

The Center for Countermeasures (CCM)

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 weapons systems, subsystems, sensors, and related components. The Center accomplishes this work in support of DOT&E, weapon systems developers, and the Services. The Center’s testing and analyses directly support evaluations of the operational effectiveness and suitability of CM/CCM systems.

Specifically, the Center:

- Determines the performance and limitations of missile warning and aircraft survivability equipment (ASE) used on rotary- and fixed-wing aircraft
- Provides T&E support to Program Offices for the rapid development and deployment of directed energy weapons (DEW)
- Supports the development of DEW test instrumentation
- Operates unique, portable test equipment that supports testing across the DOD
- Develops and evaluates CM/CCM techniques and devices
- Provides analyses and recommendations on CM/CCM effectiveness
- Supports Service exercises, training, and pre-deployment activities

The Center conducts these activities — from testing and analysis of CM/CCM systems, to support training and pre-deployment activities, and development of CM/CCM tools and techniques — to enhance and support the survivability of equipment, aircraft, and personnel. The Center’s core mission to support T&E of ASE directly leads to a “more lethal force” by enabling the survivability of aircraft in a high threat environment. Survivability enables mission success. This fiscal year, the Center expanded its test support of DEW used for

Counter-Unmanned Aircraft Systems (C-UAS) and base defense, and it was involved in the development of three new DEW test resources.

The Center completed 29 T&E activities in FY20. The coronavirus (COVID-19) pandemic affected the Center’s T&E activities during the last 6 months of FY20, which spanned the spring and summer, the busiest time of the year for T&E activities. Had COVID-19 not affected the schedule, the Center was on track to meet or exceed the 45 T&E activities it had completed the previous fiscal year. However, in coordination with DOT&E and with careful planning to ensure the safety of Center and on-site test personnel, the Center completed 13 of its total T&E activities during this challenging time. The majority of the Center’s T&E efforts focused on Joint Urgent Operational Needs Statement (JUONS) programs in support of ASE activities. The Center’s involvement in JUONS testing helped fulfill immediate mission needs that resulted in the successful deployment of critical equipment to combat theaters. In FY20, the Center increased its participation in DEW T&E activities, sending its engineers and scientists to assist program offices with data collection, reduction, and analysis, as well as providing its custom test instrumentation and equipment to collect data. The Center also provided realistic man-portable air-defense system (MANPADS) and radio frequency (RF) threat simulators to create high-threat environments for Service aircrew pre-deployment training. In the course of these activities, the Center conducted the test support and analysis of more than 33 DOD systems or subsystems and reported the results. The Center also provided subject matter experts (SMEs) to working groups, task forces, and program offices. While conducting its test activities, the Center continues to improve its T&E capabilities and test methodologies.

DEW AND C-UAS TEST ACTIVITIES

Mobile High Energy Laser Measurement (MHELM) Tests

- **Sponsor:** Test Resource Management Center (TRMC) and Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI)
- **Tests:**
 - MHELM Cruise Missile Electro-Optics (CaMEO) Target Board (TB) Static Test (September 30 to October 10, 2019), High Energy Laser Systems Test Facility (HELSTF), White Sands Missile Range (WSMR), New Mexico
 - MHELM small Unmanned Aircraft System (sUAS) Static Test (October 21 – 23, 2019), HELSTF, WSMR, New Mexico

- MHELM sUAS Phase 1 Static Follow-on Test (November 18, 2019), HELSTF, WSMR, New Mexico
- MHELM sUAS Track Illuminator Laser Illumination Test (December 4, 2019), HELSTF, WSMR, New Mexico
- MHELM CaMEO Pod 3 and 4 Ground Test (February 24 – 25, 2020), HELSTF, WSMR, New Mexico
- MHELM sUAS Ground Test Phase 2 (February 26 – 28, 2020), HELSTF, WSMR, New Mexico
- MHELM sUAS Flight Test (September 8 – 18, 2020), HELSTF, WSMR, New Mexico
- **Activity/Benefit:** TRMC is developing MHELM, which is a family of DEW instrumentation that will characterize

