B/CA Comparison: Falcon 50B, Extended-Range Gulfstream II, JetStar II, LearStar 600

A new generation of long-range business jets is in the offing. Here's an advance look at how they stack up.

B/CA Staff Report

We have reached a point in the corporate jet business where the cost of developing an all-new product runs into the hundreds of millions of dollars. Starting from ground level to create a marketable airplane — nurturing the concept through engineering, R&D, flight-testing and finally certification — boggles the mind when cost is considered. For that reason there are few truly new business jets on the horizon; most of the equipment that will be offered to operators over the next five years will be refinements of existing aircraft updated to meet existing and future needs.

Except for the LearStar 600, all of the aircraft in this B/CA comparison are, to varying degrees, latest state-of-the-art versions of existing aircraft. The extended-range Gulfstream II changed the least, with the addition of tip tanks and some minor modifications to accommodate them. (See chart for a summary of those changes.) The second-generation JetStar was made possible primarily by switching to Garrett's newer-technology TFE 731 fan engines. The Falcon 50 will be created around the basic Falcon 20 cabin section, but it will have a third engine (the three will be Garrett's TFE 731s), a new wing and a huge aft baggage area in an extended fuselage. Altogether, these changes will make the Falcon 50 almost as much different from the 20 as the G-II is from the G-I.

Of the four airplanes in this group of big-cabin, intercontinental-range business jets, the largest question mark hangs over the LearStar 600. Bill Lear's capacity for making an impossible dream come true is legendary, but the dollars and the technology needed to develop an airplane in this class have grown enormously since Lear shoved the impossible aside a dozen years ago to develop the Lear 23. Nevertheless, a significant number of operators we've talked with say they're not ruling the 600 out of their long-range thinking, and vendors with engines, hydraulic components, avionics and whatnot to sell keep showing up at Lear's door in serious quest of business, so we're including the 600 here although it's many years away.

The data on the LearStar 600 used in this comparison is, of necessity, extremely preliminary. As we began putting these numbers together, there were still major questions about what engines will be used and what the basic purpose of the airplane will be. An engineer at Lear told us that the Lycoming ALF engines are now locked in, but that "they're more suitable for commuter operations than for an executive airplane."

Nevertheless, the 600 is being talked up as an executive transport and Garrett's engine salesmen keep running up to Reno in an effort to get Lear to commit to the ATF-3 engine, which Garrett now says it will place in production. Where this will end is your guess, but if Bill Lear can pull it off, the 600 will be as remarkable in the late '70s as the Lear Jet 23 and 24 were in the mid '60s.

Speeds and fuel flows of the 600 are predicated on Bill Lear achieving theoretical projections for supercritical airfoil technology. Weights, particularly the basic empty-to-useful load ratio (0.95), presume that the structural efficiency of airline-category jets can be attained in equipment weighing only 25 percent as much as current civil aircraft that have a ratio that close to one.

The 600 numbers we're showing here are for the executive version of the airplane. In addition, Lear is proposing a 29-passenger commuter 600 and a freighter version with a cargo capacity of 7279 pounds.

The original timetable for the airplane called for a first flight a year from now, followed by deliveries in late 1977. That will undoubtedly slip by a couple of years. If the airplane is certificated in time for Bill Lear's 76th birthday in June of 1978, a lot of well-wishers — B/CA included — will be surprised.

Falcon 50B

On a projected timetable similar to that of the LearStar 600 is the Falcon 50 from Dassault. It is rumored that in spite of a disappointing number of nonrefundable $50,000 deposits for the airplane by the July 1975 deadline, the French government is prepared to put up as much as $113 million for continued development of this three-engined business jet. Although the economics of the airplane for Dassault are staggering (they'll have to build 200 units and recover a million dollars in development costs on each one before beginning to show a profit), the airplane itself is relatively straightforward. The fuselage cross-section is a Falcon 20. Cabin size, therefore, is Falcon 20, but the center aisle has been lowered for increased headroom, and the addition of a 90cubic-foot, pressurized aft baggage area frees the cabin for a hot-foods serving area and a larger powder room. In the mockup we examined in Paris last spring the cockpit seemed larger, probably because the seats were the smaller Falcon 10 units, and with careful selection of avionics there was room for everything needed in intercontinental operations.

The question is whether a Falcon 50B will ever be built. Dassault progressed through the 50 and 50A designations before building a mockup. Now Garrett has announced it's going ahead with development of a TFE 731-4 engine of 4250 pounds thrust. The 50B is to have 3700-pound Dash 3 engines. With that power the 50 will be limited to three or four passengers with full fuel, and its first-step cruise will be FL370. If the 50B were to become the 50C with Dash 4 engines and a gross of, say, 38,000 pounds, it could fly eight passengers transatlantic, probably on the same fuel as the 50B, because the higher-powered airplane would have higher initial and final cruise altitudes. Operators tell us that kind of performance would cause them to take a harder look, so we expect Dassault's engineers are examining 731-4 specifics with keen interest.

That's conjecture, however. The 50B, as now proposed, will be a strong contender in the big-airplane market. It'll be fastest of the four airplanes in this group and will be capable of operating full-range off runways of less than 5,000 feet on cooler days and less than 6,000 feet on hot ones. It'll have the longest range of any of these four aircraft except the LearStar on those hop-and-pickup missions. In addition to a small payload with full fuel, its greatest weakness will be cabin size.

