



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

***8th Annual Science & Engineering
Technology Conference/DoD Technology Exposition
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Test Resource Management Center (TRMC)

Sec. 231, FY 2003 National Defense Authorization Act

DoD Directive 5105.71, March 8, 2004

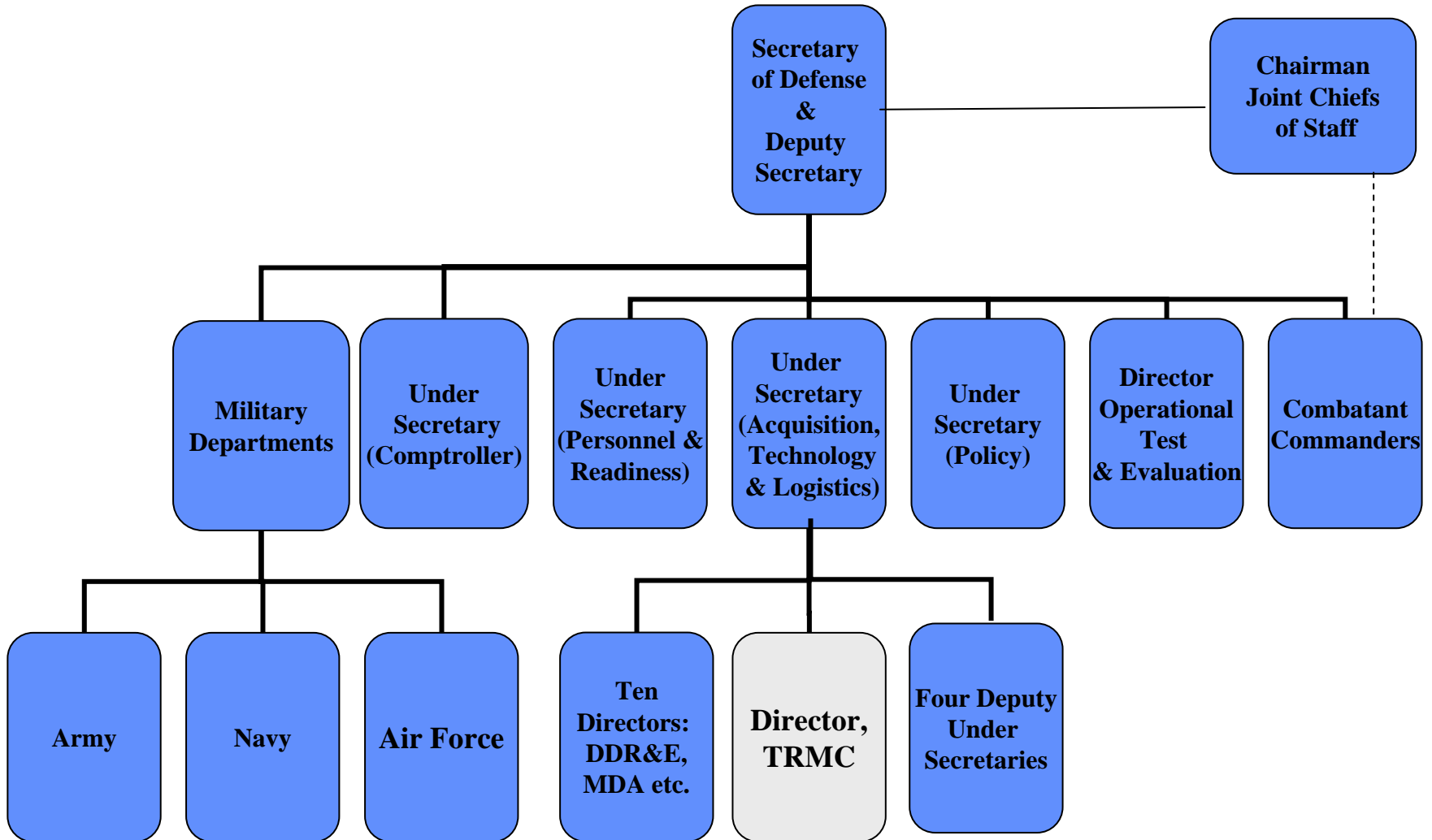


- **DoD Field Activity**
 - Established to ensure that the DoD T&E infrastructure is adequate to support the development and acquisition of defense systems
 - Led by Dr. John Foulkes, SES
 - Direct report to the Honorable Ken Krieg, Under Secretary of Defense (Acquisition Technology and Logistics)
- **Annually certify that the T&E budgets of the military departments and defense agencies are adequate**
- **Develop a biennial strategic plan that**
 - Assesses T&E requirements for a period of ten years
 - Identifies required T&E infrastructure investments
- **Responsible for all T&E infrastructure policy including DoD Directive 3200.11, Major Range and Test Facility Base (MRTFB)**
 - DODD 3200.11 covers policy and responsibilities for the management and operation of MRTFBs
- **Administer three major T&E investment programs:**
 - Joint Mission Environment Test Capability Program (JMETC)
 - Central Test and Evaluation Investment Program (CTEIP)
 - Test and Evaluation/Science and Technology (T&E/S&T) Program



