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CONTINUING COVERAGE WEST CHESTER TWP.

GE Aviation invests millions in engine

As launch date nears, effect being felt on southwest Ohio's economy.

By Chelsey Levingston

Staff Writer

WEST CHESTER TWP. — GE Aviation is less than a year away from launching its next all-new commercial jet engine to airline customers, and the debut of the LEAP engine is already having a ripple effect on southwest Ohio's economy.

The jet engine manufacturer pledged to spend \$300 million on its Ohio buildings and equipment from 2013 until the end of this year. Investments include a new test engine facility to handle higher production volumes in Peebles, the Electrical Power Integrated Systems Research and Development Center opened at University of Dayton, and a consolidated Additive Development Center opening in West Chester Twp. to study new materials.

Additionally, GE is the state's largest manufacturing employer of more than 15,000 people and anchors an aerospace parts manufacturing industry that employs thousands more in the region.

"Virtually all the GE suppliers that we know anything about in the region are going full-tilt," said Gary Conley, president of nonprofit manufacturing industry consultant TechSolve. "The long-term outlook for any of the companies participating in the GE supply chain looks very positive."

The LEAP engine is a product of GE's joint venture with French company Snecma (a division of Safran) called CFM International.

The stakes riding on LEAP's success are high.

Evendale-based GE Aviation and West Chester Twp.-based CFM are having an unprecedented ramp-up for jet engine production to keep pace with sales. The backlog of orders for engines made by GE and its joint ventures — including existing engines already on the market and those still in development like LEAP — have swelled to more than 15,000, said GE spokesman Rick Kennedy.

The number of engines delivered to customers grew from 3,296 in 2012 to approximately 3,740 last year and is expected to grow again this year.

And then grow again next year.

"They've never had backlogs this big," Kennedy said.

Not only does GE Aviation have to keep up with growing volume moving through its production lines, GE and CFM will be making engine parts using materials and processes the companies have never manufactured on a large scale before.

CFM's LEAP will be the first commercial jet engine to contain an additively manufactured part in a critical area as well as materials made from ceramic matrix composites, said CFM spokeswoman Jamie Jewell. The new technologies mean the engine will be lighter than traditional materials and able to withstand hotter temperatures, which will improve fuel efficiency 15 percent over CFM's existing engine.

GE claims its existing CFM56 engine is the world's best-selling commercial jet engine in flight and orders are still coming in. While LEAP will transition to eventually replace CFM56, the LEAP is already sold out for delivery in 2016 and 2017, Jewell said.

The commercial aviation industry and the demand for jet engines is increasing due to the growth of airlines in emerging markets such as Asia and Africa, as well as an aging fleet of planes in the air, GE officials say. Airlines are seeking new aircraft carrying more efficient engines to help cut fuel costs, one of the largest chunks of their budgets.

"If (GE) can pull it off, it sets the business for the next 10, 15, 20 years," Kennedy said of the new engine launches.

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Now, the company is conducting tests on versions of the LEAP engine for performance and federal certification.

"We are in the development cycle. So we build engines to blow them up, to test them, to make sure that they withstand all the conditions they'll see in flight," said Dan Waugh, manager of development assembly for GE Aviation in Evendale where test engines are built by hand.

"Before they actually launch into production, we have about a two-year phase where we're doing nothing but building test engines," Waugh said.

LEAP will contain shrouds in the turbine made using ceramic matrix composites, a material with microscopic fibers woven together. Its fuel nozzles will be made using the 3-D manufacturing process which layers material upon material into the shape of the product.

GE has researched both technologies in local and national laboratories to develop parts but also to prove results.

Even after manufacturing a working proto type, the company had to figure out how to manufacture thousands of the same part before it can be declared engine and market ready.

"We've been working on this for more than a decade and that's why we have the confidence that we do," Jewell said.

Meanwhile, seven new facilities have been announced since 2007 for production.

Sites include the first manufacturing plant for mass production of ceramic matrix composites near Asheville, N.C.; also the first additive manufacturing plant in Auburn, Ala.; a Dayton research center for studying electrical power systems; and a plant under construction in West Lafayette, Ind., for final LEAP assembly.

Other new sites are in Batesville and Ellisville, Miss.; and Greenville, S.C.

At GE Aviation's headquarters campus in Even- dale in suburban Cincinnati, it established in 2013 the GE Aviation Research Center in collaboration with the University of Cincinnati Research Institute, according to the company.

GE Aviation has a second commercial engine in development that is planned to enter the market by the end of the decade and will have parts built at some of the same factories. The GE9X, as it's called, will expand composites to more of the engine, including the combustor, Kennedy says.

Altogether, GE has previously announced that it expects total capital investments from 2013 to 2017 to reach \$3.5 billion worldwide. to Growth last for expected decades

GE Aviation's suppliers have to be as good as GE is, Jewell of CFM says.

Rhinestahl Corp. makes tools used to assemble, disassemble and conduct maintenance on jet engines for GE and its customers across the globe. In 2009, the supplier took over GE's customer tooling solutions business and moved its headquarters and manufacturing operations from Blue Ash to Mason as part of the expansion, said Chief Executive Officer Dieter Moeller.

Five years ago, Rhinestahl had 60 employees. Its since grown to 150 workers, Moeller said.

"In addition to our own manufacturing, we've got a supply base of over 100 companies we work with, most of them in the Midwest," Moeller said.

"The one message we're constantly working with our supply base is continued capacity growth," he said. "The growth that is expected with these new engines coming online is growth that's expected to last for decades."

While Waugh's team will test versions of the LEAP engine for conditions in the air, CFM will also be testing its suppliers to fix any problems caught on the factory floor, said Cristina Seda-Hoelle, LEAP manufacturing programs manager.

