GE Transportation
Aircraft Engines

Service Solutions

September-October 2005 / Volume 5, Issue 5

GE's Bold Component Repair Program Focuses on Reducing Operating Costs

GE is committed to improving the total cost of ownership for the GE engine fleet. This commitment applies the savings impact of repair to reduce shop visit costs and supports efforts to improve time on wing. Through investment, research and development, and process improvements, engine hardware can be repaired to the new part specification, reducing the requirement for new spare hardware.

Since 2004, GE has aggressively invested in all facets of Component Repair. This year, GE has increased the investment in Component Repair to over $30 million in technology and resources. GE has also invested over $25 million in shop operations to improve processes, including repair yields. In addition, 25 new engineers have been added to GE's international repair development team, working at sites in the United States, Brazil and Singapore to create new repairs.

This investment is now producing dividends in the form of new repairs, improved repair yields and, ultimately, customer savings. The program has produced a spectacular increase of 50 percent in the number of new repairs, from 600 in 2003 to more than 900 in 2004. And GE is already developing over 1,000 of the 1,200 new repairs it intends to introduce this year!

The repair development teams work closely with the GE Global Research Center and the original engine component design teams to develop the repairs that your fleet requires. These unique resources provide the tools to identify new techniques to repair more hardware and maintain GE standards for durability. The overall engine performance integrity is maintained through our understanding of the role each part and component plays in your engine system and how each part and component interconnects and interacts with the others.

Engine repair is provided through GE's OnPoint℠ services. As part of the OnPoint portfolio, three repair products are featured: Standard Repair, Technology Upgrade, and Accessory Repair.

Accessory Repair recovers a comprehensive list of propulsion hardware external to the engine. Accessory Repair provides a single contact for complete engine support with aggressive turnaround times and excellent workmanship.

Standard Repair recovers engine parts from normal wear and damage and returns them to "like-new" condition. Standard Repair is supported by the original equipment manufacturer's experience and technological know-how, which draws from a comprehensive portfolio of more than 14,000 repairs. For example, GE is developing new technologies that can extend the life of some high-pressure turbine (HPT) blades. Enhanced rejuvenation technology removes less of the blade wall thickness than the full repair does and avoids a thick coating buildup of back-to-back standard rejuvenation repairs. The GE suite of HPT blade repairs with enhanced rejuvenation helps keep HPT blades on wing longer while minimizing unscheduled engine removal exposure. The enhanced rejuvenation repair technology is now available for the CF6-80C2 HPT stage 1 blade.

Technology Upgrade is an opportunity to repair old engine hardware to the latest design specifications. Technology Upgrade often modifies the part geometry, material or coatings to the latest configuration, improving durability and performance. For example, a new repair is

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GE Introduces Engine Exchange: New Life for Your Fleet

GE's Engine Exchange program, introduced as one of GE's OnPoint Solutions, is now available to operators of CF34-3, CFM56-3, and CF6-80C2B1F through B7F engines.

Engine Exchange offers savings in two critical areas of successful fleet operations: time and money.

An exchange engine is immediately available, with all service bulletins incorporated, all maintenance records current, and time on wing guaranteed. The only costs incurred are the fixed price of the exchange engine (minus the fair-market value of the "trade-in" engine credited to the customer) plus the cost of installing the exchange engine. There is no concern about spare or lease engines, turnaround time, and tracking the engine in the shop.

In addition, the titles will be transferred at a location approved by the customer and GE.

The time-on-wing guarantee specifies a certain number of cycles or hours before the next shop visit. Premature removal for engine cause, including life-limited parts, is compensated according to the number of cycles/hours guaranteed versus the number of cycles/hours flown. For example, if 6,000 cycles are guaranteed, and fewer than 5,000 have been flown before the engine is removed, GE will either (1) provide a spare engine, at no charge, while the removed engine is being repaired, or (2) provide another exchange engine guaranteed for the remaining cycles. If 5,000 or more cycles have been completed, GE will grant a pro-rata credit for the next exchange or for a time-and-material shop visit.

Engine Exchange = Savings

Editor's note: The following is a hypothetical example, based on a CFM56-3 engine. Actual savings will vary according to circumstances.

Time-and-Material Shop Visit

Shop visit cost	$1,400,000
Lease engine fees	180,000
Cost of two engine changes @ $15,000	30,000
TOTAL COST	$1,610,000

GE's Engine Exchange

Engine exchange cost	$3,000,000
Credit for customer engine	(1,600,000)
Net cost	1,400,000
Cost of one engine exchange	15,000
TOTAL COST	$1,415,000
TOTAL SAVINGS	**$ 195,000**

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available for the CFM56-3 combustor. This is an extended liner repair that upgrades the design of the combustor liner to the latest specifications. The design improvement reduces unscheduled engine removals due to the combustor and reduces future maintenance costs.

