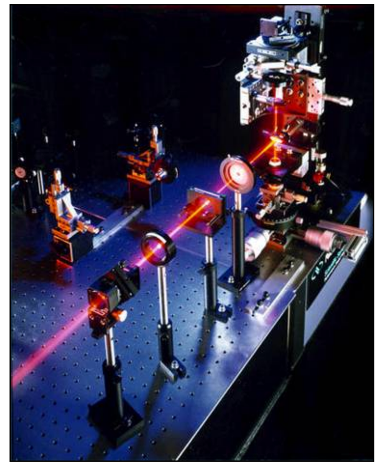
NAWCWD Quick Facts
China Lake & Point Mugu, CA NAVAIR

# Lauritsen Laboratory

Electronics Development, Integration and Evaluation, Multi-Mode Sensor Seeker, Multi-Sensor Fusion, Optics and Laser Research, Proximity Fuze and Sensors



**Mission.** Lauritsen Laboratory opened in 1976 and features a 56,000-SF structure that incorporates special features in three well-equipped wings with a focus on laser and optical work. Specialized facilities include an 8- x 100-foot room designed for optical experiments, a rooftop facility provided for outdoor tests to the horizon, and provisions for lasing from inside the building to a 500-meter eye-safe outdoor laser test range. Today, numerous major laboratories encompass much of the work.

**Major Facilities**

**Multi-Sensor Fusion Laboratory (MSFL).** The MSFL develops and tests algorithms for combining information from multiple sensors to produce actionable intelligence for targeting and fire control. As the Distributed Ground-Sensor-Grid Threat Detection System (DGTDS) program evolved, this laboratory has been used to continue refining the correlation algorithms and preparing for the end-to-end demonstration of DGTDS. The MSFL also includes a unique mobile sensor fusion tool known as the Vehicle Integrated Sensor Suite for Targeting Applications (VISSTA) that may be integrated with various imaging sensors to develop and demonstrate sensor fusion algorithms and in-the-field processing.

- **RDT&E.** The DGTDS algorithms continue to undergo refinement for the primary counter MANPADS capability. DGTDS can also be tailored for other applications as well.

- **Cost / Time Savings.** In the case of DGTDS, the original algorithms were developed to provide an almost instantaneous track on a boosting missile to allow time for deploying effective countermeasures. This laboratory is used to tailor the algorithms to trade off speed of response for accuracy or to evaluate multiple tracks of boosting missiles to determine which constitutes the most critical threat to the targeted aircraft.

- **Equipment / Instrumentation.** Currently, the MSFL is divided into two areas—one is used for development and the other for office and meeting spaces. The laboratory maintains 20 computer systems (Apple and PC-based with LINUX systems).

**Multi-Mode Sensor Seeker Laboratory (MMSSL).** The MMSSL develops and evaluates LADAR and Automatic and Aided Target Recognition (AiTR). It is the only laboratory of its kind in NAVAIR, and one of only a few in the DoD dedicated to developing LADAR automatic target recognition (ATR).

- **RDT&E.** The goal of the multi-mode sensor seeker (MMSS) program is to provide AiTR to UAS operators using 3D LADAR imaging, which extends the identification range by a factor of 5 over imaging IR systems of equivalent apertures. LADAR can provide a variety of information for each pixel in the imagery. Currently, the NAVAIR focus is on 3D (angle / angle / range) imagery, but future systems will employ coherent detection so that Doppler can be added to the information set. Work is also being conducted to investigate 1D (profiles) and 2D (angle / angle) techniques for identifying targets. MMSS began fabrication of a 16-inch sensor turret, sized to be deployed aboard the Fire Scout Vertical Takeoff Unmanned Air Vehicle (VTUAV) that includes a high-resolution 3D LADAR sensor. The award winning design expands the capabilities of the existing BRITE Star II sensor turret (from FLIR Systems, Portland, Oregon) that contains mid-wave infrared (MWIR) and visible imaging sensors and a laser designator.

- **Cost / Time Savings.** The reason NAWCWD has elected to perform the AiTR in-house is to ensure the government owns the AiTR algorithms and can provide them to any LADAR program without additional cost to the Navy. This can result in substantial savings over the life of a program where several software iterations can be expected.

