



GE Engine Services

service solutions

engines

maintenance

material

finance

information

Double Exposure

Maturation program ages GE90® engine 20 years in just 3

Beginning this summer, GE and Boeing will initiate the first phases of a rigorous maturation test program designed to ensure the durability of the GE90-115B propulsion system and position the 777-300ER aircraft for ETOPS (Extended Twin Operations) beyond the current 180-minute limit, to a level of 300 minutes or more. As the FAA examines and proposes new regulations that would extend ETOPS and allow twin-engine planes to operate on the same flight paths that three- and four-engine planes currently follow, GE and Boeing look to raise the bar on propulsion system durability. The new FAA regulations are expected late this year.

Over the course of the next three years, GE will test and diagnostically evaluate the condition of three developmental and four flight-test propulsion systems. The planned testing, equivalent to 15 to 20 years of airline service experience, is almost double the test cycles accumulated on the original service entry program. It will involve a variety of engine operating cycles and conditions, simulating elevated vibratory and temperature environments that could drive unscheduled maintenance and operational events.

“The GE90-115B maturation process represents an evolving technology,” said Rick Stanley, vice president, GEAE Engineering. “And the lessons learned will be applied to all GE product lines.”

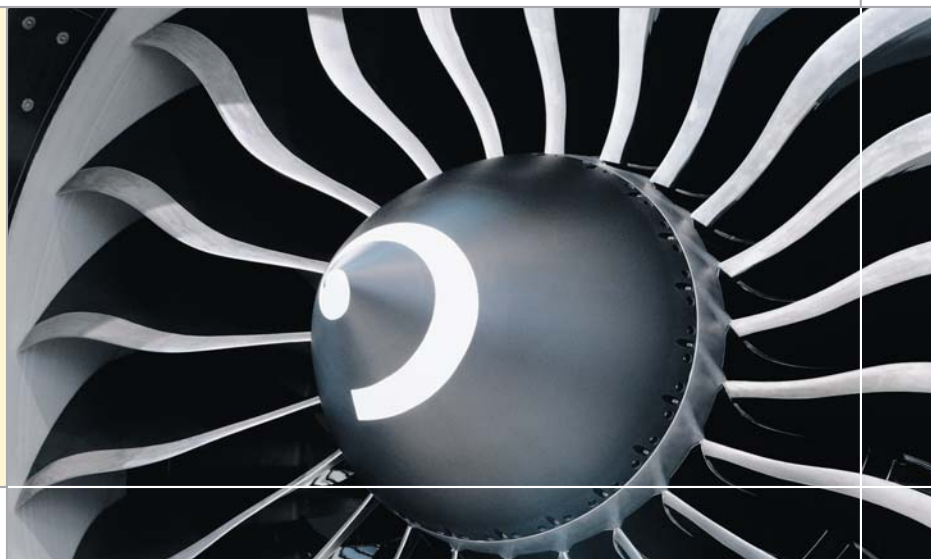
Real-time remote engine diagnostics is another technology that GE pioneered and offers to the airline industry. In addition to a rigorous maturation program, the company will encourage airline operators to employ the diagnostic technology during service operation to proactively identify and avoid potential causes of unscheduled maintenance and operational events.

The application of these technologies is expected to drive the GE90-115B’s propulsion system durability and reliability to new levels as the 777-300ER aircraft raises the bar for ETOPS service beyond the current 180-minute level.

In a future issue, we will follow up with additional details regarding the maturation program and talk about the testing that GE and Boeing will conduct in support of ETOPS beyond 180 minutes.

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Extending Part Life While Reducing Customer Costs

New Product Introduction (NPI) process enables overall success of repairs

GE continuously strives to reduce cost of ownership for its customers. One effective cost-reduction technique is the development of engine component repairs. Due to the extreme operating environment and extended time on wing afforded by today's engines, repairs must be subjected to a rigorous development program to maximize repair durability.

The NPI process is a product creation and management method used to determine the tasks required to evaluate the commercial and technical viability of a repair. Essentially, we study and evaluate our extensive fleet performance and maintenance data and determine the most effective solution to reduce a customer's cost of ownership.

The NPI process engages teams across the business to complete tasks that are categorized into ten distinct tollgates. These tollgates provide a framework for providing the what, why, when and how of a project. Each tollgate represents a phase in the repair process that must be completed before the next phase can begin.

