

**Mission.** NAWCWD is one of the Navy's foremost activities that field UxSs. Several teams, including the Unmanned Systems Activity (USA), are involved with the UxS effort. The USA is responsible for unmanned systems in all domains—air, ground, surface, and subsurface—and provides all the components needed to launch, control, and recover these systems. In addition, the Weapons Division is a technical lead for UxS sensors, weapons integration, cost and effectiveness analyses, as well as T&E.

UxS efforts are outpacing manned systems in terms of total accumulated flight hours and revenue generated for the China Lake land ranges. UxS work is a strategic thrust area for NAWCWD, and unmanned systems work continues to grow.

## NAWCWD UxS “Firsts”

### First Flights

- **Orion – Aurora Flight Sciences.** Successfully completed its first flight on August 24, 2013 on the China Lake test range. The flight lasted three hours and thirty-one minutes and reached a maximum altitude of 8,000 feet above mean sea level.
- **Fire Scout (RQ-8) and Pegasus (X-47A) – Northrop-Grumman.**
- **Global Hawk – Northrop-Grumman.** First FAA-authorized transcontinental flight from Patuxent River to Point Mugu.
- **ScanEagle.** Navy's first flight.

### First Launches

- AGM-114P against moving target from Army Sky Warrior; single AGM-114 (Hellfire) off MQ-1 (Predator A); air-to-air Stinger from MQ-1.

### First Releases

- GBU-39 Joint Direct Attack Munition (JDAM) from MQ-9 (Reaper); GBU-12 (Paveway II) from MQ-1 and MQ-9 (Reaper); first GPS-guided small smart bomb (SSB) from the Boeing X-45A.

### Other Noteworthy Firsts

- **Predator B.** First to support Unmanned Aerial Vehicle (UAV) search and rescue on land and sea.
- **MQ-9.** First full power GPS jamming testing.
- **Orion World Endurance Record.** The Aurora Flight Sciences UAS Orion demonstrated its ultra-long-endurance potential, and the company filed for a world endurance record following an 80-hour flight during testing on the China Lake Ranges December 5, 2014. Orion reached an altitude of 18,000 feet carrying a 1,000 pound load. The previous record of 30.5 hours was set by the Northrop Grumman RQ-4 Global Hawk in 2001. With an 11,200-pound-gross takeoff-weight, Orion has been described as an “ISR Truck.” The twin engine craft landed with approximately 1,700 pounds of fuel remaining. The craft has a 132-foot single piece wing that required significant transport logistics. Orion began life as a hydrogen-fueled, high-altitude unmanned aircraft but evolved into a diesel-powered platform designed to fly at medium altitude for five days and promises dramatically reduced operating costs. The flight was a U.S. Air Force concept demonstration. Orion solves a critical joint warfighting problem regarding the need for extreme persistence. Enabling surveillance, reconnaissance, signal intelligence, communications relay, telecommunications infrastructure, and mapping combined with significant operational efficiency gains. A 120-hour endurance flight at 20,000 feet is planned for the near future. NAWCWD's direct involvement in the test was significant. More than 100 safety and test conductors and managers, range support personnel, and communication experts worked for more than eight months to help ensure the success of this record breaking flight.

## NAWCWD — Current UxS Role



**UxS Full Spectrum Support.** There are few places in the nation where UxS customers can enjoy full spectrum (cradle-to-grave) UxS RDT&E support. Regardless of the stage of development, from new unproven systems to battle tested systems pushing the weapons test envelope, NAWCWD can handle any requirements. Whether the customer needs large time and airspace blocks for sensor operator training or multiple weapon launch scenarios, NAWCWD is able to support concurrent operations. In addition, the Weapons Division controls military restricted airspace, so authorized customers do not need to obtain an FAA certificate of authorization to operate UAVs on the ranges.

**Cost Efficiencies / Optimum T&E Weather.** Benefiting from more than 350 clear days per year, NAWCWD has optimum meteorological conditions that few UxS testing locations nationwide can match. If there is a technical problem, a customer can reschedule to fly the next day, if necessary. Customers save time and money by testing / operating in one location.

**UxS Weaponization.** The UxS field has evolved so rapidly that there has been very little standardization. There are a multitude of size designs that range from very large platforms (equivalent to airliners) down to vehicles that can fit in the palm of a hand, can fly over land and sea, and some that operate in undersea environments. Therefore, engineers are considering all possibilities across a broad spectrum when developing future weapon options. NAWCWD complies with all arms control agreements.



