ARCHIVED REPORT

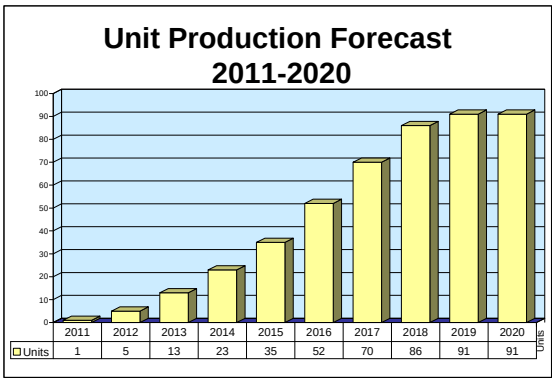
For data and forecasts on current programs please visit

www.forecastinternational.com or call +1 203.426.0800

General Electric/Rolls-Royce F136

Outlook

- GE tests full F136 STOVL propulsion system in 2010
- Flight tests expected in late 2011
- Test program reached 950 hours by end of 2010



Orientation

Description. Twin-spool, low-bypass-ratio, augmented military turbofan engine in the 40,000-lbst (180-kN) class.

Sponsor. Engine developed jointly by General Electric and Rolls-Royce, with funding provided by the U.S. Congress.

Status. In System Development and Demonstration (SDD) phase.

Total Produced. At the start of 2011, six complete engines had been produced (two pre-SDD, four SDD).

Application. Lockheed Martin F-35 Lightning fighter.

Price Range. Estimated at $5.5-$7 million at full-rate production (2011 dollars), not including liftfan system.

Contractors

Prime

GE - Aviation	http://www.geae.com, 1000 Western Ave, Lynn, MA 01905-2655 United States, Tel: + 1 (617) 594-0100, Fax: + 1 (617) 594-4729, Co-producer
Rolls-Royce plc	http://www.rolls-royce.com, 65 Buckingham Gate, London, SW1E 6AT United Kingdom, Tel: + 44 20 7222 9020, Fax: + 44 20 7227 9170, Co-producer

Subcontractor

Aircraft Gear Corporation	6633 W 65 St, Bedford Park, IL 60499 United States, Tel: + 1 (708) 594-2100 (Accessory Drive Gearbox)
Lear Romec Corp	http://www.craneaerospace.com/about_us/lear_romec.htm, PO Box 4014, 241 S Abbe Rd, Elyria, OH 44036 United States, Tel: + 1 (216) 323-3211, Fax: + 1 (216) 322-3378 (Lube & Scavenge Pump)

General Electric/Rolls-Royce F136

Precision Gear Inc	48-09 108th St, Corona, NY 11368-2911 United States, Tel: + 1 (718) 592-7100, Fax: + 1 (718) 592-2525 (Gearshaft Assembly)

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. The basic F136 has the following design features:

Fan. Titanium, wide chord.

Compressor. Three-stage blisk LPC, first-stage hollow core blade, Stages 2 and 3 solid blade. Five-stage all-blisk HPC.

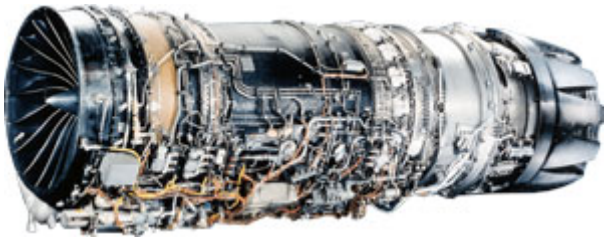
Combustor. Single annular, fabricated from Lamilloy.

Turbine. Single-stage HPT, three-stage LPT.

Augmentor. Radial, non-stage, variable flow control.

Variants/Upgrades

F136. Basic engine design details are listed above. There is only one version of the F136, and it is interchangeable in all three F-35 variants.



GE F136

Source: General Electric

Program Review

Background. The F136 engine is being jointly developed by General Electric and Rolls-Royce as one of two engines that will power Lockheed Martin's F-35 Lightning II (also called the Joint Strike Fighter). GE owns approximately 60 percent of the F136 program and is responsible for development of the high-pressure compressor, the low- and high-pressure turbines, and the augmentor. Rolls-Royce's responsibility is the front fan, combustor, Stage 2 and Stage 3 of the LPT, and gearboxes.

The F136 is derived from GE's F120 engine, which competed against Pratt & Whitney's F119 engine for the U.S. Air Force's F-22 engine contract. The GE/Rolls team was awarded a $2.4 billion contract for System Development and Demonstration in August 2005. The U.S. Department of Defense attempted to terminate the Alternative Engine Program in the 2007 budget, citing program cost savings, but funding was restored by Congress.

Funding

U.S. FUNDING

	FY07	FY08	FY09	FY10
PE#064800F and PE#064800N	$340.0	$480.0	$495.0*	$540.0

All $ are in millions.
*Reflects the conference authorization mark for FY09

Timetable

Month	Year	Major Development
	1997	Pre-SDD Phase 1 engine definition completed
	2002	Detail design completed
	2003	Critical Design Review completed
	2004	First engine to test
	2005	First engine to run STOVL
Aug	2005	GE/Rolls awarded $2.4 billion SDD contract
Sept	2007	First test of augmentor
Mar	2008	High-altitude testing completed
Oct	2009	$540 million approved for AEP
4Q	2010	Assembly of first flight test engine begins
4Q	2012	First flight of F136 expected

Forecast Rationale

GE continues development and testing of the F136, and has expanded its test program. The year 2010 saw the addition of four engines to the test fleet, with the first flight test engine to be completed in early 2011. Testing of six engines began in 2010, for purposes of measuring engine performance and endurance. GE reports the test engines have so far met expectations in the areas of thrust, temperature margins, and fuel consumption.

The fifth development engine (Engine 008) is slated for CTOL flight clearance endurance testing, and will advance the program toward the initial flight release in 2011.

F136 Testing Program Goals

GE's plan included reaching 1,000 hours of testing in 2010, and a number of program achievements have been realized: reaching maximum augmented thrust and demonstrating consistent, successful light-offs and operability of the augmentor; successfully completing CTOL common exhaust system clearance testing; and demonstrating significant thrust margins at sea-level test conditions. By year's end, total testing time had reached over 950 hours.

In early December 2010, GE ran a complete propulsion system for the first time with the common hardware for STOVL operation (including the Rolls-Royce LiftFan®). That same month, production began on test engine #41, which will be the first F136 to fly on the F-35. Final assembly began in early 2011, with acceptance testing expected to occur mid-year. Flight testing is scheduled to begin on an AF-1 test aircraft late in 2012.

We estimate production at 467 engines during the 10-year forecast period.

General Electric/Rolls-Royce F136

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		**High Confidence**				**Good Confidence**			**Speculative**			
	Thru 2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
GE - Aviation												
F136 Military <> F-35												
	0	1	5	13	23	35	52	70	86	91	91	467
Total	0	1	5	13	23	35	52	70	86	91	91	467