A strategically positioned GV mural is one of the first things passengers see when arriving at the SAV terminal.

The Gulfstream V

Evaluating the first long-range corporate jet.

WHEN Gulfstream invited Pro Pilot *to test fly the GV we wanted the best pilot we could find to do the job. Someone who was familiar with earlier Gulfstream series aircraft and who'd be able to look beyond the boxes, avionics and individual systems to give* Pro Pilot *readers an intuitive overview of the world's first 6500-nm business jet.*

What would this airplane be like to fly, maintain and operate compared with other business jets and what differences would flightcrews notice over the GIV? It didn't take the Pro Pilot *staff long to realize that there was no one better qualified for the task than Clay Lacy—founder of Clay Lacy Aviation and a true pilot's pilot.*

Since starting out as a United Airlines DC-3 first officer in the early 1950s, Clay has built up over 45,000 flying hours in a variety of corporate and airline transport equipment. He acquired his first business jet, a Learjet 24, in 1968 and he has maintained a stable of these sprightly twinjets ever since.

Clay's been flying Gulfstreams for several years and bought his own GIISP in 1992. Today Clay manages and charters Allen Paulson's GIV, a GIII and two GIIs as part of a 17-plane fleet at Clay Lacy Aviation VNY (Van Nuys CA). In addition to charter, Clay's aerial photography business has conducted over 2500 air-to-air photography flights.

Clay spent the day in Savannah on Monday, March 31, 1997 with Gulfstream Chief Customer Engineer Ed Flinn, Product Support Mgr Jim Dempsey, Dir Flight Ops Ed Mendenhall and Chief Test Pilot Randy Gaston before climbing into the Gulfstream V simulator in preparation for a flight the next morning in the left seat of Gulfstream's latest corporate offering.

Photos by Jack Sykes

Gulfstream Chief Customer Engineer Ed Flinn explains some of the finer points of the GV to Clay Lacy.

By Clay Lacy
ATP/CFII/FE/Helo/Sea. Gulfstream II/III/IV, Learjet series, Boeing 747 and 25 miscellaneous type ratings.

IT was perfect flying weather when I met up with Randy Gaston at 9 am on April 1 at SAV (Savannah GA). After a 10-min preflight briefing, we walked out to s/n 504, a green Gulfstream V with some test equipment in the cabin and a large ice detection unit fitted on the top of the fuselage.

Photo courtesy Gulfstream

At 90,500 lbs MTOW, the 6500-nm Gulfstream V (above) will cruise comfortably at up to FL510 for 14 hrs at a stretch. (Inset) Clay Lacy (L) and Randy Gaston (R) put the GV through its paces off the coast of Georgia.

Photo by Jack Sykes

Gulfstream's GV simulator at SAV (above) features state-of-the-art daylight visuals. Clay Lacy and Randy Gaston (right) put in an hour of simulator time prior to departing aboard GV s/n 504.

Gulfstream's flight-test people had everything ready for us, including positioning the FMS. We gave our passengers, *Pro Pilot* Publisher Murray Smith and Art Director Jack Sykes, a quick safety briefing before I climbed into the left seat and Randy got in the right. We went through an abbreviated flight-test checklist, put the performance figures in the FMS and set V_1 and V_2 speeds manually.

The BMW Rolls-Royce BR710 engines took a little longer to come up to speed than the Tays do on a GIV, but they accelerated nice and smoothly with very low temperatures during start. At our taxi weight of 56,800 lbs, which included 7000 lbs of fuel, we were light enough that we hardly had to add power to move out from the blocks. In order not to ride the brakes as we taxied out to Rwy 36, it was necessary to put both engines into idle/reverse at times to control speed.

My impression on taxi, from beginning to end, was that the nosewheel steering works extremely well—it's smooth and as nice a system as I've experienced on any aircraft. I was equally impressed with the brakes—they were not touchy, didn't grab and required very little pedal pressure to make them work.

Takeoff and climb

After the tower cleared us for takeoff, I pushed the throttles to the stop and the BR710 FADEC fuel controls took care of everything automatically. At our takeoff gross weight of 56,500 lbs, we rotated at a V_1 speed of 114 kts with 20° of flaps and accelerated to a V_2 of 125 kts. After takeoff, Randy raised the gear and flaps while I hand-flew the aircraft to 15,000 ft with 1-min level-offs at both 3000 ft and 10,000 ft. We were then cleared direct to FL450 within an offshore restricted area.

