



Gulfstream IVSP

Operators laud dispatch reliability, operational flexibility and passenger comfort.

This is the G-IV that delivers on Gulfstream's original mid-1980s promises.

When Gulfstream Aerospace announced the Gulfstream IV in the early 1980s, the firm promised the third-generation Gulfstream business jet would have the most advanced technology of any business aircraft yet built. The G-IV also promised to have the most operational flexibility and offer passengers the most comfortable cabin of any Gulfstream yet built. Just as importantly, it would offer historical Gulfstream dispatch reliability.

Plainly put, the early G-IV turned out to be a mixed success. To its credit, the aircraft's passengers were coddled in a spacious cabin with virtually unmatched low noise levels. The G-IV's maximum range performance allowed it to fly nonstop from most European airports to the

By Fred George

Photography by Paul Brou

United States. Its more fuel efficient Rolls-Royce Tay 611 turbofans endowed the G-IV with low FAR Part 36 noise levels, making it a welcome airport visitor.

However, operators felt shortchanged on range/payload flexibility. The original G-IV had a 2,200-pound greater BOW than a G-III, but it retained the G-III's 58,500-pound maximum landing weight (MLW). Compared to the G-III, this reduced the G-IV's range after landing without refueling.

And many of the G-IV's systems proved to be trouble-prone and expensive to repair, particularly the electrical, brake-

by-wire and avionics systems. To remedy these problems, Gulfstream upgraded the G-IV to the G-IVSP (Special Performance) configuration in 1992, starting at serial number 1214. The G-IVSP was equipped with more-reliable components, a 7,500-pound increase in MLW and 2,500 pounds more maximum zero fuel weight, and it was fitted with more-robust brakes. The SP promised to deliver on all the promises that Gulfstream made for the original aircraft.

B/CA interviewed operators of more than 40 aircraft, starting with serial number 1214 delivered in 1992 and going up to serial number 1383 delivered in March 2000, to find out how well the G-IVSP performs in everyday service. Here's what they told us.

Best Features

The G-IVSP is an aircraft that delivers on its promises, according to operators. They cited dispatch reliability as one of the aircraft's best traits. The operators said this results from the nearly flawless performance of the Rolls-Royce Tay 611-8 turbofan engines, sufficient systems redundancy and a comprehensive Minimum Equipment List that provides dispatch flexibility with inoperative equipment.

"It's been a wonderful airplane. It never breaks, knock on wood," commented Duane Rice, chief pilot for Fort Lauderdale, Fla.-based Southern Aircraft Services.

"It's the best overall [large cabin business] airplane on the market today," claimed Dick Chartrain, JCPenney's chief pilot.

"It's too perfect. The G-IVSP comes right out of the factory and runs and runs and runs," lauded John Messina, president and chief pilot of Burbank-based Avjet Corp., an aircraft management and charter company.

"Our passengers love the airplane. It represents home and security to them when they're traveling overseas," explained another operator regarding the G-IVSP's dispatch reliability.

Virtually gone are the problems with the Bendix AC power converters, devices that convert the 115 VAC, variable frequency output of the AC generators into 115 VAC, 400 Hz power for use by the aircraft's systems, operators said. On the G-IVSP, Gulfstream replaced the technically sophisticated brake-by-wire system with a conventional hydro-mechanical analog braking system, resulting in almost maintenance-free operation. In addition, the more-robust Dunlop carbon-carbon wheel brakes reduce stopping distances by 13 percent and they last longer, making them less expensive to maintain than the original G-IV wheel brakes.

The Honeywell SPZ-8000 boxes fitted to early G-IVSP aircraft and the upgraded SPZ-8400 avionics on serial number 1253 and subsequent aircraft are highly reliable, including the DU880 EFIS tubes.

