

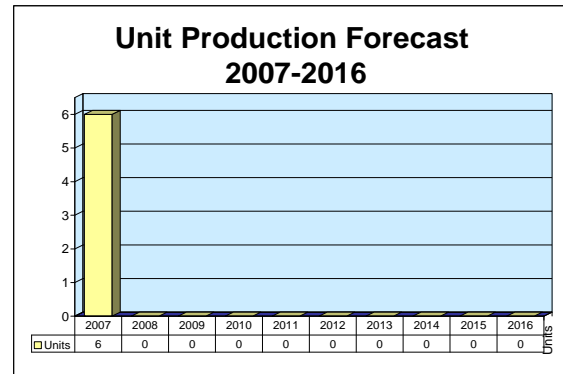
ARCHIVED REPORT

For data and forecasts on current programs please visit
www.forecastinternational.com or call +1 203.426.0800

CFE Company CFE738

Outlook

- Production expected to end after 2007; PW308C replaces CFE738 on Falcon 2000EX
- No other applications at this time



Orientation

Description. Two-spool axial-centrifugal high-bypass-ratio aviation turbofan engine in the 5,000- to 7,000-lbft class.

Status. In production for Dassault Falcon 2000 medium business jet. FAA certification granted 1993; JAA validation, 1994.

Sponsor. The CFE738 was privately developed by the prime contractor.

Total Produced. At the end of 2006, an estimated 557 engines had been assembled, including eight engines for testing and proof-of-concept.

Power Class. 5,600 to 7,000 lbft (24.90 to 31.13 kN).

Application. Business jets and light turbofan-powered transport aircraft whose weight ranges from 30,000 to 40,000 pounds (13,608 to 18,144 kg). Current applications include the following:

Engine Variant	Thrust Rating	Application	Units per Airframe
CFE738	5,918 lbft (26.8 kN) ^(a)	Dassault Falcon 2000	2

^(a) Maximum T-O thrust is 5,990 lbft (26.64 kN).

Price Range. The estimated price of the CFE738 is \$1.9 million (2007 dollars).

Competition. The chief engine competition that the CFE738 faces is the Pratt & Whitney Canada PW308, flat-rated at 5,700 lbft (25.35 kN).

Contractors

Prime

CFE Company	111 South 34th St, PO Box 62332, Phoenix, AZ 85082-2332 United States,
-------------	--

CFE Company CFE738

	Tel: + 1 (602) 231-4570, Fax: + 1 (602) 231-5030, Prime
--	---

Subcontractor

Goodrich Turbine Fuel Technologies	http://www.goodrich.com , 811 4th St, PO Box 65100, West Des Moines, IA 50265-0100 United States, Tel: + 1 (515) 274-1561, Fax: + 1 (515) 271-7201 (Fuel Nozzle)
Goodrich Turbomachinery Products	http://www.tmp.goodrich.com , 5th St, Peabody Industrial Park, Peabody, MA 01960 United States, Tel: + 1 (978) 532-2350, Fax: + 1 (378) 532-3048 (HP Blade)
Hispano-Suiza	http://www.hispano-suiza-sa.com , 18 Blvd Louis-Seguín, Colombes, 92707 France, Tel: + 33 1 4130 5010, Fax: + 33 1 4130 5412 (Accessory Drive Gearbox)
Honeywell Aerospace	http://www.honeywell.com/sites/aero/ , 717 N Bendix Dr, South Bend, IN 46620 United States, Tel: + 1 (574) 231-2000, Fax: + 1 (574) 231-3335 (Fuel Control System)
Mors SA	Centre D'Affaires Paris-North, Tour Continental, Le Blanc Mesnil, F-93153 France (Engine Vibration Monitor Control)
Unison Industries	http://www.unisonindustries.com , 7575 Baymeadows Way, Jacksonville, FL 32256 United States, Tel: + 1 (904) 739-4000, Fax: + 1 (904) 739-4093 (Exciter & Rotor & Stator)

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to www.forecastinternational.com (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800.

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

Design Features. Some of the features of the CFE738 can be traced to the GE27/MTDE effort on the part of GE Aircraft Engines. The CFE Company CFE738 has the following design features:

Fan. Single-stage fan with 28 titanium blades having part-span snubbers and rotating biconical spinner; fan is driven by the three-stage LP turbine. Maximum airflow is approximately 248 lb/sec (112.5 kg/sec). Bypass ratio is 5.4:1. Fan pressure ratio is approximately 1.7:1.

