Center for Countermeasures

The Center for Countermeasures (the Center) is a joint activity that directs, coordinates, supports, and conducts independent countermeasure/counter-countermeasure (CM/CCM) T&E activities of U.S. and foreign weapon systems, subsystems, sensors, and related components in support of the DOT&E, Deputy Assistant SECDEF (DASD) Developmental Test & Evaluation (DT&E), weapon system developers, and the Services. The Center's testing and analysis directly supports evaluation of the operational effectiveness and suitability of CM/CCM systems.

Specifically, the Center:

- Performs early assessments of CM effectiveness against threat and DoD systems and subsystems.
- Determines performance and limitations of missile warning and aircraft survivability equipment (ASE) used on rotary-wing and fixed-wing aircraft.
- Determines effectiveness of precision guided weapon (PGW) systems and subsystems when operating in a CM degraded environment.
- Develops and evaluates CM/CCM techniques and devices.
- Tests and develops new CMs as they are discovered on the modern battlefield in operationally realistic environments.
- Provides analysis and recommendations on CM/CCM effectiveness to Service Program Offices, DOT&E, DASD(DT&E) and the Service member.
- Supports Service member exercises, training, and pre-deployment activities.

During FY11, the Center tested, analyzed, and reported on more than 40 DoD electro-optical systems or subsystems with special emphasis on rotary-wing survivability. The Center participated in operational/developmental tests for rotary- and fixed-wing ASE testing, PGWs, hostile fire indicator (HFI) data collection, experimentation tests, and pre-deployment/exercise support related to the CM/CCM mission area.

Approximately 66 percent of the Center's efforts were spent on ASE and HFI systems, and 18 percent of the Center's efforts were focused on overseas contingency operations (OCO) support with emphasis on CM-based, pre-deployment training for rotary-wing units. About 4 percent of the Center's efforts were spent on PGW testing, and 12 percent were applied to internal improvement and modernization efforts to enhance test capabilities and efforts to develop test methodologies for use across the Services.

The Center continued to develop multiple test tools for evaluating ASE infrared countermeasure (IRCM) systems and hostile fire signature (HSIG) models used to support development of HFI systems. In addition to leading test tool development efforts, the Center also developed an ASE T&E methodology guidebook to provide DoD with guidance for planning, executing, and reporting on ASE test events. The Center remains an active participant in providing subject matter expertise to numerous working groups and task forces.

The following activities are representative of those conducted by the Center during the past year.

ASE AND HFI ACTIVITIES

ROTARY-WING TEST EVENTS

Navy: Department of the Navy Large Aircraft Infrared Countermeasure (DoN LAIRCM) Laser Warning Sensor Lab Test

- **Sponsor**: Navy Program Executive Officer, Advanced Tactical Aircraft Protection Systems Program Office (PMA 272)
- **Activity**: The Center provided laser test assets, facility, and crew to perform developmental testing of a laser detector assembly.
- **Benefit**: The data collected from this effort were used to determine the sensor response characteristics of a modified laser warning sensor circuit card assembly and to collect data for use in laser detection algorithm development against threat-representative laser assets across multiple spectral bands.

OSD: Rotorcraft Aircraft Survivability Equipment (RASE) Experiment

- **Sponsor**: Assistant SECDEF (Research and Engineering) ASD(R&E)
- **Activity**: The Center served as Experiment Director and radiometric data collector during the RASE event at Yuma Proving Ground, Arizona. Twenty-two different systems mounted on Maverick Unmanned Aerial Vehicles and/or a fixed tower participated in the experiment.
- **Benefit**: The RASE Experiment is a venue focused on ASE that enhances decision makers' understanding of ASE performance and advances the ASE state of the art testing. The RASE Experiment is expected to improve realism and standardization in the testing of ASE, improve the extent of testing prior to fielding, and provide an opportunity for multiple developers to save costs overall.

Army: Hostile Fire Indicting System (HFIS) – Army Flight Test 1

- **Sponsor**: U.S. Special Operations Command (USSOCOM), Technology Applications Program Office
- **Activity**: The Center provided the Joint Mobile IRCM Test System (JMITS) for missile simulation to support a flight data collection event with a USSOCOM MH-47 equipped with the HFIS system in Yuma Proving Ground, Arizona.
- **Benefit**: The sponsor used this event to collect background and live fire data from the AN/AAR-57 Common Missile Warning System (CMWS), AN/AVR-2B Laser Detecting Set, Helicopter Alert Threat Termination-Acoustics, and BAE Systems acoustic detection ring for HFIS development systems installed on a representative aircraft.

