

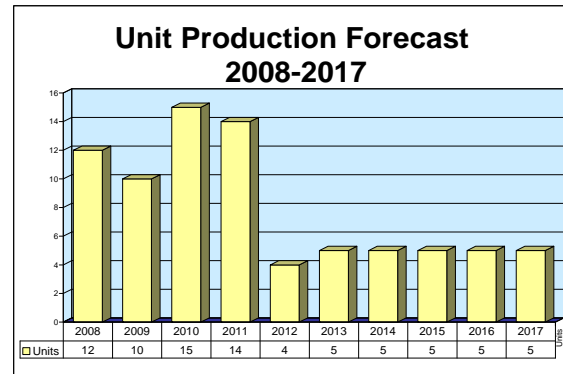
ARCHIVED REPORT

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Honeywell JFS 190

Outlook

- F-15 production for Korea and Singapore will continue into 2012
- Low-rate production expected for existing F-15 fleet



Orientation

Description. The JFS 190 is a single-shaft gas turbine jet fuel starter/auxiliary hydraulic power unit (JFS/APU) having a power output of approximately 166 shp.

Sponsor. The JFS 190 unit was privately developed by the prime manufacturer, identified below.

Power Class. Maximum power output is approximately 166 shp (123.7 kW). With no bleed, power output is 54 shp (40.26 kW) in a limited-duty mode.

Application. Heavy fighter/attack/strike aircraft. Recent, current, and proposed applications include the following:

Status. In production.

Total Produced. At the start of 2008, 1,530 JFS 190 auxiliary power units were built in the U.S. and Japan.

Series production of the JFS 190 currently takes place in the U.S.; intermittent production can occur at any time in Japan.

<u>Model Variant</u>	<u>Power or Thrust Rating</u>	<u>Current Application</u>	<u>Units per Airframe</u>
JFS 190-1	(See above)	Boeing F-15G, F-15K	1
	(See above)	Recent Applications	
		Boeing F-15 (other models/variants)	1
		Mitsubishi F-15J/DJ (production ended)	1

Price Range. Estimated at \$250,000-\$260,000 in 2008 U.S. dollars.

Competition. Because the JFS 190 was specifically developed for its sole application, it does not have any

direct competition. There are many small gas turbine machines that have approximately the same shaft power/bleed air parameters of the JFS 190, which are used in an APU or APU/EPU capacity.

Honeywell JFS 190

Contractors

Prime

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, Prime
Mitsubishi Heavy Industries (MHI) Ltd	http://www.mhi.co.jp , 16-5 Konan 2-chome, Minato-ku, Tokyo, 108-8215 Japan, Tel: + 81 3 6716 3111, Fax: + 81 3 6716 5800, Licensee

Subcontractor

Arrowhead Products	http://www.arrowheadproducts.net , 4411 Katella Ave, Los Alamitos, CA 90720 United States, Tel: + 1 (714) 828-7770, Fax: + 1 (714) 995-3452, Email: amead@arrowheadproducts.net (Exhaust Duct)
Barden Corp	http://www.bardenbearings.com , 200 Park Ave, PO Box 2449, Danbury, CT 06813-2449 United States, Tel: + 1 (203) 744-2211, Fax: + 1 (203) 744-3756 (Jet Fuel Starter Ball Bearings)
Car-Graph Inc	http://www.car-graph.com , 1545 West Elna Rae St, Tempe, AZ 85281 United States, Tel: + 1 (480) 894-1356, Fax: + 1 (480) 966-7550 (Carbon Seal Assembly)
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 (Exciter)
MPB Corp - Timken Super Precision	http://www.timken.com , 7 Optical Ave, PO Box 547, Keene, NH 03431-0547 United States, Tel: + 1 (602) 352-0310, Fax: + 1 (602) 355-4554 (Ball Bearings)
Parker Aerospace Gas Turbine Fuel Systems Division	http://www.parker.com/ag , 9200 Tyler Blvd, Mentor, OH 44060 United States, Tel: + 1 (440) 954-8100, Fax: + 1 (440) 954-8199 (Fluid Management System)
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)

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Technical Data

While the **Design Features** and **Dimensions** of the Honeywell JFS 190 are considered proprietary, the total weight of the system, including JFS, CGB, and AMAD, is approximately 260 pounds (117.9 kg).

Variants/Upgrades

The JFS 190 APU for the F-15 carried the designation JFS 190-1. No variants or upgrades were reported.

Program Review

Background. The Honeywell JFS 190 jet fuel starter/auxiliary power unit (JFS/APU) was developed for the McDonnell Douglas (now The Boeing Company) F-15. It is incorporated in its secondary power system and is similar in arrangement to the Rockwell B-1B. The small power unit provides engine

starting, and electrical and/or hydraulic power in the air or on the ground for system checkout, independent of the main engine. The F-15 is totally dependent on the JFS for engine starting.

Honeywell JFS 190

The JFS 190 system is composed of four assemblies: the jet fuel starter (JFS), the center gearbox (CGB), and two airframe-mounted accessory drive gearboxes (AMADs). It is a small, compact free-turbine-type power section that relies on the integral center gearbox for starting, lubrication, and control logic, as well as for power transmission. The CGB transfers power from the JFS to either of the two accessory drive gearboxes for main engine starting, or to the left-hand accessory gear drive during ground maintenance operations. Each accessory drive gearbox is connected to the aircraft's main engines by a power takeoff (PTO) system. Power is transmitted from the gearbox to the engine during engine operation. The left-hand gear drive incorporates a manually actuated disconnect for disengaging the left-hand engine during ground power motoring.