LP/HP Compressor. Six-stage (five axial and one centrifugal) compressor stages with first three stages variable. Maximum pressure ratio is 36:1 at 0.75 Mach/35,000 feet (10,667 m). All stages are bladed-disk (blisk) design, produced by European Gas Turbines.

Combustor. In-line single annular combustor with 15 air atomizing fuel nozzles. Turbine Inlet Temperature

(TIT) approximately 2,500°F (1,371°C). Ignition components provided by Unison Industries.

HP Turbine. Two-stage axial, using single-crystal high-temperature air-cooled blades in both stages.

LP Turbine. Three-stage axial unit, with uncooled cast blades and vanes.

Jetpipe. The jetpipe/fan mixer assembly has a 20-chute assembly for mixing the hot and cold airflows from the core and bypass duct. Exhaust mixer produced by Israel Aircraft Industries.

Accessories. Honeywell Full Authority Digital Electronic Control (FADEC) system and fuel pump. Accessory gearbox by Hispano-Suiza. Nacelles and thrust reversers for the Falcon 2000 produced by Alenia and Dee Howard, respectively.

Dimensions. The approximate dimensions of the CFE738 are as follows:

	Metric Units	English Units
Length ^(a)	1,734.8 mm	68.3 in
Diameter, fan	901.7 mm	35.5 in
Weight, basic ^(b)	550.6 kg	1,214 lb

^(a) Flange to flange.

^(b) Maximum dry.

CFE Company CFE738

Performance. The approximate thrust parameters of the CFE738 are as follows:

	<u>Metric Units</u>	<u>English Units</u>
Maximum T-O ^(a)	26.64 kN	5,990 lbst
Normal T-O	24.90 kN	5,600 lbst
At cruise ^(b)	6.68 kN	1,465 lbst
At cruise ^(c)	7.26 kN	1,632 lbst

^(a) S/L, static, 86°F (30°C).

^(b) 0.80 Mach/40,000 feet (12,191 m).

^(c) 0.75 Mach/35,000 feet (10,667 m).

	<u>Metric Units</u>	<u>English Units</u>
At T-O ^(a)	10.4 mg/Ns	0.371 lb/hr/lbst
At cruise ^(b)	18.7 mg/Ns	0.644 lb/hr/lbst

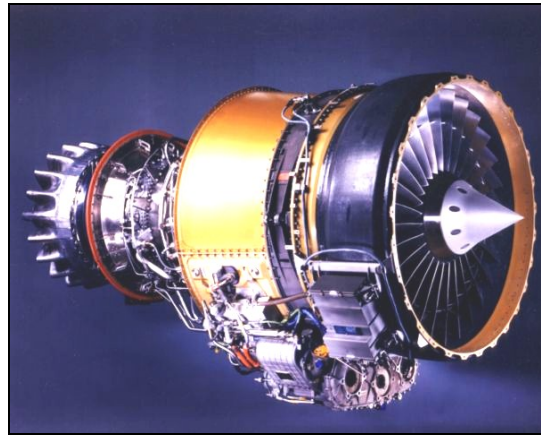
^(a) S/L, static, 86°F (30°C).

^(b) At 1,465 lbst (6.62 kN) at 0.80 Mach/40,000 feet (12,191 m).

Variants/Upgrades

No identifiable major variants or upgrades have been manufactured. A version developing 7,195 lbst (32 kN) was being considered for the Falcon 9000 inter-continental business jet design being studied by

Dassault. Growth to 7,400 lbst (33 kN) has been considered, though growth beyond 6,000 lbst would require larger diameter components and new materials, according to Dassault.



CFE738

Source: CFE Engines

Program Review

Background. In 1985, GE and Garrett Engine Division (now Honeywell) began development of a 6,000 lbst (26.68 kN) modern technology engine for corporate business jet aircraft in the 30,000-pound (13,608-kg) gross T-O weight class. The joint effort combined the two companies' talents as follows:

GE contributed the HP turbine, combustor, and compressor section of the GE27 turboshaft engine that the company had built for the U.S. Army's Modern Technology Demonstrator Engine (MTDE) program.

