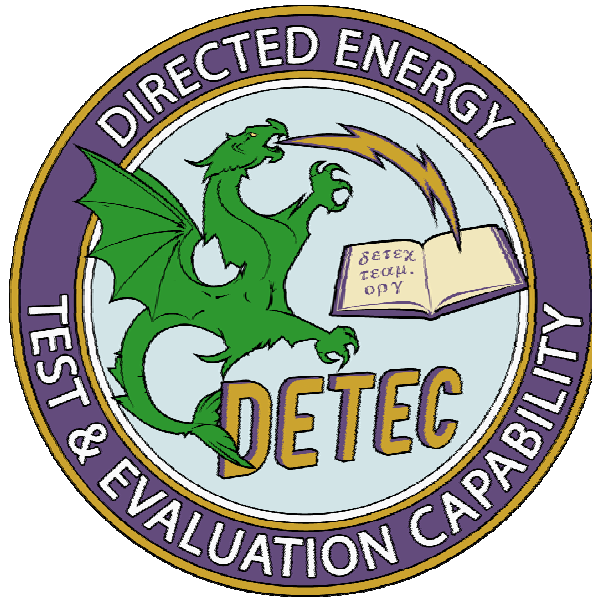


# Directed Energy Test & Evaluation

Unique Target and Range Requirements



31 October 2006

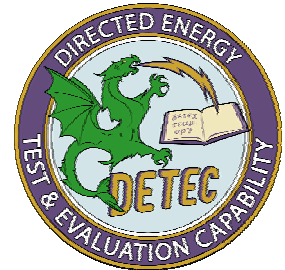
Colonel Tom Buter, USAF  
Commander, USAF SEEK EAGLE Office,  
DETEC AF Deputy Director

Key Team Members:

Minh Vuong, PEO STRI - Project Director  
Brad King, WSMR – TD/Army Deputy  
Mark Henderson, NAWC-WD – Navy Deputy



# The Transformational Nature of Directed Energy



## Speed of Light

- Immediate attack from 1 to 1000's of kilometers
- Impossible to outmaneuver

## Precision Engagement

- High value, selectable targets
- Rapid retargeting



## Controlled Effects

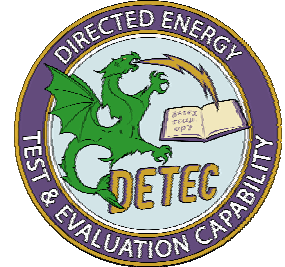
- Minimum collateral damage
- Graduated effects from deny to destroy

***DE provides unique game changing capabilities***



# Lasers and Microwaves

## Synergistic, Complementary and Capable



**Microwaves**  
 3 m – 3 mm  
 100 MHz – 100 GHz

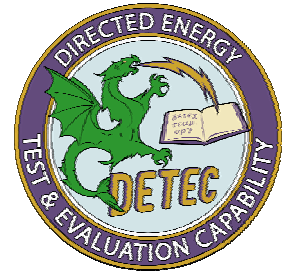
**Lasers**  
 10 μm – 0.2 μm  
 30 THz – 1,500 THz

High Power Microwave s	High Energy Lasers
Generally flood target areas with radiation (multiple simultaneous targets)	Generally uses small laser spots on target areas (surgical attack)
Generally affects components inside systems - electronic disruption.	Generally affects targets from outside in-- structural destruction.
Weather insensitive--sees through clouds and dust.	Weather sensitive to clouds, dust and molecular absorption.
Generally bigger apertures-metal antennas, ground planes	Modest apertures - glass mirrors, coatings and cleaner transmitters needed

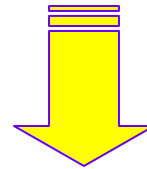
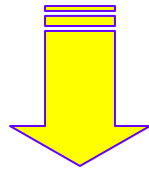
- But....on the other hand,... they both
- Speed of light to the target – Impossible to outmaneuver – Rapid retargeting
  - Capable of graduated effects from deny, disrupt, degrade, to destroy.
  - Minimum collateral damage
  - Unlimited magazines – refuel/rearm



