



**GE Engine Services**

# service solutions

engines
maintenance
material
finance
information

## Maintenance Contracts Yield Value for FedEx and GE.

FedEx Express, the world's largest express transportation company, relies on its 638 aircraft traveling to 378 airports worldwide to maintain its position as a market leader in the package delivery business. In order to deliver the 3.3 million shipments a day that the company processes and to stay consistent with its slogan, "The World On Time," FedEx Express maintains strategic relationships with vendors around the globe. As a global company, FedEx Express operates a variety of different entities and divisions to best serve its customers' needs. This is accomplished every day by the FedEx Express airplane fleet traveling nearly 500,000 miles, while its ground couriers log 2.5 million miles per day—or the equivalent of 100 trips around the world!

FedEx Express has relied on GE Aircraft Engines as a valued supplier for many years. Recently, FedEx Express strengthened this relationship by signing a variety of Customized Service Agreements (CSA's) for the maintenance of its CF6 engines, such as MCPH (Maintenance Cost Per Hour) and MCPC (Maintenance Cost Per Cycle) contracts with GE. With approximately 500 total CF6 engines currently maintained under these contracts and over 50 more to enter

the programs through 2006, there is great synergy between the two companies. Additionally, FedEx Express, as a launch customer for the Airbus A380 freighter, has currently chosen the GP7000 engines manufactured by the GE/PW Engine Alliance to power this aircraft.

In a business driven by on-time delivery and service, Michael Cukor, Vice President of Base Maintenance for FedEx Express, says the company relies on its supply chains to maintain a competitive advantage. Mr. Cukor states a variety of factors influenced the decision to sign long-term maintenance contracts with GE. "Quality of workmanship, customer support, reliability and cost were taken into consideration," he says. "GE was already supporting our CF6-6 and CF6-80A engine maintenance programs, and the transition to the CF6-80C2 and the CF6-50 engine models has been seamless."

FedEx Express, previously under MCPH contracts with GE for CF6-6 engines, has transitioned to MCPC agreements. Mr. Cukor attributes the reason for the change to more predictable costs. "The MCPH and the MCPC concepts smooth out the maintenance costs associated with engine restorations. In the

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## An Engine That Checks Its Own Oil

### One of a Kind Continuous Debris Monitoring System for GE90 Engines

Keeping planes in the air and avoiding unnecessary maintenance and repairs is the goal of any operator. With that in mind, GE is always looking for ways to help make this happen for its customers, and the GE90<sup>®</sup> Oil Debris Monitoring System (DMS) is an example of one such offering.

Magnetic particles or debris in the engine's oil system may be a sign of impending failures. GE has found that monitoring chip collectors is a proactive way to detect bearing failures or other problems that could lead to shutdowns. Conventional chip collectors consist of a powerful magnet that is used to collect magnetic particles from an engine's oil system to try to provide warning of impending bearing failures. Periodically, a mechanic must unscrew the magnetic chip collection plug and examine the chips that it has collected. This allows operators to be more proactive in maintenance decisions and to prevent mechanical failures that could cause in-flight shutdowns or increase unscheduled maintenance.

The DMS is an electronic chip detection and counting system that is currently used on GE90 engines and in some military engines, and will be used on the GP7000. The DMS performs all the functions of a conventional magnetic chip collector, but it also utilizes an electronic sensor that continuously counts the particles it collects and can notify operators and maintenance management of potential issues. "This can be an extremely powerful feature when combined with a trend monitoring system such as GEAE's Remote Diagnostics in real-time analysis and notification of impending bearing, gear and shaft wear events," says John Lammas, manager, GE90 Product Support Engineering.

GE typically recommends that chip collectors be checked a minimum of every 350 flight hours to every 400 flight cycles. Some operators check their chip collectors as often as daily, and some only check them during scheduled maintenance. But, in traditional chip collectors a mechanic must physically remove the chip plug to check for particles. The DMS allows for the same monitoring to be done continuously without the plug being removed and thus reduces the additional line maintenance cost and the risk of problems/system contamination during or after reassembly.

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This is the sixth in a series of articles  
about the capabilities of Unison Industries.

## Unison<sup>®</sup> Program Ignites Improved Benefits and Savings

When it comes to maximizing service life and making sure every engine part is achieving peak performance, aviation mechanics must always be one step ahead of the game. Unison's Service Express Programs play a key role in helping airlines worldwide maintain peak performance from its products. Continuing an ongoing commitment to customer service, Unison offers two unique programs that can optimize CFM56<sup>®</sup> and CF6<sup>®</sup> igniter service life: the Plug Refurbishment Program (PRP) and the Plug Life Optimization Program (POP). These programs assist customers in achieving maximum igniter service life, while complementing the high level of reliability Unison igniters are known for industry-wide.

Customers participating in PRP return their used igniters to Unison, where they undergo a seven-step refurbishment process, including detailed inspection, cleaning and testing procedures. Igniters that pass all steps with at least 50 percent of service life remaining, based on firing tip erosion measurement, are recertified by Unison for continued service and sent back to the engine operator. Igniters that fail are scrapped on-site or replaced with new units, based on a customer's preference. Igniter plugs produced by other manufacturers may also be serviced through Unison's PRP program. Plugs that fail are replaced by Unison's equivalent igniter plug.



