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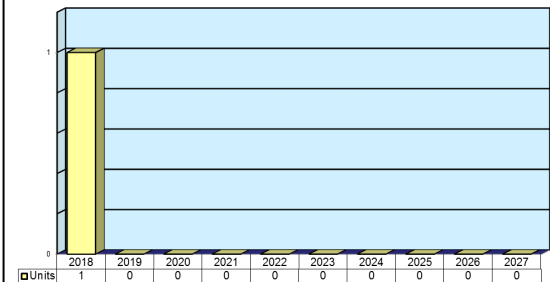
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Gulfstream G450

Outlook

- The final G450 delivery occurred in January 2018
- The all-new G500 has replaced the G450 in the Gulfstream product line

Unit Production Forecast 2018-2027



Orientation

Description. Twin-turboprop-powered, intercontinental-range, corporate/executive transport aircraft.

Sponsor. Gulfstream Aerospace Corp.

Status. Gulfstream delivered the final G450 in January 2018.

Total Produced. Gulfstream produced 354 G450s over the life of the program. The company had also

built 256 GIIIs, 206 GIIIs, 537 GIV/G300/G400s, and 11 G350s.

Application. Transcontinental and intercontinental executive/corporate transportation.

Price Range. G450, estimated at \$38.9 million in 2016 U.S. dollars.



Gulfstream G450

Source: Flexjet

Gulfstream G450**Contractors****Prime**

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Subcontractor

Honeywell Aerospace, Aviation & Air Transport	http://www.honeywell.com , 21111 N 19th Ave, Phoenix, AZ 85027 United States, Tel: + 1 (602) 436-2311 (Primus Epic Avionics System)
IWG Technologies Inc	http://www.iwgtech.com , Unit One, 3771 N Fraser Way, Burnaby, British Columbia, Canada, Tel: + 1 (604) 255-5555, Fax: + 1 (604) 255-5685 (NPS-A6 Water Treatment Unit)
Rolls-Royce plc	http://www.rolls-royce.com , 65 Buckingham Gate, London, United Kingdom, Tel: + 44 20 7222 9020, Fax: + 44 20 7227 9170 (Tay Mk 611-8C Turbofan Engine)
Triumph Aerospace Structures	http://www.triumphgroup.com , 1801 SE Airport Rd, Stuart, FL 34996 United States, Tel: + 1 (772) 220-5301 (Nacelle System)
Triumph Aerospace Structures	http://www.triumphgroup.com , 1431 Vultee Blvd, Nashville, TN 37217 United States, Tel: + 1 (615) 361-2000 (Wing)

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**(G450)**

Design Features. The G450 was a cantilever low-wing monoplane with a cantilever T-tail, retractable tricycle type landing gear with twin wheels on each unit, and the Gulfstream PlaneView cockpit. The G450 wing, manufactured by Triumph, was constructed of aluminum. It had aluminum honeycomb winglets,

aluminum ailerons, and single-slotted Fowler flaps; three spoilers were on each wing. The vertical and horizontal stabilizers were swept and incorporated a single rudder and trim tab, and elevators and trim tabs, respectively.

Dimensions

Length
Height
Wingspan
Cabin length
Cabin width
Cabin height
Cabin volume

Metric

27.23 m
7.67 m
23.72 m
12.29 m
2.24 m
1.88 m
43.2 cu m

U.S.

89.33 ft
25.17 ft
77.83 ft
40.33 ft
7.33 ft
6.17 ft
1,525 cu ft

Weight

Basic operating weight
Maximum takeoff weight
Maximum landing weight
Maximum zero-fuel weight
Maximum payload

19,505 kg
33,838 kg
29,937 kg
22,226 kg
2,722 kg

43,000 lb
74,600 lb
66,000 lb
49,000 lb
6,000 lb

Gulfstream G450

	<u>Metric</u>	<u>U.S.</u>
Performance		
Mmo	Mach 0.88	Mach 0.88
Takeoff distance (SL, ISA, MTOW)	1,707 m	5,600 ft
Maximum cruise altitude	13,716 m	45,000 ft
Range at Mach 0.80 with eight pax, three crew, and NBAA IFR reserves	8,056 km	4,350 nm

Propulsion

G450 (2) Rolls-Royce Tay Mk 611-8C turbofan engines rated 61.6 kN (13,850 lbf) each.

Seating

G450: Typical configuration was for 12-16 passengers (19 maximum), plus crew of two or three and a cabin attendant.