The climb schedule we used was the same as for a GIV—250 kts to 10,000 ft, then 300 kts until a Mach .78 climb that had us at FL450 in just under 17 mins. I estimate that, without those three level-offs, we could have made a straight climb up to FL450 in about 14 mins. After stabilizing at 45,000 ft with a cruise speed of Mach .80, fuel flows steadied out at about 1170 lbs per side. However, without a 3-ft-long ice detector test unit mounted on our upper fuselage, fuel burn would have been somewhat lower.

Randy Gaston (L) and Clay Lacy (R) wrap up a quick preflight briefing prior to departure from Gulfstream's customer delivery center.

Yanking and banking

After a few minutes at cruise, we did some 45° bank turns at FL450. The aircraft felt so solid that I would have thought we were at 10,000 ft. Randy suggested trying 60°, 2G turns, and at Mach .78 we experienced only minor Mach buffeting, proving the wide margin between low- and high-speed buffet. Randy mentioned that even at FL510, one can bank to 55° with only minimal Mach buffet.

We then headed down to 12,500 ft at Mach .80 with engines at idle. During the descent I deployed the spoilers rapidly two or three times and noticed very little pitch change. Putting the spoilers out at normal rate, I didn't notice a change in pitch. Once we were down to 12,500 ft, we slowed the aircraft to 250 kts and selected 10° flaps, added 20° of flaps at 190 kts and put the gear down at 154 kts and full flaps.

We did 45° bank turns at 125 kts to check low-speed maneuverability and then reduced power in a 1 kt/sec deceleration to stick shaker and stick pusher, which occurred at 98 kts and 88 kts, respectively, with our weight of about 53,500 lbs. The stick push-

er is quite strong—it definitely puts the nose down—but you can overpower it if you need to.

Inside details

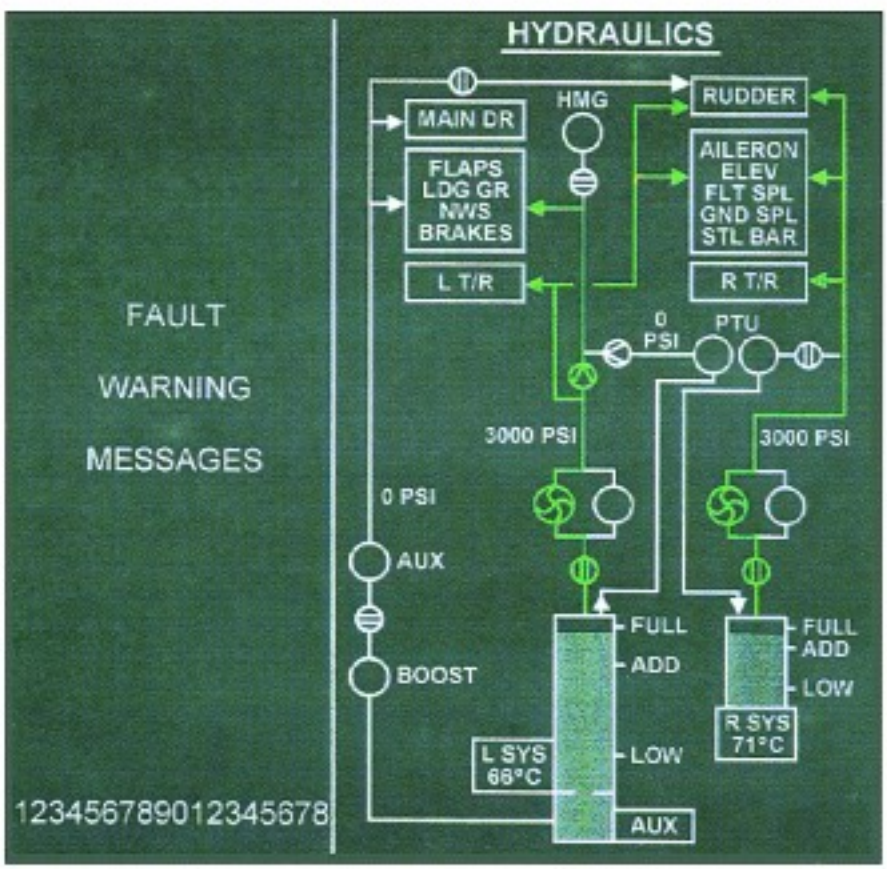
As far as avionics are concerned, the GV, like the GIV, continues to set the pace for corporate aviation. One thing I liked that I had not seen before was the low-speed awareness cue. This is a little bar that comes up on the airspeed indicator to show you where your shaker is. It enables you to monitor precisely how close you're getting to the point of shaker. This should be a very worthwhile feature if you're in stall recovery trying to get maximum performance. If you're coming out of a stall and have lost altitude, you would be able to fly the aircraft right to the edge of the awareness cue resulting in a minimum loss of altitude. I also thought the flightpath angle cue was a nice feature.

