



## Customized Material Solutions: The Customer/GE Cost-Savings Collaboration

“Customized Material Solutions offer the customer a choice of high-quality GE and CFM International [CFM\*] materials ranging from new parts, used parts and cost-saving repairs to technology upgrades that lower fuel consumption, extend time on wing and reduce emissions,” says Bill Millhaem, general manager of GE Aviation’s material services division.

Offered as part of the OnPoint\* solutions program—GE’s response to customers’ expressed desire to reduce cost of ownership and improve engine performance—Customized Material Solutions are, according to Millhaem, “tailored to each customer’s ownership horizon and requirements, whether long-term, short-term or somewhere in between.”

GE Aviation Materials’ inventory and access to used-serviceable material—the largest in the world for CFM, CF34\*, CF6\* and GE90\* engines—recently grew even larger through the acquisition of The Memphis Group (see *Service Solutions*, February/March 2007).

“This ready availability of materials enables GE to fully support each customer’s specific operating needs,” Millhaem adds.

If the customer needs no more than two to three years of service from an engine, the customer can arrange for GE to exchange longer life-limited parts, and GE will guarantee an appropriate level of used-serviceable material to



meet the customer’s needs for the desired period of continued service.

### Technology Upgrades

Extending time on wing for a longer term is accommodated equally well. GE can upgrade the customer’s engine by incorporating proven, newer technology adapted from current production engine models. Moreover, GE buys back the customer’s older-configuration material, thereby enabling the customer to realize an earlier payback.

“GE’s infusion of technological innovations introduced on new engines is an especially effective means of directly benefiting the

operators of mature engines. Reduced maintenance costs, increased time on wing, lower fuel consumption, enhanced residual value—all are reflected in the cost of ownership of upgraded older engines, just as they are in new engines just entering service,” explains Millhaem.

### Advanced Repair

Component repair is yet another avenue by which the customer can realize its operational objectives. GE develops approximately 1,000 new repair procedures annually, many of which increase repair yield, extend component life and/or lengthen engine time on wing.

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# Qatar Airways Sets Time-On-Wing Record for GE's CF6-80E Engines

Qatar Airways has set a time-on-wing record for CF6-80E engines operating in a hot, sandy environment. The engine on the airline's Airbus A330\* aircraft accumulated more than 4,300 cycles over four years of service.

With a fleet of Airbus A330 aircraft powered by GE's CF6\* engines, the airline recently ordered 44 high-thrust GE90-115B engines to power 22 longer-range Boeing 777s\*. Delivery of the 777s is scheduled to begin in November of this year.

"We are extremely pleased with the outstanding reliability of the CF6-80E on our large A330 fleet, particularly in view of the challenging environment that Qatar Airways operates in," says Akbar Al Baker, the airline's CEO. "GE has been extremely proactive in



supporting the CF6, and we have similarly high expectations in respect to the reliability and product support for the GE90\* engines that will enter service on our 777-300ERs later this year."

The airline has an OnPoint\* solution agreement that covers its entire CF6-80 fleet. As part of this agreement, Qatar Airways and GE have worked together to ensure the reliability of the engines with fleet monitoring through GE's diagnostics services, fleet management programs and On Wing Support.

One of the world's fastest-growing airlines, Qatar Airways operates a fleet of 53 aircraft flying to 72 destinations worldwide from its operational hub of Doha, capital of the State of Qatar. Named "Airline of the Year" at the annual Middle East and North Africa travel awards, it is also one of only four airlines in the world with a five-star ranking for service and excellence by Skytrax, the independent aviation industry-monitoring agency.

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A repair called enhanced rejuvenation, for example, strips the worn protective coating from airfoils and applies a new coating with little, if any, effect on the airfoil parent metal. Enhanced rejuvenation permits repeated repair, rather than more costly replacement, of high-pressure turbine (HPT) blades.

Another HPT blade repair uses new-technology, crack-resistant, high-temperature materials in the repair of worn blade tips to restore engine clearances. Proper clearances serve to lengthen time on wing by improving performance, reducing fuel consumption and helping to ensure that adequate temperature margin is maintained.

## Significant Savings

Customized Material Solutions are applied across all GE and CFM commercial engine lines, and the savings realized by the customer reflect the success of the program. Since 2000, the hourly maintenance cost for GE and CFM commercial engines has been reduced by \$10 to \$30, depending on the engine. Average annual savings per aircraft exceeds \$50,000.

On average, the first shop visit of a CFM56-3 engine occurs after approximately six years, but the norm for CFM56-5B and -7 engines is



approximately nine years before the initial shop visit—a 50% differential that translates to very real savings. GE can incorporate into the engines of the CFM56-3 operator the three-dimensional aerodynamic (3-D aero) technology of the -5B and -7 that is the primary contributor to those savings.

In the CF6 family, time on wing has been increased by a full year since 1990, primarily by redesigning and introducing new materials in key components such as the HPT blades and vanes. According to independent industry data, CF6-80C2 direct maintenance costs are the lowest in its class: Savings may reach as much as \$350,000 per year for some aircraft.