Operators also praised the G-IVSP for operating flexibility. Many said they routinely tanker fuel, taking advantage of low fuel prices at certain airports or allowing them to tap into their own fuel farms for many work-a-day roundtrips. After a stopover at max landing weight, for example, an unrefueled G-IVSP can fly more than 3,000 miles and land with NBAA IFR reserves, according to Jeppesen DataPlan.

Multiple leg trips without refueling also are a strong suit of the aircraft. For example, a G-IVSP with eight passengers can



The G-IVSP's 66,000-pound max landing weight is made possible by more-robust rolling stock and wheel brakes, plus recalibrated main landing-gear strut damping.

depart from White Plains, N.Y., fly to Chicago Palwaukee, then Kansas City International, then Washington National and back to White Plains on one tank of fuel, according to Jeppesen DataPlan. That's emblematic of the 53-percent better range/payload flexibility than that offered by the original G-IV.

Excellent runway, climb and cruise performance, long a virtue of Gulfstream aircraft, often were mentioned by operators. With the G-IVSP's sporty 2.69 weight-to-thrust ratio (the best in class), operators

feel comfortable operating out of 5,000-foot runways on most trips, then being able to climb directly in the low forties and cruise at 0.80 to 0.83 Mach. According to the *B/CA Purchase Planning Handbook*, a G-IVSP with four passengers on board needs only 3,500 feet of runway for takeoff on a 1,000-nm trip. Its landing distance, with four passengers and NBAA IFR fuel reserves, is less than 2,700 feet.

Many operators also like the G-IVSP's handling qualities, although they are accompanied by relatively heavy control forces. Crosswind handling characteristics received praise by some operators because of the generous yaw control authority provided by the large rudder.

Cockpit automation is another of the aircraft's virtues. Most all the flying chores are handled by the Honeywell integrated avionics, except for takeoff and landing. Pilots report they use the onboard performance computer to calculate runway performance, proper thrust settings and optimum cruise performance. The auto-throttle system manages thrust adjustments from the beginning of the takeoff roll to shortly before landing flare. The versatile and powerful FMS provides automatic lateral and vertical flight guidance for most phases of flight, including three-dimensional guidance for published non-precision instrument approaches.

Operators said their passengers praise the G-IVSP for cabin comfort and low interior noise levels. "Our passengers like the cabin comfort and the interior layout," said John Skelton, chief pilot of The Southern Cos., expressing the feelings of



The Rolls-Royce Tay 611 engines received "A+" ratings from most operators, because of reliability and low maintenance requirements.

Operator Survey

many other operators contacted by B/CA. One reason is the 33.8-foot-long cabin, measured from the aft side of the radio racks to the rear lavatory/baggage compartment bulkhead. The G-IVSP, with the longest cabin in this business aircraft class, easily accommodates three seating areas, an aft galley and one or two lavatories.

Low cabin vibration and ambient noise levels also are appreciated by passengers. This results from the acoustical isolation of the Rolls-Royce Tay engines from the airframe and the 7,000-pound outfitting allowance made possible by the G-IVSP's 49,000-pound maximum zero fuel weight — 4,000 pounds more than the original G-IV. The relatively large outfitting allowance allows plenty of noise-deadening insulation to be installed during the completion process.

Moreover, operators frequently exceed the 7,000-pound allowance by 500 to 1,000 pounds, or more, by loading up their aircraft with optional avionics and airborne office systems, with little impact on everyday range/payload flexibility. The U.S. Air Force, for example, loaded its USAF/Gulfstream C-20 aircraft with extra communications gear and other equipment, boosting the BOW to 45,600 pounds.

Shortcomings

While operators weren't shy about praising the G-IVSP, they didn't hesitate to point out its shortcomings. "The metal work isn't as good as it was on our G-II and G-III aircraft," one operator commented. "While our G-IVSP was still green, we saw uneven rivet patterns, rip-



The G-IVSP has a 7,500-pound max landing weight increase, compared to the original G-IV, enabling operators to tanker less-expensive fuel for multiple leg trips.

pled skin sections and fasteners of different sizes," Gary Sanders of Gannett noted.