The company has invested in dual sourcing, which means multiple locations will be manufacturing and assembling the same parts as back up. And the same is true for its suppliers as GE/CFM will have dual and sometimes triple contracts for the supply of the same component to prevent any holdups possible due to natural disasters, production, or other reasons, Seda-Hoelle said.

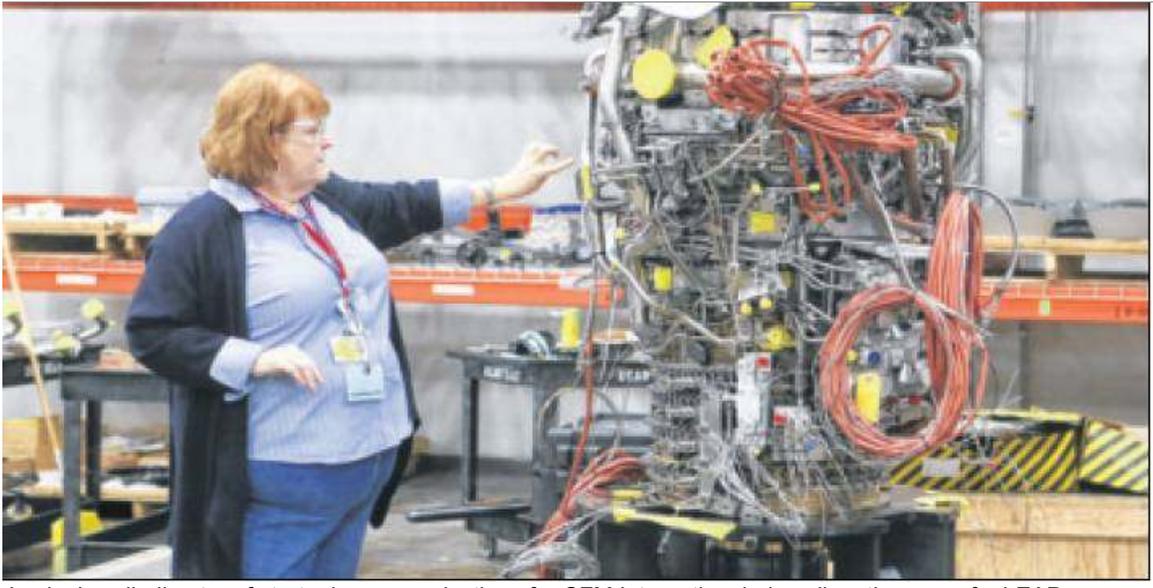
"For assembly, both GE and Snecma will have dual locations where they can do assembly obviously for risk mitigation but to support the capacity needed," she said. "We're doing that more with this program than ever before and we're doing it earlier than ever before."

This year, CFM will also conduct stress tests on its manufacturing operations. Its internal and external shops will experiment with running at full production rates to identify what could go wrong with manpower, training, tooling or equipment issues, Seda-Hoelle said.

Those problems will be fixed. Then they'll do the stress tests again, she said.

"We're going to test the system now so that we can be prepared in the event we need surge capacity to support our customers," she said.

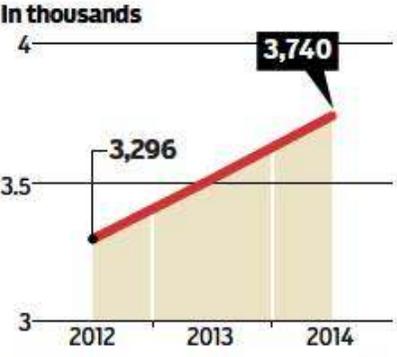
GE Aviation including CFM employs more than 9,000 people in southwest Ohio. Worldwide, the company employs approximately 44,000 people at more than 80 locations.



Jamie Jewell, director of strategic communications for CFM International, describes the core of a LEAP commercial jet test engine at GE Aviation. The engine is a joint venture between GE and Snecma. **STAFF / 2014**

GE Aviation jet engine deliveries

Commercial and military engines delivered by GE and its joint ventures including CFM International to customers.



Source: GE Aviation STEVE LOPEZ/STAFF



Dan Waugh, manager of development assembly for GE Aviation, talks about their new LEAP commercial jet test engine at the Evendale plant. **STAFF / 2014**

THREE WAYS THIS MATTERS TO YOU

1. **LOCAL IMPACT:** The rollout of the LEAP engine and another new engine program after that this decade, the GE9X, means GE Aviation and its joint venture CFM International are upping investments in facilities, jobs and spend with regional suppliers. GE expects capital investments between 2013 and 2017 in anticipation of the new engine launches to reach \$300 million in Ohio and \$3.5 billion worldwide.

2. **INNOVATION:** While the new engines won't all be assembled in Ohio, the test engines and final assemblies all pass through Peebles, Ohio, for testing. Major GE engineering and research operations are kept close to home in greater Cincinnati. GE established in 2013 the GE Aviation Research Center in partnership with University of Cincinnati on its Evendale campus to study composite matrix materials, low-emission combustion, and energy and thermal management. Plans are to consolidate additive manufacturing research activities currently spread across multiple locations into a single site in West Chester Twp.

3. **TOP EMPLOYER:** GE Aviation is headquartered in Evendale. Its parent company General Electric Co. is Ohio's largest manufacturing employer of more than 15,000 people when including the GE Lighting division in the Cleveland area, GE Capital, as well as the approximately 9,000 people employed in aviation in southwest Ohio. CFM International, a joint venture between GE and Snecma, is headquartered in West Chester Twp.



The LEAP commercial jet test engine, which is being worked on in Evendale, is a product of a joint venture between GE and French manufacturer Snecma. The engine will be more fuel efficient and contain advanced materials. **STAFF / 2014**