Happy landings

As we approached the Georgia coastline, we cleaned the aircraft up and accelerated to 250 kts on a vector back to SAV. Our first approach followed the ILS to Rwy 36 at a V_{ref} speed of 125 kts and a gross weight of 52,000 lbs. The wind was moderately gusty—15 kts from 320° with gusts up to 26 kts. As in the GIV, you need to close throttles early to reduce ground effect float, so we brought both engines to idle as we approached the end of the runway, touching down at 108 kts. I used full reverse at Randy's suggestion, and it was very easy to turn off the runway early with just moderate braking.

We then taxied back and repositioned the flaps and trim for a quick closed pattern with a climbing turn to the left and level-off at 1500 ft. I held our downwind heading awhile for a departing Delta B727 and, this time, Randy suggested an approach at 1.3 V_{so}, which worked out to be 115 kts. The GV, like the GIV, has a tendency to float if held off. Our touchdown was about 98 kts using only idle reverse and minimal braking, which had us at a speed of under 10 kts as we approached a taxiway that was 3000 ft from our touchdown point. I found the airplane to have very good short-field landing characteristics. We had 3100 lbs of fuel remaining after our 1:10 flight.

Clay Lacy (L) looks on as Randy Gaston (R) explains the GV's simplified overhead panel.

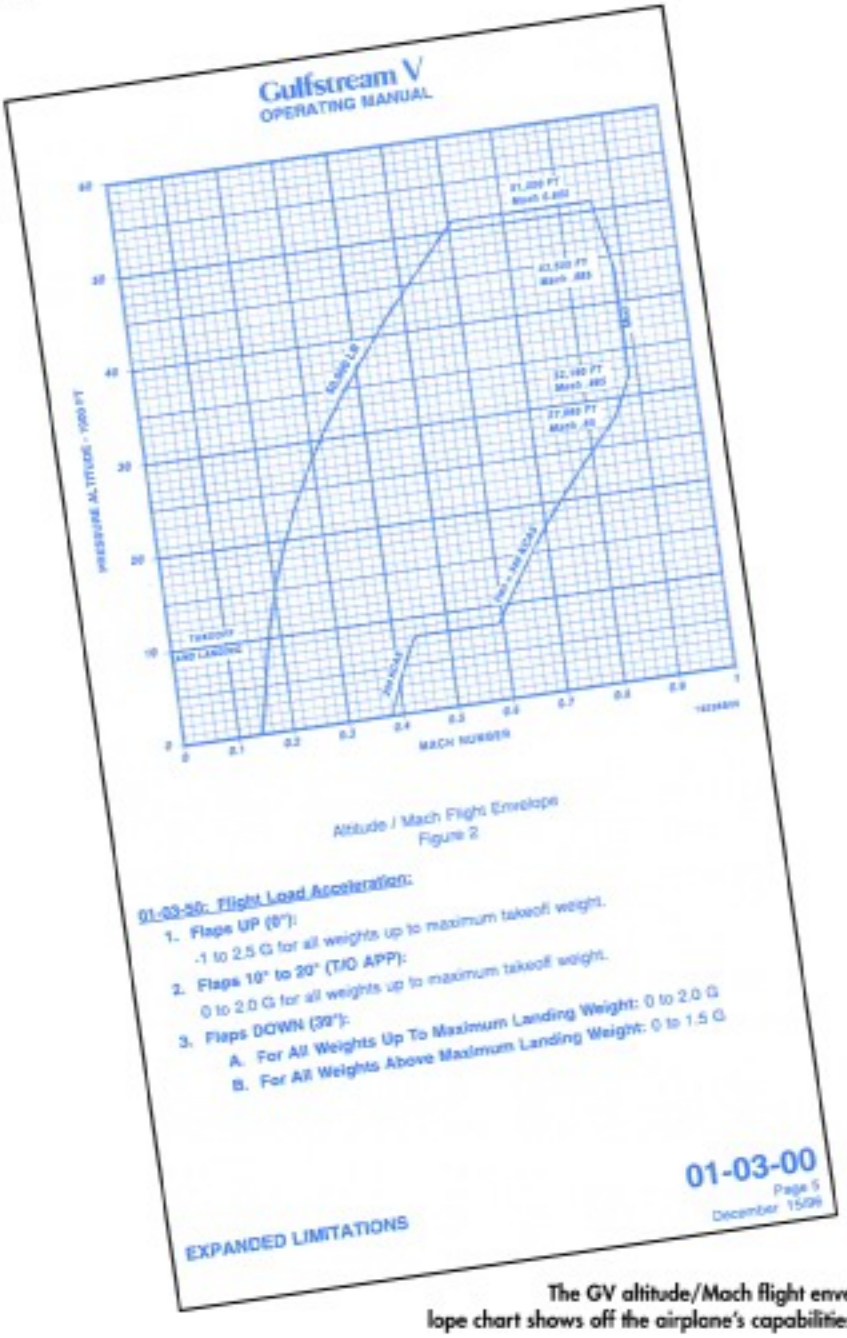


The new EICAS system on the GV displays schematics of all systems. Above, the hydralic system diagram is displayed on a MFD.

Coming home

On taxi back to the factory, I was again impressed with the smoothness of the nosewheel steering and the brakes, which will be a real plus for passengers riding in this airplane. It should be easy for pilots to taxi the GV in such a way that passengers will hardly be aware that the aircraft is moving. On the taxi in, we started up the AlliedSignal RE 220 APU, which works exactly like the GIV system,

Clay Lacy and Randy Gaston (above) first shoot the ILS Rwy 36 approach into SAV with a V_{ref} of 125 kts.



Altitude / Mach Flight Envelope
Figure 2