Variants/Upgrades

GII. The Gulfstream II (GII) business jet was launched by Grumman American in the mid-1960s, with initial deliveries occurring in 1967. A total of 256 were built through 1979, after which the production line in Savannah, Georgia, switched to the improved Gulfstream III (GIII).

GIIB. In 1979, newly independent Gulfstream began marketing a retrofit of the GII, utilizing the wing of the GIII, called the Gulfstream IIB (GIIB). Forty ultimately were converted, beginning in March 1981. Gulfstream eventually terminated the program when the company found that many GIIB customers were also candidates for the new GIII.

GIII. First conceived by Grumman American, the GIII was relaunched by Gulfstream in the spring of 1978. This much-improved version of the GII was built through 1986, and was a true intercontinental-range aircraft, with a maximum IFR capability of more than 3,500 nautical miles. Its new wing incorporated drag-reducing winglets, while the fuselage was stretched 0.6 meters (2.0 ft), giving a total cabin length of 12.6 meters (41.3 ft). A total of 206 IIIs were built through 1986.

The IIIs that have been operated by the U.S. Air Force are called C-20A/Bs. In June 1983, Gulfstream was awarded a \$3.2 million contract by the Air Force covering the lease of three IIIs, designated C-20As, which replaced the service's aging fleet of Lockheed C-140Bs in the Special Air Missions role. These aircraft were delivered in 1983, and USAF later purchased them outright. All three were retired in 2002.

The Air Force purchased eight additional IIIs, designated C-20Bs, in 1986 and took delivery of them in 1987. The B models differ from the C-20As in that they feature a modified interior layout and a new

mission communications system. Three C-20Bs remain in active service.

The SRA-1 was a military version of the GIII. It was marketed for reconnaissance, anti-submarine warfare (ASW), and maritime patrol. Gulfstream rolled out the SRA-1 in 1984. The aircraft had a long-range cruise speed of Mach 0.77 and an IFR range of 6,485 kilometers (3,500 nm).

GIIC. The Gulfstream IIC (GIIC) was a proposed re-winged version of the GII using the airfoil from the Gulfstream IV and either new Rolls-Royce Tay turbofan engines or Rolls-Royce/Quiet Nacelle-developed hushkits for the GII's existing Spey engines. The GIIC would have had a maximum takeoff weight of 31,843 kilograms (70,200 lb) and a range of about 4,000 nautical miles.

GIV/G400. The Tay-powered Gulfstream IV (GIV) first flew in 1985 and was certificated in April 1987. GIVs delivered beginning in late 1992 were designated GIV-SP and had increased maximum takeoff weight (33,838 kg/74,600 lb) and maximum landing weight (29,937 kg/66,000 lb). The GIV-SP had new landing gear and modifications to the empennage and wing. In 2002, Gulfstream renamed the GIV-SP, giving it the designation G400.

In 1994, Gulfstream began marketing the Gulfstream IV-MPA (Multipurpose Aircraft). This derivative featured an optional cargo door as well as quick-change capabilities for passenger, cargo, or combination configurations.

GIVs operated by the U.S. military are called C-20F/G/Hs. The U.S. Army procured one C-20F, the U.S. Navy and the U.S. Marine Corps bought five C-20Gs, and USAF purchased two C-20Hs. The C-20G is a quick-change passenger/cargo transport.

Gulfstream G450

Gulfstream developed a military version of the GIV called the SRA-4. A number of mission configurations for this aircraft were available, including electronic warfare support, medical evacuation, ASW, maritime patrol, reconnaissance, and priority cargo transport.

G300. The G300 was derived from the G400. The two aircraft had the same airframe, wing, Rolls-Royce Tay Mk 611-8 engines, and Honeywell SPZ-8400 avionics.

Customization was not available for the G300 as it was for the G400. This meant that most optional equipment for the G300 was sold only as part of already-defined option packages.

The U.S. Federal Aviation Administration (FAA) granted certification to the G300 in January 2003. Initial delivery of a G300, to charter operator Royal Jet, occurred in August 2003.

GIVB. In March 1985, Gulfstream announced that it was studying a stretched GIV seating 24-26 passengers, prompted by interest from two U.S. airlines. The aircraft was called the Gulfstream IVB (GIVB). For this model, the GIV fuselage would have incorporated a 3.7-meter (12.3-ft) extension forward of the wing, as well as a 1.9-meter (6.1-ft) plug aft. The GIVB would have been powered by a pair of Tay engines, and would have had a range at Mach 0.80 of 6,670 kilometers (3,600 nm). Projected maximum takeoff weight was 35,517 kilograms (78,300 lb). This GIVB concept never entered development, and neither did an all-cargo version of the aircraft. The latter featured a 6,804-kilogram (15,000-lb) payload capacity, 63.15 cubic meters (2,230 cu ft) of cargo space, and a high-speed range of 5,559 kilometers (3,000 nm).