# Emerging Challenge



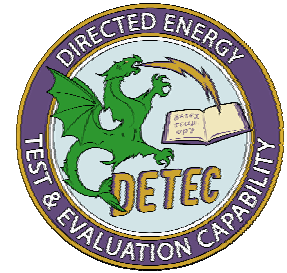
- As concepts leveraging directed energy mature and ...
  - Advanced concept demonstrations prove successful
  - Warfighter buy-in gains strength
  - Developmental programs are stood up



- The MRTFBs must take the T&E burden off the labs
  - Must determine test capability gaps...difficult to do without firm system requirements
  - Lead time needed to implement is driving speculative investment
  - Starting with 'common' needs; evolving transportable capabilities



# DETEC Mission



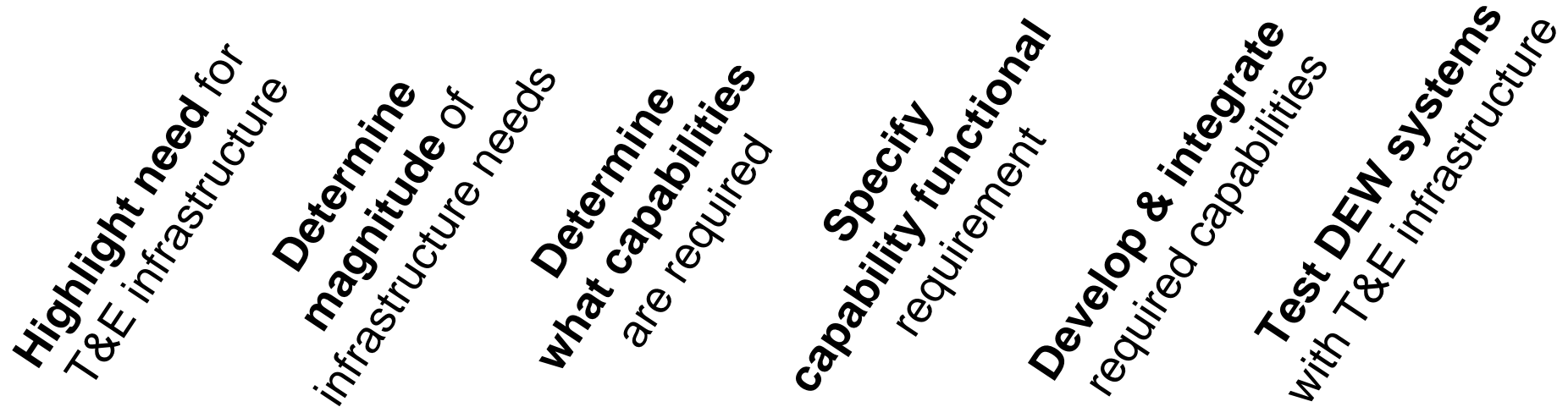
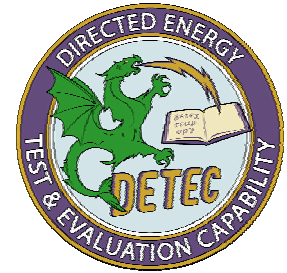
- Develop Joint T&E MRTFB infrastructure required for T&E of DEW systems
  - Instrumentation
  - Equipment
  - Tools
- DEW systems supported
  - High Energy Laser (HEL)
  - High Power Microwave (HPM)
- Coordinate T&E needs with TRMC S&T efforts



DEW – Directed Energy Weapon  
MRTFB – Major Range and Test Facility Base  
TRMC - Test Resource Management Center



# DETEC Role in Establishing DE T&E Infrastructure



← Range of Infrastructure Development Activities →

- Navy Study
- Army Study
- AF Study

**DETEC T-SS**  
 ~1000s of "Requirements"  
 ~100 Shortfalls

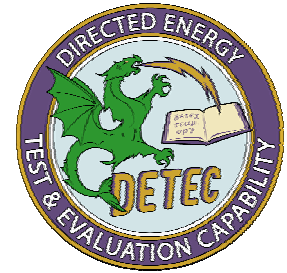
**DETEC**  
 Material Solutions for  
 12 High-Priority Shortfalls

