Overview

- DETEC Mission
- DETEC Role in Establishing DE T&E Infrastructure
- Acquisition and Management Strategy
- Capability Development Process
- Master Schedule
- Capability Descriptions
- Factors Critical to Success
- DETEC Information Sources
- Summary
DETEC Mission

- Develop Joint T&E MRTFB infrastructure required for T&E of DEW systems
  - Instrumentation
  - Equipment
  - Software 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

Highlight need for T&E Infrastructure
Determine Magnitude of Infrastructure Needs
Determine What Capabilities are Required
Specify Capability Requirement
Develop & Integrate Required Capabilities
Test DEW Systems With T&E Infrastructure

T-SS: Tri-Service Study

DEOTET

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

Material Solutions addressing 40 T-SS Shortfalls

Service MRTFB Investment
DEW Program Investment

Navy Study
Army Study
AF Study
DEOTET
Acquisition & Management Strategy

• Systems Integration Contractor (SIC) in charge of capability development and integration efforts
  – Requirements validation
  – Capability acquisition (subcontract award and management)
  – Capability integration, training, acceptance testing

• Capability solutions provided by industry, government, academia

• Capability solutions acceptance by DETEC PD & MRTFB
  – MRTFB site takes ownership
  – Capabilities to be mobile/transportable to other ranges

• IPT structure for efficient management and oversight
  – Stakeholder membership (Government, SIC, Program Offices, Ranges)
  – Subject matter expert support
### DETEC Master Schedule

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**NOTE:** Shaded milestones are complete.
DETLEC Capabilities Provided

DETLEC developing 16 solutions addressing 40 T-SS shortfalls:

- HEL TSP Handbook
- HEL TREM
- HEL GTIM
- HEL ATIM
- HPM THP
- HPM TTSS Reference Guide
- HPM SS
- HPM WBTS
- HPM COTS WBTS (2)
- HPM PEM
- HPM TSM Database
- HPM NBTS-A
- HPM NBTS-A’
- HPM NBTS-B
- HPM NBTS-C
HPM Tunable Narrowband Threat Systems Subsystem A (NBTS-A)

Project Manager (DETEC SIC)
Cyndi Mora

Product
– HPM narrowband threat surrogate
– Developed by Ktech Corp of Albuquerque, NM

Available Now
Contact Mr. Russell Blundell at White Sands Missile Range, 575-678-5584
Russell.blundell@us.army.mil

Project Description:
HPM sources that accurately portray narrowband HPM source characteristics. The tunable nature of the sources allows a single source to emit in various narrow frequency bands.

<table>
<thead>
<tr>
<th>NBTS System Designation</th>
<th>Radar Band</th>
<th>Frequency (GHz)</th>
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<tr>
<td>NBTS-A</td>
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<td>1.0 – 1.7</td>
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HPM NBTS A Features
– Power >32 MW
– Intensity on the surface of a planar test object located at the far-field of the radiating antenna 500 kW/m²
– 32 m² 3 dB spot size
– Pulse Repetition Frequency up to 20 Hz
– Pulse Width up to 500 ns
– Radiate in both vertical and horizontal polarizations
– Single and repetitive pulse modes
– Remote Operation
HPM Tunable Narrowband Threat Systems
Subsystem A Prime (NBTS-A’)

Project Description:
HPM sources that accurately portray narrowband HPM source characteristics. The tunable nature of the sources allows a single source to emit in various narrow frequency bands.

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<th>NBTS System Designation</th>
<th>Radar Band</th>
<th>Frequency (GHz)</th>
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<tr>
<td>NBTS-A’</td>
<td>S – lower</td>
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HPM NBTS A’ Features
- Power >48 MW
- Intensity on the surface of a planar test object located at the far-field of the radiating antenna 2.0 MW/m²
- 12 m² 3 dB spot size
- Pulse Repetition Frequency up to 20 Hz
- Pulse Width up to 200 ns
- Radiate in both vertical and horizontal polarizations
- Single and repetitive pulse modes
- Remote Operation

Project Manager (DETEC SIC)
Cyndi Mora
Product
- HPM narrowband threat surrogate
- Developed by Ktech Corp of Albuquerque, NM

Available Now
Contact Mr. Russell Blundell at White Sands Missile Range, 575-678-5584
Russell.blundell@us.army.mil
HPM Tunable Narrowband Threat Systems Subsystem B (NBTS-B)

Project Description:
HPM sources that accurately portray narrowband HPM source characteristics. The tunable nature of the sources allows a single source to emit in various narrow frequency bands.