The GV altitude/Mach flight envelope chart shows off the airplane's capabilities.

although more air capacity is required to start the BMW Rolls-Royce BR710 turbines.

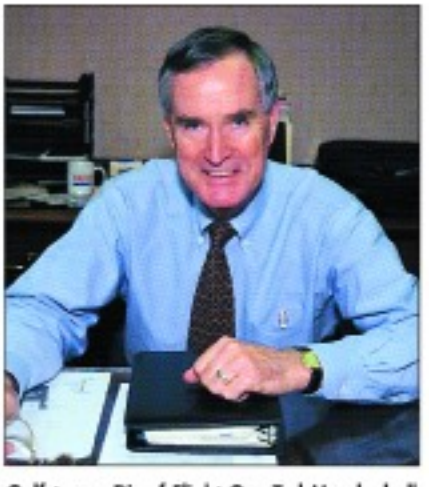
Similarities

The entire flightdeck of the GV looks very familiar to that of the GIV, but there are fewer switches on the overhead panel and the electrical system has been greatly simplified.

Hydraulic systems seem really foolproof on the GV—everything happens automatically. You have two engine-driven pumps on each engine—any one of which will power all systems—plus the same GIV-type electric aux pump for nosewheel steering, flaps and gear. The left-side systems run the landing gear, flaps, nosewheel steering, brakes and flight controls while the right side powers flight controls and ground spoilers.

The fuel shutoff switches are different from previous Gulfstreams in that they are electric and similar to those found on the Boeing 747-400 and other aircraft with FADEC fuel controls.

The GV stabilizer is electrically indexed to flap position rather than mechanically as on the other turbofan-powered Gulfstreams. Another new feature designed into the GV is independent control of elevators and ailerons. In the unlikely event you have a jammed control surface, the other elevator or aileron can still be controlled with the flight control interlink disconnected. Each pilot position controls one elevator or aileron



Gulfstream Dir of Flight Ops Ted Mendenhall coordinates GV flight test programs with a team of nine pilots.

The GV flightdeck features a Honeywell SPZ-8500 panel and a triple-wide pedestal (L). A spacious 16-passenger layout is a typical completion format (upper R). Quiet BMW Rolls-Royce BR710 turbofans provide 14,750 lbs of thrust per side (lower R).

Gulfstream GV Specifications

Price	
Basic equipped ($MIL US)	$36
Powerplants (2)	BMW/Rolls-Royce BR710 turbofans
Total power output	14,750 lbs static (SL,ISA) each
Dimensions	
Wingspan (ft)	93.50
Length	96.42
Height	25.83
Cabin length	50.08
Width	7.33
Height	6.17
Volume (cu ft)	1669
Normal seating	
Short-range crew/pax	2/16
Long-range crew/pax	4/8

Figures supplied by Gulfstream Aerospace.

