BUSINESS

Fans Give Propellers a New Spin

GE Leads High-Stakes Competition
For Aircraft Engines With Its ‘Fan’

By Martha M. Hamilton
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The aircraft engine of the future has propellers on it.

The newest jet engines under development have gone back to the future, updating the old propeller with new materials and technology to produce a thinner blade swept into an aerodynamically efficient shape.

As a result, the engines can provide more power for less fuel for a new generation of airplanes, according to their developers.

Several groups are working to perfect such an engine which, if successful, would provide immense cost savings to airlines. And it would benefit aircraft makers by giving carriers another incentive to buy new planes.

Currently, the lead belongs to General Electric. The company’s Aircraft Engine Business Group has flown a modified Boeing 727 powered by its new engine in 22 flight tests above the Mojave Desert and will soon test the engine on a McDonnell Douglas MD80 aircraft. So far, GE’s engine is the only one to reach the test-flight stage.

The engine, which will cost approximately $1.2 billion to get into production, represents a high-stakes gamble for GE, which hopes to get the jump on competitors and make it standard on passenger airplanes of the next decade. The company hopes to have the engine, which it calls the “unducted fan” (UDF), in service by 1992, and Boeing Co.—the world’s largest aircraft manufacturer—considers it the leading contender to power the 717 aircraft now under development.

Development began five years ago, when fuel prices were at their peak and carriers were searching frantically for ways to cut costs. It has proceeded despite the plunge in oil prices—which has reduced pressure on airlines to move to more fuel-efficient aircraft—because GE feels its potential savings will make it sell even if oil prices do not rise markedly.

“A 5 to 10 percent fuel savings doesn’t save enough over even 15 years” to warrant the expenditure for the new engines, which will cost more than existing ones, said Bruce J. Gordon, general manager of the UDF program for GE. But GE estimates that the engine will consume at least 20 percent to 25 percent less fuel than other engines available to power similar-sized aircraft.

The idea arose “back in 1981 or 1982,” said Brian Rowe, who heads GE’s engine business. “We were having a meeting and started talking about what we could do. Because of material changes and because of See ENGINE, H4, Col. 1
GE has taken off the metal covering (the duct) from around the fan and improved the fan, in the company's estimation, by dramatically redesigning it and moving it to the back of the engine. Test versions have two sets of eight blades each, turning in the opposite direction from each other to produce what GE describes as major cost savings and considerably less noise in comparison with today's engines. The blades are made of graphite-reinforced epoxy and weigh about 20 pounds each. By the time the engine reaches production, they will be even lighter, the company says.

"The economic advantages over existing fleets are just astonishing, and I think in many cases would be enough to justify replacements," said Del Landis, who is in charge of the flight tests of the UDF for GE.

Gordon estimates that there is a market for more than 6,000 engines delivering 25,000 pounds of thrust—a medium-sized engine of the size now found on the Boeing 737-300, which carries 130 to 150 passengers—and said that GE may expand the idea into a family of engines to power larger and smaller airplanes.

"Developing an engine is such a high-stakes venture that a company must sell a large number of units to turn a profit. The payback, because of competitive pressures and pricing pressures, is a way out," said Gordon.

In addition to GE, Pratt & Whitney, working with General Motor's Allison Gas Turbine Division, is working on a similar engine. "We refer to ours as a prop-fan engine," said Allen S. Novick, chief project engineer for advanced large engines at Allison. The Allison engine has a gear system that connects the turbine to the propellers; the GE engine does not. Flight testing of that engine, on a McDonnell Douglas MD80, is scheduled to begin in December.

International Aero Engines (IAE), a consortium of Rolls-Royce, Pratt & Whitney, MTU of Germany, Fiat and Japanese Aero Engines, is developing the V2500 Superfan, an engine that offers increased thrust and lower fuel consumption in an "ultralight bypass" powerplant covered by ducting.

GE's aircraft engine officials express disdain for both competing concepts, but Airbus Industrie, a European aircraft manufacturing consortium, recently announced that it would offer the Superfan on its proposed A340 long-range aircraft. Boeing also said last month that it is looking at the Superfan in addition to the Unducted Fan as a contender to power the 7J7.

"UDF is still the baseline engine for our design," said Boeing spokesman Dick Schlegh. "If Boeing were to opt for the Superfan, instead, it would be a serious blow for GE's engine program. Sometimes aircraft manufacturers provide airplane models with a choice of engines but in the case of the UDF versus the Superfan, that cannot be done. The aft-mounted UDF and the wing-mounted Superfan are so different that they require substantially different airplanes."

"Our design is a ducted fan... by putting the ducting around it you solve two major design problems," said Alan Brothers, public relations manager for the consortium. The problems are safety—blade containment—and noise, he said.

GE is "definitely further ahead than the competition on the engine," said one industry analyst. "They got started sooner. The key is going to be what Boeing does with the 7J7."

Flight International magazine, in an editorial about the competition shaping up, noted that "Superfan, assuming that it arrives, will have the distinct advantage of looking and behaving like a turbofan, which the airlines might like." But it also noted that propfans such as the UDF or the Pratt-Allison engine appear to offer savings of an estimated 40 percent over today's turbosfans, compared with a more modest 25 percent fuel saving for the Superfan.

"The battle between the engine makers at designer, company and consortium levels promises to be the bloodiest sporting event since Rome closed the Coliseum, to be exceeded only by the struggle among the airframe manufacturers that will follow it," according to the British magazine.

In the meantime, GE is continuing its flight tests. In addition to saving fuel, the engine must demonstrate that it can meet stricter federal noise standards for new aircraft. It will be able to meet the most stringent noise standards at airports such as Washington National Airport with room to spare, said GE officials. During a recent flight test, with the plane passing overhead at a low altitude, conversation carried on in a normal tone of voice was perfectly audible.

The engine has passed the "hot test" too. Four 1/2-pound birds, two 4-pound birds (bird facsimiles, actually) and a tire tare have been thrown into the engines without creating problems.

"Five or six years ago people were saying this thing would never work," said Landis, welcoming press contingent to the flight test.

"Having shown in their proof-of-concept engine that it works, there's a lot less skepticism that there was even a year ago," said Boeing spokesman Jim Worsham, corporate vice president of McDonnell Douglas and former president of Douglas Aircraft Co., was at the Mojave Airport watching the flight test.
"We've been working on this flight for about five years or so. We're very anxious to get flying and see if there are any problems we haven't anticipated."
GE Gambles With New ‘Fan’ Engine For Aircraft

ENGINE, From H1

... technological changes, [we thought] maybe we could use some ideas we threw out..."

When GE went to the National Aeronautics and Space Administration with the idea, NASA's response was, "Why the hell would anyone go back to propellers?" said Rowe. "We said, 'They're not propellers. They're fans.'" NASA has contributed $27.5 million to development of the engine.

So fans they are. "People felt that modern was fans, and old technology was propellers. So now we've got this modern propeller which we want to call a fan."

Modern jet engines already have fans in front of the engine, enclosed by a metal cowl, or duct. The fans increase the efficiency of the engines through a technology called "high bypass." Some of the air moved by the fan passes through the engine, is mixed with burning fuel and is expelled at the rear to provide thrust. But most of the air bypasses the core engine, providing forward push like that of the propeller on a piston engine.

The effect is to generate more thrust for less fuel.

GE's aerodynamically efficient "unducted fan" engine with counter-rotating blades produces more power with less fuel.

THE EVOLUTION OF THE JET ENGINE

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