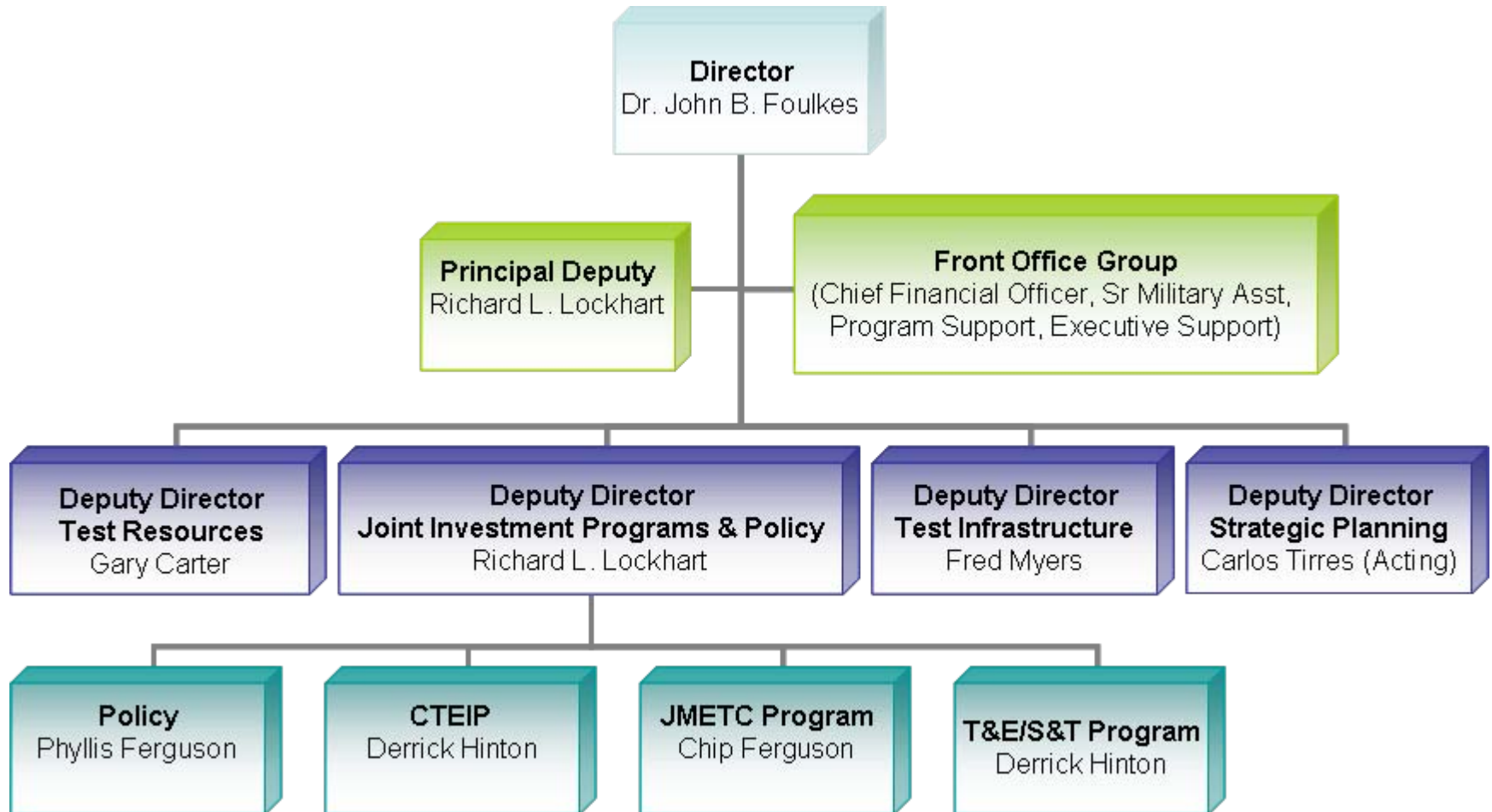
TRMC

Direct Report to USD(AT&L)