In late 1994, Gulfstream and Textron Aerostructures began studying a longer-range version of the GIV. This new variant, which assumed the GIVB designation, would have had a range of 4,450 nautical miles. Compared to the GIV-SP, the GIVB would have had an increased-span wing combined with winglets from the Gulfstream V. The longer wing of the GIVB would have allowed space for additional fuel. The span increase would have been achieved through the use of wingtip extensions.

In June 1995, Gulfstream decided to put development of the GIVB on hold. This decision followed a study that indicated that the market did not place a high value on the 5 to 7 percent range increase that the GIVB would have provided over the GIV-SP. Potential customers advised Gulfstream to continue producing the GIV-SP. The company did continue to evaluate the market for the GIVB, but never launched the model.

The GIVB would have replaced the GIV-SP on the Gulfstream assembly line.

G450. The G450 was announced by Gulfstream in October 2003. It combined the nose section of the G550 with the wing and tail unit of the G400 and a stretched (by 30.5 cm/12 in) G400 fuselage tube. The G450 also included a pair of 13,850-lb-st Rolls-Royce Tay Mk 611-8C engines, a Honeywell 36-150GIV auxiliary power unit (APU), and, as found on the G550, a PlaneView cockpit. The latter included the Honeywell Primus Epic avionics suite.

In green configuration, the G450 weighed 500 pounds less than the G400. This was achieved primarily through the use of lightweight composite nacelles from Vought and single-pivot thrust reversers from Nordam.

Gulfstream secretly began development of the G450 in 2001. Four G450 development aircraft were built, the first of which made its initial flight in April 2003. FAA type certification was awarded in August 2004, and was followed by European Aviation Safety Agency (EASA) type certification in November 2004. Service entry occurred in May 2005.

Range of the G450 with eight passengers, three crew, and NBAA IFR reserves was 4,350 nautical miles, an increase of 250 nautical miles over that of the G400.

G350. Gulfstream introduced the G350 in February 2004. It was a reduced-specification, shorter-range, less expensive version of the G450. The G350 was similar in design to the G450, and had the same airframe, wing, physical dimensions, flight control systems, APU, and cabin and baggage area volume. As was the G450, the G350 was equipped with Rolls-Royce Tay Mk 611-8C engines and the PlaneView cockpit. The two aircraft also shared numerous other systems, including electrical power and environmental control systems.

The G350 had a maximum takeoff weight of 32,160 kilograms (70,900 lb) and a maximum payload of 2,858 kilograms (6,300 lb).

FAA certification of the G350 was received in November 2004. Service entry occurred in June 2005.

The G350 had a range with eight passengers, three crew, and NBAA IFR reserves of 3,800 nautical miles.

G350 customers could choose among six floor plans for their aircraft. Interior customization was not available on the G350, though it was on the G450. In addition, the G350, unlike the G450, did not have as standard equipment the Gulfstream/Kollsman Enhanced Vision System II (EVS II), the Rockwell Collins Head-Up Display II (HUD II), and certain in-cabin electronic and communications systems. The EVS II and HUD II were available as options on the G350.

Gulfstream G450**Program Review**

Background. Production of Grumman American's Gulfstream II (GII) business jet ended in 1979. It was replaced in the product line by the stretched, new-winged, longer-range GIII. GIII production continued until 1986, when it in turn was replaced by the Tay-powered GIV.

The GII had the ability to cross the continental United States nonstop, in both directions, at all times of the year. It also had a stand-up, widebody cabin. The GIII extended the reach of the basic Gulfstream to become a true intercontinental-range, twin-engine business jet, capable of more than 3,500 nautical miles with eight passengers. The GIV featured a 4,000+ nautical-mile range, new avionics, and the flexibility to perform short- and medium-range missions in a cost-effective manner.

Gulfstream III Development. The initial concept for the GIII, intended to be a successor to the GII, was announced in 1976 by Grumman. However, Grumman canceled this program in May 1977.

In early 1978, after Grumman sold its Savannah-based American division to Allen Paulson, a new GIII proposal was announced. Compared to the GII, this model featured a 0.6-meter (2.0-ft) fuselage stretch, a wrap-around windshield, an increased-span wing, Whitcomb winglets, and a longer, more streamlined nose.