- Service MRTFB Investment
- DEW Program Investment

Tri-Service Study ~ T-SS



# High Priority DE TEC Tri-Service Study Shortfalls



Solutions needed to support T&E of emerging DE systems

## HEL

- Target Subsystems Protection
- Target Reflected Energy Measurement
- Ground Target Irradiance / Fluence Measurement
- Target Surface Temperature Measurement
- Airborne Target Irradiance and Imagery Measurements

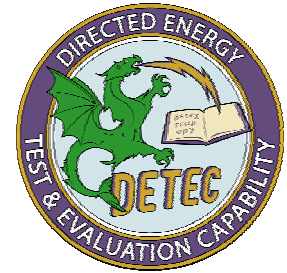
## HPM

- Test Hazard Prediction
- Test Target Subsystems Surety
- Sensor Suite
- Wideband Threat Systems
- Narrowband Threat Systems
- Propagation Environment Measurement
- Target Surrogate Materials

*Blue capabilities focus on target solutions and range ops needs*



# DE T&E Focus for Targets and Range Ops

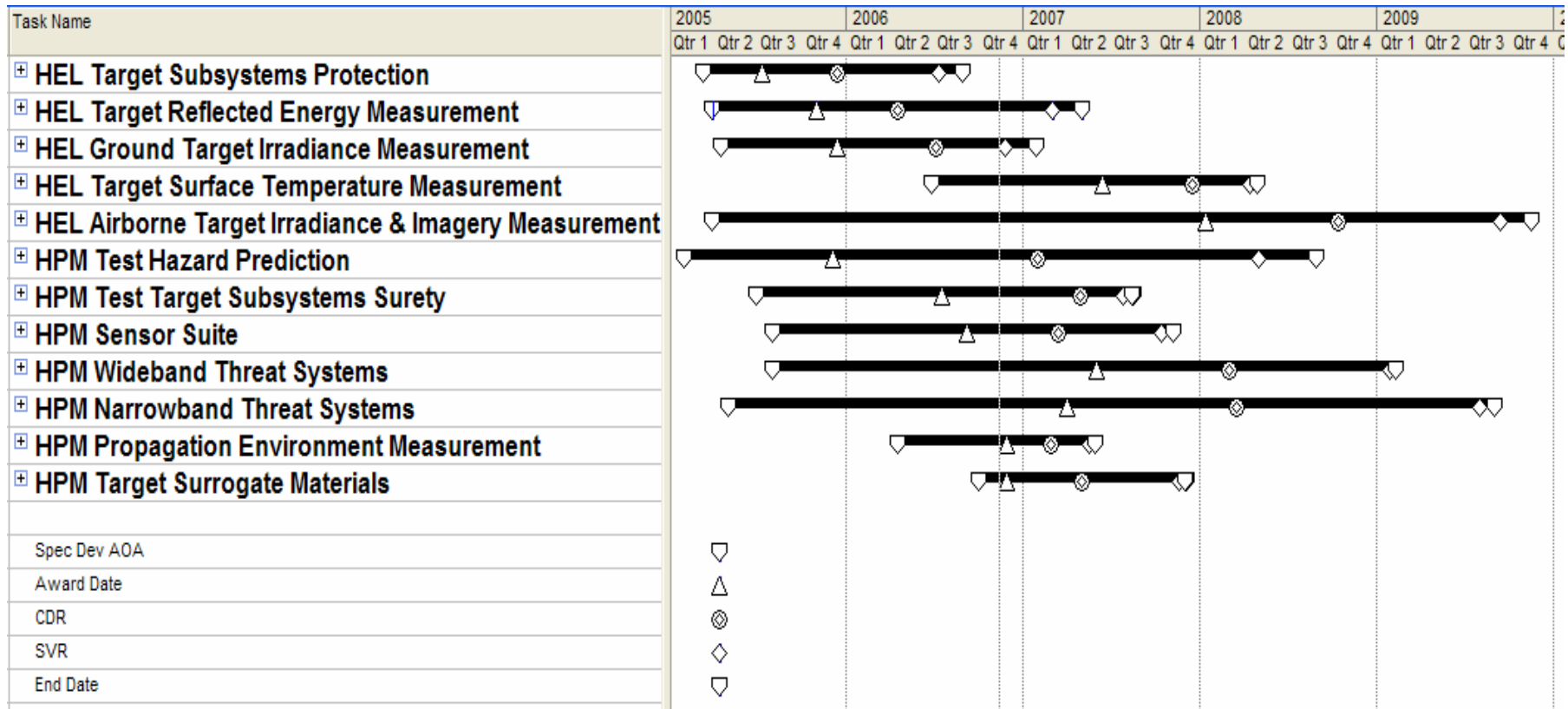
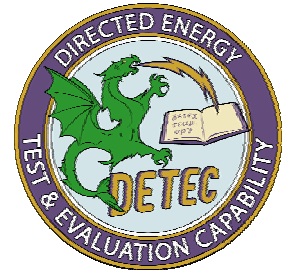