TRMC Organization Chart





T&E/S&T Program Overview



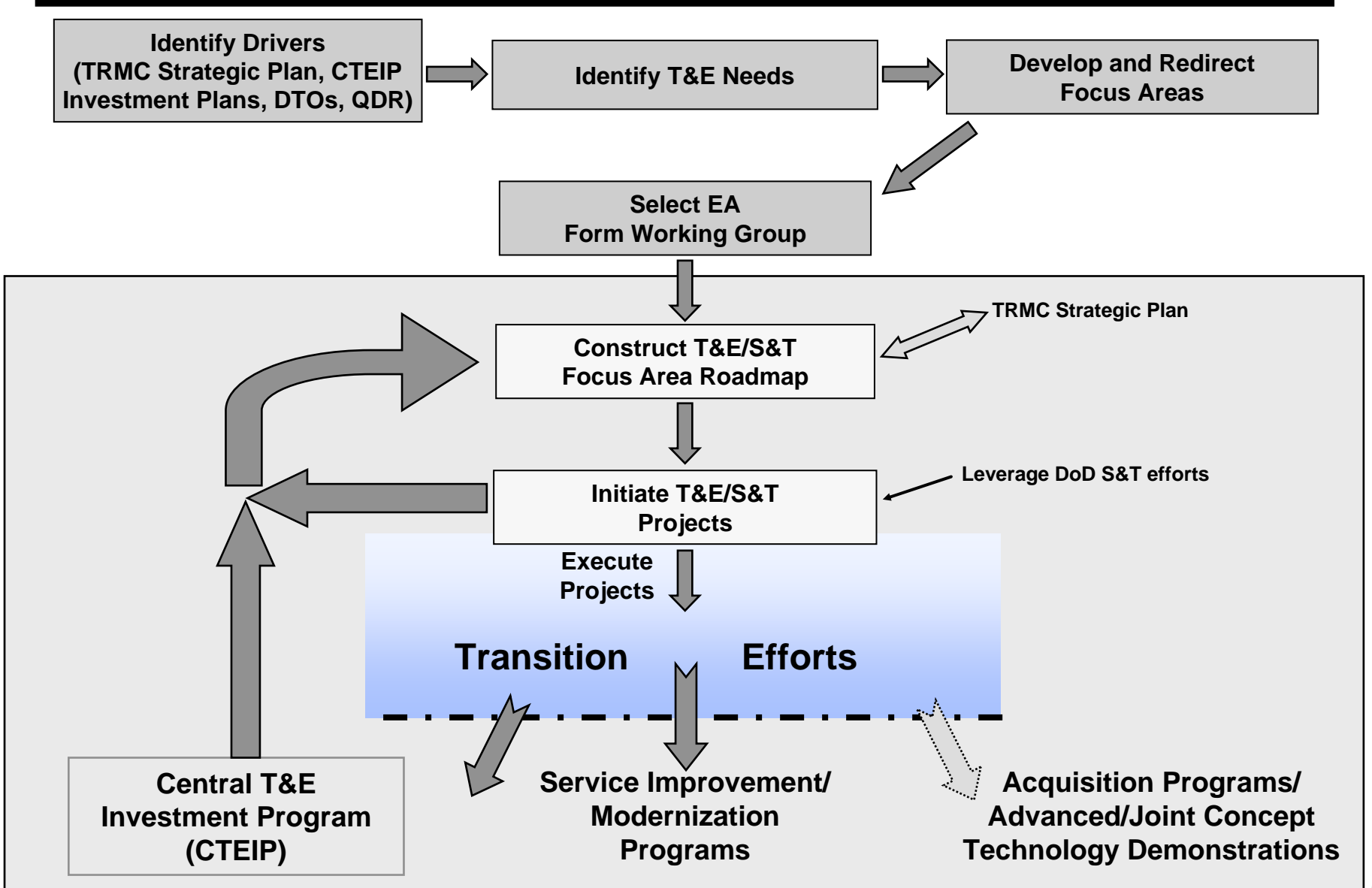
- **Program started in FY 2002**
 - Joint DDR&E / DOT&E initiative
 - Transitioned to TRMC in Feb 2005

- **Mission**
 - **Investigate and 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
 - Netcentric systems