<table>
<thead>
<tr>
<th>NBTS System Designation</th>
<th>Radar Band</th>
<th>Threshold Center Frequency (GHz)</th>
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<tbody>
<tr>
<td>NBTS-B</td>
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<td>10.2 – 10.5</td>
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HPM NBTS B Features
- Power >100 MW
- Intensity on the surface of a planar test object located at the far-field of the radiating antenna 50 MW/m²
- 1 m² 3 dB spot size
- Pulse Repetition Frequency up to 200 Hz
- Pulse Width up to 15 ns
- Radiate in both vertical and horizontal polarizations
- Single and repetitive pulse modes
- Remote Operation

Project Manager (DETEC SIC)
Cyndi Mora
Product
- HPM narrowband threat surrogates
- Developed by Ktech Corp of Albuquerque, NM

Available Now
Contact Mr. Russell Blundell at White Sands Missile Range, 575-678-5584 Russell.blundell@us.army.mil

HPM narrowband threat surrogates
Developed by Ktech Corp of Albuquerque, NM
Available Now
Contact Mr. Russell Blundell at White Sands Missile Range, 575-678-5584 Russell.blundell@us.army.mil
HPM Tunable Narrowband Threat Systems Subsystem C (NBTS-C)

Project Description:
HPM sources that accurately portray narrowband HPM source characteristics. The tunable nature of the sources allows a single source to emit in various narrow frequency bands.

<table>
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<th>NBTS System Designation</th>
<th>Radar Band</th>
<th>Frequency (GHz)</th>
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<tr>
<td>NBTS-C</td>
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<td>0.2 – 0.75</td>
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Available Now
Contact Mr. Russell Blundell at White Sands Missile Range, 575-678-5584
Russell.blundell@us.army.mil

Project Manager (DETEC SIC)
Cyndi Mora

Product
- HPM narrowband threat surrogate
- Developed by Ktech Corp of Albuquerque, NM

HPM NBTS C Features
- Power >8 MW
- Intensity on the surface of a planar test object located at the far-field of the radiating antenna 250 kW/m²
- 32 m² 3 dB spot size
- Pulse Repetition Frequency up to 10 Hz
- Pulse Width up to 400 ns
- Radiate in both vertical and horizontal polarizations
- Single and repetitive pulse modes
- Remote Operation
HPM Wideband Threat Systems (WBTS)

Project Description:
Construct a HPM system and acquire a COTS HPM source that accurately portray wideband HPM source characteristics to allow emissions in a broad range of frequencies, pulse repetition rates, pulse widths, energy on target, and other parameters.

HPM WBTS Features
- Small Sources
  - Diehl DS110T commercially available source
  - Mechanically tunable over a principal frequency range from 100 – 300 MHz
  - Fully autonomous or remote operation.
- High Power Source
  - 200 MHz to 6000 MHz in nine bands
  - E-field at target: 30 – 110 V/m/MHz (depending on frequency)
  - Pulse Repetition Frequency: 1 – 100 Hz
  - Pulse length: ≥1 ns

Project Manager (DETEC SIC)
Cyndi Mora

Product
- Wideband HPM sources as threat surrogates
- Developed by L-3 Pulse Sciences of San Leandro, CA

Available Now
Contact Mr. Russell Blundell at WSMR or Mr. John Crim at Patuxent River, 301-757-3612, john.crim@navy.mil
HPM Sensor Suite (SS)

**Project Manager (DETEC SIC)**
Roger Olson

**Product**
- Suite of sensors, van, and data tools
- Developed by EG&G Technical Services of Albuquerque, NM

**Available Now**
Contact Mr. Russell Blundell at White Sands Missile Range, 575-678-5584
Russell.blundell@us.army.mil

**Project Description:**
Capability to make very accurate, time stamped measurements of external radio frequency field strength, beam, and power characteristics as well as internal target and imagery measurements, within pulse intervals during an HPM shot.