Many operators said that the cockpit was cramped. "We surely could use an extra 12 inches of legroom, like pilots have in the G-V," Ed Boyken, chief pilot for Meridian, Miss.-based Peavey Electronics, told B/CA, echoing the comments of others. Several operators also said that the pilot seats were uncomfortable on long trips, no doubt in part due to the perceived lack of legroom. And some operators remarked there was insufficient chart and navigation publication room on the



Operators said the SPZ-8000 avionics package (SPZ-8400 for serial number 1253 and subsequent) was quite reliable and capable. As shown in this photo, few opted to install the optional Honeywell-GEC Marconi HUD 2020.

flight deck. (Gulfstream officials point out that the IPECO crew seats are available with a variety of seat cushions that can make them fit individual pilots better than the standard cushions.)

Gulfstream's traditional avionics racks located in the vestibule are the main reason that the cockpit is cramped. However, there is little room to relocate the avionics boxes under the floor because of wiring harnesses, control linkages and ducts, according to Preston Henne, Gulfstream's senior vice president, programs.

A new generation of more-compact avionics boxes might result in smaller avionics racks in the G-IVSP, thereby freeing up room for a longer cockpit, according to Henne. Gulfstream has no plans to change the current avionics configuration.

How Operators Use Their Aircraft

While the G-IVSP has a tanks-full, MTOW range of more than 4,000 miles, few operators use this capability routinely. The average trip is about two to two and one-half hours, according to operators. The average stage length is 700 to 1,000 miles. Most operators say they climb directly to FL 410 and cruise at 0.80 Mach on such trips. However, the average fuel burn varies from 3,000 pph to 3,600 pph because of ATC restrictions. A few operators said they cruise at 0.83 Mach on most trips, resulting in average fuel burns of about 3,800 pph.

These reports are consistent with computer-generated flight plans from Jeppesen DataPlan. On an 851-mile trip from Kansas City International to Washington National, for example, Jeppesen DataPlan predicted a two hour 14 minute en route time and a total fuel burn of 7,023 pounds, assuming standard day, no wind conditions and a cruise altitude of FL 410. On this representative trip, the fuel burn averages 3,144 pph, if there are no ground or inflight delays.

Start-up to shutdown fuel flows can be considerably higher in the real-world operating environment. One operator, who tracks fuel use carefully, told B/CA that his fleet of G-IVSP aircraft on two-hour missions averages 4,127 pph, including APU use, ground delays, long taxi runs and frequent low altitude, off-course vectors.

On their longest trips, operators said they felt comfortable flying the G-IVSP 3,800 to 4,000 miles under no wind conditions. Some said they would fly as far as 4,200 miles, or more, if the weather is clear at the destination and there are several, suitable, VFR, nearby alternate landing



Passengers say that the comfortable, quiet cabin is one of the G-IVSP's five best features. Gulfstream Aerospace, which completed all but a few aircraft in B/CA's Operator Survey, generally received good marks for craftsmanship. Company officials say quality has improved in recent months.

facilities. For long overwater flights, though, few said they would stretch the range beyond 3,500 miles because of the paucity of suitable divert fields while en route and when approaching the destination airport.

On long flights, operators said their aircraft climb to an initial cruise altitude of FL 370 to FL 410, depending upon takeoff weight and temperature aloft. For example, FL 370 to FL 390 is a typical initial cruise altitude on an ISA+10°C day, depending upon takeoff weight, according to operators. If the temperature aloft approaches ISA+20°C, the G-IVSP's initial cruise altitude is FL 330 to 350 when departing at MTOW, according to Jeppesen DataPlan.

