Dryden Flight Research Center

Fact Sheets

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DC-8 Airborne Laboratory

NASA operates a highly modified McDonnell Douglas DC-8 jetliner as a flying science laboratory. The platform aircraft, based at NASA's Dryden Aircraft Operations Facility, Palmdale, Calif., collects data for experiments in support of scientific projects serving the world's scientific community. Included in this community are NASA, federal, state, academic and foreign investigators.

The DC-8 flies over the Dryden Aircraft Operations Facility, Palmdale, Calif. NASA Photo: ED07-0256-13

Data gathered by the DC-8 at flight altitude and by remote sensing have been used for scientific studies in archaeology, ecology, geography, hydrology, meteorology, oceanography, volcanology, atmospheric chemistry, soil science and biology.

Missions

The DC-8 flies three primary missions: sensor development, satellite sensor verification and basic research studies of the Earth's surface and atmosphere.

Sensor Development

Because it flies in the Earth's atmosphere, the DC-8 offers a comparatively inexpensive way to test and verify prototype space shuttle or satellite instruments.

Scientists use the DC-8 to develop ideas in instrument technology, test new instruments and modify them if necessary, based on flight results. Potential problems can be corrected before new instruments are launched into space. As a result, flight-proven hardware can lead to substantial savings in time and resources.

Satellite Sensor Verification

Once in orbit, satellite instruments may send back billions of bits of data daily. The DC-8 helps scientists answer questions about the accuracy of data obtained and how to interpret it. For these missions the DC-8 flies under a satellite's path, using instruments to compile the same information as that collected by the satellite. Through this process, algorithms used to interpret satellite data are evaluated and updated to reflect the results verified by DC-8 instrumentation.

Despite near-record levels of chemical ozone destruction in the Arctic in January and February 2005, observations from the Aura satellite showed that other atmospheric processes restored ozone amounts to near average and stopped high levels of harmful ultraviolet radiation from reaching Earth's surface. Instruments flown on the DC-8 during NASA's Polar Aura Validation Experiment confirmed the satellite data. The aircraft carried 10 instruments that were used to measure temperature, aerosols, ozone, nitric acid and other gases, as it flew beneath Aura as it passed over the polar vortex.

Basic Research Studies

In 1991, NASA launched a comprehensive program to study the Earth as an environmental system. The DC-8's extended range, prolonged flight-duration capability, large payload capacity and laboratory environment make it one of the premier research aircraft available to NASA's Science Mission Directorate. Combined with other aircraft, satellites or ground stations, the DC-8 complements and extends the range of any instrument package, allowing scientists to successfully address today's planetary issues, including global warming and deforestation.

As part of Arctic ozone experiments, the DC-8 flew in polar regions to collect atmospheric information that may contribute to human understanding of ozone depletion. Teamed with NASA's ER-2 high-altitude research aircraft, the DC-8 participated in

the SAGE III Ozone Loss and Validation Experiment, or SOLVE, in Kiruna, Sweden. The SOLVE mission, which took place during the winter of 1999-2000, was one of the largest NASA-sponsored field campaigns that measured ozone amounts in the Arctic stratosphere. The DC-8 returned to Sweden for SOLVE II in January 2003.

The Convection and Moisture Experiment, or CAMEX, is a series of field research investigations intended to improve understanding and prediction of hurricane activity. The fourth campaign, during the summer of 2001, studied hurricane development, tracking, intensification and landfall. The DC-8 and a NASA ER-2 carried instruments that yielded information about hurricane structure, dynamics and motion.

The Airborne Synthetic Aperture Radar, developed by NASA's Jet Propulsion Laboratory, Pasadena, Calif., is an all-weather imaging device that can penetrate clouds, forest canopies, thin sand and dry snow packs. In early 2004, the sensor was carried on the DC-8 to survey selected sites in Central America to uncover archaeological sites hidden beneath the forest. The aircraft continued on to South America and Antarctica, where it collected data on the contribution of Southern Hemisphere glaciers to a rise in sea level due to climate change.

DC-8-72 Aircraft

NASA's DC-8 airborne science laboratory is shadowed by a NASA F/A-18 chase plane during a flyover of the Dryden Aircraft Operations Facility in Palmdale, Calif.

The NASA DC-8-72 is a four-engine jet transport aircraft that has been highly modified to support the agency's Airborne Science mission. The aircraft, acquired in 1985, is 157 feet long with a 148-foot wingspan. With a range of 5,400 nautical miles, it can fly at altitudes from 1,000 to 42,000 feet for up to 12 hours, although most science missions average six to 10 hours. The DC-8 can carry 30,000 pounds of scientific instruments and equipment.

Among the aircraft's features are wing pylons for aerosol sampling; a gyro-stabilized pointing and tracking mirror system; a dropsonde delivery tube; atmospheric chemistry sampling probes; and multiple reinforced ports that accept experiments that can be aimed in virtually any direction. Experiment support capabilities include weather radar, an integrated navigation management system, a satellite-based time code generator, a stand-alone Global Positioning System, and a weather satellite receiver system. Each experiment is supported by an information collection and transmission system that provides navigation, aircraft flight conditions and environmental data measured by the aircraft's sensors.

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