NASA Facts

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Altair / Predator B

The first Predator B prototype is shown during an initial development test flight. An upgraded extended-wingspan version known as the Altair is being developed for NASA to perform high-altitude, long-endurance earth science missions.

An Earth Science Aircraft for the 21st Century

NASA's Dryden Flight Research Center has partnered with General Atomics Aeronautical Systems, Inc., (GA-ASI) to demonstrate technologies that will expand the capabilities of remotely operated, uninhabited aircraft to perform high-altitude earth science missions. To accomplish the task, GA-ASI is developing an enlarged version of its Predator reconnaissance aircraft, the Predator BÆ, including an extended-wingspan Altair version for NASA, to meet these requirements.

GA-ASI's task under NASA's Environmental Research Aircraft and Sensor Technology (ERAST) Joint Sponsored Research Agreement calls for the San Diego firm to develop and demonstrate technical performance and operational capabilities that will meet the needs of the science community. As joint partners in the project, which covers flight validation as well as development of the aircraft, NASA's Office of Aerospace Technology is investing approximately $10 million, while GA-ASI is contributing additional funds, with about $8 million earmarked for the Altair project.

NASA's Office of Earth Science established a stringent set of requirements for the conventionally powered, remotely or autonomously operated aircraft. Among these requirements were a mission endurance of 24 to 48 hours at a primary altitude range of 40,000 to 65,000 feet with a payload of at least 660 lb. (300 kg). Another key requirement is to develop the capability and operational procedures to allow operations from conventional airports without conflict with piloted aircraft. In addition, the Altair will have to demonstrate "over-the-horizon" command and control beyond line-of-sight radio capability via a satellite link, "see-and-avoid" operation in unrestricted airspace and the ability to communicate with Federal Aviation Administration (FAA) controllers. The aircraft will also have to meet all FAA airworthiness and maintenance standards.

The first Predator B prototype uninhabited air vehicle (UAV) is powered by a Honeywell TPE-331-10T turboprop engine, derated to 700 shaft horsepower, driving a rear-mounted three-blade controllable-pitch propeller. The Predator B is 36 feet long and has a wingspan of 64 feet, about 16 feet longer than the Predator. It is distinguished from its smaller cousin by its Y-shaped tail, with a ventral vertical fin. It is designed for a maximum gross takeoff weight of 6,400 lbs. The first turbine-powered aircraft built by GA-ASI, the Predator B is designed to fly as long as 25 hours at up to 200 knots indicated airspeed at altitudes as high as 45,000 feet, while carrying payloads of up to 750 lbs. The aircraft are designed to meet Federal Air Regulations Part 23 requirements.

The modified Altair version of the Predator B, shown in this computer-generated image, will have an extended wing and tail, upgraded avionics and redundant controls designed which will allow it to carry earth science payloads for more than a day at altitudes as high as 52,000 feet.

Tail Numbers 001-003

The first Predator B prototype—aircraft 001—logged its first flight Feb. 2, 2001 from the General Atomics Aeronautical Systems, Inc. (GA-ASI) flight operations facility at El Mirage, Calif. After an initial series of airworthiness test flights and downtime for various software and systems upgrades, the Predator B 001 flew a second series of flight tests in mid-summer, 2001, aimed at expansion of its flight envelope and validation of its autonomous flight capabilities. The prototype reached a maximum sustainable altitude of 48,300 feet during one of those flights over the Edwards Air Force Base test range.

The Altair technology-demonstration variant for NASA is designed to carry an equivalent payload for as long as 32 hours at up to 52,000 feet. Eleven-foot extensions will be added to each wingtip, giving the Altair an overall wingspan of 86 feet with an aspect ratio of 23.5. It also will be powered by the TPE-331-10 turboprop engine, and is also expected to begin flight tests in the spring of 2002.

Earth Science Missions

The Altair is being designed to perform a variety of Earth science missions specified by NASA's Earth Science Enterprise. To demonstrate its ability to meet those standards, GA-ASI will be required to conduct a multi-flight demonstration of the Altair representative of a scientific data-gathering mission, including all the necessary integrated logistical support that would be needed when operating from a remote location. The demonstration mission will include three long-duration, high-altitude flights with a payload of imaging and atmospheric sampling instruments, and is tentatively scheduled for late summer 2002.

Many potential science missions are being considered for the demonstration flights. These missions may take place over a wide variety of geographic locations, capitalizing on the aircraft's extreme range and duration. Volcanic observation over Hawaii, forest fire monitoring over the western states and atmospheric sampling over Alaska are among the science demonstration mission possibilities.