Navy: DoN LAIRCM GPS Antenna Regression Test

- **Sponsor**: Navy Program Executive Officer, Advanced Tactical Aircraft Protection Systems Program Office (PMA 272)
- **Activity**: The Center provided test assets and crew to perform end-to-end testing of the system to determine if the new GPS antenna integrated into the CH-46E degraded the performance of the DoN LAIRCM system; testing was conducted at White Sands Missile Range.
- **Benefit**: The assessment of this threat detection and Directed Infrared Countermeasures system resulted in verification that the new GPS antenna did not degrade the performance of the DoN LAIRCM system.

Army: Reduced Optical Signature Emissions Solution VI

- **Sponsor**: Department of the Army Technology Applications Program Office, Systems Integration and Maintenance Office (SIMO) Aircraft Survivability Equipment Cell
- **Activity**: The Center provided test assets and crew to perform effectiveness testing of flares and flare sequences against reactive captive infrared (IR) missiles. This data was used to finalize flare sequences on 160th Special Operations Aviation Regiment rotary-wing aircraft.
- **Benefit**: The outcome of this combined effort resulted in verification of the effectiveness of flare sequences used on both aircraft deployed in-theater and under development.

Navy/Marine Corps: CH-53E, MV-22, and MH-60R Flight Tests

- **Sponsor**: Naval Surface Warfare Center – Crane Division, with funding from the Aircraft Self-Protection Optimization program
- **Activity**: The Center provided test assets and crew to perform effectiveness testing of flares and flare sequences against reactive captive IR missiles. These tests evaluated new CM sequences, variations of current CM sequences using improved flares, or different flares within the sequences.
- **Benefit**: The test results on flare sequence effectiveness are being used to enhance the protection of these aircraft against IR Man-Portable Air Defense Systems (MANPADS).

Army: Intelligent Decision-aiding for Aircraft Survivability (IDAS)

- **Sponsor**: Department of the Army, Aviation Applied Technology Directorate
- **Activity**: The Center provided JMITS test equipment as well as captive-carry IR missiles and crews to support end-to-end, open-air T&E of an AH-64 rotary-wing aircraft equipped with IDAS.
- **Benefit**: The IDAS prototype testing contributed to critical future IRCM protection of Army rotary-wing aircraft.

FIXED-WING TEST EVENTS

Air Force: C-130 Avionics Modernization Program

- **Sponsor**: Department of the Air Force, 418th Flight Test Squadron
- **Activity**: The Center provided laser test assets, the JMITS, and crew to support the sponsor in their effort to determine the functionality of the C-130 AMP integrated defensive avionics software with the legacy defensive system.
- **Benefit**: The data collected were used to verify the integrated system performance between the legacy defensive system and the new integrated defensive avionics system.

Air Force: LAIRCM Next Generation Phase II C-17A Developmental Test (DT)/Operational Test (OT)

- **Sponsor**: 654th Aeronautical Systems Squadron, Wright Patterson AFB
- **Activity**: The Center provided missile simulation test assets and crew to perform end-to-end testing of the LAIRCM Next Generation system installed on the C-17A operating in an open-air environment.
- **Benefit**: This testing contributed to critical protection of Air Force heavy-lift capability during OCO operations.

Air Force: LAIRCM Next Generation Phase II C-17A IOT&E

- **Sponsor**: AFOTEC Detachment 2, Eglin AFB
- **Activity**: The Center provided the JMITS and Towed Aerial Plume Simulator (TAPS) missile simulators and crew to perform end-to-end testing of the LAIRCM Next Generation system installed on the C-17A operating in an open-air environment.
- **Benefit**: This testing contributed to critical protection of Air Force heavy-lift capability during OCO operations.

CENTER FOR COUNTERMEASURES

ROTARY- AND FIXED-WING TEST EVENTS

Army, OSD: Seeker Bowl VI

- **Sponsors**: U.S. Army Research Development and Engineering Command , and the Office of the SECDEF-Joint Electronic Advanced Technology
- **Activity**: The Center provided test assets and crew to collect test data on flare protection effectiveness for five fixed-wing and two rotary-wing aircraft against reactive captive IR missiles. The effectiveness of new flare CM sequences or variations of current flare CM sequences were evaluated.
- **Benefit**: Sponsors are using these test results on flare sequence effectiveness to enhance the protection of various aircraft against IR MANPADS.

