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# The Billion-Dollar Bet On Jet Tech That's Making Flying More Efficient

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United Technologies (<http://www.forbes.com/companies/united-technologies/>) CEO Louis Chênevert took the biggest gamble of his career on something called a geared turbofan. In a modern jet airliner there are really just two ways to increase fuel economy, the most critical selling point in an era of tiny margins and volatile costs for carriers. One way is to increase combustion temperatures so fuel is burned more efficiently. But engines are already operating at levels above 2,500 degrees Fahrenheit, the melting point of the turbine blades that propel the plane, forcing engineers to dream up exotic cooling systems and turn to special coatings and unwieldy materials like ceramics.

The other possibility is to increase bypass, or the amount of air the fan on the front blows past the engine. The problem: Bypass fans operate most efficiently at slow speeds, while turbines like to spin fast. Reconciling the two is no easy feat.

But engineers at Pratt & Whitney, UTC's storied aeronautical division, had an idea. While UTC's Connecticut (<http://www.forbes.com/places/ct/>) archival, General Electric (<http://www.forbes.com/companies/general-electric/>), went with higher combustion temperatures, Chênevert, at Pratt at the time, backed a seemingly riskier solution of putting a gearbox on the front of the engine to slow down the turbine shaft and drive the fan. If it worked the new engines would cut fuel burn by more than 15% compared with competing turbojets and produce half the noise, allowing airlines to push more flights through urban airports. "Anything that's going to burn 15% less fuel is like Christmas to the airlines," says Philip Abbott, British publisher of Aircraft Engines. "Once this sort of thing catches on, especially in this business, it tends to boom."

Skeptics questioned whether a gearbox was an unnecessary complication for a jet engine. The addition of the Fan Drive Gear (<http://www.forbes.com/gear/>). System added only seven moving parts, but the 18-inch-diameter gearbox had to be engineered to withstand thousands of high-stress takeoffs and landings without maintenance. If it failed it would likely mean the end of the commercial jet business for Pratt & Whitney, which grew famous for the Wasp engines used in thousands of B-24 bombers during World War II and the ubiquitous JT8D jet that powered [Boeing](http://www.forbes.com/companies/boeing/) (<http://www.forbes.com/companies/boeing/>) 727s and DC-9 jetliners but lately had been in decline.

Chênevert never worried. Recruited to the small-aircraft engine unit of Pratt & Whitney in 1993 before taking over the whole division in 1999, he spent several years overseeing the production of small jet turbines with gearboxes to drive helicopter blades and turboprop propellers. “I’d manufactured more gearboxes probably in the aviation industry than anybody else,” he says. He convinced then CEO George David to sign off on development costs of more than \$100 million a year, small relative to UTC’s \$4-billion-a-year R&D budget but hardly insignificant (upwards of \$1 billion) over time.

Turns out he was right. And now his very big bet is paying off in a very big way. With 3,000 orders in the 24 months since the PurePower Geared Turbofan engine was unveiled, it is proving to be one of the most successful launches in the history of the aircraft business, expected to double Pratt’s jet engine revenues—about \$12.2 billion in 2010—by 2020.

The sweetest moment came in January 2013 when Brazilian manufacturer Embraer announced it had selected the UTC engine for its next line of large regional jets, displacing incumbent General Electric’s. The geared turbofan has put Pratt in the enviable position of supplying the most power plants for the most popular airliners for the next couple of decades: single-aisle jets that will absorb much of the travel boom in emerging markets. By the end of this decade “we’re going to see volume at Pratt that we haven’t seen in 25 to 30 years,” says Chênevert, a 6-foot-6 Quebec native whose speech bears strong hints of his

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UTC Chairman Louis Chênevert (Photo by: David Yellen)

French-speaking upbringing.

It's the tastiest win since Chênevert took over Hartford-based UTC when David retired in 2008. David was a tough act to follow: A Harvard grad and international yachtsman, David has captivated the press with his marital and maritime adventures (including an ugly divorce from a Swedish countess in 2009 and a near-death experience in the 2011 Fastnet regatta, when his 100-foot racing boat capsized).

Chênevert is not nearly as glamorous. He earned a degree in production management from the Université de Montréal and spent his early career overseeing assembly workers at a General Motors factory in Canada. The most exciting entry on his social calendar lately is the upcoming birth of his third grandchild.

But Chênevert has maintained David's rigorous focus on high free-cash flow and conservative accounting. The company generated about \$5.5 billion in cash (earnings before depreciation and taxes but after necessary capital expenditures) on sales of \$55.8 billion in 2011 from operations, including Pratt aircraft engines and Hamilton Sundstrand controls, Otis elevators and Carrier heating and air-conditioning equipment.

He deftly sidestepped the financial crisis that nearly drove GE into insolvency, because UTC never built up a finance arm dependent upon commercial paper markets for funding. "Post '08, the one thing people have learned is having access to commercial paper is critical when it's choppy out there," he says, in a subtle dig at GE Chief Jeffrey Immelt.

"He's a very effective operating executive," David says of his successor. "He knows how to get projects conceived, scheduled, funded and completed."

He also maintained David's practice of expensing the costs of developing new products against current earnings, instead of capitalizing them. That means shareholders have already absorbed the entire expense of developing the geared turbofan and can immediately begin enjoying the dividends.

The geared turbofan wasn't Chênevert's only challenge. While UTC has performed well in recent years—a better than 1,000% return under David from 1994 to 2008 and another 35% return under Chênevert—the company needed to diversify away from the volatile defense business and increase its international presence.

Chênevert took a big step toward that goal last year when he completed the \$18.4 billion acquisition of Goodrich, the largest takeover in aerospace history. Chênevert initiated the talks with Goodrich's then chairman Marshall Larsen and pushed the deal through, hungry for Goodrich's jet-engine nacelles, landing gear and thrust reversers to complement aircraft engines. "A company like Goodrich only comes around once in a lifetime," he says.

Now UTC gets less than a fifth of its revenue from military aviation, including Sikorsky helicopters and engines for the new F-35 Joint Strike Fighter. Half comes from a diversified collection of nonaviation businesses with heavy exposure to China and other growing emerging markets. (Otis recently moved its business development

office from Connecticut to China, because elevator sales there dwarf the entire North American market.) And aviation is now skewed toward the commercial business, which is poised to double (measured in revenue passenger miles) over the next ten years as millions of emerging market consumers grow affluent enough to fly.

Chênevert's next goal: extract more savings from UTC's labor-intensive manufacturing operations. He's already cut 25,000 jobs and taken \$2 billion in charges. Operating margins, a key measure of efficiency, rose from 13.5% to 15.1% since he took over. Now he's promising \$400 million in similar "synergies" from the Goodrich acquisition. "There's a lot to be gotten," he says. "There's another decade ahead."



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