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



T&E/S&T Program Process





T&E/S&T Program

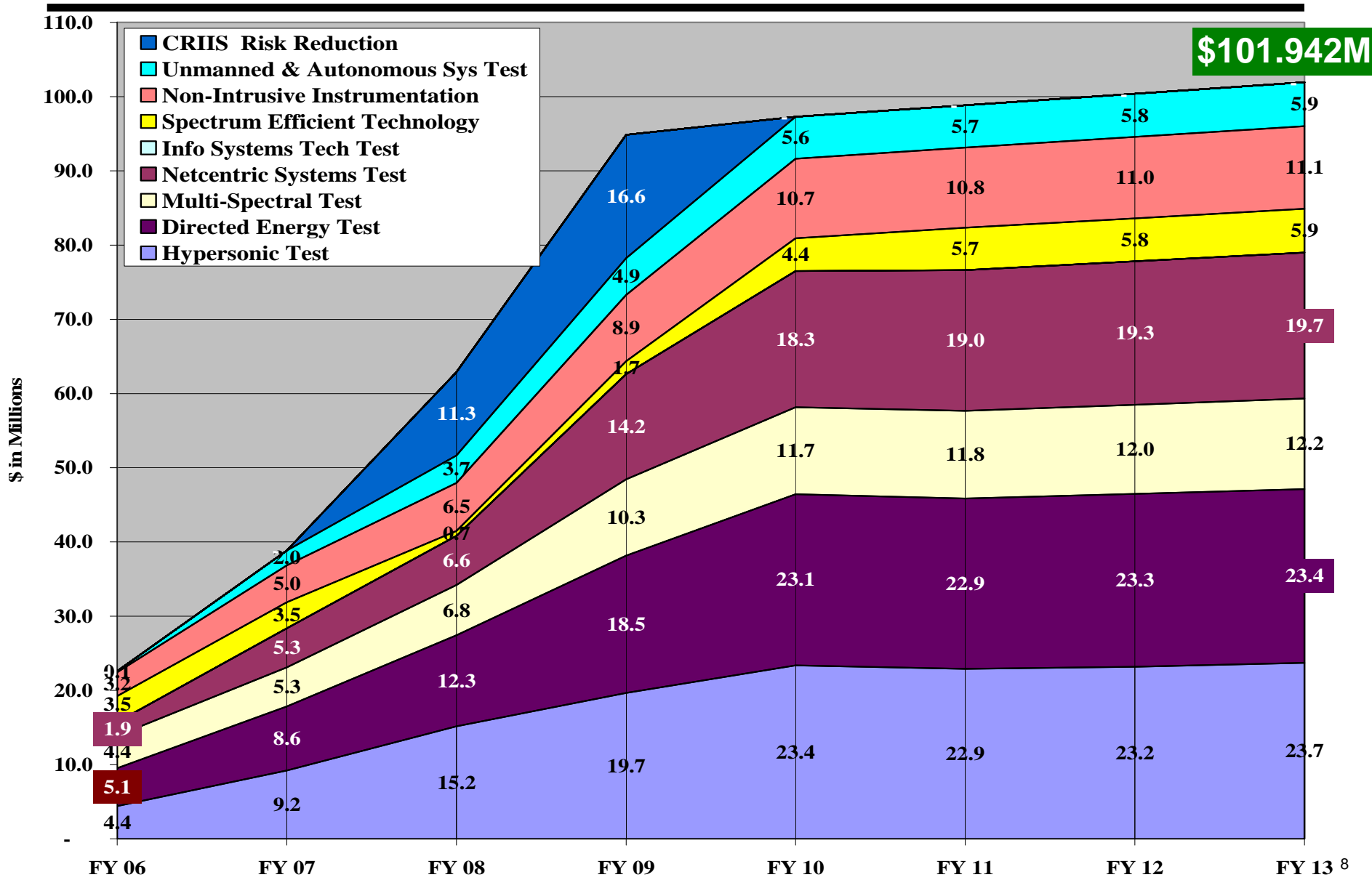
Active Focus Areas



- **Test Technologies for**
 - **Emerging Warfighting Capabilities**
 - Hypersonic Vehicles
 - 14 active projects
 - Directed Energy Weapons
 - 17 active projects
 - Multi-Spectral / Hyper-Spectral Sensors
 - 10 active projects
 - Net-Centric Warfare Systems
 - 10 active projects
 - Unmanned and Autonomous Systems (FY06 Stand-Up, Evaluating Abstracts)
 - **Enhanced Test Capabilities**
 - Spectrum Efficient Technology
 - 11 active projects
 - Non-Intrusive Instrumentation
 - 13 active projects
 - **75 Active Projects**

