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.

**Unit Production Forecast 2015-2024**

**F117 Turbofan Engine**

Source: Pratt & Whitney
**Pratt & Whitney F117**

### Contractors

#### Prime

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Website</th>
<th>Address</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pratt &amp; Whitney</td>
<td><a href="http://www.pratt-whitney.com">http://www.pratt-whitney.com</a></td>
<td>400 Main St, East Hartford, CT 06108 United States, Tel: +1 (860) 565-4321</td>
<td><a href="mailto:info@pw.utc.com">info@pw.utc.com</a></td>
<td></td>
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</table>

#### Subcontractor

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Website</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
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</thead>
<tbody>
<tr>
<td>Avio Aero</td>
<td><a href="http://www.avioaero.com">http://www.avioaero.com</a></td>
<td>Via I Maggio, 99, Rivalta di Torino, 10040 Torino, Italy, Tel: +39 011 00 82111</td>
<td>+39 011 00 82000 (Accessory Drive Gearbox)</td>
<td></td>
</tr>
<tr>
<td>GKN Aerospace Engine Systems – Sweden</td>
<td><a href="http://www.gkn.com">http://www.gkn.com</a></td>
<td>Trollhättan, 461 81 Sweden, Tel: +46 520 94000</td>
<td>+46 8 555 05678 (Engine Case)</td>
<td></td>
</tr>
<tr>
<td>Honeywell Aerospace</td>
<td><a href="http://aerospace.honeywell.com">http://aerospace.honeywell.com</a></td>
<td>1300 W Warner Rd, Tempe, AZ 85284 United States, Tel: +1 (480) 592-5000, Fax: +1 (480) 496-7811</td>
<td>Bleed Air System &amp; Control Valve</td>
<td></td>
</tr>
<tr>
<td>IHI Corporation</td>
<td><a href="http://www.ihi.co.jp">http://www.ihi.co.jp</a></td>
<td>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)</td>
<td></td>
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</tr>
<tr>
<td>Triumph Aerostructures, Vought Aircraft Division</td>
<td><a href="http://www.triumphgroup.com/companies/triumph-aerostructures-vought-aircraft-division">http://www.triumphgroup.com/companies/triumph-aerostructures-vought-aircraft-division</a>, 9314 W Jefferson Blvd, Dallas, TX 75211 United States, Tel: +1 (972) 946-2011</td>
<td>(Engine Nacelle &amp; Stabilizer)</td>
<td></td>
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<tr>
<td>UTC Aerospace Systems</td>
<td><a href="http://utcaerospacesystems.com">http://utcaerospacesystems.com</a></td>
<td>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)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unison Industries, Norwich Operations</td>
<td><a href="http://www.unisonindustries.com">http://www.unisonindustries.com</a></td>
<td>5345 State Hwy 12, PO Box 310, Norwich, NY 13815 United States, Tel: +1 (607) 335-5000, Fax: +1 (607) 335-5440 (Ignition Exciter &amp; Two-Plug Alternator)</td>
<td></td>
<td></td>
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<tr>
<td>Wyman-Gordon Investment Castings Inc</td>
<td>839 Poquonnock Rd, PO Box 999, Groton, CT 06340 United States, Tel: +1 (860) 445-7421, Fax: +1 (860) 449-8052 (Investment Cast Airfoil &amp; Hardware)</td>
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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.petitbone@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.

<table>
<thead>
<tr>
<th>Metric Units</th>
<th>U.S. Units</th>
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<tbody>
<tr>
<td>Thrust</td>
<td>181.9 kN</td>
</tr>
<tr>
<td>Weight</td>
<td>3,220.5 kg</td>
</tr>
<tr>
<td>Length</td>
<td>373 cm</td>
</tr>
<tr>
<td>Inlet diameter</td>
<td>199 cm</td>
</tr>
<tr>
<td>Maximum diameter</td>
<td>215 cm</td>
</tr>
<tr>
<td>Bypass ratio</td>
<td>5.9 to 1</td>
</tr>
<tr>
<td>Overall pressure ratio</td>
<td>30.8 to 1</td>
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June 2015
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.

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

### ESTIMATED CALENDAR YEAR UNIT PRODUCTION

<table>
<thead>
<tr>
<th>Designation or Program</th>
<th>High Confidence</th>
<th>Good Confidence</th>
<th>Speculative</th>
<th>Total</th>
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<tr>
<td><strong>Pratt &amp; Whitney</strong></td>
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<tr>
<td>F117 -PW-100 &lt;&gt; C-17 &lt;&gt; Australia/New Zealand</td>
<td>27</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F117 -PW-100 &lt;&gt; C-17 &lt;&gt; United Arab Emirates</td>
<td>28</td>
<td>7</td>
<td>0</td>
<td>0</td>
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<tr>
<td>F117 -PW-100 &lt;&gt; C-17</td>
<td>12</td>
<td>23</td>
<td>0</td>
<td>0</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>67</td>
<td>37</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>67</td>
<td>37</td>
<td>0</td>
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