Air Force, Navy: Advanced Strategic and Tactical Infrared Expendables

- **Sponsors**: Naval Surface Warfare Center – Crane Division; Air Force Special Operations Command; 46th Test Wing; and Air Mobility Command
- **Activity**: The Center provided test assets and crew to collect test data on eight different aircraft against reactive captive IR missiles. These tests evaluated new flare CM sequences, variations of current flare CM sequences using improved flares, or different flares within the sequences.
- **Benefit**: Sponsors are using these test results on flare sequence effectiveness to enhance the protection of various aircraft against IR MANPADS.

HOSTILE FIRE INDICATOR (HFI) DATA COLLECTION EVENTS

Navy: AAR-47 HFI upgrade and Multi-Function Threat Detector Live-Fire Data Collection

- **Sponsor**: Navy Program Executive Officer, Advanced Tactical Aircraft Protection Systems Program Office (PMA-272)
- **Activity**: The Center provided radiometric instruments and crew during the testing of the AAR-47 and Multi-function Threat Detector at China Lake Naval Weapons Test Center, California.
- **Benefit**: This activity provided a venue for testing of HFI systems for rapid fielding deployment and collected threat signature data for use in developing hostile fire models.

Army: Hostile Fire Detection System Signature Ammo Study (SAS)

- **Sponsor**: Program Manager-Aircraft Survivability Equipment (PM–ASE)
- **Activity**: The Center provided radiometric equipment and test crews to collect and reduce signature data on small arms (muzzle, hardbody and tracer) and rockets (eject, boost, and tracer characteristics) on three separate test events: SAS-1, SAS-2, and SAS-W.
- **Benefit**: The measured data results will determine the variability within ammunition types and country of origin. The measured data will be used to develop the DOT&E Threat Resource Activity (TETRA)-sponsored hostile fire signature (HSIG) model. The Center will develop the HSIG model that will integrate into T&E Modeling and Simulation facilities and support Hostile Fire Detection System foreign ammunition purchases to support test events.

PGW CM ACTIVITIES

Army: 66 mm Red Phosphorous Grenade IR Characterization

- **Sponsors**: U.S. Army Joint Attack Munition System Project Office, Joint Air-to-Ground Missile (JAGM) Program Office and U.S. Army Edgewood Chemical Biological Center
- **Activity**: The Center planned, coordinated, and executed a field test to characterize the 66 mm vehicle launched, self-screening grenade. The characterization consisted of various physical property and IR measurements, including the ability to conceal a target.
- **Benefit**: The characterization of the 66 mm red phosphorus grenades will provide data to support the selection of suitable battlefield obscurants for use during DT efforts to reach acquisition milestone C for the JAGM program.

CM-BASED PRE-DEPLOYMENT TRAINING FOR ROTARY-WING UNITS

Mission Employment Exercise – Nellis AFB, Nevada
HH-60 Surface Attack Training – Nellis AFB, Nevada
Enhanced Mohave Viper – Twentynine Palms, California
Emerald Warrior – Eglin AFB, Florida
Combat Search and Rescue Joint Integration Exercise – Nellis, AFB, Nevada

- **Sponsors**: Various
- **Purpose**: The Center's equipment and personnel provided a simulated threat/CM environment and subject matter expertise to observe aircraft sensor/ASE systems and crew reactions to this environment. Emphasis was placed on providing simulated MANPAD engagements for participating aircraft.
- **Benefit**: Provides realism to the training threat environment for the pilots and crews to facilitate understanding and use of CM equipment, especially ASE. Data collected are provided to the trainers for assisting units in the development/refinement of tactics, techniques, and procedures to enhance survivability.

SURVIVABILITY INITIATIVES

HSIG Model

The Center is leading development of an HSIG model to support HFI T&E and modeling efforts. The HSIG Model project is sponsored by the TETRA and will develop a physic-based, electro-optical model that produces signatures for the 12.7 mm Armor Piercing Incendiary Tracer round and rocket-propelled grenade. After initial development and validation, the HSIG model will be expanded to include more hostile fire threats.

Annual Hostile Fire Indicator Conference

The Center held an HFI symposium and workshops that included current HFI program briefings, "break-out" coordination sessions, and DoD and international partner information exchange. This Center-led initiative provides a venue for cross-Service discussion on the common problem of Service member protection from hostile fire in theater.