**HPM SS Features**
- Frequency coverage: narrowband and wideband (50 MHz—10 GHz); millimeter band (91 GHz—98 GHz)
- Number of simultaneous measurements: 30 narrowband and wideband
- Recorder channels: 30 configurable
- Field strength: 400 kV/m (narrowband and wideband) 100 W/cm² (millimeter band)
- Dynamic range: 45 dB
- Autonomous channels: 10
- Accuracy: ±3 dB
- Timing: GPS/IRIG-B time-stamps to ±1 ns
- Pulse repetition frequency: Up to 10 KHz
- Test size: 1000 events; 4 events per hour
- Cameras: Visible and infrared, 4 each
HPM Test Hazard Prediction (THP)

Project Manager (DETEC SIC)
Roger Olson

Product
– Software application that determines test hazard boundaries for personnel and electronics
– Developed by Alliant Techsystems of Albuquerque, NM

Available Now
Contact Mr. Terry Battalino at Point Mugu, 805-989-0125, terry.battalino@navy.mil

Project 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 normal ranges expected.

HPM THP Features
– Narrowband and wideband frequencies characterizations: 50 MHz – 35 GHz
– Millimeter band characterization: 94 GHz-96 GHz
– Pulse width characterization: Continuous wave to 10 ns
– Interfaces with the HPM Propagation Environment Measurement and HPM Sensor Suite Capabilities
– Provides decision aids that include field and hazard boundaries and frequency clearance forms
– Operates on a standard personal computer running Windows XP
HPM Target Surrogate Materials (TSM)

Project Description:
Identify volatile materials and surrogate 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, and solid propellants.

Project Manager (DETEC SIC)
Jerry Pavlinko

Product
Web-based, searchable database of information about and properties data for hazardous and surrogate materials used in HPM testing
- Developed by SAIC/ASO of Albuquerque, NM

Available Now
Request a copy at www.detecteam.org

HPM TSM Features
- Provides recommended surrogate materials that may be substituted for energetic materials used in HPM test target objects
- Graphically compares electric and magnetic properties of a hazardous material to those of surrogate materials to suggest a surrogate material to substitute
- Finds test target objects used at test ranges, their hazardous material components, and hazardous materials permitted for or prohibited from use at test ranges
- Provides a printable catalog of the materials information and data contained in the database
Project Description:
Capability for near real-time monitoring of soil/water conductivity, dielectric constant, atmospheric temperature and relative humidity conditions, as well as the absorption and scattering effects of atmospheric obscurants (smoke, dust chaff, etc.) within HPM beams.

HPM PEM Features
- Measures and telemeters atmospheric data up to 2 km altitude
  - Temperature: -50 to +60 C
  - Humidity: 0 to 1005 RH
  - Pressure: 500 to 1080 hPa
  - Uses UHF meteorology telemetry channel
- Measures ocean surface characteristics
  - Wave motion: Period to 100 s, height ±20 m
  - Surface temperature: -5 to 46 C
  - Uses VHF buoy telemetry channel
- Interfaces with the HPM Test Hazard Prediction to update predictions

Project Manager (DETEC SIC)
Roger Olson

Product
- State-of-the-art COTS measurement devices (Buoy & Tethersonde) plus Soil characteristics reference database
- Developed by Alliant Techsystems of Albuquerque, NM

Available Now
Contact Mr. Terry Battalino at Point Mugu
805-989-0125, terry.battalino@navy.mil
Project Description:
Deliver an assessment for protecting test subsystems installed on HPM targets. TTSS is required for protection of target Flight Termination System (FTS) for airborne targets and the target controller and telemetry systems for both airborne and ground targets from HPM effects.