"New parts, serviceable used parts, upgrades, economical repairs—all available through Customized Material Solutions jointly developed by the customer and GE, the original equipment manufacturer—can provide an optimal savings opportunity for the customer, either on an individual shop visit basis or for longer-term cost per operating hour," says Millhaem.

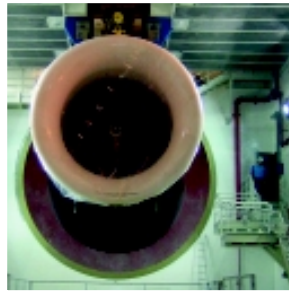
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# New Emirates Engine Test Facility Largest in Middle East

Emirates, the international airline of the United Arab Emirates, is completing construction on a new engine test facility in Dubai. Designed and managed in cooperation with GE International, Inc., the Engine Maintenance Centre will enhance Emirates' maintenance capabilities for the newest and largest aircraft in its rapidly growing fleet.

At its opening, it becomes the largest engine test facility of its kind in the Middle East and one of about 12 such facilities worldwide. The facility includes a 37-meter by 13-meter test cell chamber and an auxiliary power unit test cell. In addition, an engine test preparation area includes a 30-ton-capacity engine-handling system featuring a network of interconnected monorails with a bridge crane and turntable.

"The availability of the test cell with this capability in Dubai will reduce engine turnaround time and lower our cost of ownership," says Adel Al-Redha, executive vice president, Emirates Airline Operations and Engineering. "We are proud to have worked jointly with GE on this state-of-the-art facility."



The facility accommodates engines rated at up to 150,000 pounds (667 kN) of thrust. Personnel will have the capability of testing turbofan engines such as the GE90-115B, GEnx\* and Engine Alliance\* GP7200\* as well as a number of other engine platforms.

The new test facility has been designed to meet the most stringent regulations for noise, emissions and waste management in addition to safety and other environmental requirements.

"GE has worked with Emirates for more than 20 years," says Muhammad Al-Lamadani, GE Aviation, Sales general manager for Eastern Europe, Central Asia and the Middle East. "We continue our strong cooperation in many fields, including engine services. To this end, GE is building for Emirates a state-of-the-art test cell facility and will support its plan to build engine services capabilities in Dubai."

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## GEnx-1B OnPoint Solutions Now Include Goodrich Nacelle Support Option

GE Aviation customers can now include Goodrich Corporation's nacelle support as a component of their GEnx-1B OnPoint\* solutions agreements, through a recently announced cooperative marketing effort with Goodrich.

"By working together to provide our customers with related service offerings, we can continue to help them lower their cost of ownership," says John Jarczyk, general manager, GEnx\* engine services. "In keeping with our commitment to provide flexible solutions, our GEnx customers can now supplement their OnPoint services with the Goodrich total nacelle system support on Boeing's 787\* Dreamliner\* aircraft."

Traditionally, nacelle maintenance has not been coordinated with the sale of engine

maintenance, sometimes leaving customers without a complete propulsion solution. "To complement GE's OnPoint engine services, our Goodrich team of nacelle and thrust reverser experts will package all customer support needs into a unified nacelle program," explains Bob Gustafson, Goodrich's Aerostructures division Aftermarket Services vice president and general manager.

"Furthermore, through the use of proactive maintenance management, we will employ parts, rotables, logistics, AOG [aircraft on ground] protection and MRO [maintenance, repair and overhaul] to deliver operational satisfaction and also reduce lifecycle costs for our customers," he adds.



### GEnx First Flight

On February 22, the GEnx-1B took flight for the first time on board GE's 747-100 flying testbed in Victorville, California. During the four-hour first flight, the GEnx-1B engine demonstrated aircraft systems and instrumentation functionality, climbed to nearly 40,000 feet and established engine performance baseline for flight testing. Engine certification is scheduled for September 2007.

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# CF34-8 Upgrade to Power New Bombardier CRJ1000 Regional Aircraft

Bombardier Aerospace has recently announced that the CF34-8C5A2 engine will be one of the CF34-8C5 family variants to power its new CRJ1000\* regional jet. The CRJ1000 was launched by Bombardier with 38 firm orders announced in February 2007 and is scheduled to enter service in late 2009. The GE CF34-8C5 family of engines also powers the Bombardier CRJ700\*, CRJ705\* and CRJ900\* aircraft.

The new engine version, the CF34-8C5A2, will be rated at 14,510 pounds (65 kN) of static thrust—same as the original CF34-8C5, but with a greater thrust capability at takeoff. It will provide 5% more thrust at normal takeoff and up to 3% more thrust at maximum takeoff from low altitudes. To achieve the new thrust ratings, the engine will include software modifications to the engine control system. The CF34-8C5 engine family provides commonality for

customers operating Bombardier regional jets ranging from the CRJ700 to the CRJ1000.

Also included in the engine will be an upgraded high-pressure turbine (HPT) module for greater durability. Upgrades will include design modifications to the airfoils, improved coatings and enhanced cooling schemes.

These changes are intended to improve the time on wing of the engines, thereby reducing the number of shop visits, which can lead to lower maintenance costs. Savings are projected to be up to 3% for the higher-thrust models. These changes will become standard



production hardware for the CF34-8 family of regional jet engines. Engine certification for the CF34-8C5A2 is targeted for early 2009.

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