FUEL-SAVING PROPFAN BEGINS TESTS AT LOCKHEED-GEORGIA

MARIETTA, Ga., May 19 -- Lockheed-Georgia Company has begun flight testing an advanced, fuel-saving type propeller called a "propfan" here in a $56 million NASA-sponsored research program.

The propfan propulsion system is mounted on the left wing of a Gulfstream II business jet. Data gathered in the flight research program will aid engineers in designing a new generation of propfan-propelled aircraft.

NASA's Lewis Research Center is funding and managing the research effort, called Propfan Test Assessment (PTA). Lockheed-Georgia is prime contractor.

Aircraft equipped with propfan propulsion systems will burn 15-30 percent less fuel than the most advanced turbofan-powered aircraft flying in the 1990s while flying at the same speeds as today's jets.

But engineers need more information on propfans before designing new aircraft to use them.

The 150-hour PTA research flight test program is aimed specifically at evaluating the structural integrity of the propfan blades, investigating associated propfan-related cabin noise and vibration, and evaluating community noise.

The research flights will be conducted at Lockheed-Georgia Company's Marietta, Ga., facility. They will cover test points ranging from 1,000 feet above the ground to 35,000 feet and Mach 0.8 (about 550 miles per hour). The two jet engines on the testbed aircraft will provide the prime propulsive power during the flight tests.

"No one in the industry -- airframe manufacturer, engine manufacturer, or airline operator -- will commit to a major new technology like this without validating it in flight test," said William E. Arndt, manager of the PTA program for Lockheed-Georgia at a news conference before the test flight.

"That's the purpose of the PTA research flight tests -- to provide engineers with information they can trust in designing propfan-powered planes. We're bringing the technology out of the lab. NASA will provide this information to the U.S. aerospace industry."

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The propfan is a revolutionary type propeller with eight thin blades and highly swept tips. The blades are swept back like the wings of a jet aircraft for greater efficiency at high speed.

The PTA research effort is aimed at validating technologies and analysis codes critical to developing high-speed propellers.

Lockheed-Georgia Company is responsible to NASA's Lewis Research Center for overall design and management of the the Propfan Test Assessment. Five other aerospace companies are also on the PTA team.

Allison Division of General Motors (Indianapolis, Ind.) provided the 6,000-horsepower turboshift engine for the propfan propulsion system.

Hamilton Standard, a division of United Technologies (Windsor Locks, Conn.), manufactured the nine-foot diameter, eight-bladed propfan under a separate NASA contract. Hamilton Standard is also providing technical support including analyzing propfan blade stress data from PTA ground and flight tests.

Rohr Industries, Inc. (Chula Vista, Calif.) made the forward nacelle (the aerodynamic housing for the engine) and provided facilities for extensive PTA propulsion system static tests last year.

Gulfstream Aerospace Corp. (Savannah, Ga.) installed the propfan propulsion system on the left wing of the Gulfstream II business jet in Savannah earlier this year. Also, the wings of the plane were beefed up to accommodate the extra weight, a 2,100-pound static balance boom was added to the right wingtip for balance, a 300-pound dynamic balance boom was installed on the left wingtip to dampen flutter, and other modifications were made for instrumentation and control of the propfan.

Lockheed-California Company (Burbank, Calif.), a leader in cabin acoustics, is responsible for analyzing and evaluating cabin acoustic flight test data.

Extensive instrumentation on the testbed aircraft -- microphones, accelerometers, and other instruments -- are recording more than 600 data parameters during the flight tests. This instrumentation and the highly controlled test conditions will give design engineers confidence in the PTA flight test data.

Propfan noise -- how the noise gets into the cabin and how to dampen it efficiently -- is a crucial issue in developing the new propfan technology.
"No matter how much fuel you save, if the airplane's too noisy, nobody will want to fly in it," said Arndt. "Traditional acoustic treatment methods won't work with propfan noise; so we are exploring some new ideas."

Acoustic treatment technology development after the 150-hour PTA research flight test program will continue under a NASA-Langley Research Center initiative.

Lockheed-California Company will design and fabricate an acoustic treatment test section in 1987, and it will be installed in the PTA testbed aircraft for flight testing in early 1988. The flight tests will be aimed at determining how effective this acoustic treatment is in attenuating propfan noise.

In addition to commercial airliner applications, propfan propulsion systems are being evaluated as candidates for a new tactical airlifter. A contract for Advanced Transport Technology Mission Analysis, awarded to Lockheed-Georgia by the U.S. Air Force last year, calls for examination of technologies for use on STOL (Short Take-Off and Landing) and VSTOL (Vertical and STOL) conceptual designs for the year 2000 and beyond.

From these analyses, propfan propulsion technology appears attractive, primarily because of the significant reduction in fuel consumption compared to equivalent technology turbofan engines.