Garrett (now Honeywell) contributed the low-pressure spool, composed of a single-stage fan driven by a

CFE Company CFE738

three-stage LP turbine. The engine benefits from Garrett's experience with the popular TFE731 engine family. In addition to a Garrett-provided gearbox, the overall engine has a Bendix control system.

The engine was designated the CFE738. A joint company, the CFE Company, was established in 1987. In the joint program, CFE Company provided technical direction to the program, conducted marketing activities, directed product support, and performed general administrative duties. Responsibility for CFE738 product liability was retained through the joint company. The partnership anticipated creation of a single production line once full production was initiated.

With a certified power rating of 6,000 lbst and the potential to develop over 7,000 lbst, the engine fits somewhere between the 5,400-lbst three-spool Garrett ATF3 and the 9,000-lbst twin-spool GE CF34. Despite the seemingly low-risk work involved, each company probably invested several hundred million dollars in development, test, certification, marketing, and the post-certification effort.

Maintainability. The engine is made up of four modules – gearbox, fan, core, and LP turbine – for ease of maintenance. In addition, use of special tooling permits the removal of the combustor and HP turbine from the core at the customer's site. Core inspections for mature engines are required about every 6,000 hours, estimated by GE to be approximately 10 years of normal use.

Development. Bench-test runs of the CFE738 began in 1989, with first flight-testing in 1992. Ground testing on the Falcon 2000 began in 1992. Each company built

and tested prototype CFE738s concurrently, shipping to each other the parts needed for a complete engine. The total development program ran for roughly 50 months, involving 11 engines and 6,000 running hours. FAA engine type certification was awarded in 1994, along with the production certificate allowing shipment of engines to customers.

In 1998, CFE announced that the CFE738 fleet had accumulated more than 100,000 hours since entering service in 1989, and was accumulating additional hours at a rate of 4,000 per month.

CFE738 Application

Falcon 2000. In 1987, Dassault-Breguet (now Dassault Aviation) announced that it had been working on the design of a follow-on to its Falcon 2000. The aircraft was seen as being a serious rival to the Gulfstream IV.

The Falcon 2000 is 63.1 feet (19.2 m) long and has a wingspan of 63.4 feet (19.3 m). It has a maximum takeoff weight of 34,998 pounds (15,875 kg), a maximum range of 3,130 nautical miles (5,550 km) with eight passengers, and seating for up to 19 passengers in a high-density configuration. While the powerplant competition for the Falcon 2000 included the CFE738, the PWC/MTU PW300 series, and the Textron Lycoming (now Honeywell) LF500 series, the CFE738 was selected in 1990.

The maiden flight of the aircraft was made in 1993. European JAA certification was granted in 1994, followed by U.S. FAA certification in 1995.

Funding

No funding pertaining to the CFE738 has been identified.

Contracts/Orders & Options

No major contracts pertaining to the CFE738 have been issued during the past year. No known military contracts have been awarded or received.

Timetable

Month	Year	Major Development
	1982	GE begins GE27 rig tests of selected components
Dec	1983	GE begins MTDE gas generator testing
Nov	1984	First GE MTDE engine tested
Mid	1986	GE and Garrett effort announced
Jun	1987	CFE Company created
Jun	1988	CFE738 program officially launched

CFE Company CFE738

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Apr	1990	CFE738 chosen to power Falcon 2000
May	1990	First CFE738 engine run in test cell
Mar	1993	First flight of Falcon 2000
Dec	1993	CFE738 FAA certification
Jan	1994	Production engines become available
Feb	1995	Initial delivery of Falcon 2000
	2007	Production of CFE738 to end
Thru	2016	Continued fleet support

Worldwide Distribution/Inventories

At the end of 2006, an estimated 557 CFE738 engines had been built for bench testing, proof-of-concept, the test program for the Falcon 2000, and Falcon 2000 deliveries.

Forecast Rationale

CFE738 production is expected to end in 2007 after a two-year extension. The only application had been Dassault's Falcon 2000, but when the 2000EX and 2000DX were added, Dassault selected Pratt & Whitney

Canada's PW308C engine to power both. We anticipate GE/Honeywell to continue to support the engine indefinitely for the CFE738-powered Falcons in the fleet.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
CFE Company												
CFE738 <- Falcon 2000												
	557	6	0	0	0	0	0	0	0	0	0	6
Total	557	6	0	0	0	0	0	0	0	0	0	6