NASAfacts

C-20A Airborne Science Research Aircraft

An eight-foot-long pod designed to carry a synthetic aperture radar hangs from the underbelly of NASA's C-20A research test bed, seen taking off from NASA's Armstrong Flight Research Center in Palmdale, California. Credit: NASA

NASA's Armstrong Flight Research Center in Edwards, California, operates a C-20A aircraft — a military version of the Gulfstream III business jet — as a flying science laboratory for a wide range of Earth research missions.

The aircraft was acquired from the U.S. Air Force in September 2002 and has since been heavily modified. Upgrades include a synthetic aperture radar mounted in a pod under the aircraft, a data collection and processing system (DCAPS), and a precision autopilot that allows the plane to fly the same path repeatedly, staying within a 10-meter area of the planned route.

The twin-engine jet gives NASA and its partners — including other agencies, universities, and private companies — a reliable, long-term platform for collecting environmental data from the air.

Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR)

Developed by NASA's Jet Propulsion Laboratory (JPL) in Southern California, the UAVSAR is a high-resolution radar system. Though it was originally created for use on drones, it's currently flown on the C-20A and is mounted in a specially designed pod that could be used on uncrewed aircraft in the future.

The UAVSAR uses a method called interferometry to detect even tiny changes in Earth's surface. It collects data for studies related to earthquake fault lines, volcanic activity, glacier motion, landslides, permafrost changes, underground water table fluctuation, wildfire heat sources, and fire scars. Since 2009, the radar system has logged more than

5,500 flight hours on research missions. To carry the UAVSAR pod, NASA modified the aircraft to add a special ejector rack under the fuselage. This rack, which includes power and data connections, can also hold other science instruments for future projects.

Data Collection and Processing System (DCAPS)

The DCAPS is a built-in data system designed to streamline operations. It simplifies setup for each mission and reduces the need for extensive engineering support.

The system includes both primary and backup components to ensure reliable performance. The backup system can also run in parallel, when needed. The DCAPS is flexible and can be updated or expanded with new features. It can operate automatically or be manually controlled.

Developed for the C-20A, the system processes, shares, displays, and stores flight and experiment data in real time.

Platform Precision Autopilot (PPA)

The C-20A is equipped with a precision autopilot created by NASA Armstrong engineers. The Platform Precision Autopilot (PPA) uses a high-accuracy GPS system developed by JPL, along with the aircraft's onboard navigation tools, to keep the plane on a highly consistent flight path — within 10 meters or less of the planned route.

This allows the radar system to gather highly detailed, repeat-pass data that can detect surface changes as small as a few millimeters.

Other Modifications

Additional features include onboard video systems and multiple satellite communications tools. The cabin electrical system includes 115-volt, 60-hertz, and 400-hertz AC, as well as 28-volt DC.

Tuffs of yarn are attached to the underside and pylon of NASA's C-20A research aircraft to help engineers study how air flows around the synthetic aperture radar pod, known as UAVSAR. Credit: NASA

Aircraft Description

The Gulfstream III was originally designed as a business jet, capable of carrying up to 12 passengers.

The Air Force version, the C-20 (A through C variants), has been used to transport senior military and government officials.

NASA's C-20A has a maximum takeoff weight of 69,700 pounds when fully loaded with fuel and passengers or equipment. Its empty weight is around 38,000 pounds. The plane is about 83 feet long, with a wingspan of 77 feet and a height of 24 feet.

The aircraft typically cruises at 527 mph and can reach top speeds of 576 mph (Mach 0.85). It can fly at altitudes up to 45,000 feet and travel about 3,400 nautical miles — or roughly 4,000 statute miles — on a full load.

It's powered by two Rolls-Royce Spey Mark 511-8 turbofan engines, each generating 11,400 pounds of thrust.

National Aeronautics and Space Administration

Armstrong Flight Research Center
4800 Lilly Drive
Edwards, CA 93523
www.nasa.gov/Armstrong