Repair has a direct impact on the operating cost of engines. Repair reduces the requirement for new material by improving yields on existing repairs as well as releasing new repairs. The integrity of our repairs is verified through GE's extensive system and component knowledge supporting engine time on wing. To that end, GE is focused on the creation of highly effective repairs in unprecedented quantities in order to empower customers to better control cost of ownership.

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AeroTurbine Joins GE's Engine Exchange Program

Virtually as soon as GE introduced Engine Exchange, AeroTurbine Inc. signed on as the first customer. AeroTurbine had a number of lease-pool engines scheduled for heavy maintenance within a short span of time, and Engine Exchange ensured that the number of engines in AeroTurbine's lease pool would be sufficient to meet the needs of its customers.

Customer care is the priority at AeroTurbine, which specializes in aftermarket commercial aircraft engines sales and leasing, plus engine and aircraft parts sales, to a customer base that includes airlines, operators, leasing organizations and maintenance facilities around the world.

Kent Lehmann, the GE sales director who worked with AeroTurbine on the Engine Exchange agreement, recently met with Mike Mullen (AeroTurbine's SVP Operations) to interview him with regard to AeroTurbine's overall experience with the program. Following are quotes from the interview:

"We considered the downtime that was going to be required to put our engine repair candidate through a major shop visit and the potential associated lost lease revenue during the same period. In our overall analysis, it made sense for AeroTurbine to enter into an engine exchange with GE, given the repair cost was about the same, and there would be no compromise in quality.

"For our engine removal that required extensive refurbishment, GE's Engine Exchange program offered us the quickest and most economical solution to maximize our engine spares availability.

"The performance guarantee that covered our engine exchange is one of the most comprehensive we have ever seen. AeroTurbine was very confident GE was providing us with a quality engine, and that they would be there to support us in the event of an unforeseen problem.

"It's a given that GE maintains one of the industry's most stringent quality standards in the build of its engines. Knowing that many of AeroTurbine's engines end up in operation with customers who will not accept PMA or DER repairs, we can be confident that GE's exchange engines will be universally accepted regardless of airworthiness jurisdiction.

"Downtime and overhaul expense aside, it takes a tremendous amount of administrative oversight to properly manage an engine through a shop visit, even in the best MRO facilities. The simplicity of GE's Engine Exchange allowed our engineers, records analysts, and purchasing and contract administration personnel to focus on other pressing matters.

"Our customers benefit because AeroTurbine maintains its lease pool engine availability at an acceptable level, even during the peak summer demand for CFM56-3C1 lease engines. This is a critical aspect of AeroTurbine's lease pool services.

"Overall, we were very satisfied. We found that GE's Engine Exchange helped us to minimize our lease pool engine downtime and repair costs, while alleviating administrative workload and maintaining high quality standards."

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Shenzhen Airlines Signs New Agreement with GE

Shenzhen Airlines has signed a new 15-year OnPoint Solutions engine services agreement for the maintenance, overhaul and repair of CFM56-5B engines that will power the airline's fleet of Airbus A320® family aircraft.

In 2004, the airline signed three separate 10-year maintenance agreements for its fleet of CFM56-3 and CFM56-7 engines.

Shenzhen Airlines is one of the fastest growing airlines in China, serving both domestic and international routes. The airline has received three champions of "National Passengers Assessment on Civil Aviation" and "National Customer Satisfied Enterprise" awards for having the best customer services recognized by the industry.

"We have great confidence in the quality GE Engine Services provides and we are pleased to be entering into a long-term relationship with them," said Yang Jia Bao, vice president of Shenzhen Airlines. "This relationship not only helps keep our maintenance costs more predictable, it also helps us meet the commitment for safety and reliability that we have made to our customers."

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Singapore Airlines Introduces **On**Point Solutions to GE90 Engines

Singapore Airlines (SIA) has signed the first OnPoint Solutions services agreement for GE90® engines. The 10-year agreement provides for the maintenance, overhaul and repair of GE90-115B engines that will power 19 Boeing 777-300ERs, which are scheduled to enter SIA service in 2006.

Bey Soo Khiang, Singapore Airlines senior executive vice president (Operations and Services) described the agreement as the beginning of a new relationship with GE. "We are pleased that GE is able to provide comprehensive maintenance support for the engines. The agreement helps to align both SIA's and GE's interests in optimizing engine maintenance cost while maintaining our high standards of safety and reliability. By entering into such arrangements, our maintenance costs become more predictable and correspond directly with our operating pattern."

Since it began operations in 1947 as a regional carrier with a fleet of one aircraft, Singapore Airlines has evolved into an esteemed international airline that flies one of the youngest fleets in the world: currently 90 aircraft with an average age of less than six years.

Perennially recognized as a favorite of travelers, Singapore Airlines' more recent acknowledgments include being voted World's Best International Airline by readers of *Travel & Leisure* Magazine—an honor it has received every year since the inception of the award 10 years ago.

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AE-45754E (09/05) Printed in U.S.A.

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