B. Dryden Flight Research Center (DFRC)

Located at Edwards Air Force Base, California, DFRC is NASA's primary installation for flight research and flight testing. Projects at Dryden over the past 67 years have led to major advancements in the design and capabilities of many civilian and military aircraft. In the past, DFRC has also conducted tests in support of the Agency's space programs.

The Center supports operations and development of future access-to-space vehicles, conducts airborne science missions and flight operations, and develops piloted and UAS test beds for research and science missions.

Range Safety at Dryden was established by the Dryden Center Director under an alliance agreement with the Air Force Test Center (AFTC) to provide independent review and oversight of Range Safety issues. Range Safety supports the Center by providing trained FTS engineers, Range Safety risk analysts, and Range Safety Officers to provide mission and project support primarily for UAS Projects.

1. Enhanced Flight Termination System

The DFRC/AFTC Range Safety Alliance has an operational EFTS transmitter site. The EFTS transmitter site has successfully been used to support four UAS Projects. Modifications are being planned to address the needs of upcoming flight Projects. Dryden also continues to support flight Projects with Inter-Range Instrumentation Group (IRIG) Flight Termination systems.

Dryden has supported other Ranges by assisting in the verification process for their respective fixed EFTS transmitter sites.

2. DFRC/AFTC Range Safety Alliance

Dryden Range Safety continues to provide FTS support to AFTC. Dryden is also providing assistance to the AFTC Range Safety Office as it completes a major reorganization.

Dryden Range Safety continues to support the testing of UASs. The UASs that were flown with Dryden assistance include:

a. Small UASs

Small Unmanned Aircraft Systems (sUAS) are in the model-type classification of flight vehicles. Dryden has established an area that offers sUAS projects a unique opportunity to conduct flights within the restricted airspace. Dryden has also established a streamlined flight approval process for sUASs that makes the airworthiness and safety review quicker and easier than those performed for larger UASs. Dryden has supported many hours of operations on multiple platforms from different manufacturers.

Dryden currently operates two radio controlled model aircraft named Dryden Remotely Operated Integrated Drone (DROID). One of the vehicles is used for low-cost flight research while the other is used as a UAS trainer for Dryden's UAS Pilots.

b. Blended Wing Body Low Speed Vehicle

The Blended Wing Body (BWB) Low Speed Vehicle (LSV) UAS, also known as X-48 LSV, is a dynamically scaled version of the original concept vehicle. The X-48 LSV Project is a partnership between NASA, Boeing, USAF Research Laboratory, and Cranfield Aerospace. The primary goals of the test and research project are to study the flight and handling characteristics of the BWB design, match the vehicle's performance with engineering predictions based on computer and wind tunnel studies, develop and evaluate digital flight control algorithms, and assess the integration of the propulsion system to the airframe. The BWB testing will address several key goals of NASA's Environmentally Responsible Aviation (ERA) Project, namely noise reduction, emissions reduction, and improvement in fuel economy. Industry studies suggest that because of its efficient configuration, the BWB would consume 20 percent less fuel than jetliners of today, while cruising at high subsonic speeds on flights of up to 7,000 nautical miles.

FIGURE 11: BLENDED WING BODY LOW SPEED VEHICLE

To date, the Project has conducted 92 successful flights in the X-48B configuration and 30 successful flights in the X-48C configuration, all with LSV #2. LSV #2 achieved the 100th flight milestone in October 2012. On April 09, 2013, the X-48 LSV airframe flew its last flight, ending the 6-year flight test project.

c. NASA Global Hawk

Dryden has acquired two former USAF Advanced Concept Technology Demonstration (ACTD) Global Hawk UASs. These pre-production Global Hawks were built by Northrop Grumman for the purpose of carrying reconnaissance payloads. The vehicles are now supporting NASA's Science Mission Directorate by providing a high altitude, long endurance airborne science platform. The vehicle has an 11,000 nautical mile range and 30+ hour endurance at altitudes above 60,000 feet mean sea level (MSL). NASA Global Hawk supported two Earth Science campaigns during 2013, each of which was a month in duration. During the first campaign, NASA 872 successfully supported the Airborne Tropical Tropopause Experiment (ATTREX 2013) that flew over the Pacific Ocean in February. NASA 872 logged 152 flight hours in support of the ATTREX campaign. Both NASA Global Hawks supported the successful second Earth science campaign of the year, the Hurricane and Severe Storm Sentinel (HS3 2013), based out of Wallops Flight Facility and flown over the Atlantic Ocean. During HS3 campaign, the vehicles collectively logged a total of 282 flight hours during the month of September.