Some operators who frequently fly over the North Atlantic, where temperatures aloft are typically 15°C above standard, said their aircraft could use more high-altitude cruise thrust. Operators, though, who fly closer to the equator on their longest range trips, had no such complaints, mainly because the temperatures aloft in low latitudes are closer to standard day, or below. Temperature aloft also has an impact on fuel burn and maximum range performance. Each 10 degrees above standard reduces the G-IVSP's maximum range by 120 miles, according to the G-IVSP cruise control manual.

On the long-range trips flown at 0.80 Mach in near standard day conditions, the G-IVSP burns 4,100 pph during the first hour, 3,100 pph during the second and third hours, 2,800 pounds for the fourth and fifth hours, and 2,500 pph thereafter, according to the cruise control manual.

Operators, though, reported somewhat higher fuel flows because of ATC delays and higher than standard temperatures aloft, characteristic of the stratosphere at high latitudes. Gulfstream officials noted that it's important to fly the aircraft according to true airspeed, not indicated Mach number, to squeeze out maximum range performance on warm days.

Cabin Furnishings

The interior configuration of the G-IVSP is anything but cookie-cutter standard. Most interior layouts, though, have 12 to 14 seats arranged in three seating groups with an aft galley and aft lavatory, adjoin-

ing the full-width, pressurized baggage compartment, which is accessible inflight. Virtually all G-IVSP aircraft in B/CA's survey were completed at one of Gulfstream's facilities. About half of the aircraft, according to operators, have forward and aft lavatories, enabling the crew to have access to the forward lav without disturbing the passengers on long flights.

A number of operators said they have one or two dedicated work stations in the cabin, complete with airborne office equipment. Most operators said their aircraft are equipped with both MagnaStar air-to-ground radio-telephones and Honeywell/Marconi satcom systems.

Operators said their average load is four to six passengers. Only a few said they routinely take advantage of the 12- to 14-passenger seating capacity. One exception is San Antonio-based USAA. Bill Hodde, the firm's chief pilot, said USAA's G-IVSP carries an average of 11 passengers. Hodde also mentioned that the firm appreciates the G-IVSP's 66,000-pound MLW, thus allowing the firm to tanker fuel for roundtrips and reduce operating expense.

Increased Production Rates, Quality Control and Support Capacity

Most G-IVSP operators are long-time Gulfstream operators, essentially members of an extended family who are quite loyal to the marque. While they are impressed with Gulfstream's aura of quality, some said, though, the metal work of their aircraft wasn't up to traditional Gulfstream standards.

Gulfstream officials weren't reluctant to own up to these concerns. "I'm not sur-



Cabin configurations vary, but almost all have three seating areas, with an aft galley and aft lavatory. About half of the operators said their aircraft have a second, forward crew lavatory.



It's a chore to load heavy items through the high baggage door, according to operators.

prised at that [criticism]," Henne said candidly. "We did have a situation three to four years ago when we ramped up production rates." Production rates were being increased from 48 to 70 aircraft per year during that period. "We had to go through a lot of training of new people. On more recent serial numbers, the quality [of our metal work] has improved considerably," he claimed.

Henne's candor was echoed by Joe Lombardo, senior vice president, operations. Increased production strained the capacity of Gulfstream's work force in Savannah. Moreover, skilled technicians in Georgia were offered a chance to relocate to one of three facilities newly acquired by Gulfstream from K-C Aviation. Some Savannah workers moved to Appleton, Wis., Dallas and Westfield, Mass., to help ease the transition and boost completion center capacity.

For the increase in production, new workers were recruited at all facilities, according to Gulfstream officials, younger workers that didn't necessarily understand Gulfstream's traditional quality standards. "The mindset of a younger work force tends to change [regarding standards of quality]. Three years ago, we didn't do as much advanced metal work training as we should have.

Now, though, the expertise and experience of our work force has gone up dramatically because of our training programs," Lombardo explained.