<b>DETEC Capabilities:</b>	<i>Target Subsystems Upgrades</i>	<i>Range Safety</i>	<i>Ops (Freq Mgmt)</i>	<i>Plan/Sched</i>
<b>HEL Target Subsystems Protection (TSP)</b>	X	X		
<b>HEL Target Reflected Energy Measurement (TREM)</b>		X		X
<b>HPM Test Hazard Prediction (TSP)</b>		X	X	X
<b>HPM Test Target Subsystems Surety (TTSS)</b>	X	X		
<b>HPM Target Surrogate Materials (TSM)</b>		X		



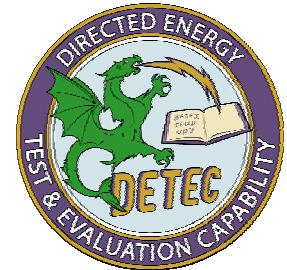


# DETEC Master Schedule





# HEL Target Subsystem Protection (TSP)



## Description:

Joint best practices methodology for protecting test subsystems installed on HEL targets - required for protection of target Flight Termination System (FTS) for airborne targets and the target controller and telemetry systems on airborne and ground targets from laser irradiation

**Benefit:** reduces target preparation time and cost; improves commonality across MRTFB and confidence in target performance

## Subcontract Information:

Sparta - Huntsville, AL

CPFF @ \$1,179K

PoP: 06 May 05 – 31 May 06

## Product:

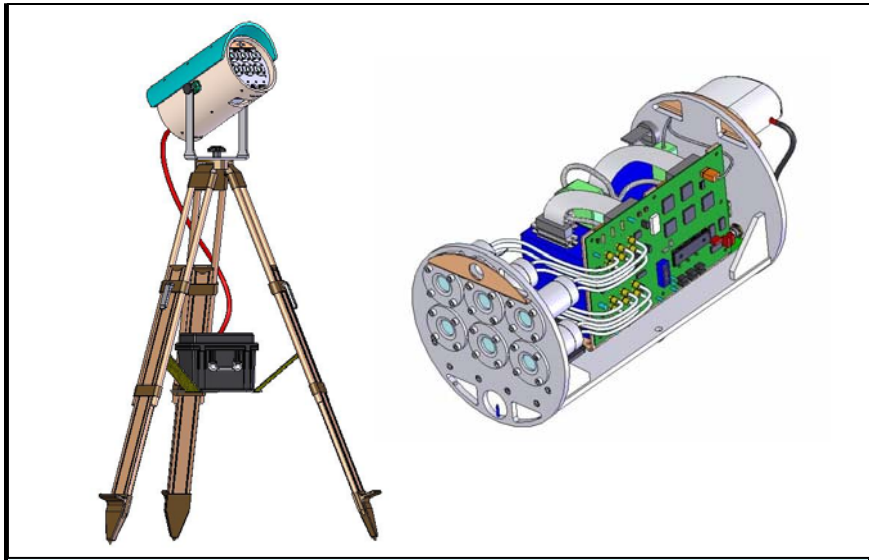
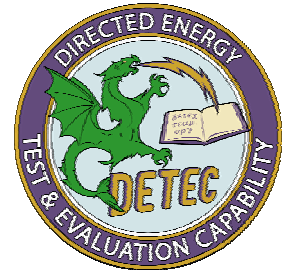
Handbook, available to all potential MRTFB users on DETEC web site: [www.detec-team.org](http://www.detec-team.org)