Lockheed-Georgia Company has been developing propfan technology since 1977. NASA's propfan effort, directed by the Advanced Turboprop Office at NASA-Lewis, dates to 1975.
LOCKHEED DEMONSTRATES FUEL-SAVING PROPFAN

MARIETTA, Ga., May 20 -- Lockheed-Georgia Company and NASA demonstrated a revolutionary aircraft propulsion technology yesterday at the company's Marietta, Ga., facility for more than 100 aerospace industry and government officials.

A test aircraft equipped with a "propfan" made three low passes over the runway at Dobbins Air Force Base. Frank Hadden, Lockheed-Georgia's chief engineering test pilot, flew the test plane over the crowd twice with only the propfan-equipped engine powering it, and once with only the test plane's jet engines providing power. This let the crowd hear the difference between the jets and the quieter propfan.

The fuel-saving propfan, which Lockheed-Georgia is testing for NASA's Lewis Research Center, will cut transport aircraft fuel consumption 20-50 percent when it is introduced in the 1990s.

Lockheed-Georgia is gathering data in the flight research program that will aid engineers in designing the new generation of propfan-propelled aircraft. Not only will these aircraft be less expensive for airlines to operate and conserve a scarce resource, but they will fly just as fast as today's jetliners.

"No one in the industry -- airframe manufacturer, engine manufacturer, or airline operator -- will commit to a major new technology like this without first validating it in flight test," said William E. Arndt, manager of the $56 million Propfan Test Assessment program for Lockheed-Georgia.

NASA will provide the data Lockheed-Georgia gathers in the Propfan Test Assessment program to the U.S. aerospace industry, thus helping the U.S. maintain its lead in worldwide aerospace development, and especially in propfan technology.

Observers from as far away as France and Japan, as well as from leading companies in the U.S. aerospace industry, were on hand for the flight demonstration.
LOCKHEED COMPLETES ACOUSTICAL FLIGHT TESTING OF ADVANCED PROPFAN

MARIETTA, Ga., May 5 -- Lockheed Aeronautical Systems Company-Georgia (LASC-Georgia) and NASA, in the final flight test phase of a 133.25 hour Proppfan Test Assessment (PTA) program, have completed advanced technology cabin acoustic treatment testing of a proppfan propulsion system.

A modified Gulfstream Aerospace Corporation G-II business jet was used as a test bed. This flight test phase consisted of seven flights totaling 12 hours and 37 minutes. During these flights the proppfan engine, mounted on the left wing of the G-II, was operated for 11 hours and 30 minutes.

For the cabin acoustic tests, LASC-Georgia installed a module inside the cabin which incorporated a high technology lightweight noise attenuation treatment. Sensors in this module measured noise levels and served to evaluate the effectiveness of the treatment in attenuating low frequency tones. Such tones are characteristic of proppfan propulsion systems.

According to Dyckman Poland, manager of the PTA program for LASC-Georgia, the interior cabin treatment was tested in several configurations. It was tested isolated from the airframe as well as rigidly mounted to the airframe to gather vibration and noise transmission data.

"The primary feature of the treatment is an array of Helmholtz resonators which are tuned to attenuate the noise at the prop's fundamental frequency. Performance of the resonators was examined over a wide range of propeller RPMs. The resonators also were deactivated to determine how the treatment performed without the resonators operating," said Poland.

Using 31 microphones inside and 20 outside the airplane, data were acquired while the G-II was flown, in the cruise configuration, at an altitude of 15,000 feet at Mach 0.5 and 25,000 and 35,000 feet at Mach 0.8. These data were compared with data gathered earlier in the program, without the cabin acoustic treatment.

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"We are encouraged from what we have seen of the data so far. Cabin noise levels were significantly reduced by the treatment, but we don't yet have a full assessment of the resonator effectiveness," added Poland.

Conclusion of the flight phase of the PTA program represents the culmination of 133.25 hours of gathering acoustic data from the ground, in-flight from a nearby NASA chase plane and the testbed G-II itself.

Complete results of the PTA program will not be available for several months when the large volume of data will have been processed and analyzed. When this is done, LASC-Georgia will make a final report on the findings to NASA-Lewis Research Center, Cleveland, Ohio.

The PTA propulsion system incorporates an advanced technology propeller which has eight highly swept blades powered by a turboshaft engine. The eight-blade, single-rotation Hamilton Standard propfan is nine feet in diameter and is powered by a 6,000 shaft horsepower Allison engine.

NASA-Lewis Research Center and the NASA/Industry Advanced Turboprop Team were awarded the 1987 Robert J. Collier Trophy. The selection was made for the conception, technology development and flight verification of several advanced turboprop propulsion systems.

The award was announced by the National Aeronautics Association, Washington, D.C. It cites the NASA/Lockheed PTA program and other NASA/Industry teams for testing and verifying the technology readiness of advanced turboprop systems which demonstrate the potential for reducing fuel consumption by 25 to 30 percent over future turbofan engines with equivalent levels of advanced technology.

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