GE AVIATION TO BUILD UNIQUE MATERIALS FACTORIES

News / Manufacturer

In a ceremony yesterday with Alabama public officials, GE Aviation broke ground on two adjacent factories to mass-produce silicon carbide (SiC) materials used to manufacture ceramic matrix composite components (CMCs) for jet engines and land-based gas turbines for electric power.

GE Aviation is investing more than $200 million to construct two factories on 100 acres in Huntsville. When the factories are fully operational later this decade, they are expected to employ up to 300 people. The plants are expected to be completed by the first half of 2018. Production begins in 2018. GE expects to begin hiring the hourly workforce later this year.

“GE Aviation is creating a fully integrated supply chain for producing CMC components in large volume, which is unique to the United States,” said Sanjay Correa, vice president who leads the industrialization of advanced technologies at GE Aviation. “The new factories in Alabama are vital

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to this strategy. We are deeply gratified by the tremendous local, state, and national support for this effort."

While meeting critical U.S. needs for CMC materials for commercial and government-funded programs, the new plants will support GE and its international partners in selling and supporting jet engines and gas turbines worldwide. For example, approximately 61% of GE Aviation's 2015 revenues of $25 billion were derived from customers based outside the United States. GE and its partner companies sell most 70% of its commercial jet engines to non-U.S. companies.

"This GE facility puts a global spotlight on Huntsville as a leader in the most progressive, ceramic matrix composite technologies," said Huntsville Mayor Tommy Battle. "Our community is proud to provide the talent, support, and environment for this revolutionary advancement in materials."

"GE Aviation is at the forefront of innovation in aerospace manufacturing, and I am excited to see Alabama expand its partnership with this industry leader," Governor Robert Bentley said. "This project shows the sophistication of GE Aviation's technology while also demonstrating the company's confidence in Alabama to supply a skilled workforce."

One plant of the Huntsville plants will produce silicon carbide (SiC) ceramic fiber. It will be the first such operation in the United States. Today, the only large-scale SiC ceramic fiber factory in the world is operated by NGS Advanced Fibers in Japan, which is a joint company of Nippon Carbon, GE, and Safran of France.

The second factory will use this SiC ceramic fiber to produce the unidirectional CMC tape necessary to fabricate CMC components.

An advanced materials revolution in jet propulsion

The use of lightweight, heat-resistant CMCs in the hot section of GE jet engines is a breakthrough for the jet propulsion industry. CMCs comprise SiC ceramic fibers in a SiC matrix, enhanced by proprietary coatings.

With one-third the density of metal alloys, these ultra-lightweight CMCs reduce the overall engine weight. Further, their high-temperature properties greatly enhance engine performance, durability and fuel economy. CMCs are far more heat resistant than metal alloys, hence requiring less cooling air in the engine's hot section. By using this air instead in the engine flow path, an engine runs more efficiently.

For more than 20 years, scientists at GE's Global Research Centers and GE's industrial businesses have worked to develop CMCs for commercial applications. The best-selling LEAP engine, being developed by CFM International, the 50/50 joint company of GE and Safran Aircraft Engines of France, is the first commercial jet engine to use CMCs in the high-pressure turbine section. The LEAPengine, with more than 10,500 orders and commitments, is currently completing certification testing. It is scheduled to enter airline service next year powering the Airbus A320neo and in 2017 powering the Boeing 737 MAX.

The Alabama plants: From ceramic fiber to ceramic tape to CMC components

Producing CMCs requires complex processing steps using a synthetically produced compound of silicon and carbon. The two GE Aviation factories being established are involved in separate steps in the process – the production of SiC ceramic fibers and the production of SiC ceramic tape. The factories:

Ceramic Fiber Plant: Supported by funding ($21.9 million) from the U.S. Air Force Research Lab

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TitleIII Office, this plant will dramatically increase U.S. capability to produce SiC ceramic fiber capable of withstanding temperatures of 2400°F.

The SiC ceramic fibers plant will license fiber-producing technology from NGS Advanced Fibers Co. in Japan, a joint company formed in 2012 with Japan's Nippon Carbon (with 50% ownership in NGS), GE (25% ownership), and Safran Ceramics of France (25% ownership). NGS, which already produces SiC fibers for GE's CMC components, is establishing a second factory in Japan to increase capacity to meet growing demand. The GE fiber plant in Huntsville will complement the growing capacity atNGS.

Once the Huntsville plant is operational, it will sell fiber to the U.S. Department of Defense, GE businesses, Safran and other outside customers subject to U.S. regulations. It will be the first U.S.-based factory to produce SiC ceramic fiber on a large industrial scale. The two other NGS partners will ultimately have the opportunity to become equity partners in the Huntsville plant.

CMC Tape Operation: This adjacent plant, financed solely by GE, will apply proprietary coatings to the ceramic fiber and form them into a matrix to produce CMC tape. The ceramic tape will be used by GE Aviation at its new CMC manufacturing site in Asheville, N.C., which opened in 2014. The Asheville facility fabricates CMC shrouds for the LEAP engine's high-pressure turbine section.

In addition, GE's Power and Water business is testing CMCs in its newest and most efficient, air-cooled gas turbine. At GE Power and Water's new Advanced Manufacturing Works facility in Greenville, SC, prototype CMC components are being built to replace super alloys in large gas turbines.

Rising GE Demand for CMC Components

The demand for CMCs is expected to grow tenfold over the next decade. Each LEAP engine has 18CMC turbine shrouds, which are stationary parts in the high-pressure turbine that direct air and ensure turbine blade efficiency. Also, CMCs are being used in the combustor and high-pressure turbine section of the new GE9X engine under development for the Boeing 777X twin-aisle aircraft. More than 700 GE9X engines are on order today, with the aircraft entering service by 2020.

GE is incorporating CMC components in advanced military engines including the GE3000 for the U.S. Army's ITEP program. GE's advanced turboshaft demonstrator FATE (Future Affordable Turbine Engine) also for the Army increases the use of hot-section CMCs to achieve aggressive fuel efficiency, power-to-weight ratio and lower maintenance cost goals. CMCs are currently being evaluated for upgrades to existing engines like the highly popular T700 helicopter engine.

GE Aviation's growing commitment to Alabama

Today's ceremony represents GE Aviation's second significant factory investment in Alabama in recent years. Since 2013, GE Aviation has also invested more than $100 million in a 300,000-square-foot factory in Auburn, near the storied Auburn University campus, where the company is engaged in jet engine component manufacturing (super-alloy machined parts) as well as establishing the world's highest-volume additive manufacturing center.

Using the additive manufacturing process, the Auburn plant is now using laser melting machines to produce the interiors of fuel nozzles for the best-selling LEAP engine by CFM International. It marks the first time such a complex jet engine component will be manufactured using additive technology.

GE Aviation, an operating unit of GE (NYSE: GE), is a world-leading provider of jet and turboprop engines, components, integrated digital, avionics, electrical power and mechanical systems for

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commercial, military, business and general aviation aircraft. GE Aviation has a global service network to support these offerings and is part of the world's Digital Industrial Company with software-defined machines and solutions that are connected, responsive and predictive.

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