NAWCWD Quick Facts
China Lake & Point Mugu, CA NAVAIR

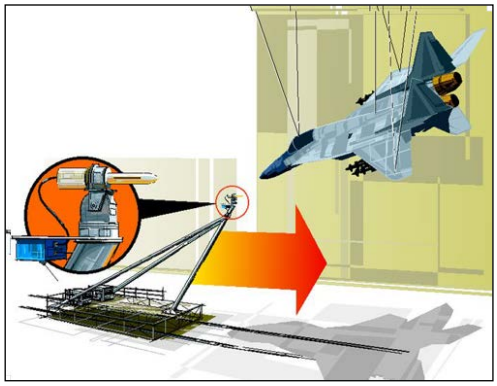
Missile Engagement Simulation Arena (MESA)

(Dr. Jon A. Wunderlich Laboratory)

Mission. Measures the electromagnetic interaction of a sensory system (fuze or guidance) with its intended target. It provides cost-effective, timely, and accurate dynamic missile engagement test data. Missile fuzes are tested against various targets, including full-scale fighter aircraft, in a secure, controlled laboratory environment with all-weather, round-the-clock operational capabilities.

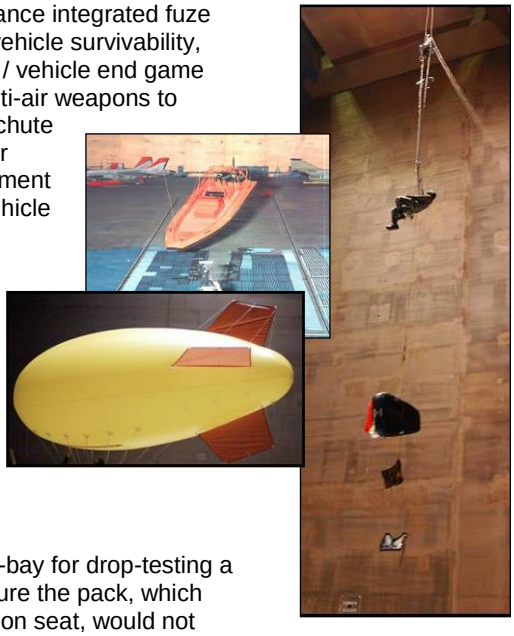
Unique Features. It is the only facility of its kind in the world that provides a cost-effective and accurate method of developing, testing, and assessing the performance of proximity fuze systems, validating fuze models and endgame simulations, studying the survivability of platforms, and making live-fire T&E predictions. The ability to model encounters with threat targets under realistic and varied conditions and under laboratory conditions sets this facility apart from outdoor backscatter ranges.

Cost / Time Savings. MESA is the most cost-effective alternative to expensive and often uncontrollable test conditions associated with field tests. Hundreds of runs can be made each day in a controlled and repeatable fashion. Field tests such as full-scale missile firings, flyovers, supersonic sled runs, and pull-by tests are all costly, and they lack test control and repeatability. Targets are often restricted to available drones or U.S. aircraft. MESA is the answer.



RDT&E. Hundreds of encounters can be simulated in an 8-hour shift. Proximity fuze testing requires a significant number of tests with the actual missile and target, with good coverage of missile / target encounter geometries, accurate measurements of timing and encounter geometries, and accurate measurements of fuze sensor response.

Types of Testing / Service. Guidance integrated fuze (GIF) testing, missile lethality, air-vehicle survivability, accurate measurements of sensor / vehicle end game properties, development of new anti-air weapons to meet evolving threats, NASA parachute testing for Mars Lander, laser radar tests and simulated ocean environment testing, multi-purpose all-terrain vehicle (ATV)-based ground robots, radar cross section (RCS) measurements of small watercraft, and small UAV quad-rotor aircraft control testing.



Examples

- **Boat Hull Modification.** The IBAR team modified the boat's hull, integrated sensors into the platform, suspended the craft from the rafters, and collected more than 300 measurements each day.
- **Surveillance Blimp.** Because of its unique size, MESA's bay was ideal for preliminary testing of ISISA — a rapidly deployable, small, lightweight, persistent-surveillance, 24-foot blimp and ground station that provides warfighters with real-time target video in remote locations.
- **Personal Survival Pack (PSP) Drop-Testing.** The Navy used MESA's high-bay for drop-testing a new PSP to heighten pilot survivability. The Navy performed the tests to ensure the pack, which incorporates a new carbon dioxide (CO_2) inflated life raft into the pilot's ejection seat, would not interfere with seat / occupant aircraft separation and the raft inflated automatically.

Building Exterior Used as a Target. A unique black-and-white test pattern is painted on MESA's south wall that serves as an optical-edge "target" containing vertical and horizontal edges. Pilots from Edwards Air Force Base use MESA for measuring the Edge Response Function of an electro-optic imaging system. This "target" has a total of 12 points recorded with exact latitude, longitude, and elevation coordinates, which allows sensors to determine how sharp the thermal transition edge is on the metal siding between the black-and-white painted surfaces.