JetStar II

Closer at hand than either the LearStar 600 or the Falcon 50 is the JetStar II. In essence it's already flying in the form of the AiResearch 731 JetStar modification. (See B/CA, July 1975, page 58.) The recent announcement by Garrett that a go-ahead has been given on development of the TFE 7314 also brings up a question on powerplants for the JetStar II It's apparent that Lockheed is building greater strength into the structure of the new airplane through the use of newer-technology metals and heat-treat processes. Does that mean Lockheed engineers have been looking toward a higher gross weight?

Possibly with the present JetStar II weight situation, when the tanks are stuffed (they'll actually hold 400 to 500 pounds more fuel than Lockheed claims), the airplane is limited to four or five passengers on intercontinental trips. In addition, the JetStar II could use the extra power of the Dash 4 Garretts to improve its balanced field length. As it stands now, the airplane has the range to go White Plains to London nonstop when the winds are right, but if the HPN temperature is above 20°C, it runs into a runway length problem.

The major pluses of the JetStar II are the proven design and the four-engine safety. With improved systems and clean, quiet, modern engines, it's a known quantity, and it'll become available a couple of years before its head-to-head competitor, the Falcon 50.

Finally, the extended-range Gulfstream II. Of these four airplanes, it's the bird in the hand. Wind tunnel investigations of the effects of adding tip tanks have been completed, and the structural engineering is lacking only in minor details.

This comparison shows that the G-II will continue to be the ultimate airplane designed exclusively for business transportation. In range, payload with full tanks, maximum passenger capacity. Cabin room per-passenger, baggage volume per seat and pressurization differential, it's number one.

It's also number one in acquisition cost (but not in operating costs) and in the airport noise department.

Speaking of noise, we can observe a general trend developing. While the extended-range G-II is the noisiest of the group and, without operational modifications, does not comply with FAR Part 36, the remaining three fall within the EPA guidelines for noise.

Although no noise data is available for the Falcon 50B, it shouldn't be much noisier than the Lear 36 (which has similar engines) since the Falcon's third engine will be buried in the fuselage and will contribute only slightly to the decibels reaching the ground. The JetStar and LearStar 600 noise levels promise to be well within FAR Part 36 guidelines.

As is true of every comparison using purely objective numbers, this one must be used with your own subjective preferences out front. Although each manufacturer represented in this group has been trying for 10 years or more to create the perfect airplane, none has succeeded. But each has succeeded in designing an airplane that is perfect for a significant number of operators.

We must also caution you that this comparison is, for the most part, based on preliminary data. As development progresses, specifications and performances will be altered. In this class of airplane, the odds are that performances of delivered aircraft will tend to be better than the projections. The engineers of large jets are by nature conservative, and in this case there is also the possibility of improved powerplants becoming available earlier than was thought when the design goals were first laid down.

Finally, we must recognize the absence of Cessna's promised Citation 700 from this comparison. The reason is a total lack of data from Cessna. Russell Meyer, Cessna chairman, recently told a group of newsmen that the program is definitely going ahead. The airplane will offer airliner speeds and long range — but "the concept may be changed." If the 700 as it eventually evolves will do everything claimed for it earlier, but the concept is different, the natural supposition is that it'll be altered in configuration from the three-engined artist's drawing first shown eight months ago. With clean, high-bypass-ratio engines of 5,000 to 6,000 pounds now on the horizon — particularly the Pratt & Whitney and Rolls-Royce combine JT25D/R.B.401 — Cessna's three holer could turn out to be a twin or a 15,000-pound-thrust trijet with astounding performance. B/CA

Specifications and Performance

	Falcon 50	E.R. G-II	JetStar II	LearStar 600
Powerplant	(3) TFE-731-3(2) Spey 511-8(4)TFE-731-3(2)ALF-502D			
Takeoff thrust (lbs.)	11,000	22,800	14,800	13,000
Thrust to weight ratio	0.30	0.35	0.34	0.65
Seating	2+9	2+12	2+9	2+10
Cabin volume (cu. ft.)	700	1269	850	928
Cabin vol./seat (cu. ft.)	77.7	106.0	86.3	92.8
Baggage volume (lbs.)	90	148	customer option	93
Max cert. ceiling (ft.)	45,000	43,000	43,000	50,000
Max cabin pressure (PSI)	8.7	9.5	8.9	9.0
Weights (lbs.)				
Max ramp	36,596	66,000	44,000	23,500
Max takeoff	36,696	65,500	43,750	23,000
Max landing	34,854	58,500	36,000	23,000
Max zero fuel	22,597	42,000	27,000	18,000
Basic operating (typical)	20,445	36,700	24,593	11,819
Max fuel cap.	15,316	27,300	17,822	10,500
Payload w/max fuel	835	2,000	1,595	681
Max payload	2,152	5,300	2,407	6,181
Fuel w/max payload	13,999	24,000	17,000	5,000
Performance				
VMO/MMO	350/.85	367/.85	350/.82	360/.90
BFL (ISA) (ft.)	4500	5600	6200	3500
BFL (ISA+20) (ft.)	5585	6950	8040	4513
TAS (high speed) (kts.)	530	512	468	515
TAS (long range) (kts.)	470	410	442	430
Range (nm)				
Maximum	3,000	3,300	3,100	4,383
Pickup*	2,716	2,228	1,610	4,383

***After landing at max landing weight.**