Weights and loading	
MTOW (lbs)	90,500
Zero fuel weight	54,500
Operating empty weight	48,000
Max payload	6500
Max fuel (lbs)	41,300
Performance	
T/O SL/ISA @MTOW (BFL in ft)	5990
Max rate climb (fpm) all engines	4188
one engine out	805
Certificated ceiling (ft)	51,000
Pressurization Delta P	10.17
Normal cruise (KTAS)	459
@ altitude (ISA)	41,000
Fuel flow (lb/hr total)	3261
Range (nm) NBAA IFR	6500
M_{MO}	.87
V_{SO}	95
V_{MO}	499

The flight test aircraft, s/n 504 (above), was fitted with a water droplet measuring device used for icing tests.

A new winglet design for the GV (far left) features a wider-curve transition from wing to winglet and offers improved performance. Pilots should be particularly impressed with the smoothness of the GV's nosewheel steering system (left).

surface; however this does not apply to rudder control.

Provisional certification has set min V_{ref} speed at 125 kts for weights below 68,000 lbs until autopilot and autothrottle testing is completed. At a landing weight of 50,000 lbs 1.3 Vso is 105 kts but this is limited by the inflight minimum control speed of 112 kts.

The transition from the GIV to the GV should be a very simple process. In fact, I'm really surprised that the GV requires a separate type rating. I feel that, for qualified GIV pilots, a three-day differences school, with one or two simulator rides, would be sufficient. Any crew familiar with the GIV will find this aircraft a simple transition and they'll feel at home almost immediately.

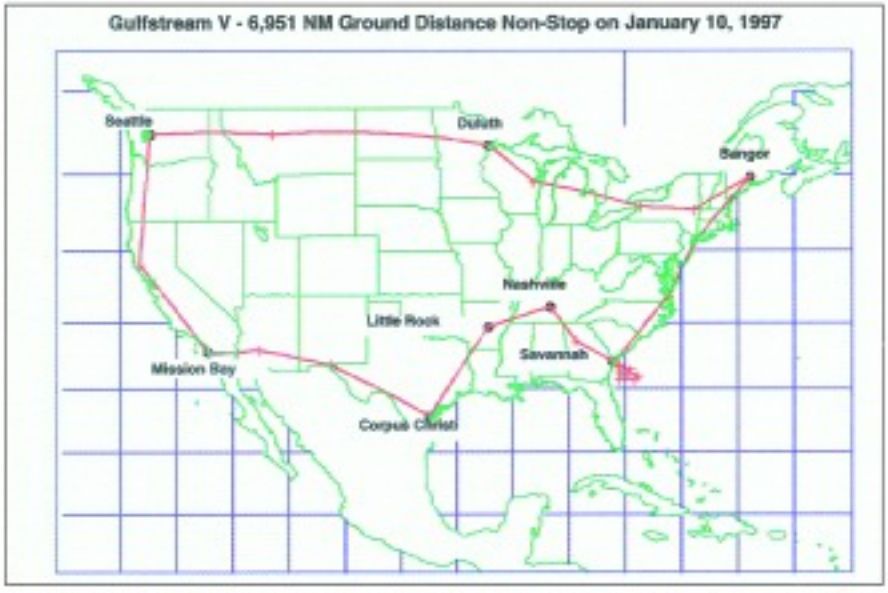
In summary, I would say the GV has kept all the best characteristics of previous models—good handling, great power to weight ratio and excellent high-altitude performance. But the new airplane also features many improvements and much simplification that I'm sure any pilot will find a real delight to fly.

Maintenance considerations

One thing I was particularly interested in learning on this visit was how Gulfstream has addressed maintenance and inspection requirements on the new GV. Clay Lacy Aviation operates GIIs, GIIIs and a GIV and calendar-based requirements can be quite onerous when compared to transport category aircraft such as the B727 and DC-9. If you want to go off on a long trip, it often requires all sorts of work up-front just so you don't get stuck with calendar inspections overseas. To learn more about these engineering aspects, I spent some time with GV Product Support Mgr Jim Dempsey.

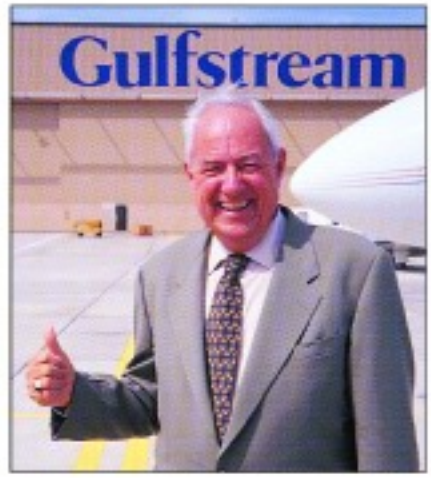
We talked a little about the maintenance steering group (MSG-3) program for the GV. The A check on the GV is at 450 hrs while the B check comes at 12 months compared to 150 hrs and 9 months respectively on the IV. Zone inspections have been increased from 18-month intervals on the IV to 48- to 96-month requirements on the V. All this will be a real plus for people going on long trips who don't want to have to do maintenance while they're gone.

