



## Airborne Science Operations at NASA Dryden



NASA's Global Hawks on the aircraft ramp at NASA Dryden Flight Research Center.

NASA's Dryden Flight Research Center operates a fleet of specialized aircraft of varied capabilities to support environmental and Earth science research missions under the Airborne Science Program of the agency's Science Mission Directorate.

As part of the directorate's Earth Science Division, NASA's Airborne Science Program uses these unique aircraft and sensors to conduct observations and collect in-atmosphere data, as well as advance the use of satellite data. The primary objectives of this program include:

- Conduct in-situ atmospheric measurements with varying vertical and horizontal resolutions
- Collect high-resolution imagery for focused process studies and sub-pixel resolution for space-borne calibration.
- Develop new technologies, such as remotely operated unmanned aircraft systems, to expand the capability of aircraft to serve as platforms for Earth science.
- Test new sensor technologies in space-like environments.
- Calibrate/validate space-based measurements and retrieval algorithms.

Most of NASA Dryden's science aircraft are based at the Dryden Aircraft Operations Facility in Palmdale, Calif. They include a Douglas DC-8 jetliner converted into a flying science laboratory, two high-altitude Lockheed ER-2s and a Gulfstream C-20A (G-III).

In addition, two Northrop Grumman Global Hawks and a General Atomics Predator B named "Ikhana," all unmanned remotely operated aircraft, are based at Dryden's main facility at Edwards Air Force Base, as is a Beechcraft B200 Super King Air used for both science and aeronautical research.

NASA's DC-8 aircraft carries sensors that collect data in support of scientific projects serving the world science community. These studies include archaeology, ecology, soil science, geography, hydrology, meteorology, atmospheric chemistry, oceanography, volcanology, and biology. The four-engine aircraft has been highly modified to support NASA's science missions, including sensor development, and satellite sensor verification. The DC-8 flies at altitudes from 1,000 to 42,000 feet for up to 12 hours, although most science missions last between six and 10 hours. The aircraft has a range of 5,400 nautical miles. The DC-8 can carry 30,000 pounds of scientific instruments and equipment.

NASA also uses its two Lockheed ER-2 Earth resources aircraft as flying laboratories. The single-seat aircraft routinely operate at up to 70,000 feet altitude and acquire data above 95 percent of the Earth's atmosphere. The ER-2s participate in studies of the Earth, celestial observations, atmospheric chemistry and dynamics, and oceanic processes. The aircraft are also used for electronic sensor research and development, satellite calibration, and satellite data validation. The aircraft



DC-8 airborne science laboratory.

fly missions of up to 10 hours and carry maximum payloads of 2,600 pounds distributed in the equipment bay behind the cockpit, the nose area and wing-mounted pods.



ER-2 Earth resources aircraft.

NASA's C-20A has been modified and instrumented as a platform for a variety of Earth science research experiments. The aircraft features a Platform Precision Autopilot designed by engineers at Dryden and a centerline pod that can house various types of sensors such as the UAVSAR synthetic aperture radar developed by NASA's Jet Propulsion Laboratory in Pasadena, Calif. The autopilot enables the aircraft to follow a desired flight path with an accuracy of less than 15 feet at cruise speeds. This capability allows the aircraft to conduct repeat passes virtually identical to previously flown flight paths to obtain precision measurements using the radar instrument to compare with data obtained on prior passes over the same terrain.

A General Atomics Predator B unmanned aircraft system



NASA's C-20A (G-III) with UAVSAR pod

named "Ikhana" is available for both environmental science and aeronautical research experiments. Ikhana is a word from the Native American Choctaw language that means intelligence, conscious or aware. The aircraft is designed for long-endurance, high-altitude flight. A variety of atmospheric and remote sensing instruments, including duplicates of those sensors on orbiting satellites, can be installed to collect data during flights lasting up to 30 hours. More than 400 pounds of sensors can be carried internally and over 2,000 pounds in external under-wing pods.



NASA's Predator B "Ikhana."

Two Global Hawk aircraft are used on a variety of Earth science missions requiring their high-altitude, long-endurance capabilities. The pre-production Global Hawks were transferred from the U.S. Air Force to NASA following the conclusion of the Air Force's Advanced Concept Technology Demonstration program.

The Global Hawk can fly at altitudes of 65,000 feet for more than 30 hours and cover 11,000 nautical miles while both its flight and mission experiments are being controlled from the Global Hawk Operations Center at NASA Dryden. Payloads are carried in internal bays and can total over 1,500 pounds. The ability of the unmanned Global Hawk aircraft to autonomously fly long distances and remain aloft for extended periods brings a new capability to the science community for measuring, monitoring and observing remote locations on Earth.

The twin-turboprop Beechcraft B200 No. 801, modified for use in both science and aeronautical research, is fitted with wingtip winglets that improve aerodynamic efficiency and reduce fuel burn.



NASA's B200 Super King Air No. 801

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