- **Forward-Firing Miniature Munition (F2M2) (formerly called “Spike”).** China Lake is credited with developing the world’s smallest guided missile. Weighing about 6 pounds, this fire-and-forget missile is approximately 24 inches in length and is suitable for a variety of manned and unmanned systems; it is accurate and portable – designed to be shoulder or platform-launch capable.
- **Miniature Guided Bomb Unit (MGBU).** Engineer teams are researching and developing this miniaturized gravity bomb for line-of-sight applications. The MGBU weighs less than 4 pounds and is designed for accuracy with minimal collateral effects. It can be used by small UAVs, such as the small tactical unmanned aerial system (STUAS) and RQ-7 Shadow.
- **GPS-Guided Miniature Munition (G2M).** Engineers are developing this 40-mm-sized precision miniature munition for non-line-of-sight applications. It is intended to be compatible with shoulder or platform-launch applications. G2M is undergoing navigation testing and development of other critical system components and subsystems. Future development options may include integration of sensors and components to expand capability and increase range.

**UxS Payload Integration – System-of-Systems Standards-Based Approach.** UxS platforms require multiple payload capabilities with various size, weight, and power constraints. Since point solutions are often unaffordable and unsustainable, China Lake designed, built, and applied system-of-systems engineering to develop a standards-based stores management approach that is both platform and payload agnostic. This small, lightweight, low power, interoperable system can be integrated across domain platforms for strike and force protection with many payloads including nonlethal weapons. In addition, the Division made significant advances in micro-electromechanical systems (MEMS), nanotechnology, micro-explosives, and super-capacitor technology that significantly reduce the size and weight power supply requirements for UxS. Nanoplasmonic and metamaterials accommodate the need for miniaturization of optoelectronic components that are critical to reduce the footprint and weight of future weapon systems.

**Shipboard Efforts**

- Performed ship integration efforts for Pioneer; maritized vertical takeoff and landing UAV system (MAVUS); improved the tactical air-launched decoy (TALD)
- Performed shipboard flight certification and operational demonstration with MAVUS
- Performed shipboard operations with Fire Scout UAS



**Naval Integrated Operations**

- Integrated Predator UAS, flown from San Nicolas Island, into Fleet Composite Training Unit Exercise (COMPTUEX) 96-1A for Training Exercise (TRACKEX) surveillance, reconnaissance, mini-strike (day and night), and mobile target track support
- Integrated Predator, ScanEagle, and Raven UAVs into Tomahawk operational test launch, thus allowing for tactical targeting and battle damage assessment
- Demonstrated tactical control system level 5 C<sup>2</sup> (using Block 0 with Predator, Block 2 with Fire Scout)
- Participated in the unmanned combat aerial vehicle (UCAV) integration for Predator / Reaper Hellfire, GBU-32, and Fire Scout Hydra 2.75-inch rockets
- Support and host Black Dart counter-UAS flight operations on an annual basis
- Conduct flight test programs for the entire array of unmanned systems



**UxS Systems Flown / Tested on NAVAIR Ranges**

**UxS Land Range Testing.** AeroLite, Aerosky, Aerosonde, Amber, Dakota, Dragon Eye, Exdrone, Falcon Prowl (UK), Fire Scout, Global Hawk, Global Observer, Hunter, J-UCAS X-45A, MAVUS, Medium Altitude Endurance UAV (MQ-1, MQ-9), Micro Air Vehicle (MAV), Pegasus, Pioneer, Pointer, Predator, Raven, Reaper, REECE, Scan Eagle, Shadow, Sky Owl, Sky Warrior, Swift, Switchblade, TALD, TCS, Tilt Rotor UAV System (TRUS), UAV-Medium Range, UAV-Short Range, Vertical Takeoff and Landing Tactical UAV, and Wasp.

**Drone Aircraft and Surface Craft Testing.** AQM-37, BQM-34, BQM-74, BQM-126, BQM-145, HSMST, KD-2R5, MA-31, MST, QF-4, QF-86, QST-35, and Vandal.



**UxS Sea Range Testing.** A wide variety of UxSs have been tested on the NAWCWD Sea Range, including ScanEagle flights supporting the Collaborative On-line Reconnaissance Provider Operationally Responsive Attached Link (CORPORAL) JCTD; the Broad Area Maritime Surveillance—Demonstrator (BAMS-D); RQ-8A ship testing—MQ-8B Fleet Operational Site (2013); Raven Acceptance Test Plan (ATP) and Fleet Demonstration; AeroVironment fleet of vehicles (Puma, Switchblade, Wasp); and the Predator fleet exercise (FLEETEX).