Dempsey advised us that MSG-3 is going to be applied to the GIV family of aircraft as well, which will be welcomed by GIV operators. They'll start work on the GIV MSG-3 program next year with a goal of having the same inspection intervals on both the GV and the GIV. Unfortunately there are not yet any plans in place for this same program for GIIs and IIIs.



On January 10, 1997, a Gulfstream V accomplished a 6971-nm circle-USA flight in 14:48, landing with 2500-lbs of fuel.

Above, after a rigorous 1:10 test flight in the GV, Clay (L) gives his impressions of the spirited, high-performance corporate transport to Gulfstream Aircraft President and COO Bill Boisture (R). Clay gives a thumbs-up after his first GV flight (R).



Reduced workload

With noticeable improvements in reduced overhead switching and simplified electrical and hydraulic systems, there are fewer action items in both normal and abnormal procedures. This results in the crew having more time to monitor aircraft operations, thereby enhancing overall safety.

The real strong suit of the GV is its 6500-nm range, which Gulfstream demonstrated in January with a 14:44 flight that landed with 2500 lbs of fuel. It is obvious that Gulfstream is meeting, or exceeding, all guaranteed performance specifications.

One thing all flightcrews should like about the GV is the noticeably larger and more spacious flightdeck. The rear flightdeck bulkhead has been pushed back and seats track back an additional foot over the GIV. This is going to be beneficial for a couple of reasons. First, it makes the aircraft much easier to get in and out of. By moving the seat all the way back, you can easily step over just a corner of the triple-wide pedestal to get into the seat. The second real plus is that crew seats recline when needed, an important benefit on long-range flights.

There's an observer's seat that comes out from behind the pilot seat on the left side to the center of the aisle that fully reclines to give a three-person crew very useable sleep opportunities. On aircraft not outfitted with a crew bunk or rest station, this will be a welcome feature.

The GV 10.2 PSI cabin pressure, allowing a 6000-ft cabin pressure at FL510, will be another enhancement to comfort and alertness on long-haul operations.

Crews will have to be aware of the longer 93.5-ft wingspan on the GV when taxiing. When hangaring the airplane, you'll probably want to remind ramp personnel not to use the same centerline that they use for the GIV.

A refined airplane

If you're a GIV pilot, you will feel right at home in the GV, but you'll see noticeable refinements. New EICAS displays provide excellent systems awareness, allowing you to call up any system diagrams, from brakes to fuel, to let you see what's really hapening, Ground handling is excellent and the aircraft is easy to land. This airplane makes the pilot look good.

Passenger Comfort

THE GV offers an additional 7 ft of cabin length over the GIV and, with a 6700-lb interior outfitting allowance, many opportunities for cabin comfort are provided. Of the initial nine deliveries, all of which are in completion centers, over half are being fitted with crew rest areas, close to half are being configured with a forward galley and about one third will be delivered with onboard showers. First operational delivery of a GV will take place this month, and production is being increased to a combined total of 60 GIV/Vs per year. Current GV order backlog extends to late 1999 while GIV positions are sold out through late 1998.

A Honeywell/Gulfstream HUD 2020 head-up-display will soon be certified on the GV to augment the Honeywell SPZ-8500 avionics with anticipated approval for enhanced vision FLIR sensor inputs in the near future. Puritan-Bennett Aero Systems CCTV exterior camera systems are a standard option on the GV, which has been selected by close to half of the current customer base. Satcom, digital phone systems and onboard entertainment systems, complete with multiple-screen flat panel displays, are also routine GV completion requests. □

"I've been intrigued with aircraft since I was five years old and knew that I wanted to be a pilot about age seven. When I was 12, I started working at an airport—trading work time for flying time. In fact, I only worked one day in my life outside of aviation—it was in a grocery store and I lasted three hours. I feel lucky that I knew early what I wanted to do and was able to pursue it. I've had fun and I don't know what I would change. I've had the opportunity to meet really great people in aviation—that's the best part of it—and I've got to know a lot of good aircraft. I've hardly met an aircraft I didn't like."

—Clay Lacy