high-energy laser (HEL) and high-power microwave weapon performance. The MHELM instrumentation is expected to support upcoming U.S. Navy Solid State Laser Technology Maturation Laser Weapon System Demonstrator and HEL & Integrated Optical Dazzler with Surveillance systems. The Center, in partnership with HELSTF, assisted with test planning and setup; operated a HEL system surrogate and beam diagnostic recorders; and reduced data in support of the verification and validation testing for the CaMEO and sUAS TBs. The subsonic CaMEO and sUAS TBs are expected to provide HEL spot measurements (total power on target, beam center position, beam spread/shape, derived beam irradiance, and beam jitter/walk) on an inflight, operationally representative cruise missile and Group-1 unmanned aerial vehicle targets. The CaMEO and sUAS are being developed under the MHELM portfolio, which the TRMC Central T&E Investment Program (CTEIP) funds and PEO STRI executes.

- **Tests:**
 - Counter Drone II (October 21 to November 14, 2019), WSMR, New Mexico
 - Apollyon 2020 (August 10 – 21, 2020), Eglin AFB, Florida
- **Activity/Benefit:** Center personnel, in partnership with the White Sands Test Center, conducted the Counter Drone II test to evaluate the maturity and current capabilities of commercial off-the-shelf (COTS) C-UAS systems and to determine how well COTS C-UASs effectively neutralize sUAS threats. The Center also collected data, conducted an analysis, and reported the results. During Apollyon 2020, the Center collected data and assembled the sUASs to assess current, commercial, counter drone system-of-systems testing and counter drone system testing. The commercial test asset included communication augmentation systems, acquisition and tracking radars, electro-optical (EO) tracking camera systems, and high-power microwave systems.

C-UAS Tests

- **Sponsor:** Defense Threat Reduction Agency, Research and Development Directorate, Threat Technology Department

ASE JUONS TEST ACTIVITIES

Army: Advanced Threat Warner (ATW) and Common Infrared Countermeasures (CIRCM) Tests

- **Sponsor:** U.S. Army Technology Applications Program Office (TAPO) and the 160th Special Operations Aviation Regiment (SOAR) Systems Integration and Maintenance Office (SIMO)
- **Tests:**
 - ATW and CIRCM MH-47G Test (February 27 – 29, 2020), Redstone Arsenal, Alabama
 - ATW and CIRCM MH-47G Test (September 21 – 25, 2020), Redstone Arsenal, Alabama
- **Activity/Benefit:** The Center provided one Joint Mobile Infrared Countermeasure Test System (JMITS) for simultaneous, two-color infrared (IR) missile plume simulations and jam beam data collection. The IR simulations elicited a response from the ATW and provided an IR source for the CIRCM to track; the jam beam radiometers (centerline and outer) characterized the CIRCM jam return. The Center’s simulator conducted single threat engagements during both tests, and the Center provided near real-time feedback on missile plume simulation quality and jam beam data. The Center collected data and assessed the ATW’s ability to detect and declare threats and provide a handoff to the CIRCM, CIRCM’s ability to put energy on the threat, and characterized CIRCM jitter and bias. The Center’s assessment helped TAPO/SIMO evaluate the integrated ATW/CIRCM system, as installed on the MH-47G, and determine its readiness for fielding. Center participation in these tests was in direct support of ongoing TAPO ATW JUONS efforts to increase aircraft protection for the MH-47G against IR-guided threats.