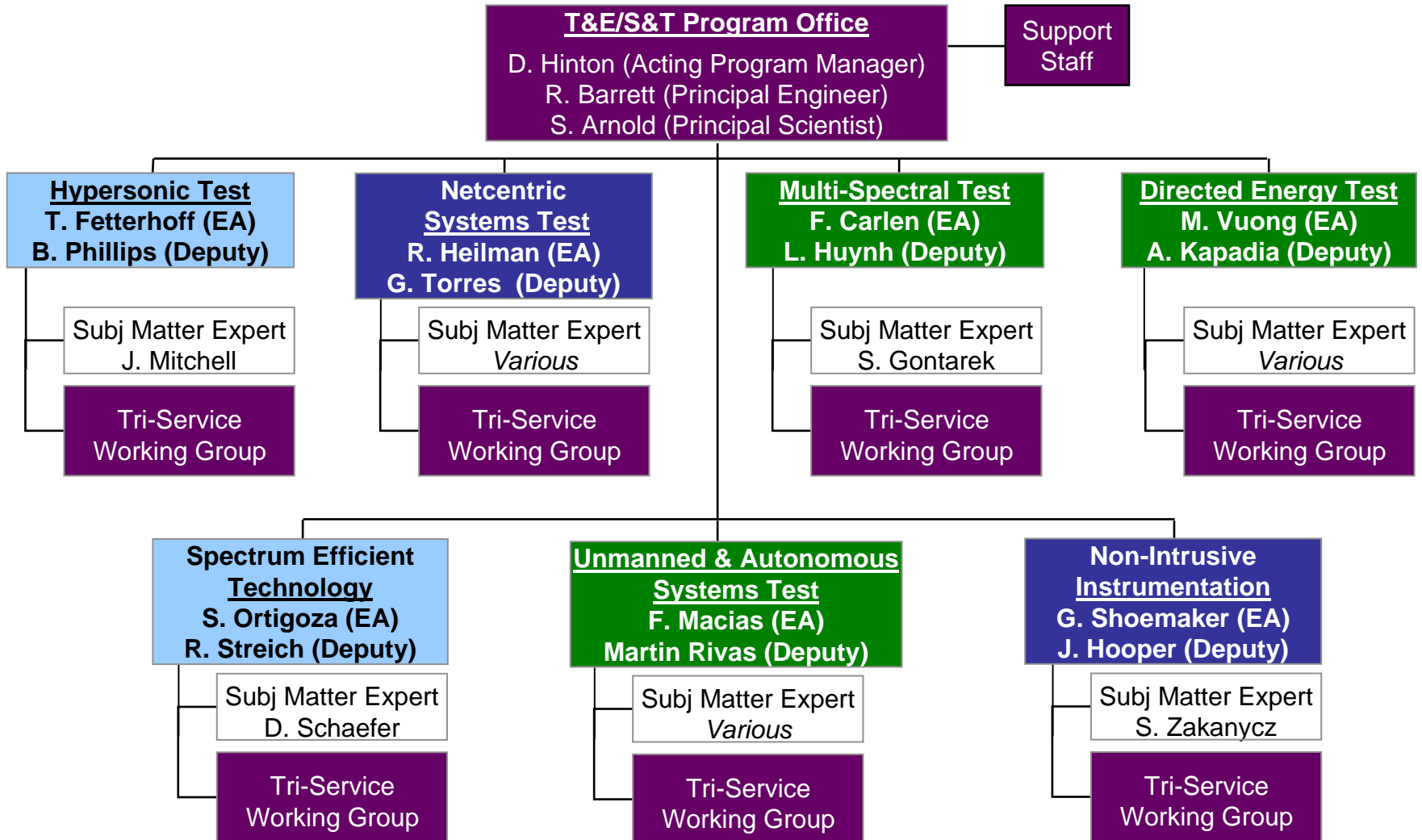


Test & Evaluation/Science & Technology FY 2006 – 2013 Budget





T&E/S&T Program Structure



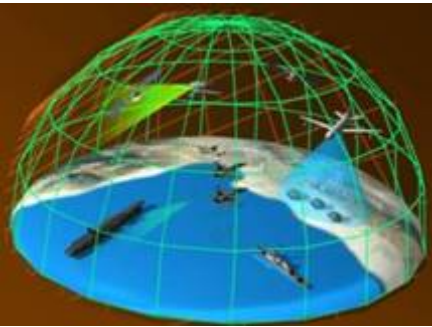


T&E/S&T Program



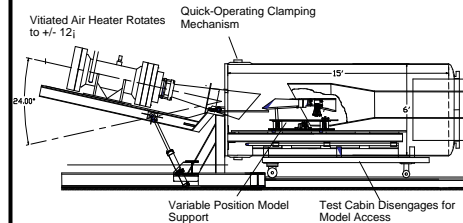
Technologies to Test Emerging Capabilities

Netcentric Systems Test



- Creating a Composable, Distributed Live-Virtual-Constructive Test Environment
- T&E of Service Oriented Architectures
- Information Assurance (IA) Testing
- Test Environment Control and Situational Awareness

High Speed/Hypersonic Test



- Variable Mach test capabilities
- Clean air heaters
- Heat flux sensors
- Combustion gas analysis
- Advanced computational fluid dynamics
- Measurement of high pressure, temperature, and shear stress
- Technologies to determine effects of vitiates

Directed Energy Test



- Measuring the effects of Directed Energy on the target
- Survivable on-board instrumentation
- Instrumentation on targets that is non-intrusive to performance and threat signature
- Instrumentation to determine performance margins
- Evidence of the degree of hard kill and soft kill
- Emulating far-field effects in near-field conditions

Multi-Spectral Test



- Simultaneous generation and injection of RF, UV, visible and IR bands
- Wide-range, dynamic scene projectors with fast frame rates in step with next-generation focal plane array sensors and seekers
- Hi-fidelity simulations to create realistic scenes
- Affordable processors to run hi-fidelity simulations
- End-to-end multi-spectral test capability



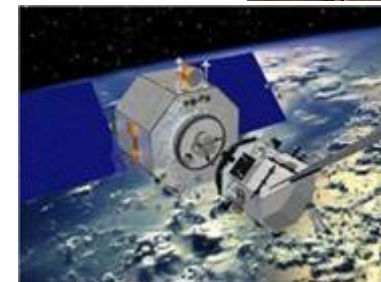
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Technologies to Test Emerging Capabilities