Advanced subsystems on the Altair include over-the-horizon satellite communication-based command and control, a redundant flight control system to improve operational reliability, "see and avoid" capability, voice relay so air traffic controllers can communicate directly with the ground-based pilot at extreme ranges, and fault-tolerant avionics, considered essential to meeting NASA's science mission requirements. It will also be capable of transmitting research data via a satellite link in real time to scientists on the ground.

Begun as a company-funded effort in 1999, the Predator B development program became a jointly-funded effort by GA-ASI and NASA in January, 2000, after NASA selected the Altair variant from several competing proposals for development to meet the agency's Earth Science Enterprise UAV requirements.

GA-ASI is no stranger to the ERAST project—its Altus II® had been involved in ERAST as a technology demonstrator of aerodynamic, propulsion and control system technologies for future high-altitude, long-endurance UAVs designed for civil scientific and commercial uses. The Altus II has also been utilized for several earth resources missions, most notably a high-altitude atmospheric cloud radiation study conducted over Hawaii in the spring of 1999.

The ERAST project is managed for NASA by the Dryden Flight Research Center, Edwards, Calif.

Operational Requirements for ERAST Earth Science Platform Aircraft

NASA's Earth Science Enterprise has established a stringent set of requirements for the Altair / Predator B to demonstrate its capability to serve as a high-altitude remotely or autonomously operated airborne platform for Earth Science missions. The requirements include:

- Flight demonstrate a primary altitude range of 40,000 to 65,000 feet
- Flight demonstrate a mission endurance of 24 to 48 hours with a minimum 660 lb. (300kg) payload at the primary altitude range
- Demonstrate ease of ground handling so that the vehicle is capable of operating from general aviation airports and can integrate with conventional aircraft operations
- Demonstrate a flight environment envelope that is consistent with the weather and operating maneuverability necessary to support a broad range of science missions
- Demonstrate UAV compliance with current applicable FAA requirements or guidelines on UAV operations in civil airspace including, but not limited to:
- See & Avoid compliance criteria
- Airworthiness/maintenance standards criteria
- Demonstrate Over the Horizon / See & Avoid Operations (in unrestricted FAA airspace, beyond line-of-sight) including,, but not limited to:
- Communication with FAA Centers (SATCOM relay of switchable UHF)
- Communication of See & Avoid information
- Demonstrate logistics capability of the integrated system (UAV, GSE, GCS, etc.) to be deployable and/or transportable to remote locations
- Perform a successful multi-flight demonstration of a mission representative of those typically used for gathering science data

Altair / Predator B Specifications

- **Profile:** Low-wing monoplane with narrow fuselage and high aspect-ratio wing, large V-shaped tail with ventral fin, rear-mounted turboprop or turbofan engine. Enlarged fuselage nose to accommodate various payloads. Retractable tricycle landing gear. Dual-redundant flight controls.
- **Wingspan:** Predator B 001/002 — 64 feet; Altair – 86 feet with wingtip extensions.
- **Length:** 34 feet.
- **Wing Aspect Ratio:** Predator B – 17.5; Altair – 23.5
- **Gross weight:** Predator B – 6,400 lbs; Altair – 7,000 lbs.
- **Payload:** Up to 750 lbs. of sensors, radar, communications and imaging equipment.
- **Airspeed:** Predator B 001 & Altair (003) – 210 KIAS; Predator B 002 – 270 KIAS.
- **Altitude (maximum):** Predator B 001 – 45,000 ft., Predator B 002 – 60,000 ft., Altair (003) – 52,000 ft.
- **Propulsion:** Predator B 001 and Altair (003) — Allied-Signal TPE-331-10T turboprop, flat rated at 700 shp, driving a three-blade constant-speed propeller; Predator B 002 – Williams FJ44-2A turbofan, rated at about 2,300 lbs. thrust at sea level.
- **Fuel system/capacity:** Six tanks in fuselage and wings, 3,000 lb. capacity, JP-8, Jet-A or similar fuels.
- **Endurance:** Predator B 001 – 24 hrs; Predator B 002 – 12 hrs; Altair (003) – 32 hrs.
- **Manufacturer**: General Atomics Aeronautical Systems, Inc., San Diego, Calif.
- **Primary materials**: Molded lightweight uni- and bi-directional graphite composites with Nomex honeycomb stiffening panels.