- **Equipment / Instrumentation.** The laboratory workstations and computer systems are capable of rapidly manipulating LADAR imagery from field tests and simulations. The classified laboratory is composed of several workstations that can access an extensive (over 1,000 signatures) classified database gathered from multiple field trials. Each workstation also has access to an extensive 3D model database, which is used to develop robust ATR algorithms**.**

**Sensor Technology Integration and Evaluation Laboratory (STIEL).** This lab assembles and integrates large EO/IR and eye safe laser systems whose performance is evaluated before flight testing. 1,100-SF laboratory with 20-foot high ceiling is equipped with 28 volts direct current (VDC), 3-phase 208-volt 400 cycle and 110-volt power, high pressure air, and a high bay access door. Six work benches are used for assembly and test.

- **RDT&E.** The STIEL facility was used to integrate the original DGTDS system before it was field tested. The evaluation included mapping of the MWIR camera response and validating the interfaces between all six cameras to allow the generation of precision tracks within seconds of an event. Similarly, the Long-Range Infrared System (LAIRS) will use STIEL to help establish the boresighting of the various cameras and laser sources. LAIRS is a reflector telescope mated to a long-wave IR camera and a mid-wave IR camera that can image at the same time via beam-splitting optics.

- **Cost / Time Savings.** DGTDS is the best example of a high profile quick-reaction program. In only 90 days, engineers developed a complete shoulder-launched missile detection and tracking system. No U.S. company would bid on the cameras because of the high performance requirements, so cameras were purchased from France and detector arrays were provided by Israel. The optical systems were assembled at STIEL, and all six cameras had to work in conjunction with each other to provide the desired angular coverage. The hardware and software were successfully integrated in this facility before field testing, and the results were spectacular.

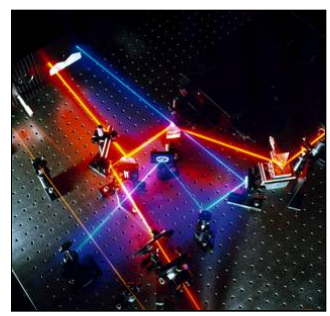
- **Equipment / Instrumentation.** The DGTDS and LAIRS hardware comprise the EO / IR systems in this facility. In the future, Infrared Search and Track (IRST) systems and eye safe laser profilers will be integrated and tested here.

**Targeting Laboratory.** Secured area for classified processing of radar data. It is the only facility of this size in NAVAIR for exclusively processing classified radar data.

- **RDT&E.** The focus of the work has been automatic radar classification of maritime vessels. It is being applied to various radar modalities for vessels in port and at sea. Although automatic radar ship classification has not reached the Fleet, this is the facility that will support making it happen in the very near future. In general, classifiers can be forced to make their best guess about the target, but results often yield a low confidence level—validating this is an area where the Targeting Laboratory capabilities are essential.

- **Cost / Time Savings.** Each developer has access to their own classified machine that is then networked with 34 other computers. The result is significant time savings that translates to cost reductions. The Automatic Radar Periscope Detection and Discrimination (ARPDD) program is an excellent example of how this facility is used to rush a capability to the Fleet. The ARPDD program has been so successful that the facility is being used to develop the actual software that will be used with the MH-60 radar.

- **Equipment / Instrumentation.** Contains over 50 separate computer systems, all performing classified processing. In addition, it contains a large storage capability based on redundant array of independent disks (RAID) with multi-terabyte memory. With a common central hub controlling access, this is a highly efficient system for the 20+ users.



**Optics and Laser Research Facility.** Characterization of optics and materials to include reflectometry, transmission, absorption of coatings (surface) and bulk materials, and total integrated scatter. Unique equipment to provide absolute reflectometry measurements in the IR regime. The design of simple to complex optical trains becomes reality with in-house optic fabrication using computer numerically controlled and single point diamond turning equipment.

- **RDT&E.** Areas of research include laser devices, laser interaction with matter, protection against laser radiation, atmospheric propagation and characterization, image correction, ellipsometry / polarimetry, electrically conductive optical coatings, IR sensors, and image recognition. Capabilities include optical design and fabrication, diamond turning, optical thin films, optical characterization, ultra-fast laser devices and effects, laser spectroscopy, and large optics. Surface finishing by diamond-single-point machines, reactive-sputtering coating, and precision measurement of surface finish and optical performance are all conducted in a single location.