Unmanned and Autonomous Systems Test

- **Unmanned and Autonomous Systems are emerging weapon systems**
 - Limited ability to test
- **Established new focus area in FY06**
 - Develop technologies required to support T&E of Unmanned and Autonomous Systems
 - Leverage efforts in DoD, academia and industry to ensure test ranges can support testing of adaptive, learning systems
- **Developing detailed roadmap to identify T&E Gaps**
 - Link efforts with Unmanned and Autonomous System technology developers
 - Work closely with T&E ranges to identify critical shortfalls
- **Will address technical challenges in this area including (but not limited to):**
 - T&E of cognitive functions
 - Ability to test/control unmanned systems in an unscripted scenario environment
- **Broad Agency Announcement issued Dec 06**
 - Requesting 21 proposals based on the 56 white papers submitted





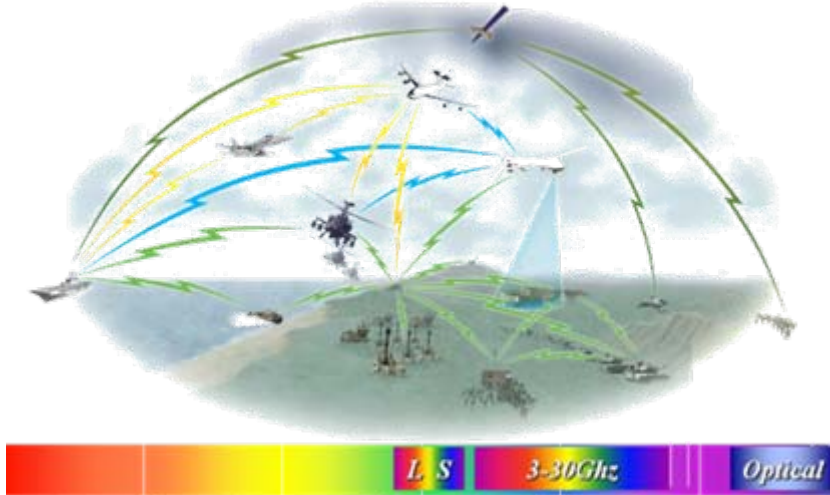
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Technologies for Enhanced Test Capabilities



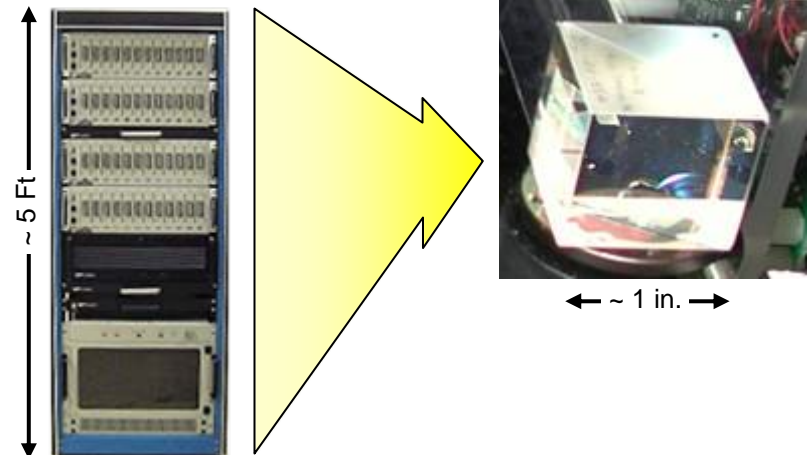
Spectrum Efficient Technology

- Spectrally-efficient, high data rate telemetry
- Steerable beam, directional antenna technologies
- Microelectromechanical Systems (MEMS) antennas
- Advanced modulation and compression techniques
- High dynamic wireless networking capabilities
- Software radios & efficient waveforms
- Use of non-traditional telemetry bands – Super High Frequency and Optical



Non-Intrusive Instrumentation

- Non-intrusive, integrated, miniaturized instrumentation
- MEMS sensors and nanotechnology
- Compact, highly-reliable, high-density data storage
- Efficient, independent power sources
- Open, modular architectures for “plug and play” assembly of components
- Enhanced survivability through improved materials and packaging techniques
- Applicable across the acquisition process as well as to training and logistics





T&E/S&T Program Project Selection Process



Drivers



Tri-Service Focus Area Working Group

- Executing Agent
- T&E Community Reps
- S&T Community Reps
- Subject Matter Experts

Needs/Requirements

Solicitations are issued through <http://www.fedbizopps.gov>

Roadmaps and Solicitations

Proposals

Source Selection Evaluation Team

- Working Group
- Subject Matter Experts
- Contracting Reps

Executing Agent



Final Selections

Recommendations

Focus Area Execution

Funding Decision



Success Criteria



- Technology Success: Demonstration of new test technology
- Capability Success: A test technology is incorporated into a test capability
- Testing Success: A test program has benefited from using the test technology