FIGURE 12: NASA GLOBAL HAWK

NASA Global Hawk is scheduled to support ATTREX 2014 by conducting Earth Science flights over the Pacific Ocean in the early part of next year. The vehicle will be basing out of Guam.

Dryden Range Safety has supported flight planning and risk analysis tasks in support of FAA Certificate of Authorization (COA) applications.

d. Ikhana

NASA's Ikhana UAS is a General Atomics Predator-B modified to support the conduct of Earth science missions for the Science Mission Directorate. Ikhana has been registered with the FAA and given the tail number N870NA. The vehicle and ground control station have undergone upgrades that standardizes the vehicle to match the rest of the Predator-B fleet. The project has taken delivery of a science payload pod in addition to purchasing a mobile ground control station. The mobile ground control station is expected to be operational early next year. Ikhana also features a turret mounted imaging system, ideal for range surveillance.

FIGURE 13: NASA'S IKHANA UAS

This year, Ikhana successfully completed a series of customer sponsored payload flights. The project has also signed an agreement to partner with a commercial customer to flight test and demonstrate the TAMDAR (Tropospheric Airborne Meteorological Data Reporting) monitoring system. The system enhances aviation safety by providing icing and turbulence data, in addition to other meteorological data. Flights are scheduled to begin early next year.

Dryden Range Safety has supported flight planning and risk analysis tasks in support of FAA Certificate of Authorization (COA) applications.

e. Boeing Phantom Eye

Phantom Eye is an autonomous, hydrogen-powered, high-altitude, long endurance vehicle built by Boeing to develop future UAS technology opportunities. The vehicle completed its first flight in June 2012. Phantom Eye has flown four successful flights this year and a total of five successful flights to date. The objective for the upcoming flights is to reach a cruising altitude of 65,000 feet MSL.

FIGURE 14: BOEING PHANTOM EYE

f. Sierra Nevada Corporation (SNC) Dream Chaser Engineering Test Article (ETA)

Sierra Nevada Corporation (SNC) Dream Chaser Engineering Test Article (ETA) is an unmanned, unpowered, full scale prototype designed to demonstrate and flight validate space transportation technologies developed for a reusable crew transport. The ETA was built as a semi-autonomous, unmanned pathfinder for the manned Dream Chaser Flight Test Article. Dream Chaser is one of the vehicles competing in NASA's Commercial Crew Development Program. The vehicle is based on the NASA HL-20 lifting body design. Dream Chaser ETA successfully flew for the first time on October 26, 2013.

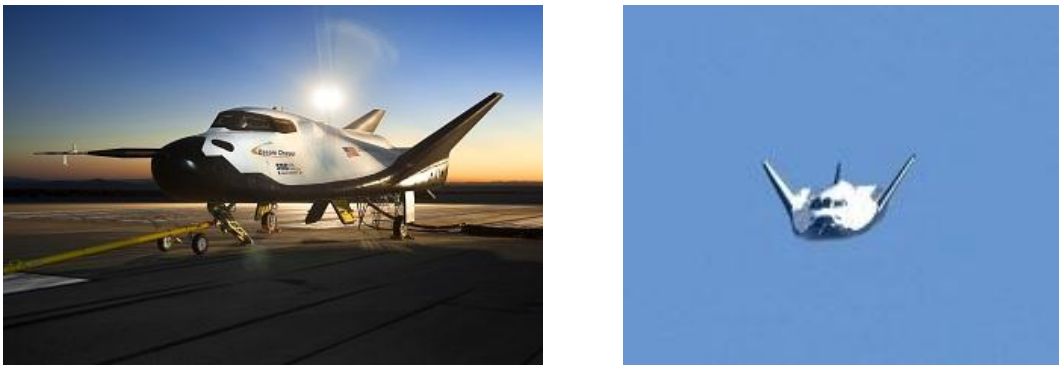

FIGURE 15: DREAM CHASER

g. Lockheed Martin X-56A

The X-56A is low speed, subscale vehicle designed to test lightweight flexible wing/fuselage technologies. First flight occurred in July 2013. X-56A has flown a total of eight successful flights this year, which completed the baseline, stiff wing flights. Flexible wing flights are scheduled to begin early next year.

FIGURE 16: LOCKHEED MARTIN X-56A