Just as importantly, according to Lombardo, workers now accompany buyers of new aircraft during walk-through inspections, learning what prospective operators expect in terms of metal work,

cabinet finishing and exterior paint quality. Lombardo also said that Gulfstream is installing computer-controlled machines to automate parts of the manufacturing process, thereby reducing variability in the manufacturing process.

After-sales support also is an issue for some operators. They remarked that spare parts were scarce at satellite locations, especially the former K-C Aviation facilities. "That registers with me," said Larry Flynn, the firm's senior vice president, aircraft services. In response to operator concerns, Gulfstream asked customers to identify parts they needed most frequently and beefed up parts inventories at satellite facilities. As a result, for example, the Dallas facility received a \$6 million infusion of spares, according to Flynn.

To support international operations, Gulfstream increased the number of service locations from four to 13, with three times the number of parts and twice the inventory value, according to Flynn.

"Our main focus is on AOG [aircraft on ground] support. With our customers; we've identified the top 10 AOG parts for each Gulfstream model and we've stocked up our inventories. We're also encouraging our customers to stock those parts in their own hangars." Flynn explained.

A perceived lack of experience and expertise on the part of Gulfstream's maintenance technicians also was expressed by operators. "We had a large turnover in 1999 at our Savannah facility as people moved to posted jobs at our Appleton, Dallas and Westfield facilities. We've put in place a significant amount of training to get our service levels back up," Flynn responded. "Our focus has been to get new

people up to speed as fast as we can."

Gulfstream has improved its service center performance in recent months, according to some operators.

Some operators also perceived that fractional ownership operators were given priority at Gulfstream service facilities, thereby draining away resources available to traditional customers. "That's absolutely, positively false," Flynn countered. "We have dedicated separate parts of our service hangars and assigned separate maintenance crews to those airplanes."

Most operators thought Gulfstream's field technical representatives did a good to excellent job. We heard few complaints. On the East coast, James Albright, Rich Petelenz and John Roe, for example, earned unsolicited kudos.

Report Card and Gulfstream's Responses

When asked to grade their G-IVSP aircraft in detail, most operators awarded their aircraft "A" for excellent or "B" for good in all categories. Few operators had anything but praise for the G-IVSP's Rolls-Royce Tay 611-8 engines. Some noted the engines seemed to lack in high-altitude performance on warm days. "That's the price you pay for high bypass ratio engines," one operator noted.

Most operators said the Honeywell GTC36-100G APU worked fine, but some reported starting problems. Gulfstream recently enhanced the APU with an improved ignition system that should solve that shortcoming. A few operators said the APU, on hot days, doesn't supply enough bleed air for rapid engine starting or cabin cooling. However, the GTV36-100G

also was used on the G-III with few complaints.

The APU's inflight operating envelope recently was reduced from FL 410 to FL 350 because of inconsistent operation at high altitude and electrical load shedding limitations. There are no plans to modify the APU to increase its operating envelope back to FL 410.

Operators gave high marks to the Honeywell SPZ-8000 integrated avionics system, upgraded to the SPZ-8400 configuration at serial number 1253. They said the EFIS system is versatile and reliable. Many, though, thought that the FMS was difficult to master and had insufficient database capacity, particularly the FMZ-920 that came as part of the SPZ package on serial number 1252 and earlier aircraft. The FMZ-2000, the standard FMS with the SPZ-8400, has more computer power and a larger main memory.

Honeywell responded to training issues by offering a full-feature PC FMS training program on CD-ROM. The training program comes with a full Jeppesen database that can be updated by means of an Internet link.

Regarding FMZ-2000 memory capacity, version 5.X hardware and software provides enough capacity to store all airports in the worldwide database with runways longer than 2,000 feet. The latest FMS version also has a Pentium processor that operates several times faster than the FMZ-920 fitted to SPZ-8000 systems. In addition, the main memory of the latest FMZ-2000 can be doubled when the need arises.

