NASAfacts

DC-8 Airborne Science Laboratory

NASA's DC-8 takes off to St. Croix in support of the Convective Processes Experiment – Aerosols and Winds campaign (CPEX-AW) on Aug. 17, 2021. Credit: NASA/Joshua Fisher

A specially modified Douglas DC-8 jetliner was operated as a flying science laboratory at NASA's Armstrong Flight Research Center in Palmdale, California. The plane collected data to support research projects used by scientists around the world. Federal, state, university, and international researchers all used NASA's DC-8.

The DC-8 ended its NASA mission in May 2024 and was retired to Idaho State University in Pocatello, Idaho. There, it is part of the Aircraft Maintenance Technology program, helping train future aircraft technicians through hands-on experience.

How the DC-8 Was Used

While flying, scientists gathered data directly from the air and through remote sensing instruments. This data helped studies in fields like archaeology, ecology, weather, ocean science, volcano monitoring, atmospheric chemistry, soil science, and biology. The plane carried out four main types of missions.

Sensor Development

Flying within Earth's atmosphere, the DC-8 was a cost-effective way to test new satellite instruments before sending them to space. Scientists used it to develop and improve instrument technology, fixing any problems found during flight tests. This helped save time and money by ensuring instruments worked properly before launch.

In winter 2016, the DC-8 took part in the Active Sensing of CO2 Emissions over Nights, Days and Seasons (ASCENDS) campaign. Flights tested

advanced laser instruments measuring carbon dioxide in the atmosphere over oceans, cities, forests, and snow. This work helped improve future satellite tools designed to track carbon dioxide.

Satellite Sensor Verification

The DC-8 helped scientists check how accurate satellite data really is. Flying under satellites, it collected the same data with onboard instruments. This allowed researchers to compare and update the methods satellites use to analyze data.

One example was the 2021 Convective Processes Experiment – Aerosols and Winds (CPEX-AW), a NASA and European Space Agency project. It focused on calibrating and validating wind-measuring satellite instruments over St. Croix in the U.S. Virgin Islands.

Telemetry and Tracking

The DC-8 was equipped with a special antenna in its nose to track telemetry (data signals) from missile defense satellite launches and NASA's Glory Earth science satellite.

The plane also helped track spacecraft as they returned to Earth, including Europe's Jules Verne cargo ship in 2008 and Japan's Hayabusa spacecraft in 2010.

Other Research Studies

Starting in 1991, NASA used the DC-8 to study Earth as a complete environmental system. The plane's long range, long flight times, and large payload capacity made it one of NASA's top research aircraft. It worked alongside satellites, ground stations, and other aircraft to help scientists study planetary issues. From 2009, the DC-8 took part in Operation IceBridge, NASA's yearly mission to study polar ice. It flew over Antarctica and later Greenland, carrying instruments to map polar ice. This research built on earlier satellite missions and helped prepare for new ones.

In 2019, the DC-8 carried 32 sensors during the Fire Influence on Regional to Global Environments – Air Quality (FIREX-AQ) campaign. This joint NASA and National Oceanic and Atmospheric Administration (NOAA) effort studied wildfire smoke over the northwest U.S., using coordinated observations from satellites, aircraft, and ground labs.

Cloud formations are visible through the window of NASA's DC-8 aircraft during a flight over the Gulf of Mexico on Aug. 17, 2010. Researchers aboard were studying weather patterns as part of the Genesis and Rapid Intensification Processes (GRIP) experiment, which aimed to improve understanding of how tropical storms develop into major hurricanes. Credit: NASA/Paul E. Alers

Aircraft Description

NASA's DC-8 is a four-engine jet built in 1969 and modified for science missions after NASA acquired it in 1985. It is 157 feet long with a wingspan of 148 feet.

The plane can fly up to 5,400 nautical miles (about 6,200 miles), reaching altitudes from 1,000 to 42,000 feet. Missions typically lasted 6 to 10 hours, but the plane could stay aloft for up to 12 hours.

The aircraft was altered to carry up to 30,000 pounds of scientific gear and could seat 45 people, including researchers and crew. NASA installed advanced sensors and communication systems on the DC-8.

The plane had satellite communications for crew and science teams, could send weather data, chat messages, limited telemetry, and even live web updates during missions.

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