HPM TTSS Features
- Provides methods and processes that can be used to protect key target subsystems during HPM weapon testing
- Includes solutions for telemetry, flight termination, and target controller subsystems
- Provides details on HPM hardening and mitigation techniques
- Provides additional detail on the analysis/modeling and simulation techniques and tools
- Includes information about test techniques and facilities

Project Manager (DETEC SIC)
Cyndi Mora

Product
- A Guideline for TTSS Methodology
- Developed by Sol Oriens LLC of Albuquerque, NM

Available Now
Request a copy at www.detecteam.org
HEL Target Subsystems Protection (TSP)

Project Description:
Deliver a joint best practices methodology for protecting test subsystems installed on HEL targets. TSP is required for protection of target Flight Termination System (FTS) for airborne targets and the target controller and telemetry systems for both airborne and ground targets from laser irradiation.

Project Manager (DETEC SIC)
Clyde Harris/Cyndi Mora

Product
- Handbook
- Developed by SPARTA, Inc. of Huntsville, AL

Available Now
Request a copy at www.detecteam.org

HEL TSP Features
- Provides best practices for protecting target subsystems from HEL irradiation
- Includes solutions for target flight termination system, target telemetry, and target controller packages
- Employs a systematic solution generation process to help the user select, generate, and evaluate a test subsystem protection solution
- Includes solution guidelines and procedures for applying non-development physical protection techniques to the target
- Includes solutions that can be applied to any developmental, operations, or live-fire HEL test that employs an operationally representative target
HEL Target Reflected Energy Measurement (TREM)

Project Description:
Accurately measure laser power reflected by a target. The measurement is for in-band reflected laser power (same spectral band as laser) at up to 30 reflection angles and locations. Data used to improve laser hazard prediction codes and employment planning tools.

HEL TREM Features
- Continuous wave measurements: 1.064 μm, 1.07 μm, 1.08 μm, and 1.315 μm
- Pulsed measurements: 1.0 μm - 1.1 μm
- Maximum fluence: 200 J/cm²
- Maximum field of view half angle: 10 degrees
- Sample rate: 100 Hz
- Operates autonomously
- Includes time-stamped measurements and data acquisition and recording
- Transportable between test sites

Project Manager (DETEC SIC)
Cyndi Mora

Product
- Network of 30 autonomous point data collectors capable of detecting and recording reflected laser energy
- Developed by Scientific Applications and Research Associates, Inc. (SARA) of Cypress, CA

Available Now
Contact Mr. Nahim Flores at the High Energy Laser Systems Test Facility, 575-679-5002 floresn@smdchl.smdc.army.mil

Contact Cyndi Mora at the High Energy Laser Systems Test Facility, 575-679-5002 cmora@smdchl.smdc.army.mil
**HEL Ground Target Irradiance Measurement (GTIM)**

**HEL GTIM Features**
- Peak instantaneous irradiance: 100 W/cm² to 10 kW/cm²
- Fluence: 180 kJ/cm²
- Spot diameter: 2-50 cm
- Interval between shots: <2 min
- Wavelength range: 1.0 – 1.6 μm
- Dynamic range: 435 (at 100 W/cm²) to 1000+
- Maximum irradiance: 13 kW/cm²
- Irradiance accuracy: ±18%
- Spatial resolution: 5% of beam diameter
- Sample rate: 50 Hz
- Fluence accuracy: ±20%
- Centroid location accuracy: 6% of spot diameter
- Jitter measurements: Up to 25 Hz

**Project Description:**
Build a transportable instrument to measure continuous wave (CW) laser irradiance (power per unit area) and compute fluence (irradiance integrated over exposure time), incident on a stationary ground target being engaged by a laser system that is either on the ground or airborne.

**Project Manager (DETEC SIC)**
Mike Bertin

**Product**
- Instrumentation package of sensor (InGaAs detector) with data collection system
- Developed by Scientific Applications and Research Associates, Inc. (SARA) of Cypress, CA

**Available Now**
Contact Mr. Nahim Flores at the High Energy Laser Systems Test Facility, 575-679-5002 floresn@smdchl.smdc.army.mil
HEL Airborne Target Irradiance and Imagery Measurement (ATIM)

Project Manager (DETEC SIC)
Mike Bertin

Product
- Instrumentation package of IR and imagery sensors with data collection system

Available Now
Contact Mr. Chris Beairsto at White Sands Missile Range, 575-679-5551
chris.beairsto@smdch1.smdc.army.mil

Project Description:
Build an instrument to
1) accurately measure the CW laser irradiance incident on, and
2) collect high-resolution imagery across several spectral bands on realistic airborne and TBM targets in outdoor live-fire testing.

