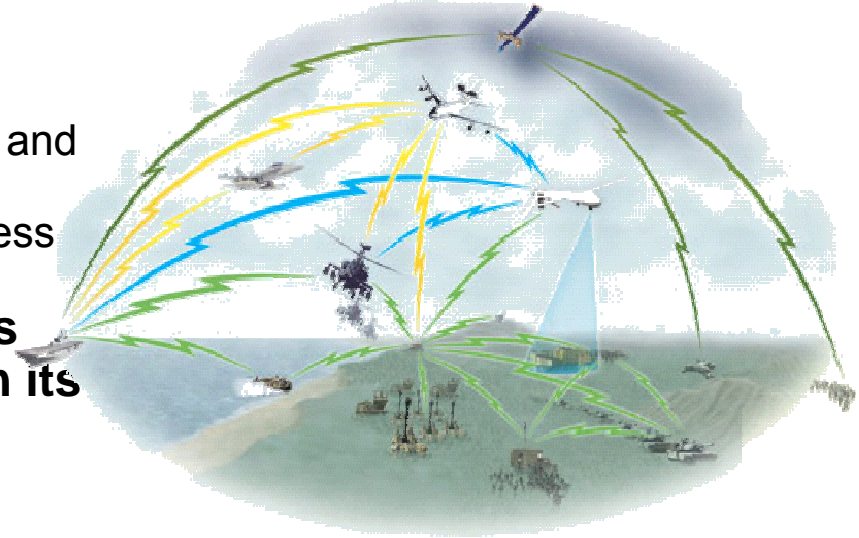
Developing a
realistic report
stream generator
with “generated
ground truth” to
enable T&E of
advanced Netcentric
architectures



T&E/S&T Program

Spectrum Efficient Technology Focus Area

- **Growth in demand for consumer communication services**
 - Traditional bands for T&E (L and S), ideally suited for telemetry because of propagation and supportable data rates
 - Same bands desirable for commercial wireless comm
- **Each new generation of military systems generates over ten times more data than its predecessor**
 - F-15 development ~256 Kbps
 - F-22 development ~10 Mbps
- **Need more spectrum for T&E**
 - More efficient L and S band operations
 - Expand into Super High Frequency (SHF)
 - Explore Optical Band
- **DDR&E Initiative: Surveillance and Knowledge Systems**
 - High Band Width Communications/Information Assurance
- **14 active projects**

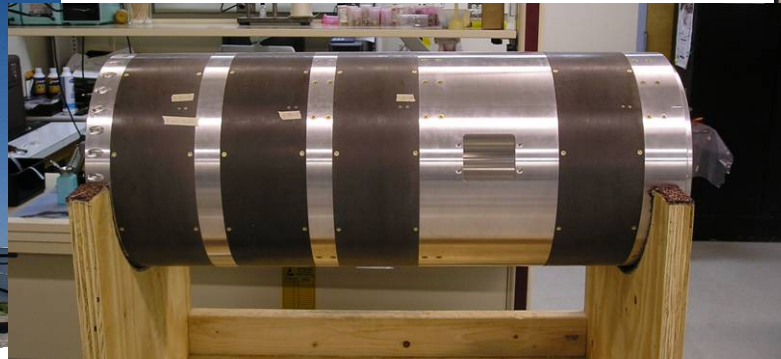




X-Band Tracking

–*Spectrum Efficient Technology*–

- Demonstrated ability to conduct telemetry operations in highly dynamic environment in the SHF band
 - **Modified an S-Band Telemetry Tracking System to operate in the X-Band**
 - **Incorporated an X-band payload into a rocket**
 - **Successfully tracked rocket and received telemetry at 7.975 GHz**