Heat Flux Sensor Development for Hypersonic Aerothermal Measurements

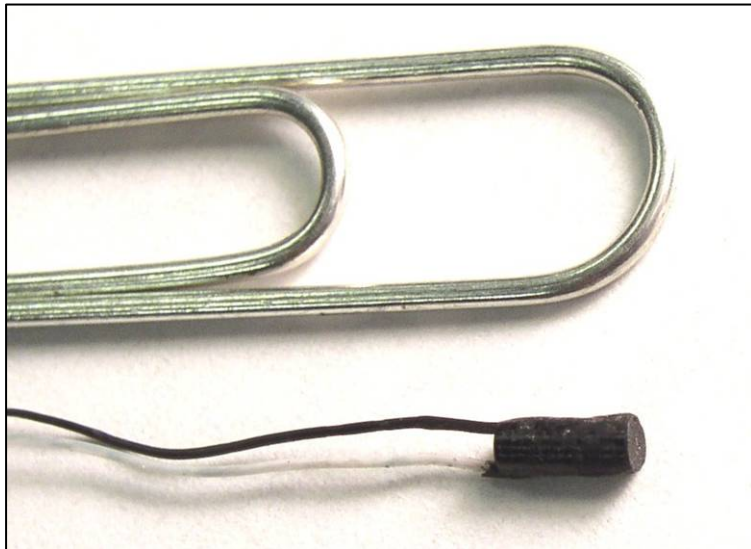
–High Speed/Hypersonic Test–



Developing miniaturized heat flux sensors with the following performance characteristics:

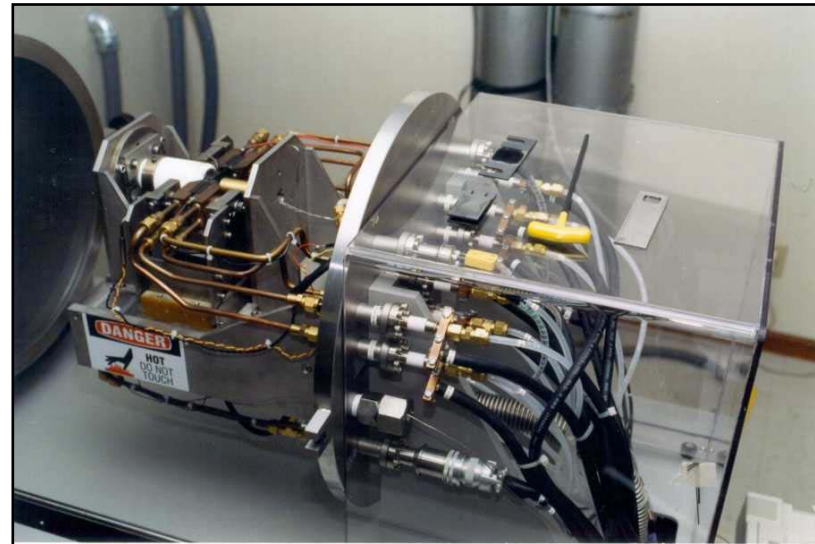
- Continuous operation at 700° F
- Calibration to 50 Btu/ft²-sec
- 0.0625 inches in diameter
- Compatible with embedding in Systems Under Test

Testing Success



0.0625 inch diameter heat flux sensor prototype

Calibration unit



Used to support NASA Shuttle Return to Flight and MDA Kinetic Energy Interceptor tests