Tollgates 0 - 3 analyze the feasibility of a given repair and assess its commercial and technical viability. Tollgates 4 - 6 emphasize the design of a repair. Once it has been agreed to proceed past tollgate 6, tooling and equipment are procured and the repair is validated. The use of tollgates, scorecards

and detailed management oversight is imperative to preserving the integrity of in-service engines.

Key elements of tollgates

Evaluating customers' maintenance data is the best way to identify repair opportunities. GE works with customers by analyzing data from shop visits or by meeting directly with them to identify cost drivers. This data is then compared with global fleet data. Once a savings opportunity is identified, the repair process is identified and potential risks and risk abatements are established. A preliminary test plan is also developed.

Identification of system interactions is also a vital step. Minor changes to weight or cooling flow may result in failures to other components. Undesirable effects may include increased loads or stresses on disks or airfoils, changes to bearing loads or changes in aerodynamic flow.

Repair engineers identify performance criteria and assign scores to validate the repair. This repair scorecard is then compared to scores validated during development of the original or production component. The repair is released only after acceptable scores are validated. Extensive computer analyses and laboratory tests may be performed during this evaluation phase. Complicated repairs may require accelerated, full-scale engine tests prior to introduction. Adhering to this development process is vital to the safety, reliability and performance of a repaired engine.

In 2002, GE utilized this process to implement more than 500 repairs throughout the GE and CFM fleet, ranging from the venerable CF6-50 to the state-of-the-art GE90. Repair savings ranged from thousands to millions of dollars for our customer fleets. We continue to monitor and improve our component repair identification and development processes to further help our customers preserve time on wing and drive down costs while ensuring our solutions perform in harmony with the entire engine system.



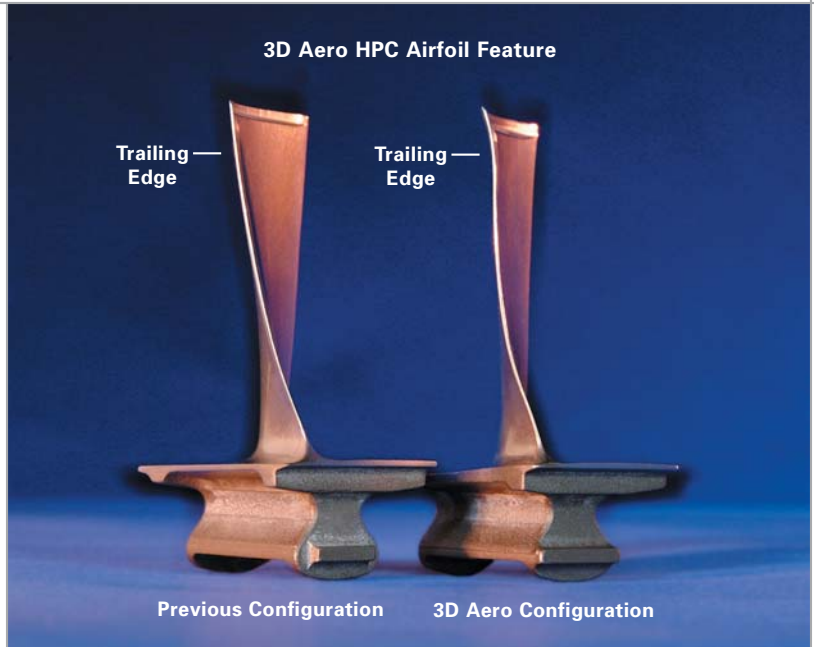
China Southern Powering Up With GE90 Upgrade

Investment reduces maintenance costs

China Southern recently approved a GE90-94B upgrade program that will reduce the airline's maintenance costs. The engine upgrade has been packaged as a kit and the GE90-94B kits are targeted for introduction to the China Southern fleet in conjunction with scheduled shop visits planned over the next three years. Upgrade benefits are significant and typically return the kit investment to the airline within a three-year period.

The decision was made after China Southern executives approached GE regarding options to reduce engine maintenance cost. To accomplish this objective, a team was assembled to work with the airline, analytically evaluating options and developing a service recommendation that would deliver value and maintenance cost savings to China Southern.