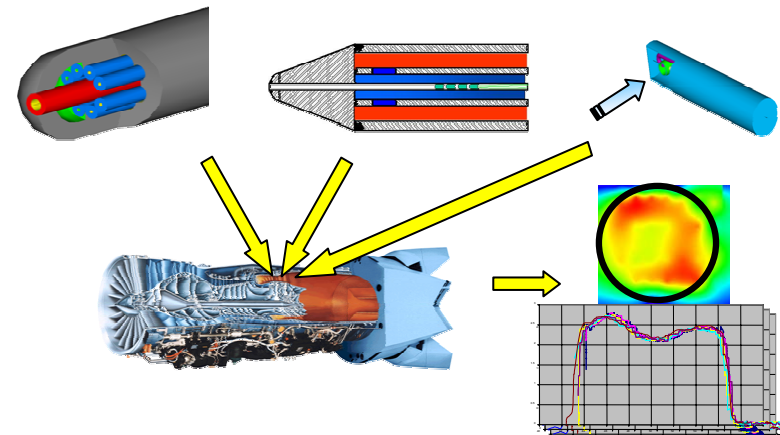
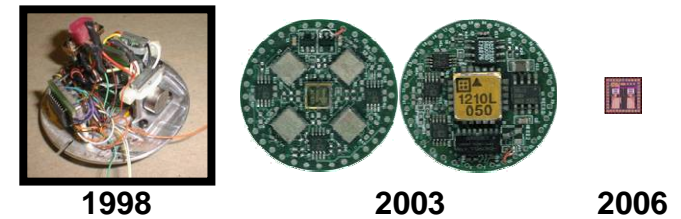
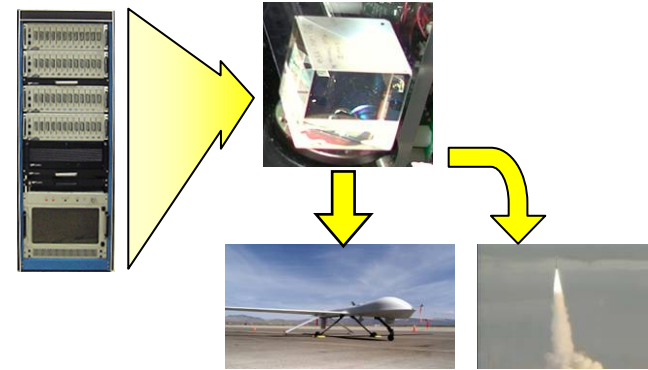
Supports DoD efforts to obtain additional telemetry spectrum



T&E/S&T Program

Embedded Instrumentation (EI) Focus Area

- **Military systems smaller, more capable, complex, interdependent, and interoperable**
 - Scarce space for sensors, wiring, and data processing and storage
 - Must minimize effects of instrumentation to the signature/ performance of the system-under-test
- **EI has the potential for providing cost savings and enhancing force readiness**
 - Key is to design EI in up front
 - CJCSI 3170.01C—The Initial Capabilities Document (ICD) and the Critical Development Document (CDD) must include consideration for EI
 - Director, J-6, Joint Staff will ensure that CDDs and Critical Production Documents (CPDs) include EI in systems tradeoff studies
- **Need technologies and architectures for non-intrusive, survivable instrumentation suites**
 - Both plug-and-play and open architectures
- **Supports T&E within DDR&E Initiatives:**
 - NAI
 - Surveillance and Knowledge Systems
 - Energy and Power Technologies
- **15 active projects**



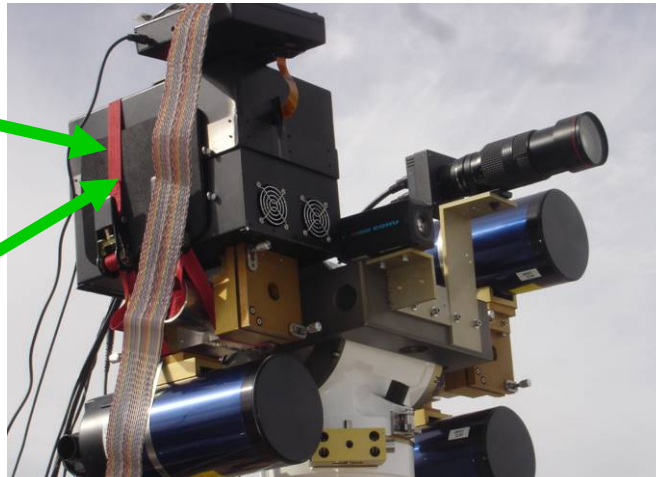
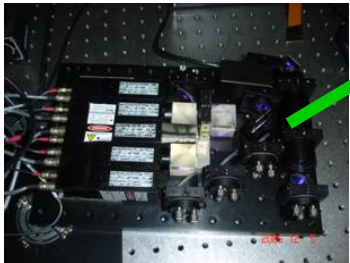


Compact Holographic Data Storage –Embedded Instrumentation–

Developed a brassboard compact holographic memory package that will support high-density, high-rate data recording. Brassboard system demonstrated:

- Storage density = 767 Gigabytes
- Bit Error Rate = 1×10^{-9}
- Writing transfer rate = 1 Gigabits/sec
- Reading transfer rate = 1 Gigabits/sec

Optics Head



Blue diode laser source

Holographic Memory Data Storage
brassboard on tracking mount

Reconstructed stored images

Enables the collection and storage of massive amounts of data required during the T&E events of advanced weapon systems



T&E/S&T Program Wrap Up

- **T&E/S&T program initiated to address critical T&E needs, tied to S&T drivers**
 - 65 active projects across 6 focus areas
- **Sustained growth and demonstrated value**
 - Mature focus areas transitioning technology into test capabilities
- **Keys to continued success**
 - Participation of Services on Joint needs definition
 - Good mix of industry, laboratories and universities working on solutions
 - Participation of Services, industry, laboratories and universities to transition technologies to T&E capabilities

Shaping Technology into Tomorrow's T&E Capabilities