

ARCHIVED REPORT

For data and forecasts on current programs please visit

www.forecastinternational.com or call +1 203.426.0800

Rolls-Royce Tay

Outlook

- Gulfstream's G450 business jet was until recently the only application for the Tay turbofan engine in production
- Production of the G450 ended in 2018
- Gulfstream's new G500, powered by Pratt & Whitney PW800 engines, replaced the G450 in Gulfstream's product line

Orientation

Description. Two-spool, low-bypass-ratio, axial-flow, augmented/non-augmented aviation turbofan engine.

Sponsor. The Tay series was privately developed.

Power Class. The Tay spans the 13,850- to 15,100-lbst (60.9- to 66.4-kN) thrust range.

Status. In production.

Total Produced. Rolls-Royce and its licensees have built an estimated 3,056 Tay engines of all variants.

Application. Large business jet aircraft.

Price Range. Tay 611 estimated at \$5.1 million.

Rolls-Royce Tay



Rolls-Royce Tay

Source: Rolls-Royce

Contractors

Prime

Rolls-Royce Civil Aerospace	http://www.rolls-royce.com/products-and-services/civil-aerospace , PO Box 31, Derby, United Kingdom, Tel: + 44 1332 248688, Fax: + 44 1332 269540, Prime
------------------------------------	---

Subcontractor

Chromalloy France	http://www.chromalloy.com , Ave des Gros-Chevaux, Z.I. du Vert Galant, Saint-Ouen-l'Aumone, France, Tel: + 33 1 3440 3636, Fax: + 33 1 3421 9737, Email: info@chromalloy.fr (HP Blade)
Collins Aerospace Systems, Electric Systems	http://www.collinsaerospace.com , 4747 Harrison Ave, Rockford, IL 61108-7929 United States, Tel: + 1 (815) 226-6000 (Integrated Drive Generator)
Meggitt Control Systems	http://www.meggitt.com , Oscar House, Wharfdale Rd, Birmingham, United Kingdom, Tel: + 44 121 623 6000, Fax: + 44 121 623 6100 (Heat Exchanger)
PCC AETC Ltd	http://www.pccairfoils.com , Victoria Ave, Yeadon, Leeds, United Kingdom, Tel: + 44 8700 666060, Fax: + 44 2113 2103006 (Machined Fan Blade)
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 & Lead)
VT San Antonio Aerospace	http://vt-saa.com , 9800 John Saunders Rd, San Antonio, TX 78216 United States, Tel: + 1 (210) 293-2661, Fax: + 1 (210) 293-2638 (Thrust Reverser)

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

Rolls-Royce Tay**Technical Data****Design Features.**

Fan. Four-stage IP compressor and 48-inch (1.219mm) fan.

HP Compressor. Features a 12-stage HP compressor with steel disc-type rotor bolted to the shaft.

Combustor. Ten straight-flow burners are housed in a steel annular casing, each with a single duplex nozzle and Nimonic flame tube.

Turbines. Two-stage LP and two-stage HP turbine arrangement.

Accessories. Two gearboxes provide drives for accessories. Left-side unit, driven from the LP shaft, drives the LP governor and tachometer. The HP rotor drives the right-side gearbox, which carries the LP and HP fuel pumps.

Applications. The following are the current or proposed applications for the Rolls-Royce Tay.

Engine Variant	Thrust Rating	Application	Units per Airframe
Tay 610	12,420 lbst (55.2 kN)	Gulfstream IV (early models; production completed)	2
Tay 611	12,420 lbst (55.2 kN)	Gulfstream IV (production completed)	2
Tay 611-8C	13,850 lbst (61.6 kN)	Gulfstream G350/450 (production completed)	2
Tay 620	13,850 lbst (61.6 kN)	Fokker 100 (early models; production completed)	2
	12,500 lbst (55.0 kN)	Fokker 70 (production completed)	2
Tay 650/651	15,100 lbst (66.4 kN) (Takeoff thrust ratings)	Fokker 100 (production completed)	2

Dimensions.

	Metric Units	U.S. Units
Length	2,405 mm	94.7 in
Diameter, fan tip		
Tay 610/611/620	1,117 mm	44.0 in
Tay 650	1,138 mm	44.8 in
Weight range, basic engine		
Tay 610/611/620/650	1,476-1,628 kg	3,255-3,590 lb

Variants/Upgrades

Tay 610. The base variant. Incorporates a single-stage fan, a three-stage low-pressure compressor, a 12-stage high-pressure compressor, 10 cannular combustion chambers, a two-stage high-pressure turbine, and a three-stage low-pressure turbine. Thrust rating is 12,420 lbst (55.1 kN) at both maximum continuous and takeoff at sea level at 99°F/37°C.