The GE90-94B upgrade program was the evaluation team's conclusion and the recommendation was approved by China Southern. Key features of the upgrade include advanced 3D aerodynamic airfoils in the HP compressor and optimized airfoil clearances in the LP turbine. Benefits delivered to the airline operator include: increased payload capability, reduced fuel burn (~1.6 percent), lower turbine temperatures (~20+ degrees Centigrade), reduced maintenance cost (~10 percent) or increased takeoff thrust (up to 94,000 pounds) and higher payload capability for operations from takeoff-limited airports within the airline's route structure.



"The analytical tools available at GE enabled the team to accurately assess the benefits of a GE90-94B upgrade program," said Lorraine Bolsinger, vice president, GEAE Marketing. "And that evaluation process resulted in a customized service solution for China Southern that will deliver payload, fuel burn and maintenance cost benefits."

On July 20, 1997, China Southern made aviation history when the airline conducted the first ETOPS (Extended Twin Operations) flight between China (Guangzhou) and the United States (Los Angeles) with a GE90-powered 777 aircraft. Today, the airline continues to service the route five times a week. Although the GE90-94B upgrade delivers reduced fuel burn and lower maintenance cost to the airline operator, it also enables significant additional payload capability on long-range city pairs.

China Southern, the largest airline operating in the People's Republic of China, is the fifth airline to order the GE90-94B upgrade kit. Other airlines that have recognized value for their operation and purchased the engine upgrade include Air France, Luda, Kuwait Airways and Saudi Arabian Airlines.

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Emirates Embraces GE90 and MCPH

Fleet Expands with Purchase of 26 GE-Powered Planes

One of the world's fastest growing airlines, Emirates Airlines, is leasing 26 new Boeing 777-300ER aircraft powered by GE's GE90 engines. The fleet expansion includes a 12-year engine Maintenance Cost Per HourSM (MCPHSM) contract and a new order for 15 GE90 engines.

The MCPH program was a custom solution designed to meet the growing needs of Emirates and was structured to deliver cost predictability throughout the life of the contract. In addition, GE's maintenance program will ensure that the engines maintain peak performance for the carrier. "This is a huge day in building our long-term relationship with Emirates,"

said David Calhoun, president and chief executive officer, GEAE. "Emirates is expanding worldwide, and the GE90-powered 777s will provide the best economics on the routes they support."

The GE90-115B powers Boeing's 777-300ER and 777-200LR aircraft. With 115,000 pounds of thrust, the engine is unprecedented. It is now powering Boeing's 777-300ER flight test plane in a 1,600-hour flight test. U.S. Federal Aviation Administration and European Joint Aviation Authorities certification for this engine/aircraft combination is anticipated in early 2004.



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Copa Airlines Taps GE For Engine Maintenance

**New service agreement grants
more reliable maintenance costs**

Copa Airlines has signed a 12-year Maintenance Cost Per Hour (MCPH) contract with GE. The maintenance agreement provides service to the airline's fleet of Boeing 737-700 and 737-800 aircraft powered by CFM56-7 engines. In addition to engine restoration services, the MCPH contract covers Service Bulletins and Airworthiness Directives. The MCPH program provides engine maintenance on a fixed price per flight hour, which provides Copa more predictable maintenance costs than traditional Time and Material programs. This helps Copa manage its maintenance budget by leveling cash flows and avoiding unexpected costs, Copa Airlines officials said.

"The signing of this maintenance agreement is another success story that allows us to forecast a large portion of our future operational expenses," said Tom Chappell, Vice President of Purchasing, Copa Airlines. "It also provides us with better financial planning and stability for years to come while we continue to grow as one of the most successful and important airlines in the Americas."

With more than 55 years of experience, Copa Airlines flies to 30 destinations in 20 countries. In 2003, the airline expects to transport 1.3 million passengers. For information visit copair.com.

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The purpose of *Service Solutions* is to enhance communications with our customers. Please contact us if we at GE Engine Services can be of further service to you.

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CWC > productivity tip

How Can I Manage All My Orders?



> The Customer Web Center (CWC) provides access to enhanced data concerning open orders. Customers can stay well informed by running a report that:

- Shows the status of all open orders
- Enables flexibility to sort by required fields
- Downloads to an Excel file
- Displays scheduled ship dates against your requested ship date
- Tracks total dollar volume to maintain inventory levels

To run an open order report, simply select Spare Parts/Search/Purchase Order on Status/Open Status.

- > Spare Parts
- > Search
- > Purchase Order on Status
- > Open Status



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