## Schedule: (Completed)

Start	6 May 05
PDR	7 Sep 05
CDR	7-8 Dec 05
IRR	14-15 Mar 06
SVR	26 Apr 06
Product Delivery	26 May 06



# HEL Target Reflected Energy Measurement (TREM)



### Description:

Instrument to accurately measure reflected target laser power - for in-band reflected laser power (same spectral band as laser) at up to 20 reflection angles and locations; data used to improve laser hazard prediction codes and employment planning tools

**Benefit:** improves safety practices; reduce cost & time for T&E planning/execution; enables doctrine and TTP development to minimize collateral damage

### Subcontract Information:

SARA - Cypress, CA  
CPFF @ \$2,643K  
PoP: Jul 05 – Jan 07

### Product:

Network of autonomous point data collectors capable of detecting and recording reflected laser energy

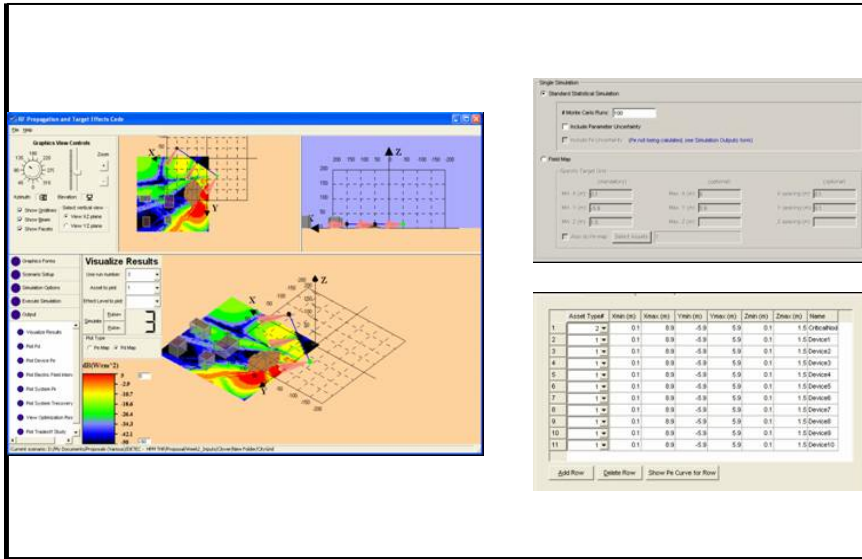
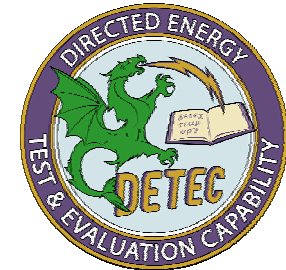
### Schedule:

Start	20 Jul 05
PDR	15 Sep 05
CDR	7-8 Feb 06
IRR	Oct 06
SVR	Dec 06
Product Delivery	Jan 07

**Host Site: HELSTF**



# HPM Test Hazard Prediction (THP)



## Description:

Integrated software and procedures to make near real-time predictions of where HPM beams may propagate beyond the target during open-air, live-fire HPM testing in all environments including ducting and channeling, which can result in HPM propagation beyond expected ranges

**Benefit:** reduces test planning costs; promotes common frequency clearance approach/criteria; expedites freq coordinator test planning

## Subcontract Information:

ATK Mission Research – Albuquerque, NM  
 CPFF @ \$2,680K  
 PoP: Oct 05 – May 08

## Product:

Software application that determines test hazard boundaries for personnel and electronics