The GIII prototype, a converted GII, first flew in December 1979. The GIII was granted type certification by the U.S. Federal Aviation Administration (FAA) in September 1980; deliveries began immediately thereafter. Included in Gulfstream's order book were three aircraft for the Royal Danish Air Force. These had a 1.6 x 2.11 meter (5.25 x 6.92 ft) cargo door and a floor roller system, enabling a configuration change in two hours. The Danes used the aircraft for maritime surveillance, search-and-rescue, and general support duties.

Gulfstream IV. In the late 1970s and early 1980s, Rolls-Royce studied various improvements to the Spey turbofan engine that was used aboard the GIII and the Fokker F.28. Ultimately, a new design was selected, incorporating the proven core of the Spey Junior, along with a new fan and low-pressure turbine from the RB211-535E4. In March 1983, Gulfstream placed an order for 200 Rolls-Royce Tay engines as it launched its GIV project. As compared with the GIII, the new aircraft provided a 15 percent improvement in fuel burn, incorporated a 0.6-meter (2.0-ft) fuselage stretch, and

featured a sixth cabin window on either side of the fuselage.

The GIV utilized "brake-by-wire," a term used to describe an anti-skid system developed by Goodyear Aerospace. The system used electrically transmitted braking signals from the pilot. Other major changes to the GIV included the use of Honeywell variable-speed constant-frequency generators, a Honeywell electronic flight instrumentation system (EFIS) based on the SPZ-8000 family of digital electronics, an integrated 3,000-psi hydraulic system for primary and secondary flight controls and utility functions, and a "steer-by-wire" steering system by Dowty. Finally, the fuel system was simplified by going to a single tank per wing from two in the GIII. This eliminated sealing at Station 145, reduced pilot workload, and simplified fuel venting.

The first GIV flight occurred in September 1985, with initial production deliveries taking place in September 1986 after receipt of provisional certification. Full certification was granted by the FAA in April 1987. At that time, Gulfstream possessed an order book of more than 110 aircraft, worth \$2.0 billion.

GIV Improvements. After certification, Gulfstream developed a number of improvements for the original GIV. A Phase II upgrade package added auto throttles, total FMS, VNAV, Cat II landing capability, and a Honeywell windshear system. Phase III was announced in 1991 and incorporated a number of airframe improvements that greatly enhanced range/payload. This version of the aircraft was designated GIV-SP. It included the use of a new HUD, a digital flight data recorder, satcom, a Mode S transponder, Honeywell lightning sensors, MLS, GPS, and three electric generators.

GIV-SP Becomes G400

New Name. Gulfstream renamed the GIV-SP the G400 in September 2002, one of several changes and revisions that the company made to its product line at that time. The reduced-specification G300 was also introduced at the time.

The last Gulfstream aircraft to carry the old GIV designation was rolled out in December 2002. This aircraft was the 500th in the GIV series. The rollout also marked the start of production of the G400 and G300. Production of these two models was terminated in 2004 in favor of the new G350 and G450.

Gulfstream G450

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
May	1965	GII announced
Oct	1966	GII first flight
Oct	1967	GII certificated
Dec	1967	Initial GII deliveries
Dec	1979	GIII first flight
Sep	1980	GIII certification and initial deliveries
Sep	1985	First flight of GIV
Sep	1986	Provisional certification and initial deliveries of GIV
Apr	1987	GIV fully certificated
Jan	2003	G300 certification
Apr	2003	First flight of G450
Aug	2003	Initial G300 delivery
Aug	2004	FAA certification of G450
Nov	2004	FAA certification of G350
May	2005	Service entry of G450
Jan	2018	Final delivery of G450

Forecast Rationale

Gulfstream had said in the fall of 2016 that it intended to end production of the G450 as it prepared for service entry of the new G500. The final delivery of a G450 occurred in mid-January 2018, to the U.S. firm Dominion Energy Services.

The clean-sheet G500 is scheduled for service entry in 2018. Gulfstream's launch of this new aircraft in

essentially the same market niche as the G450 meant that the days became numbered for the older model. Had Gulfstream chosen to keep the G450 in production, the two aircraft would have competed for many of the same customers, with most opting for the newer, larger, longer-range G500.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Total
Gulfstream Aerospace Corp												
G450 <> Tay MK 611 -8C												
	353	1	0	0	0	0	0	0	0	0	0	1
Total	353	1	0	0	0	0	0	0	0	0	0	1