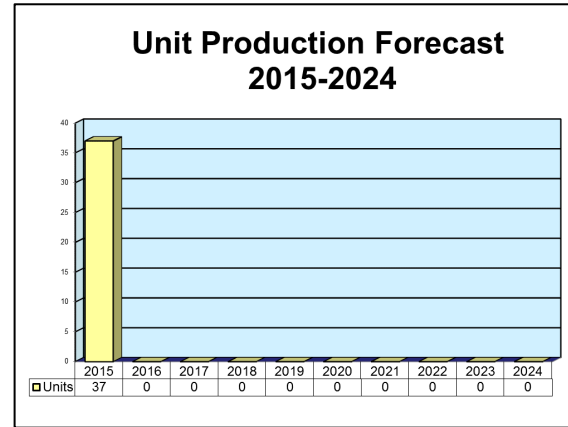


Pratt & Whitney F117

Outlook

- The F117 is a military variant of Pratt & Whitney's commercial PW2040 engine
- C-17 production to end in 2015
- Support of F117 engines in service with USAF and other customers will continue for decades



Orientation

Description. Two-shaft, axial-flow, high-bypass-ratio aviation turbofan engine.

Sponsor. The Pratt & Whitney PW2000 was privately funded and sponsored.

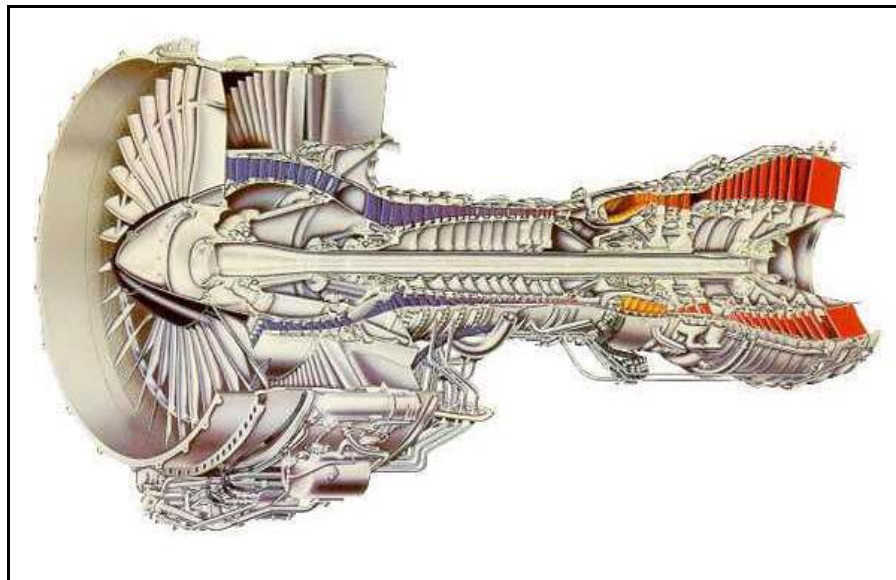
Power Class. 37,000 to 43,000 lbst (164.6 to 191.3 kN).

Status. In production for Boeing C-17 military airlifter.

Total Produced. Through December 2014, an estimated 1,199 F117 series engines had been built, including bench test units.

Application. Large military transport aircraft. The F117 is the military variant of the PW2040.

Price Range. List price estimated at \$10 million.



F117 Turbofan Engine

Source: Pratt & Whitney

Pratt & Whitney F117**Contractors****Prime**

Pratt & Whitney	http://www.pratt-whitney.com , 400 Main St, East Hartford, CT 06108 United States, Tel: + 1 (860) 565-4321, Email: info@pw.utc.com , Prime
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Subcontractor

Avio Aero	http://www.avioaero.com , Via I Maggio, 99, Rivalta di Torino, 10040 Torino, Italy, Tel: + 39 011 00 82111, Fax: + 39 011 00 82000 (Accessory Drive Gearbox)
GKN Aerospace Engine Systems – Sweden	http://www.gkn.com , Trollhättan, 461 81 Sweden, Tel: + 46 520 94000, Fax: + 46 8 555 05678 (Engine Case)
Honeywell Aerospace	http://aerospace.honeywell.com , 1300 W Warner Rd, Tempe, AZ 85284 United States, Tel: + 1 (480) 592-5000, Fax: + 1 (480) 496-7811 (Bleed Air System & Control Valve)
IHI Corporation	http://www.ihl.co.jp , Toyosu IHI Bldg, 1-1, Toyosu 3-chome, Koto-ku, Tokyo, 135-8710 Japan, Tel: + 81 3 6204 7800, Fax: + 81 3 6204 8800 (Main Shaft)
Triumph Aerostructures, Vought Aircraft Division	http://www.triumphgroup.com/companies/triumph-aerostructures-vought-aircraft-division , 9314 W Jefferson Blvd, Dallas, TX 75211 United States, Tel: + 1 (972) 946-2011 (Engine Nacelle & Stabilizer)
UTC Aerospace Systems	http://utcaerospace.com , One Hamilton Rd, Windsor Locks, CT 06096-1000 United States, Tel: + 1 (860) 654-6000, Fax: + 1 (860) 654-2621 (Digital Electronic Engine Control - FADEC)
Unison Industries, Norwich Operations	http://www.unisonindustries.com , 5345 State Hwy 12, PO Box 310, Norwich, NY 13815 United States, Tel: + 1 (607) 335-5000, Fax: + 1 (607) 335-5440 (Ignition Exciter & Two-Plug Alternator)
Wyman-Gordon Investment Castings Inc	839 Poquonnock Rd, PO Box 999, Groton, CT 06340 United States, Tel: + 1 (860) 445-7421, Fax: + 1 (860) 449-8052 (Investment Cast Airfoil & Hardware)

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 & Services; Companies, Contractors, Force Structures & Budgets) 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

The F117 is a military variant of the PW2040 engine. A single-stage fan and four-stage, axial low-pressure compressor are driven by the five-stage, uncooled, axial low-pressure turbine.