Many operators said they fitted Honeywell (nee AlliedSignal) enhanced GPWS to their aircraft. The system works fine, but the dim display on the EFIS needs improvement, operators said. Very few operators fitted their aircraft with the optional Honeywell/Marconi HUD 2020 system.

Several operators remarked that the Honeywell/Racal satcom doesn't measure up to performance expectations. The problem appears to be related to the early Racal antenna systems, units that since have been upgraded. In addition, insiders say the satcom's software needs to be improved to interface with the onboard communications management more smoothly.

The AC electrical power system received high marks, with most operators awarding the system an "A" or "B" rating. The Honeywell AC power converters are much more reliable than they were on early G-IV aircraft. Henne commented that the converters are four times more



Some operators said that moisture intrusion into the main door seal was an ongoing problem.

reliable, according to Gulfstream records. Some operators, though, say the converters still need refinement before they offer bulletproof reliability.

Most operators said the air-conditioning system works well, but we also heard complaints regarding difficulty in modulating cabin temperature and audible changes in airflow as the system adjusts to the thermostat setting. Some operators said keeping the temperature sensors clean helps. Gulfstream officials said most problems were confined to early serial number G-IVSP aircraft. The firm is eyeing a three-zone upgrade to the system, similar to that on the G-V, but the program is only a concept for now.

More than a few operators said pilots have some trouble in modulating the action of the Dunlop wheel brakes. Henne responded that thorough washing of the wheel brake assemblies appears to ease the problem, but no one told B/CA it was a cure-all. The carbon-carbon brakes have

considerably more effectiveness when warm, thus causing a difference in brake feel from when they are cold, according to factory flight test pilots.

B/CA received isolated reports of moisture intrusion in the 17- to 19-psi bleed air routed to the door seal, potentially causing freezing problems at altitude. Gulfstream advises frequent purging of the system to prevent moisture contamination.

Many operators said the G-IVSP is expensive to maintain and that part prices are too high. Gulfstream officials agreed with the operators. Customer focus groups helped Flynn identify 250 frequently replaced parts on which Gulfstream lowered the price. In addition, Gulfstream offers a nose-to-tail, fixed hourly rate ServiceCare program that largely eliminates unforeseen maintenance expense.

Gulfstream also is implementing an MSG-3 inspection program that will become standard at serial number 1400 and is available for earlier aircraft. This will reduce inspection cost by 20 to 40 percent, according to Flynn.

Would They Buy Another G-IVSP?

G-IVSP customer loyalty appears to be unsurpassed, judging from operator responses. "It's the best overall airplane on the market today," Steve West, chief pilot for Huntsman Chemical, offered.

"Operators have a sense of partnership with Gulfstream. The firm has excellent communications and doesn't try to hide dirty laundry," JCPenney's Chartrain said.

"Passengers love it. We've had it on the line three years with 100-percent dispatch reliability," Bill Douglas of Anadarko Petroleum stated.

But, given the opportunity to reflect on the original design, some operators also said they wish the fuselage cross section was wider and the cockpit roomier. More than a few thought the V speeds are relatively high, baggage loading is a chore and that the engine oil servicing is difficult. And some pilots said the G-IVSP needed better high-altitude performance and a 4,500-plus-mile maximum range.

On balance, though, virtually no B/CA Operator Surveys generated more positive responses than the G-IVSP report. "We love this airplane," said TAG Aviation's Tim Dold. "Nothing else in this category even comes close," commented Ray Abel of Van Nuys, Calif.-based Petersen Aviation. Those viewpoints apparently are shared by more than 200 present and future G-IVSP operators, with plenty of order backlog to continue the trend. **B/CA**

Operating Expenses

Hourly Operating Cost

Fuel (452 gph x \$2.35/gallon)	\$1,062.20
Maintenance, Labor	309.43
Maintenance, Parts	327.21
Engine, JSSI Complete	143.39
Miscellaneous Trip Expense	343.19
Total	\$2,185.42

Source: Aviation Research Group/US, Cincinnati