In contrast to PRP, POP is a service used to analyze Unison igniter plugs only. The objective of POP is to determine the customer's optimum "hard-time" removal interval. This is determined by assessing each returned igniter's firing tip erosion measurement versus the engine hours experienced by the igniter at the time of removal. Based on this evaluation, Unison works with the customer to determine if the current removal interval is correct or should be adjusted.

A successful POP analysis will establish the optimum igniter plug life, eliminating the need for PRP service. Unison's igniter plug customers benefit from this evaluation program at no charge.

For further information visit

[www.unisonindustries.com/services](http://www.unisonindustries.com/services)

## CF34-3 Factory Engine Testing Program

### Improving New and In-service Engines

Since introducing the CF34® engine into regional jet operation in 1992, GE has continued to focus on major durability and shop visit cost drivers as an added value to customers.

Over the past 18 months, GE has been running a series of comprehensive engine tests on the CF34-3 to introduce a number of design improvements. The focus of these improvements is higher durability, reduced maintenance costs and improved time on wing (TOW) for customers.

After careful evaluation, key initiatives and issues were identified and significant design and development programs have been completed. These include:

- new materials for HPT nozzles and a redesign of the secondary cooling systems for an estimated 2-3 time reduction in shop visit scrap rates;
- improved Materials for the HPT Shrouds targeting a 2-time plus improvement in scrap rates;
- structural design changes in the combustion system and the application of additional protective coatings targeting a greater than 50 percent improvement in cyclic life;
- development of a more robust accessory gearbox, incorporating an improved bearing system with a target of more than a 2-time improvement in life;



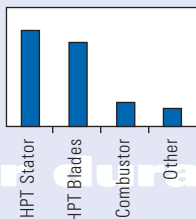
- upgrade of the lubrication and bearing systems; and
- comprehensive Life Limited Parts extension program.

To validate these results, support certification and determine the overall system effect of these changes, an extensive full-engine factory test program is ongoing. By accelerating cyclic operations and operating at maximum takeoff temperatures, these tests have simulated more than 8,700 engine cycles or 4.5 years of airline operations. This rigorous testing will continue to help add value and improvements to new and in-service CF34-3 engines. Before these improvements go into service, an additional block of similar tests will be performed. These tests demonstrate the continued commitment and investment in the CF34-3 program as demonstrated in the charts below.

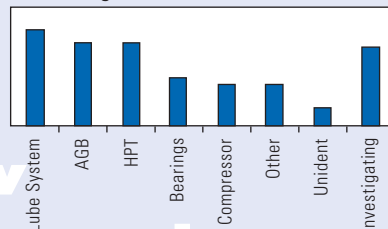
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## reduced maintenance

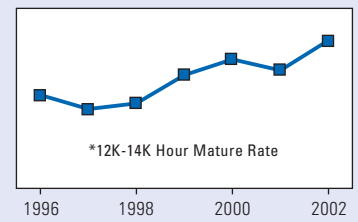
CF34-3 SV Cost Drivers



CF34-3 Engine Removal Causes



CF34-3 First Run TOW



\*Targeted mature results based on recent tests

higher durability

improved time-on-wing

## Maintenance Contracts

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past, engine restoration costs could vary drastically from one engine to another. The MCPC product enables FedEx Express to more accurately budget the amount needed for restoration, which increases the predictability of our operating costs," said Mr. Cukor.

In fact, FedEx Express was a driving force in GE's development of the MCPC service offering. "With help from FedEx Express, we changed our approach and developed a better product," says Lorraine Bolsinger, Vice President of Marketing for GE Aircraft Engines. "FedEx Express helped us to refine this approach which is now available as one of our customized solutions."

The benefits FedEx Express derives from these contracts are passed on to its customers through reliability of service. "Our fleet operates on time without incurring delays due to engine maintenance issues," Cukor says. "Each engine upgrade modification, each engine change supported by GE, and each extra cycle the engine remains reliably on wing helps FedEx Express improve our service level."



"GE is a valued supplier to FedEx Express and these contracts are an example of our faith in our relationship with them," Cukor says. "We are working together as a team to improve engine performance and look forward to many more years of quality teamwork and service from GE."

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

### > Late Part Delivery Status

GE strives to maintain a spare parts delivery performance of above 90 percent. We understand that it is very important for customers to have GE-scheduled ship dates in order to plan their shops and schedules accordingly.

The CWC is one of our best vehicles to share that information quickly. There are several ways that users can obtain information. An Open Order Report can be run or a search by PO number or by part number. This will show all orders that are open and shipped against that part number.

- > Select:
  - Spare Parts
  - Search
  - Part Number (All)
  - PO Number
 (click on the hyperlink)

Item#	Status	Part Number	Qty	Price	Item Received Date	Requested Ship Date	GE Expected Ship Date	Memo Ship Number	Invoice Number	Extended Price
531-1	IP	1679M69P02-CLAMP	3	\$225.50	21-Sep-2003	28-Sep-2003	28-Sep-2003			\$676.50
Total: \$676.50										

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