JFS 190 Applications

Boeing F-15. The Boeing Company's F-15 is a twin-engine, single-seat aircraft offering high performance and long-range air superiority. It is an all-weather, conventional, and nuclear strike aircraft with a maximum T-O weight of 81,000 pounds (36,742 kg); its maximum speed is over Mach 2.5 and its absolute ceiling is 100,000 feet (30 480 m). The aircraft is powered by two UTC PW F100 engines, with later models using the F100-PW-229 IPE engines.

The F-15K aircraft, a derivative of the F-15E, was selected by the Republic of Korea; F-15Ks are powered

by GE F110-GE-129 engines. That country ordered 40 aircraft in 2002 for deliveries in the 2005-2008 period. It also took 40 option slots on the aircraft that should result in aircraft production into 2011.

The F-15 aircraft first flew in July 1972. Deliveries of the F-15A to the USAF began in November 1974; deliveries of the F-15E began in 1988.

Since early 1994, Israel has ordered 31 F-15C/Ds plus 25 F-15I models, all of which have been delivered.

In 1992, the U.S. approved the sale of 72 F-15XPs to Saudi Arabia. Delivery of the aircraft began in 1997 and was completed in 2001.

The Republic of Singapore has placed a firm order for 12 aircraft, with options on an additional eight aircraft. Forecast International believes that all 20 aircraft will be delivered in the period from 2008-2011.

F-15 Licensed Production. Japan's Mitsubishi Heavy Industries (MHI) has produced the JFS 190 under license from Honeywell (previously AlliedSignal), with local content composing up to 60 percent of the total system. MHI has also manufactured the F-15 under license, having built and delivered 205 aircraft, plus an estimated 220 JFS 190s. The JFS 190 is built by MHI as needed to supplement Japan's F-15s.

Funding

U.S. Air Force funding for the Honeywell JFS 190 small gas turbine machine has not been itemized in the U.S. Department of the Air Force's FY08 Budget Estimates (submitted in February 2007). Limited post-production support may be aggregated under miscellaneous power system expenses.

Contracts/Orders & Options

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Goodrich Corp, U.S.	\$8.81	Aug 2005 – \$8,811,028 FFP contract modification. This is a one-year requirements contract with 2 one-year options, as well as spares, for the production of F-15 power take-off (PTO) shafts. Best estimated quantities are: basic year, 1385; option I, 649; option II, 653. 84 th Combat Sustainment Wing, Hill AFB, Utah, is the contracting agency. (FA8208-05-D-0008)
Honeywell International, U.S.	\$15.18	Jun 2005 – \$15,180,571 FFP contract. The service requirement contract is for repair of F-15 AMAD SPS. Repair/overhaul will be accomplished left-hand AMAD and right-hand AMAD. HQ, OALC, Hill AFB, is the contracting agency. (FA8208-05-D-0005)

Honeywell JFS 190

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Jul	1972	First flight of F-15 Eagle
Late	1976	First F-15 to Israel
May	1989	Initial flight of F-15S/MTD demonstrator
Sep	1992	U.S. approves sale of 72 F-15s to Saudi Arabia
Spring	1994	Israel orders 21 F-15Is
	1997	First deliveries of Israeli F-15Is
Jun	2004	Final assembly of F-15Ks begun
Late	2004	Final deliveries of F-15Es to USAF are made
	2008	Start of deliveries of F-15Gs to Singapore
	2010	Final deliveries of F-15Ks to Korea and F-15Gs to Singapore
Thru	2016	Continued production/spares activity

Worldwide Distribution/Inventories

At the start of 2008, estimated production of the JFS 190 APU was 1,530 units built in the U.S. and Japan. The gas turbine machines are in the inventory of **Israel, Japan, Korea (ROK), Saudi Arabia,** and the **U.S.** The JFS 190s for the Japanese F-15s were built in Japan.

Forecast Rationale

Korea's and Singapore's orders for F-15s will keep the JFS 190 in low-rate production for the next few years. Boeing was over halfway through its 40-aircraft order from the republic of South Korea, when the ROK exercised its option for an additional 20 aircraft, including one spare. Singapore exercised an option for eight F-15s, then ordered an additional four.

Saudi Arabia, already an F-15 operator, selected the Eurofighter Typhoon for a 72 aircraft purchase in late 2007. Therefore, a follow-on order for the F-15 appears remote. Japan and Israel may be considering a last-

minute purchase of F-15s, possibly at the expense of buying fewer F-35 Lightnings. Japan has expressed interest in the F-22, but currently the U.S. Congress does not allow exports of that aircraft.

F-15 production is expected to end in 2012, and as the JFS 190 is only used on that aircraft, we expect production after that date to be for existing fleet support. Barring any late-hour aircraft orders, we project that 80 machines will be produced during the 2008-2017 period.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence				Good Confidence			Speculative			Total	
	Thru 2007	2008	2009	2010	2011	2012	2013	2014	2015	2016		2017
Honeywell International Inc												
JFS 190 -1 Military <=> F-15												
	1,530	12	10	15	14	4	5	5	5	5	5	80
Total	1,530	12	10	15	14	4	5	5	5	5	5	80