NAWCWD Quick Facts
China Lake & Point Mugu, CA NAVAIR

Advanced Weapons Laboratory (AWL)

Mission. To improve the warfighting capability of the F/A-18 and EA-18G weapon systems for the Navy, Marine Corps, and foreign military sales (FMS) customers.

Unique Features. With continuous, institutionalized process improvement, defects found during integration testing have decreased from 22 in 1990 to fewer than 2 in 2011. Products delivered to the Fleet are at the six sigma quality level. Since 1987, the success rate in meeting schedule is 100%, and costs are less than the current industry standard.

Combat Support. The AWL continues to put multiple systems in theater to meet urgent operational requirements. These include advanced infrared systems, digital radios, new data links, improved weapons, and upgraded systems software. In Afghanistan, the Fleet needed to simultaneously carry both a weapon to attack caves and a weapon to attack troops in the open. The AWL provided a software solution in 20 days! In another example, early in the War on Terror, AWL engineers developed a portable radar test set, installed in a ruggedized suitcase, to test radar systems in their natural environment while installed in the jet. Responding to an Air Group Commander's request just 10 days prior to their deployment, an AWL team provided hands-on training to all three Hornet squadrons. In Kosovo, troops needed reconnaissance. The AWL pulled a new system forward and deployed it in less than four weeks. In fact, the system was fully integrated in only 90 days from first flight.

- **Nearly every year the AWL delivers a $100+ Million F/A-18 and EA-18G System Configuration Set (SCS) Upgrade.** Upgrades routinely have more than 100 requirements and include many new or upgraded subsystems and weapons. Recent examples include the new Active Electronically Scanned Array (AESA) radar, the latest versions of the AIM-9X and Advanced Medium-Range Air-to-Air Missile (AMRAAM), upgrades to the Joint Helmet Mounted Cueing System (JHMCS), and the Multifunctional Information Distribution System (MIDS). Also included are common and unique requirements from six FMS customers.

Cost / Time Savings. By early adoption of the Software Engineering Institute (SEI) Capabilities Maturity Model (CMM) and Capability Maturity Model Integrated (CMMI), costs have dropped dramatically while quality has continued to increase. By using the laboratories instead of expensive flight tests and by optimizing ordnance expenditures, flight hours, and range time, the cost of delivering products to the Fleet continues to be reduced.

RDT&E. The AWL integrates common avionics, EW systems, electro-optical / infrared (EO/IR) and reconnaissance systems, ground support equipment, mission and subsystem software, and radars and weapons. With new products constantly coming on line, flexibility is the name of the game, and AWL is adept at modifying laboratory, aircraft, and range equipment and procedures to suit particular requirements.

- **Full-scale**—because information moves along the cable at the speed of light. In digital warfare, nanosecond precision is essential; therefore, it is important to test with full-scale distances between sensors, plane, and bombs
- **In-laboratory mock-ups**—because in-flight testing can cost up to 25 times more
- **Sensors**—because these "eyes and ears" are our current technological edge
- **Smart planes**—because air power is the preferred tool for power projection
- **Smart bombs**—because they are more precise and limit collateral damage
- **Combinations**—because there are multiple sensors, seven airframes, and many kinds of weapons available to accomplish various missions
- **Wired together**—because it takes integrated software to make the sensors, plane, and bombs talk to each other
- **Test real-world, real-time performance**—because it is all just theory until this happens!

Software Development. For the legacy F/A-18A+/C/D and early E/F aircraft, the AWL conducts end-to-end system and subsystem design and software development. Our experience covers the entire software life cycle process including designs, requirements, algorithms, and comprehensive testing. We use assembly and higher-order languages and are continually improving our processes, which include defect-density and defect-removal tracking and measurement, in-depth project matrix reviews, regression testing for safety- and mission-critical functions, testing of logic paths and algorithm-domain coverage, and work breakdown structure based planning. For aircraft still in production, the AWL partners with Boeing for software design and development.

Test and Evaluation. The AWL verifies that system functionality meets specifications by providing hardware-in-the-loop, man-in-the-loop, and end-to-end airborne testing with real-time coupling to laboratory equipment. AWL can also validate a system's effectiveness in its operational environment, and rigorous analyses of the metrics ensure the proper balance between laboratory testing and expensive flight testing. Experience extends to embedded computers, core electronics, sensors, and software-driven systems.

Size / Description / Scope. The 127,000-SF AWL complex has over 30,000 SF dedicated to five sensor laboratories and five integration laboratories (including the EA-18G model). **Annual Test Events:** Over 11,000 lab hours, 1,500 test flights, and approximately 500 on-aircraft ground tests per year.

Main Facilities

The laboratory includes two 6-story, 110-foot-tall towers that allow line-of-sight to the China Lake North Ranges. These are the most advanced facilities in the business and many are one-of-a kind. They are flexible and can be configured for a wide range of tests, from total digital simulation, to hardware-in-the-loop, to real-time monitoring of actual flight tests. Much of the work is done in integration and simulation facilities, which are configured with actual aircraft equipment, all of which are reconfigurable to the subsystem workstation level.

Our on-line and post-test data monitoring and analysis tools provide in-depth visibility by which to assess system operation and performance. These tools include real-time nonintrusive and other state-of-the-art technologies.

Key facility features include control, monitoring and data collection, flight modes of operation, and flight test data playback. Also, AWL links to the GPS Laboratory for dynamic GPS simulation and to weapon hardware-in-the-loop and digital simulation facilities. Real-time links include weapons simulation on airborne aircraft, aircraft links during flight test, electronic-combat range, local ranges for TSPI and telemetry, Secure Defense Research and Engineering Network (SDREN), and simulated tactical environments.

Aircraft. F/A-18 aircraft assigned to Test and Evaluation Squadron THREE ONE (VX-31) are used for flight testing. Aircraft range from the earliest A+ models to the latest production models. Features include comprehensive instrumentation; local flight clearance authority; local prototyping and modification facilities; multiple cockpit video recording systems; onboard recording; real-time display of video, voice, Inter-Range Instrumentation Group-B (IRIG-B) time, TSPI, and secure telemetry.