HEL ATIM S&T Testbed Features
- Added visible, MWIR, LWIR cameras
- Upgraded capability to track highly dynamic airborne targets (70 Hz track loop)
- Added capability to control APT remotely via encrypted link
- Remote capability allows APT to be placed in hazard zone
- Operates up to Secret level
- All APT functions controlled
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
DETEC Information Sources

- Information about DETEC available via the web
  - Public site with announcements and info
  - Private site for need-to-know IPT participants, etc.

www.detecteam.org
Summary

• Improving MRTFB infrastructure supporting DEW T&E
  – Addresses 5 HEL and 7 HPM capabilities representing 32 high-priority shortfalls
  – Needed for T&E of emerging DEW systems
• DETEC project management and implementation
  – Army Project Director (PEO STRI)
  – Tri-Service Deputy Project Directors ensure Joint solutions
  – DETEC SIC (SAIC) responsible for capability development
  – IPTs provide Government insight and oversight for OTICC
  – IPTs ensure DE community involvement
  – IPT participation is key
• Continuing support from stakeholders throughout the DE and T&E communities is essential to DETEC success
• Test plans developed by IPT (SIC, Government, Developer)
  – Qualification & Integration responsibility of Developer
  – Acceptance responsibility of SI and Government
Acronyms

APT – Advanced Pointer Tracker
APOS – Advanced Polymer Optical Sciences
ATIM – Airborne Target Irradiance and Imagery Measurement
BAA – Broad Area Announcement
BOIS - Bi-Static Optical Imaging Sensor
BITS - Beam Irradiance on Target Systems
CCB – Configuration Control Board
COTS – Commercial-off-the-Shelf
CTEIP - Central Test and Evaluation Investment Program
CW – Continuous Wave
DE – Directed Energy
DET – Directed Energy Test
DETEC – Directed Energy Test and Evaluation Capability
DEW – Directed Energy Weapon
DoD – Department of Defense
DT&E – Developmental Test and Evaluation
FTS – Flight Termination System
GTIM – Ground Target Irradiance Measurement
HEL – High Energy Laser
HELSTF – High Energy Laser Systems Test Facility
HPM – High Power Microwave
IEMS - Integrated Electro-Magneto-Optic Sensor
IPT – Integrated Product Team
LCSP – Life Cycle Support Plan
LFT&E – Live Fire Test and Evaluation
MRA - Microwave Rotary Attenuator
MRTFB – Major Range and Test Facility Base
M&S – Modeling and Simulation
MSWG – Modeling and Simulation Working Group
NBTS – Narrowband Threat Systems
OT&E – Operational Test and Evaluation
OTICCC - Office of the Secretary of Defense Test Investment Coordinating Committee
PD – Project Director
PEM – Propagation Environment Measurement
PEO STRI - Program Executive Office for Simulation, Training, and Instrumentation
RAM - Rockets, Artillery, Mortars
RF – Radio Frequency
RFI – Request for Information
RFP – Request for Proposal
SAIC – Science Applications International Corporation
SHEF - Skin Heating/Electric Field Strength Measurement
SIC – Systems Integration Contractor
SME – Subject Matter Expert
SMFS - Spectrographic Magnetic Field Sensor
S&T – Science and Technology
SRG – Senior Review Group
SS – Sensor Suite
STB - Scanning Target Board
TAOS - T&E Adaptive Optics System
T&E – Test and Evaluation
THP- Test Hazard Prediction
TISM - Temperature and Irradiance Sensory Matrix
TRMC – Test Resource Management Center
TSM – Target Surrogate Materials
TSP – Target Subsystems Protection
T-SS – Tri-Service Study
TTSS – Test Target Subsystems Surety
WBTS – Wideband Threat System
WSMR – White Sands Missile Range