Joint Countermeasures T&E Working Group (JCMT&E WG)

The JCMT&E WG is co-chartered by DOT&E and DASD(DT&E) to improve the integration of aircraft self-protection developmental, live-fire and operational T&E through standardized test methodologies, instrumentation and standards. This group includes DOT&E, DASD(DT&E), all four of the U.S. Services, Australia, Canada, New Zealand, United Kingdom and NATO Air Force Armaments Group Sub-Group 2, as members of a coalition warfare sub-WG. The group is tasked with actively seeking mutually beneficial T&E opportunities to measure valid performance and suitability data necessary to provide relevant operational information to deploying Joint/Coalition Warfighters and for U.S. acquisition decision makers. Specific efforts include the following:

- The Center was instrumental in developing, coordinating and implementing an eight-year bilateral Cooperative Test and Evaluation ASE Project Arrangement with the United Kingdom. Both nation's defense organizations, ASE program offices, DT, OT and LFT&E agencies, will now be able to collaborate on common test equipment and procedures, measure operationally relevant ASE data, and improve Service member survivability.
- The JCMT&E WG has scheduled official negotiations with Australia on a bilateral ASE Project Arrangement to expand our T&E capabilities and cooperation.
- In support of former SECDEF, HON. Robert Gates, and NATO Secretary General, HON. Anders Fogh Rasmussen's High-Level NATO Multinational Approaches Initiatives, the Center developed and delivered Dr. Gilmore's DOT&E initiatives to NATO and is now leading an exploratory technical team to develop alliance-wide solutions.
- The Center is collaborating with DOT&E's TETRA in defining ASE/HFI data needs for a NATO accessed, interactive web page, and establishing a centralized location for the Coalition's HFI data that will be accessible by Service members and U.S. Service program managers.

Helicopter Survivability Task Force (HSTF)

The Center participated in the Assistant SECDEF for Research and Engineering-led HSTF discussions that examined helicopter survivability for DoD project selection (out-of-cycle funding request to Congress and the Future Years Defense Program in FY11). The Center's three recommended projects were ranked in the top four by the Services.

Aircraft Survivability Equipment Test and Evaluation Methodology Guidebook

DOT&E tasked the Center to create an ASE T&E Methodology Guidebook to provide the DoD with guidance for planning, executing, and reporting on ASE systems' test events. The ASE systems addressed in this guidebook include IRCM, UV and IR passive Missile Warning Systems (MWS), HFI, and Laser Warning Receiver systems.

The guidebook is intended to provide program managers, T&E leads, test directors, and test team members with a process for ASE system testing. Such a guide is especially critical for program managers and test managers/leads new to ASE testing. This guidebook provides suggested processes and procedures for collecting test data, as well as suggested data formats and products for presenting test data to aid the T&E community in achieving consistency and expectations.

THREAT SIMULATOR TEST AND EVALUATION TOOLS

The Center, in conjunction with the Test Resource Management Center, is leading the IRCM Test Resource Requirements Study (ITRRS) "refresh." The end product from this effort will be an updated roadmap of prioritized projects necessary to perform T&E of advanced IRCM and HFI systems. The original ITRRS roadmap was completed in 2007, which led to several projects being funded by Central Test and Evaluation Investment Program to fill the identified IRCM T&E gaps. Each product will have a functional description of the project; the priority is based upon Program of Record need dates, test requirements, and Service input.

The Center has continued to develop tools for test and evaluation of IRCM systems funded by the USD(AT&L) Test Resource Management Center, Central Test and Evaluation Investment Program. Currently, the Center is leading the development of the following test tools:

- The TAPS is used to resolve shortfalls of emulating spatial/temporal signatures for testing MWS and IRCM systems. This tool has the ability to test aircraft at various airspeeds, cover a greater portion of the operational battle space, and test in a realistic IR clutter environment. TAPS development was

completed in FY11 and supported the operational testing of LAIRCM Next Generation.

- The Multi-Spectral Sea and Land Test Simulator is a small, mobile missile simulator that can fire while moving and simulate all current tier-one missile threats. It is designed to provide simulated signatures for the new and more capable missile warning systems, such as LAIRCM Next Generation, DoN LAIRCM, and Joint and Allied Threat Awareness System.
- The Center is developing the functional requirements for the Joint Standard Instrumentation Suite (JSIS). The JSIS is to be a comprehensive, turn-key instrumentation package that can be used during hostile fire testing and MANPADS missile firing events to support model development and validation. The JSIS will provide calibrated signature measurements for T&E (enhanced test adequacy), and post-test anomaly resolution. All data collected using JSIS will be archived and made available to the Services for current and future IRCM programs.