



NASA P-3B Airborne Science Laboratory



The P-3B in a typical mission configuration layout during a check flight.

The NASA P-3B Orion aircraft is a former U.S. Navy patrol aircraft that has been extensively modified by NASA for use as an airborne science laboratory. It is owned by NASA and operated by the NASA Goddard Space Flight Center's Wallops Flight Facility Aircraft Office at Wallops Island, Virginia. The P-3 is considered a "core" platform for the NASA Airborne Science Program. The aircraft can carry instrument payloads consisting of one to several at once while supporting scientific studies all over the globe.

The aircraft supports scientific investigations by NASA and visiting scientist from universities, other agencies, and organizations worldwide. Data gathered by the P-3 has been used for scientific studies in ecology, geography, hydrology, meteorology, oceanography, atmospheric chemistry, soil science, biology, cryospheric research, and satellite calibration/validation. The P-3 is also used as a technology test bed for new airborne and satellite instrumentation.

P-3B Aircraft

The P-3 is a four-engine turboprop aircraft and is in the 135,000-pound gross weight class. The aircraft is designed for endurance and range and is capable of long duration flights of 8-14 hours, large payloads up to 14,700 pounds, true airspeeds up to 400 knots, altitudes up to 30,000 feet, and requires a typical runway length of 7,000 feet. The aircraft is 117 feet long with a 100 foot wingspan and is 34 feet tall. It has many sensor ports, 4 to 4 ½ feet of ground clearance for ease of access and calibration, and ample pressurized cabin space for user systems.

Aircraft Modifications

The P-3 has been extensively modified to support airborne science-related activities. Some of the science features include

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zenith ports, three nadir ports (aft of the wings), and eight P-3 and DC-8 style windows to mount experiments, a tail cone, nose radome and ten wing mounted locations. Most of the fuselage ports are contained within the pressurized cabin environment including the pressurized sonobouy launcher, which can deploy "A" size sonobouys and dropsondes. The unpressurized bomb bay can be converted into experimenter ports via a custom fairing. This fairing creates two large nadir ports and several oblique ports for installation of large sensors and antennas.

A project data system is available that provides aircraft navigation data, meteorological information, and flight videos to experimenters. This system is also connected to the IRIDIUM and INMARSAT satellite constellations, and provides real time uplink/downlink capability, internet access, flight tracking, and instant messaging between aircraft and ground assets. Available experiment electrical power includes 110V/60Hz AC, 110V/400Hz AC, and 28VDC.

Mission Support

The P-3 is a self-sufficient global reaching aircraft that can operate from civilian and military airports to remote areas of the world. Experiment installations are installed on the aircraft at the NASA Wallops Flight Facility hangar, which has various labs and support equipment available for experimenter use. Wallops access to nearby restricted airspace allows for unique experiments to be conducted from the P-3 that normally cannot be conducted from other facilities. Wallops mission managers, pilots, engineers, technicians, and aircraft mechanics provide an all-in-one comprehensive mission support team for all P-3 missions conducted locally or abroad.

Scientific Studies

The P-3's first mission in the early 1990's consisted of cryospheric research flights over the Arctic region. The aircraft continues these missions today with annual flights to Greenland and other Arctic areas for the Operation IceBridge campaign. Operation IceBridge began in 2009 as a way to fill the gap between the end of the IceSat I satellite and the beginning of the IceSat II satellite mission. The critical areas to be observed and measured during the Operation IceBridge 5-year campaign are coastal Greenland; in particular, the sub-glacial lakes and certain fast moving glaciers, the southeast Alaskan glaciers, and Arctic sea ice thicknesses. The aircraft is well suited for the low altitude flights over sea and land ice to map the topography of the ice, bedrock, and sea floor beneath. The P-3 has been supported by the DC-8 and other aircraft in the arctic regions in the past, but it

remains the main NASA aircraft for performing Arctic cryospheric research.

The other major area of P-3 scientific flights has been in the atmospheric chemistry regime. The P-3 flew several global campaigns called Global Troposphere Experiment (GTE) during the late 1990's and early 2000's. These missions evolved over time to study specific atmospheric phenomena culminating in a return to the P-3 in 2008 for the Arctic Research of the Composition of the Troposphere from Aircraft and Satellites (ARCTAS) campaign. In the spring of 2008, the P-3, along with several other NASA and other Agency aircraft, converged on Fairbanks, Alaska to study the effects of pollutants on the Arctic environment. The P-3 and DC-8 returned in the summer of 2008 to Yellowknife, Canada to study the specific effect of boreal forest fires on the Arctic environment. The P-3 continues its long history of atmospheric chemistry research in 2010 with a 5-year campaign called DISCOVER-AQ to study air quality over several major U.S. cities.

Other notable scientific studies that the P-3 has conducted in the recent past include surface wind measurements for satellite validation from Goose Bay, Canada and soil moisture measurements conducted over Oklahoma and the Delmarva Peninsula. The P-3 has also support numerous instrument technology demonstration flights from various universities and NASA Centers over the last several years.

National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337