Navy: Distributed Aperture Infrared Countermeasure (DAIRCM) Tests

- **Sponsor:** PEO, Tactical Aircraft Programs (PMA-272) on behalf of the Detachment 1, 413th Flight Test Squadron, TAPO, and 160th SOAR SIMO
- **Tests:**
 - MH-60S, AH-1Z IT-2.2 Phase 1 (September 19 to October 11, 2019), Eglin AFB, Florida
 - MH-60S (February 24 to March 4, 2020), Webster Field, Maryland
 - UH-1Y (June 6 – 9, 2020), Webster Field, Maryland
 - HH-60G Pave Hawk Section, Air Force Life Cycle Management Center (July 7 – 17, 2020), Nellis AFB, Nevada
 - MH-6M TAPO JUONS (August 24 – 28, 2020), Redstone Arsenal, Alabama
- **Activity/Benefit:** The Center provided one JMITS with four MANPADS threat seekers, one Multi-Spectral Sea and Land Target Simulator (MSALTS), and three threat-representative lasers for the IT-2.2 phase of the DAIRCM. The Center provided one MSALTS and three threat-representative lasers for the HH-60G testing and one MSALTS for all other phases of testing. The simulators provided the two-color IR missile plume simulations and jam beam data collection capability required to assess the DAIRCM missile warning system’s (MWS) ability to detect and declare the threat and the DAIRCM directed infrared countermeasure’s (DIRCM) ability to acquire, track, and put laser energy on the target. Center analysts used the threat-representative lasers to assess

the DAIRCM laser warning system's (LWS) ability to detect and declare laser threats. The Center's assessment helped PMA-272, DAIRCM developers, and stakeholders assess DAIRCM MWS, LWS, and DIRCM capabilities. Based on data from these tests, the DAIRCM hardware and software were upgraded, as needed, to improve the MWS, LWS, and DIRCM performance; improve aircrew situational awareness messaging traffic for audio alerts; and improve the display of threat location and CM employed on the control user interface. The Center's participation in these tests was in direct support of ongoing PMA-272 and TAPO JUONS efforts to improve aircraft protection of tactical rotary-wing platforms against IR-guided threats.

Air Force: AC-130J JUONS and Combat Mission Need Statement (CMNS) Large Aircraft IR Countermeasures (LAIRCM) Flight Test

- **Sponsor:** U.S. Department of the Air Force, Air Force Special Operations Command (AFSOC)
- **Test:** AC-130J (July 13 – 17, 2020), Eglin AFB, Florida

- **Activity/Benefit:** The purpose of the test was to evaluate the upgrade on the AC-130J from the AN/AAQ-24(V) LAIRCM system to ATW sensors, Guardian Laser Transmitter Assembly (GLTA), and a new processor to improve aircraft survivability in a high-threat environment. The Center provided one JMITS, one moving MSALTS, and one laser beamrider for single, dual, and multi-threat engagements against the AC-130J. The IR simulations elicited a response from the ATW and provided an IR source for the GLTA to track; the jam beam radiometers characterized the GLTA jam return. The Center collected data to assess the ATW MWS's ability to detect and declare threats and provide a handoff to the GLTA; to assess the GLTA's ability to put energy on the threat; and to assess the ATW LWS's ability to detect and declare laser threats. Center participation in this test was in direct support of ongoing AFSOC JUONS and CMNS efforts. The Center's assessment helped AFSOC evaluate the integrated ATW/GLTA, as installed on the AC-130J, and determine its readiness for fielding in theatre.

TRAINING SUPPORT FOR SERVICE EXERCISES

- **Exercise:** Joint Aviation Multi-Ship Integrated Air Defense System (IADS) Survivability Validation Quick Reaction Test (January 20 – 31, 2020), China Lake Naval Weapons Center, California
- **Activity/Benefit:** The Center provided realistic MANPADS threat environments used to train pilots and crew and give them a better understanding of ASE equipment and its use. Specifically, the Center provided an MSALTS and the MANPADS Technical to simulate a specific threat environment for participating aircraft. The Center also provided SME support to observe aircraft ASE systems and crew reactions to the threat environment. At the end of each exercise, the Center's SME presented MANPADS capabilities and limitations briefings to the pilots and crews, and at the end of the briefings, allowed them to hold and manipulate the specific MANPADS. The data the Center collected and provided to the trainers/testers helped the units develop and refine their tactics, techniques, and procedures to enhance survivability in a combat environment.
- **Exercise:** U.S. Army Special Operations Aviation Command, Special Operation Aviation–Advance Tactics Training (August 3 – 11, 2020), China Lake Naval Weapons Center, California
- **Activity/Benefit:** The Center supported this joint training exercise, which the 160th SOAR conducted, for pre-deployment training of aircrews and staff in a realistic, contested, near-peer threat environment. The Center provided an MSALTS to simulate the threat environment for participating aircraft. The Center also provided SME support to observe aircraft ASE systems and crew reactions to the threat environment. The 160th SOAR and AFSOC aircrews flew aircraft equipped with the latest infrared countermeasure technology on a high fidelity, electronic combat range. Aircrews conducted training with CMWS, AAQ-24, and AAQ-45. Aircrews will complete New Equipment Training and operational validation of the AAQ-45.