Directed Energy Data Acquisition Transformation

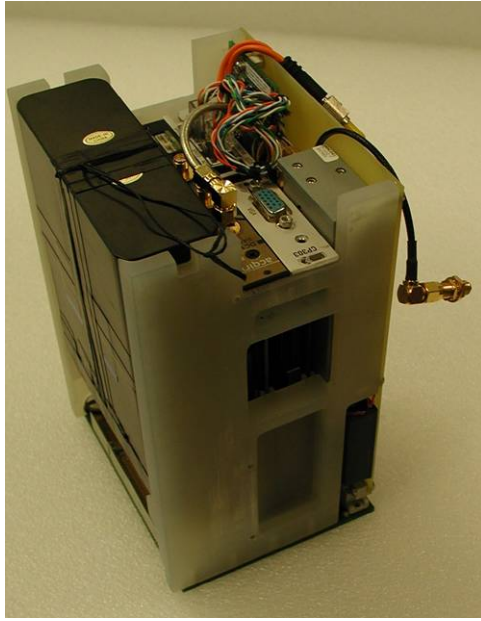
–Directed Energy Test–



- 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

Testing Success

CRDAQ Subassembly



Prototype CRDAQ



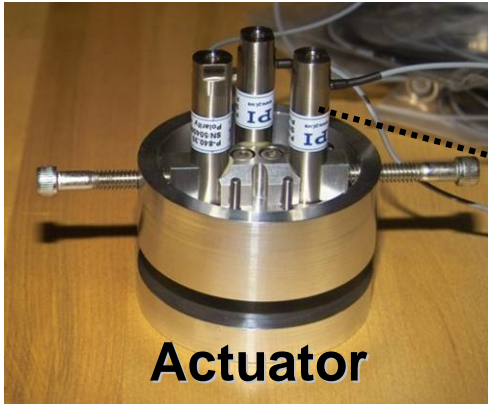
CRDAQ with open top



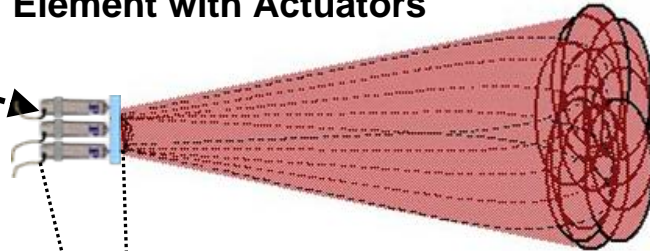
Used to support multiple HPM tests at NSWC Dahlgren Division

Beam Redistribution System

–Directed Energy Test–

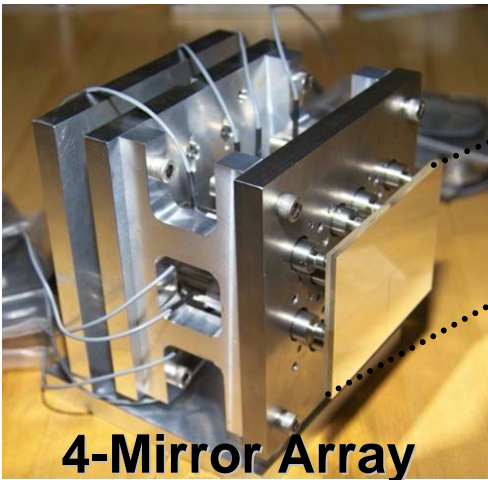


Single Randomly-Dithered Mirror Element with Actuators

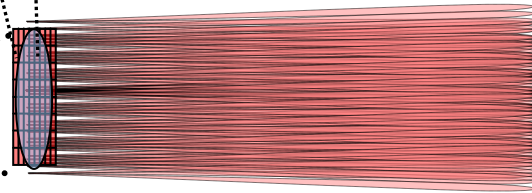


Capability Success

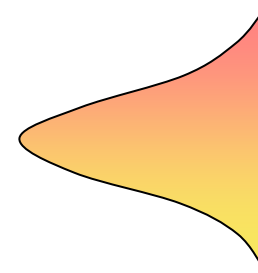
Time integral of single dithered beamlet



Segmented Mirror Array



Time integral of multiple dithered beamlets



- Developed segmented mirror array composed of individual randomly dithered mirrors
 - Multiple mirrors can achieve integration times that are short compared with the target thermal time constant
- Allows Far-Field laser testing to be conducted in Near-Field test environment

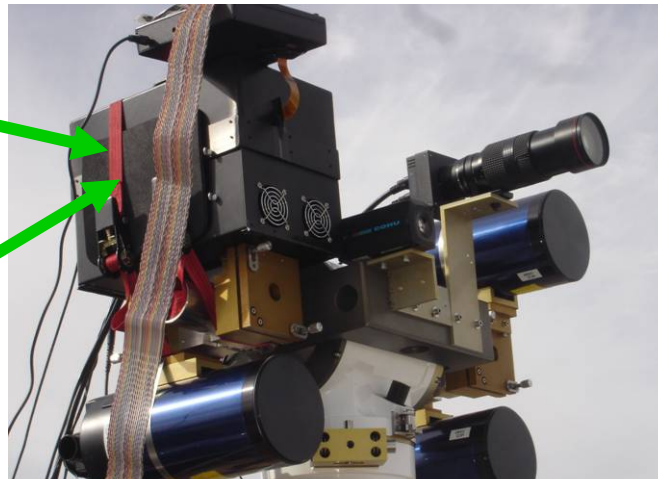
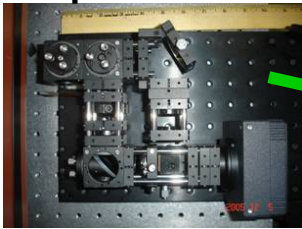
Transitioned to the CTEIP Directed Energy Test and Evaluation Capability (DETEC) Project

Compact Holographic Data Storage –Non-Intrusive Instrumentation–

Developed a brassboard compact holographic memory package that will support high-density, high-rate data recording—no moving parts. 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



Technology Success

Blue diode laser source

Holographic Memory Data Storage
brassboard on tracking mount

Reconstructed stored images

Used to store imagery from Multiple Launch Rocket System tests during WSMR test event



T&E/S&T Program Wrap Up



- **T&E/S&T program initiated to address critical T&E needs, tied to S&T drivers**
- **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