## Schedule: (Completed) Ph 1

## Ph 2

Start

stand-alone integr w/ PEM & SS

1 Oct 05

PDR

8-9 Mar 06

CDR

13-14 Jun 06

Nov 06

IRR

N/A

Feb 07

SVR

Feb 07

Feb 08

Product Delivery

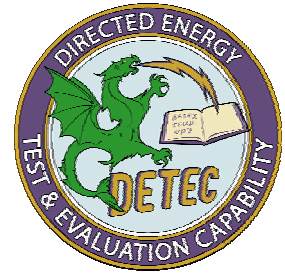
May 07

April 08

**Host Site: NAWC-WD (Pt. Mugu)**



# HPM Test Target Subsystems Surety (TTSS)



### Description:

Assessment for protecting test subsystems on HPM targets - required for protection of target Flight Termination System (FTS) for airborne targets, target controller, and telemetry systems on airborne/ground targets from HPM effects

**Benefit:** minimizes MRTFB costs to evaluate weapon systems against broad set of mobile/transportable and extensible surrogate HPM threats sources; supports Block I Survivability to DE Reqt, FCS

### Subcontract Information:

Sol Oriens – Albuquerque, NM

T&M @ \$1,292K

PoP: Apr 06 – May 07

### Product:

Software application that determines test hazard boundaries for personnel and electronics

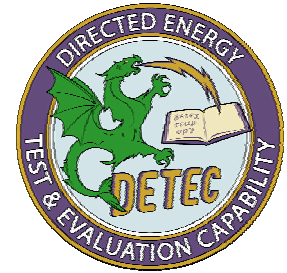
### Schedule:

Start	Apr 06
PDR	10 Aug 06
CDR	Jan 07
Product Delivery	Apr 07

*Host Site: available to all MRTFB sites*



# HPM Target Surrogate Materials (TSM)



## Description:

Identification of volatile material surrogates - inert materials that match the electric and magnetic properties of the material, having little or no affect on HPM test results; surrogate materials will emulate: explosives, fuels, solid propellants

**Benefit:** allows safe, cost effective means to determine HPM effects in full weapons system tests – eliminates explosive and fire risk with surrogate materials

## Subcontract Information:

tbd

PoP: tbd

## Product:

Reference manual of cross referenced material properties and information to acquire surrogates

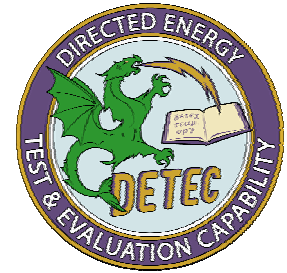
## Proposal Schedule:

RFP Release	Nov 06
Proposals Due	Dec 06
Contract Award	Feb 07

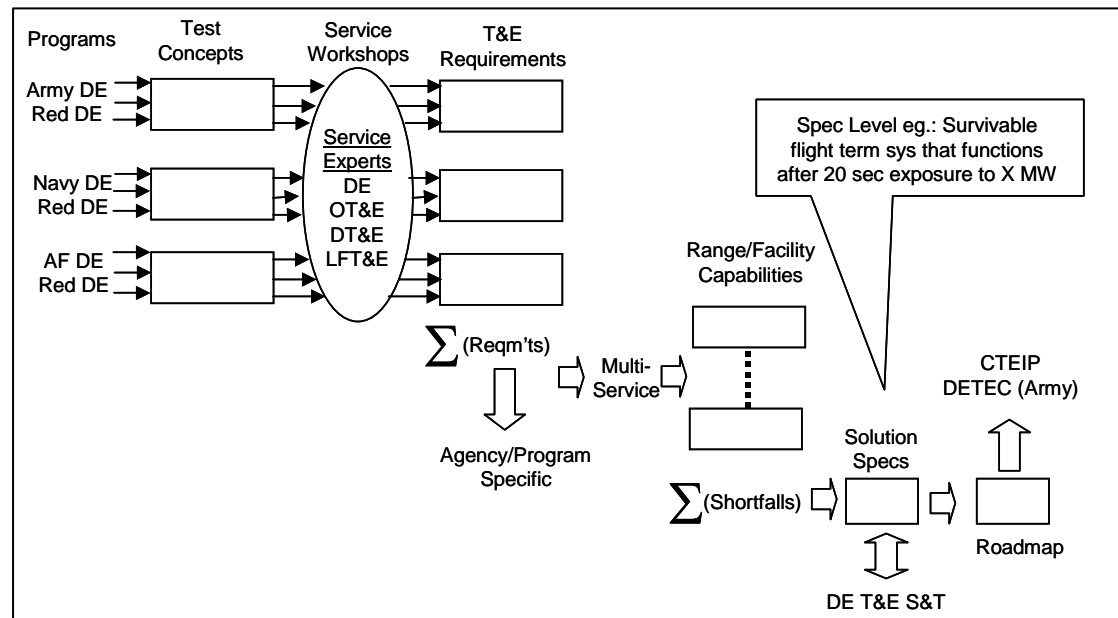
**Host Site: TBD**



# DETEC Tri-Service Study (T-SS) Update

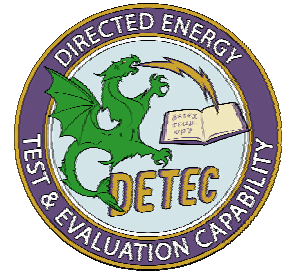


- Follows similar T-SS process with lessons learned improvements
- Identifies newest DE-unique requirements, capabilities, shortfalls, and solutions
- Includes DE systems/concepts that could be tested within the next 12 years
- Planned FY07 Efforts
  - DETEC Deputies identifying leads and Review Group members
  - Update test concept templates, update/create test concepts
  - Plan service workshops
- Strategy
  - Utilize workshops to validate needs
  - LSI to consolidate information and provide to Govt leads
  - DETEC Govt IPTs prioritize results
  - Review Group to validate prioritized results





# Factors Critical to Success

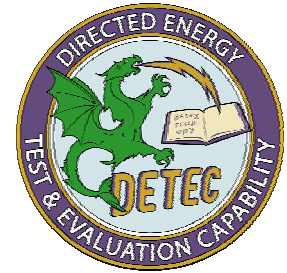


- Government participation in IPTs
  - DEW program and technology offices
  - Warfighters
  - DoD DE labs
  - Testers
- Industry, Government, and Academia awareness and participation
  - Material solution providers
  - Subject matter experts
    - Individually precluded from subsequently providing material solution by OCI plan





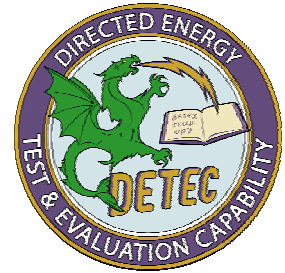
# Summary



- Advancements in DE driving new MRTFB test requirements
  - DETEC currently addressing 12 high-priority shortfalls
    - Mobile/transportable from designated host sites
    - Initial investments instrumentation-focused
    - DETEC Tri-Service study update in progress
  - First T-SS did not ID specially required targets for DE T&E
    - Focus was instead on target subsystems survivability in HEL/HPM engagements
- DETEC is providing means for ranges to (more) cost effectively support open air DE T&E
  - Tools and sensors to predict and monitor go/no go event decisions for test planning and execution
  - Range safety and operations efficiency key drivers



# DETEC Information Sources

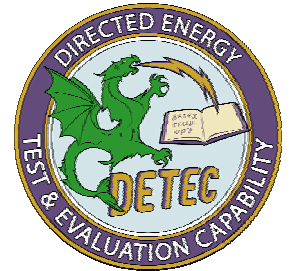


- Information about DETEC is available via the web
  - Public site with announcements and info for vendors
    - Register for email notification of postings and updates
    - Draft RFP and RFP registration for access and notifications
    - Teaming opportunities registration and postings
  - Private site for need-to-know IPT participants, etc.
  - Announcements (Draft RFP, RFP) posted on FEDBIZOPPS
- DETEC supporting future direction of DET S&T
  - DET S&T BAA info posted on the DETEC public site

[www.detecteam.org](http://www.detecteam.org)



# DETEC



[www.detecteam.org](http://www.detecteam.org)