T&E TOOLS

The Center continues to develop tools for T&E of DEW and ASE, and deploy its personnel and specialized T&E tools throughout the country. The Center takes its T&E tools to the Services, providing them with cost-effective test support to collect critical data needed to assess the performance of their CM/CCM systems. In addition, the Center supports the Service's ASE programs with its unique test equipment, which reduces duplicative T&E capabilities. This benefit, along with the transportability of the Center's unique test equipment, provides

the DOD a cost savings that results in "greater performance and affordability." The Center is constantly collaborating with the various entities within the T&E community to identify and solve shortfalls in the T&E infrastructure in support of the National Defense Strategy.

The Center is a permanent member of the TRMC Directed Energy Instrumentation Initiative review panel. PEO STRI chairs this panel and serves as its executive agent for testing of Services

rapid prototyping and fielding. The Center is actively engaged in building partnerships and providing the DEW community its expertise from a DOT&E perspective.

HEL Remote Target Scoring (HRTS)

HRTS addresses a capability gap in HEL target scoring in operationally realistic environments. PEO STRI and the Center are leading the development of the HRTS system under the Directed Energy Instrumentation Initiative portfolio funded in 2019 through a congressional plus-up. The HRTS will have the capability to evaluate the effectiveness of tri-service HEL weapon systems on land and in maritime environments. The HRTS system will integrate a sensor suite onto a Kineto-Tracking Mount to track, image, score, and provide Time-Space-Position Information from a mobile/transportable, remotely operated platform during HEL engagements. This capability will enable the tracking and scoring of a variety of targets during HEL engagements, including light boats, rocket-artillery-mortars, UAS, and subsonic and supersonic cruise missiles. Additionally, the Center has identified both common HRTS hardware and capabilities for possible use and integration with other Center activities and T&E tools, including the JSIS. The HRTS system will extend Center and WSMR testing capabilities with two deliverable systems that can operate in various T&E environments. The HRTS contract was awarded in FY20, and HRTS successfully went through the Preliminary Design Review conducted in June 2020. The HRTS system is currently expected to be available for use by all Services in 4QFY21.

Beam Characterization Sensor Suite (BCSS)

The Center is developing the BCSS, which is an integrated sensor suite with associated computing hardware that gives HEL beam and target characterization capabilities of static targets. The BCSS beam measuring capability will help HEL programs determine laser beam characteristics on static targets prior to engaging costlier operational targets. The BCSS target characterization capability will provide calibrated imagery and radiometry to support lethality and survivability testing. The BCSS IOC, which is currently under development, will provide a baseline of overall intended capability. In its full operational capability (FOC), the BCSS is expected to incorporate direct power measurements and expanded calibrated imagery capabilities. The BCSS IOC is expected in 1QFY21 and FOC configuration is expected in 4QFY21.

Gyro-Stabilized Tracking Mount (GSTM)

The objective of the GSTM is to provide a low footprint, point and track sensor solution for ship-based HEL weapon system T&E. Specifically, the GSTM will be used to point the receiving end of the Differential Image Motion Monitor and Wide Angle Tele-radiometric Transmissometer atmospheric path sensors while performing a stabilized track of aerial targets and munitions from a sea-based platform. The Center partnered with the Naval Air Warfare Center Weapons Division in the development and procurement of the GSTM, leveraging their T&E expertise and developmental approaches to best meet maritime specifications

for this tracking mount in support of future testing of naval HEL programs. GSTM availability is expected in 1QFY21.