Tay 620. The Tay 620 has the same basic configuration as the Tay 610, but with a higher mass flow and turbine entry temperature (TET). Takeoff and maximum continuous static thrust are increased to 13,475 lbst (59.8 kN) and 13,850 lbst (61.6 kN), respectively, at sea level, flat-rated to 86°F (30°C) ambient temperature.

Tay 611. The Tay 611 has the same basic configuration as the Tay 610, and runs at the same continuous thrust (12,420 lbst/55.2 kN), but increases to

the 13,850-lbst (61.6-kN) takeoff rating of the Tay 620 at sea level. A Tay 611-8B variant has a modified gearing arrangement in the gearbox for a higher output generator. The Tay 611-8C was developed to power the G350 and G450.

Tay 650. The Tay 650 is similar to the Tay 620, but incorporates a slightly larger-diameter fan, combustor section improvements, and new high-pressure turbine blades and vanes. Compared with the Tay 610, thrust is 9 percent greater in maximum takeoff and maximum continuous climb and cruise. A Tay 650-14 variant has the same accessory gearbox and fan air extraction system as the Tay 610 and Tay 611 models. The Tay 650-15 is generally the same as the Tay 650-14, but has a slightly increased-diameter fan, improved combustors, and new high-temperature turbine blades and vanes. The Tay 651 variant is a modification of the Tay 650 for the Dee Howard/Boeing 727-100 QF (Quiet

Rolls-Royce Tay

Freighter) installation. Gearbox changes were made to suit this application, and the engines were altered to accept a Dee Howard thrust reverser on the side-mount engines and a Dee Howard jet pipe on the center engine.

Tay 670. While the 610/611/620/650 variants feature a three-stage IP compressor, the Tay 670 design had a four-stage unit. Other changes included a larger-diameter fan (moved forward), a larger

intermediate casing with new mount positions, a new gearbox, a larger structural bypass duct, cooled HP2 blades, and a new mounting structure to suit McDD DC-9 and other installations. The Tay 670 was not launched, as the re-engining programs for this engine never moved forward.

Program Review

The Tay is an advanced derivative of the Mk 555 Spey that incorporates technology from the RB211-535E4 program. It received a new 3.04:1 to 3.18:1 ratio bypass fan with wide-chord, snubberless blades; a new three- or four-stage LP or IP compressor; a low-loss bypass duct derived from the RB211-535E4; and an advanced-technology three-stage LP turbine. The engine was designed for low noise generation and high fuel efficiency, while maintaining the high reliability of the -555 by retaining that variant's high-pressure compressor and turbine sections.

Applications. Out-of-production applications include the Gulfstream IV and IV-SP, which used the Tay 611. The Fokker 70 used the Tay 620, and the Fokker 100

initially used the Tay 620 and later the Tay 650 when it needed more thrust. The Tay 650 was also used on a few Boeing 727-derived freighters in the early 1990s.

The Gulfstream G350/450 models were the most recent applications for the Tay engine; of the two, only the G450 remains in production. Incorporating a 12-inch (30.5-cm) stretch compared to the GIV/G400, it uses Tay 611-8C engines.

In August 2004, the Gulfstream G450 received type certification from the FAA. Three months later, the G350 received its type certification as well. The first G450 entered service in May 2005, and the first G350 followed suit one month later.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1959	RB163 Spey design initiated
Jan	1962	First flight of Hawker Siddeley Trident with the Spey
Jul	1964	Spey certificated for Trident
Dec	1982	Rolls-Royce launches Tay program
Mar	1983	Gulfstream orders 200 Tays for GIV
Nov	1983	Fokker launches the Model 100, orders 100 Tays
Aug	1985	Delivery of first preproduction Tay to Gulfstream
Jun	1986	Tay 610 and 620 certificated in U.S.
Oct	1988	Initial deliveries of Tay 650 for Fokker 100
May	1994	500th Tay engine installed
Apr	1995	Tay 650 low-emissions combustor receives CAA certificate
Oct	2002	1,000th Tay engine delivered to Gulfstream Aerospace
Apr	2003	First flight of 611-8C-powered G450
Aug	2004	FAA certification of G450
Nov	2004	FAA certification of G350
May	2005	Service entry of Gulfstream G450
Jun	2005	Service entry of Gulfstream G350
	2013	G350 no longer marketed
	2018	Final G450 delivered

Rolls-Royce Tay

Forecast Rationale

Gulfstream terminated production of the G450 in 2018, leaving the Roll-Royce Tay without an application in production. The replacement for the G450 in Gulfstream's business jet line, the all new G500, is powered by Pratt & Whitney PW800 engines and will not provide a new application for the Tay.

The advent of the G500 always meant that demand for Tay engines would dry up. We assume that Rolls-Royce delivered the last Tay engine in 2018.

* * *