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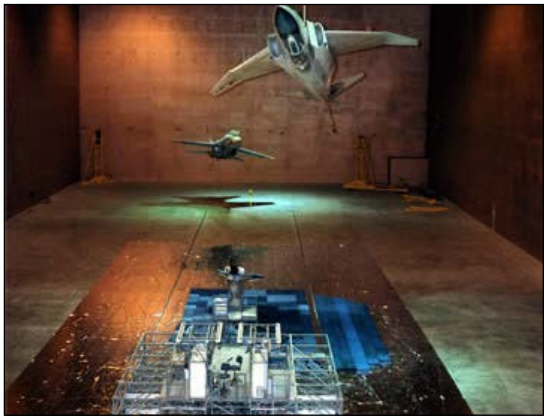
Software

- **Engagement.** Translates desired endgame geometry into range coordinates
- **Control.** Moves and positions the sensor and target hardware
- **Data Acquisition.** Controls the measurement radar and collects and stores the received signals on each dynamic run
- **Data Analysis.** Graphical data analysis provides geometrically corrected near-field RF intensity contour plots
- **Quality Assurance (QA).** Performs QA after test runs, processes data, and presents results in a graphical format in near real time
- **Virtualization.** Complete interactive 3D endgame geometry provides planning and independent checking



Overhead Target Support. MESA has two overhead target supports. Each has six control lines, six encoder lines, and a safety line. Each target support is controlled by two dedicated computers. MESA's flexibility permits large-scale variations in target and sensor geometry. In most cases, geometry changes can happen in less than one minute.

- **Weight Limits.** 25 to 25,000 pounds for each full-scale target
- **Accuracy.** Within 0.25 inch either vertically or horizontally
- **Positioning.** Vertical or horizontal in a wide range of yaw, pitch, and roll angles

Size / Description / Scope. Dimensions: 84,190 SF, 90 feet high x 405 feet long x 150 feet wide. **Plant Value.** $100M+.

Main Facilities. Interior surfaces are coated to minimize and control background clutter. MESA (chamber 7 office spaces) is also used for laser signature measurement, portable RCS measurement, Jet Propulsion Laboratory (JPL) Mars lander work, targets of opportunity from 4th deck, directed energy weapons, and electromagnetic environmental effects (E^3).

Equipment. Includes two controllers that can position calibration spheres in two dimensions, mid-range and down-range overhead target support, instrumentation radar, three-axis sensor positioner, range control station, target suspension system, and a data recording station and sensor transporter. In a simulated encounter, the transporter carries the sensor along a 260-foot track toward a precisely positioned target model that is suspended.

Targets. Full-scale and one-fifth scale models. Aircraft (fixed-wing, rotary-wing, manned and unmanned) targets can weigh up to 11.3 metric tons. The models are suspended in MESA's high bay, and targets are positioned within 1/4-inch accuracy in a wide variety of angles.

Sensors. Sensors weighing up to 200 pounds are mounted on a three-axis positioner accurate to within 0.1 degree. The sensors are transported past the target at speeds from 0.1 to 10 feet per second along the relative velocity vector. It supports and positions the fuze sensor model to accurately simulate fuze orientation. The MESA sensor / radar can simulate any microwave fuze system and provide superior quality data. MESA radar specifications include operating frequency to match most fuze systems within the 65-dB dynamic range and the 70-dB clutter rejection.

Sensor Transporter. Dynamic testing is provided by the mobile sensor transporter that moves the fuze sensor toward the target at scaled speeds along the relative velocity vector during tests. Sensor motion is computer controlled.

- **Scaled Speeds.** 0.1 to 10 feet per second
- **Sensor Coverage (Minimum).** 45 foot spherical coverage on high setup, 75 foot hemisphere coverage on low setup
- **Positioner Capabilities.** 0.1-degree accuracy, 500-pound sensor-handling capacity
- **Motion Compensation.** Phase compensation due to sensor motions for sub-millimeter wavelengths is available

Instrumentation. MESA has advanced equipment for recording sensor response data as well as encounter geometry. Complete integration with MatLab and other programs provide quick data access, and permanent data is archived.

Recognition / Awards. MESA is both nationally and internationally recognized. Recent projects include joint Navy / Air Force testing for Sidewinder, ESSM, and NATO allies.

Historical Significance. The laboratory opened its doors in 1992, taking over the functions formerly provided by the Encounter Simulation Laboratory (ESL) at Corona, California. MESA was developed to meet emerging needs for low observable platforms and long range fuze technologies.

Future Plans. MESA is currently developing a bistatic fuzing capability and developing methods to measure patterns of antennas mounted on aircraft bodies.