Broad Area Target System (BATS)

The Center is complementing its current HEL characterization test instrumentation suite with the BATS, which is a smart TB for directly detecting and characterizing a HEL beam at target distance. The BATS will provide the Center with a compact, standalone TB solution that can be integrated into operationally representative ground targets. The BATS sensor array spatially and temporally samples HEL beam profiles and is designed to be a reusable system that can withstand direct exposure to high power, continuous wave lasers. The BATS is a larger version of the “beam irradiance target system,” which was the outcome of a PEO STRI Science and Technology project. BATS availability is expected in 2QFY21.

JSIS

JSIS provides the capability to collect MANPADS missile plume and hostile fire signatures, Time-Space-Position Information, and related data for ASE T&E and threat model development. JSIS’s transportability allows it to be used both in the United States and abroad to reduce costs and expand the types of threat data available in the United States. The JSIS baseline was developed from FY13 through FY18 under sponsorship from the TRMC’s CTEIP. JSIS 2.0, also sponsored by CTEIP, will provide a missile attitude determination capability. Implementation of the FOC began in FY19 and will be completed in FY23. The Center is also evaluating JSIS development to incorporate DEW T&E capabilities.

Intelligence agencies require high-fidelity threat data to produce/improve certified threat models (i.e., trajectory and signature), and threat models form the basis of the majority of ASE T&E. The Missile and Space Intelligence Center uses data collected by JSIS, including data collected during the FY20 CIRCIM IOT&E Free Flight Missile event, to create threat models for use in modeling and simulation (M&S) of ASE. The Navy (PMA-272), Army (PMO ASE), and Air Force (LAIRCM System Program Office) have endorsed JSIS, and it will be an integral support element of each Program Office’s aircraft self-protection capability development.

In FY18, JSIS reached its IOC. Among the added capabilities will be a full complement of signature data collection instrumentation to support current programs of record; a full complement of signature data collection instrumentation focused on emerging programs; additional instrumentation to support data collection for multiple, concurrent events; instrumentation to support static, live fire events; and full trajectory coverage for missile attitude related data collection along with supporting computer, network, and support trailers to field throughout the United States and outside the continental United States. The Preliminary Design Review was completed in May 2019 and Block I Critical Design Review was completed in October 2019.

Missile Simulator Emitters Upgrade

The Center is currently overseeing a TRMC-funded project to upgrade the emitters on JMITS/MSALTS. This upgrade will increase JMITS/MSALTS bandwidth and processing capabilities to meet the requirements of advanced MWS/DIRCM systems. IOC for the first upgraded simulator is expected during 1QFY21.

Threat Signature Generation

The Center continually generates plume signatures that are used as the input signatures for JMITS and MSALTS in open-air missile simulator testing of MWS/DIRCM systems. The Center has generated over 10,000 signatures for this purpose. Also, the Center provides signatures to various programs upon request for use in signature model analysis and test activities not involving the Center. The Center has been a key participant in multiple working groups, including the Test and Evaluation Threat Resource Activity (TETRA) IR Configuration Control Board and the IR Missile Model Management Group, which continually

evaluate threat signature models with the goal of improving them and creating uniformity in model version use.

Towed Optical Plume Simulator (TOPS)

The TOPS system is currently an Air Force effort to investigate ways to improve the Towed Airborne Plume Simulator (TAPS) system by replacing the pyrophoric fuel source with solid-state optical emitter sources to simultaneously emit energy in two independently controlled IR bands (Red and Blue) and one UV band. The energy sources will be mounted in a pod towed behind an aircraft. In support of this effort, the Center provided short-range, ground-based data collection in past developmental phases. The project has now moved to its next phase, which consists of building a pod that can be towed behind an aircraft. Arnold Engineering Development Complex leads the project, and the Center participates and monitors the effort as a future technology improvement for the TAPS system.