- **Cost / Time Savings.** Provides cost and time savings due to a rapid prototype fabrication capability. This includes design, subsystem fabrication, system integration, and prototype testing. For example, 16-inch range telescopes were fabricated at less than half the cost of commercial estimates, with prototypes delivered in three months. A dynamic Differential Image Motion Monitor went from concept to shipboard placement in only 18 months. The device measures atmospheric turbulence.

- **Equipment / Instrumentation.** Optical fabrication, diamond turning machine, optical coating chambers, material processing equipment, optical characterization facilities for reflection, absorption, transmission and total integrated scatter, polarimeters / ellipsometers, optical multichannel analyzers, multiple laser systems and test equipment, spectrometers, laser devices and effects, spectroscopy, large optics, multiple channel digital recording, and fiber optical splicers are available. This is the only DoD facility that can produce Fiber Bragg Gratings.

**Electronics Development Laboratory.** This lab designs and develops prototype electronics for weapons systems, signal processing, interfacing, and data acquisition, in addition to quick-turn design and prototype electronics, which includes small-scale production.

- **RDT&E.** Experience covers a broad range of electronics from RF, controls, analog, interface, high-speed design, EW, and embedded digital design.
- **Cost / Time Savings.** Advanced design for a wide variety of products. Technical staff is skilled at quickly resolving design issues right up front.
- **Equipment / Instrumentation.** Prototype Laboratory, printed wiring board router, pick and place machine, and X-ray inspection.

**Proximity Fuze and Sensors Laboratory (PFSL).** Designs, develops, and provides acquisition, production, and full life cycle support for naval proximity fuze systems and other short range sensor technologies. This is the only laboratory of its kind in NAVAIR and one of only three in the DoD dedicated to proximity fuze and short range sensor systems.

- **RDT&E.** Capabilities include miniaturization of electronic systems and advanced design of new sensor systems to meet evolving threats. Advanced simulation and analysis reduces the number of flight tests required.
- **Cost / Time Savings.** Consists of a quick response hardware / firmware / software exploratory development section that creates prototypes of new developmental systems. The PFSL also has the most advanced simulation and analysis capability in the Navy for proximity fuze systems.
- **Equipment / Instrumentation.** Laser tunnels, antenna range, anechoic chamber, and simulation and analysis processing laboratories.

**Size / Description / Scope:** 56,000 SF located at China Lake. **Plant Value:** $26M+.

- **Annual Test Events:** 100+ MANPADS launches observed with DGTDS.
- **MMSSL. Annual Test Events:** 100+. **Year Opened:** 2009.
- **STIEL. DoD Customers:** OSD for DGTDS. **Annual Test Events:** 6. **Year Opened:** 1979.
- **Targeting Laboratory. Annual Classification Cycles:** 1,000s. **Year Opened:** 1984.
- **Optics and Laser Research Facility. Annual Test Events:** 100+. **Year Opened:** 1979.
- **Electronics Development Laboratory. Systems Supported:** 7+.
- **PFSL. Annual Analysis Cycles:** 1,000s. **Annual Test Events Supported:** 25. **Weapon Systems Supported:** 7. **Year Opened:** 1970s.

**Historical Significance.** This impressive facility is named after Dr. Charles C. Lauritsen, and the facility was dedicated in June 1976. Lauritsen earned his PhD from the California Institute of Technology (CalTech) in 1929, and he rapidly developed a reputation as a brilliant researcher. In 1930, he took over direction of research efforts in the new Kellogg Radiation Laboratory. While there, he directed development of the first million-volt X-ray tube, an important breakthrough in radiation therapy. During World War II, Lauritsen was perhaps the only scientist to have held a leading part in three major weapons developments: proximity fuzes, rockets, and the atomic bomb. A citation by President Truman paid tribute to his “superb guidance and inventiveness.”

Dr. Charles C. Lauritsen’s legacy looms large at China Lake. He first pushed for expansion of this country’s World War II rocket program. When CalTech required more testing space, Lauritsen and Commander Sherman E. Burroughs led the way in selecting the very land upon which China Lake is now located. Lauritsen and his colleagues at CalTech first tackled the problem of rocket propellant. By early 1942, they were able to manufacture dry-extruded ballistite that proved suitable for their rockets. Their early successes in rocketry included development of air-launched retrorockets and barrage rockets.