The 12-stage axial compressor is driven by the two-stage axial turbine. Stages 1-5 have variable stators. The last eight stages of the high-pressure (HP) compressor employ active clearance controls. Blades

are designed and manufactured with thicker leading edges and are contoured for greater efficiency.

A single annular nickel alloy combustor employs 24 single-orifice, airblast fuel nozzles.

The HP turbine includes two axial stages. The fan and low-pressure compressor are direct-driven by the supercharged, five-stage uncooled axial turbine.

	<u>Metric Units</u>	<u>U.S. Units</u>
Thrust	181.9 kN	40,900 lbst
Weight	3,220.5 kg	7,100 lb
Length	373 cm	146.8 in
Inlet diameter	199 cm	78.5 in
Maximum diameter	215 cm	84.5 in
Bypass ratio	5.9 to 1	5.9 to 1
Overall pressure ratio	30.8 to 1	30.8 to 1

Pratt & Whitney F117**Variants/Upgrades**

F117-PW-100. F117 is the U.S. Air Force designation for the PW2040 engine used on Boeing's 757 airliner and the Russian-made Ilyushin IL-96M. The F117, four of which are used on the Boeing C-17, differs slightly from the commercial variant on the 757 by its use of a titanium fan case, composite fan exit guide vanes, a

second hydraulic pump, 17th-stage HP compressor bleed air ports, and bifurcation panels. The first engine was delivered in 1988. Pratt & Whitney began delivering F117 engines with the Improvement 94 Package in 1994.

Program Review

Background. Pratt derived the F117 engine from the civil model PW2000 series of commercial turbofans that achieved certification in December 1983. The first engine, the PW2037, was designed to be much smaller and lighter than any other commercial turbofan engine. It operates at core speeds virtually unheard of for engines in the high-thrust class, and had significantly fewer parts than comparable engines of the time.

In 1979, the USAF adopted the four-engine CX concept to fill a requirement for a long-range, strategic transport that would complement the C-5 force. Boeing, Lockheed, and McDonnell Douglas submitted proposals in 1980. Nearly a year later, MDC was selected as prime development contractor. The MDC design, later

designated the C-17, first flew in 1991. The aircraft's Initial Operational Capability was achieved in 1995.

The C-17's F117 engines initially were not able to meet the performance criteria specified by the USAF when first deployed. The engines were performing at an SFC rating 2.8 percent higher than originally specified. With the introduction of Pratt's Improvement 94 Package in 1994, the F117's SFC improved 0.5 percent, along with an estimated 22 percent maintenance savings. The upgrade kits cost about \$1 million each in then-year dollars.

Boeing subsequently merged with MDC in 1997, inheriting the C-17 along with other MDC civil and military aircraft programs.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Jan	1987	PW2040 granted FAA certification
May	1988	First F117 delivered
Sep	1991	First flight of C-17
Mar	1994	PW2000 Improvement 94 standard engine enters service
Jan	1995	C-17 Initial Operational Capability
Mar	1995	PW2043 FAA certification
Sep	2003	F117 on C-17 reaches two-million-flight-hour milestone
Jul	2007	P&W awarded \$1.05 billion contract from USAF for F117 engines
	2015	Production of complete F117 engines scheduled to end

Forecast Rationale

Time is running out for the F117 program. Boeing will terminate production of the C-17 in late 2015 after building eight aircraft in 2014 and nine in 2015.

In January 2015, the company indicated that it was building three C-17s for undisclosed customers and seven "white-tail" aircraft for which customers have not yet been secured.

Boeing rolled out the first of these 10 aircraft in late 2014, leaving nine to be completed in 2015. Australia

will take two, Canada one, and the United Arab Emirates two. The five remaining white-tailed C-17s will be stored until Boeing can place the aircraft with customers. The manufacturer expects to complete this process by the end of 2017.

Once complete engine production ends, Pratt will transition to a support role, building engine modules and producing spare parts to support the installed fleet of F117 engines.

Pratt & Whitney F117

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Pratt & Whitney												
F117 -PW-100 <> C-17 <> Australia/New Zealand												
	27	7	0	0	0	0	0	0	0	0	0	7
F117 -PW-100 <> C-17 <> United Arab Emirates												
	28	7	0	0	0	0	0	0	0	0	0	7
F117 -PW-100 <> C-17												
	12	23	0	0	0	0	0	0	0	0	0	23
Subtotal	67	37	0	0	0	0	0	0	0	0	0	37
Total	67	37	0	0	0	0	0	0	0	0	0	37