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PILOT REPORT

Operator Survey: Learjet 31A

Owners and operators rave about the Learjet 31A's performance, but carp about cabin size and baggage access.

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Take a moment and open B/CA's May *1993 Planning & Purchasing Handbook*. One business aircraft—and only one—can depart at maximum takeoff weight from runways shorter than 3,300 feet on a sea-level, standard day, can initially climb in excess of 5,000 fpm and then level off at FL 450 in less than 24 minutes. That aircraft is the Learjet 31A.

There is no need, though, to accept our performance numbers on faith. When asked about their aircraft, Learjet 31A operators told us they routinely meet the performance numbers published in the *Learjet 31A Pilot's Manual* and eke out even better fuel efficiency.

The ingredients that make possible such performance are a classic blend. Combine a weight-to-thrust ratio (power loading) of 2.36 (which is better than any other current production business aircraft) with the lowest wing loading and lowest drag of any current production Learjet, and the result is spectacular climb performance. Add in the long-appreciated, high-altitude fuel miserliness of the AlliedSignal TFE731, and the result is fuel economy second only to the CitationJet among all certificated turbofan business aircraft.

Along with the Learjet 60, the Learjet 31A uses a "long horn" wing characterized by its winglets and the absence of tip tanks. Initially designed for the Learjet 28 and 29, the long horn wing series has superior aerodynamic performance compared with the older design Learjet 20- and 30-series wings fitted with tip tanks. Without tip tanks, though, it also carries much less total fuel.

The Learjet 31A's ability to climb directly to the mid- to high-forties' enables it to cruise almost 1,300 nm and land with NBAA IFR fuel reserves, even though all of its tanks hold only 4,124 pounds of fuel. At altitude, the Learjet 31A can top three miles per gallon while cruising at 424 knots true.

High performance and fuel economy, however, aren't the only qualities that won points with operators. They also praised the aircraft for its versatility, reliability, airframe systems and new AlliedSignal integrated avionics package.

Nearly unanimous praise was expressed for the Universal Navigation Systems UNS-1B, the, standard flight management system installed in the Learjet 31A. B/CA didn't specifically ask operators to comment on the FMS; they just volunteered to talk about it during our interviews.

OPERATOR PROFILE

Since deliveries of the Learjet 31A began in 1991, 37 aircraft have a been delivered to 31 customers, so the average age of the fleet is young, and its numbers are small-especially considering the relatively large numbers of 20-series and other 30-series Learjets in the business aircraft fleet. Those two factors have a strong influence on the outcome of our Learjet 31A operator survey.

Learjet 31A operators that responded to our survey fall into two categories. The first category consists of the more than half of the respondents who said the Learjet 31A is the largest and longest range aircraft they operate. Thus, their perspective on the airplane is geared toward the light jet class. If they currently operate anoth-

er aircraft, it is usually a piston twin or a small turboprop. For many of these operators, stepping up into the light jet class provides a quantum leap in range and mobility, but the cost of parts and maintenance for this class of aircraft takes some adjustment.

The second and smaller category of operators told us they also operate medium jet aircraft, such as Citation IIIs, Hawkers and Learjet 55s. The Learjet 31A is the smallest aircraft for these operators, and their responses reflect what might be termed a medium jet mentality toward the light jet class. These operators laud the Learjet 31A for its relative operating economy,but lament its compact passenger cabin and baggage volume.

When we asked both groups of operators about other aircraft they considered at the time they acquired the Learjet 31A, they most frequently said the closest competitor was the Citation V. That business jet is the Learjet 31A's closest competitor in certificated passenger seating capacity and runway performance capability.

Operators also told us they looked at the Citation II, Beechjet 400A, IAI 1125 Astra, Hawker 800 and Piaggio P180, among other aircraft with larger cabins than the Learjet 31A. Notably, one operator who had considered the P180 decided to disqualify it as a candidate because of the lack of a full capability simulator in the United States.

For almost all operators, the purchase decision came down to putting the highest priority on performance and fuel efficiency instead of cabin volume. They rate the aircraft's runway, climb rate and high cruise altitude performance, along with its reliability, fuel economy and AlliedSignal integrated avionics suite, as its best features. One operator commented, "It's a smaller version of a larger airplane, fitted with systems to which we've become accustomed in medium jets. It has [optional] three inverters, [optional] dual emergency batteries and powered nosewheel steering, among other features."

Most operators principally use the airplane for company transportation, but for many, customer transportation ranks a close second. One remarked, "My boss calls the airplane his sales battleship." More than a few operators confessed they bought the aircraft partly because of its impressive good looks.

Learjet 31A airplanes don't spend a lot of time resting on their chocks. A large number of operators fly their airplane 500 hours or more per year. A second, slightly smaller group flies 350 to 450 hours, and a few operators fly 300 hours or less per year.

TRIP PROFILES

Operators told us they carry three to four passengers on average, but a few load it with five to six for most of their trips. The average stage length is 350 to 450 nm, resulting in block times of 0.9 to 1.3 hours. Some operators, though, regularly use the aircraft for 250 to 300 nm because of its relatively high fuel efficiency even on short trips. On a 300-mile trip, the Learjet 31A burns 980 pounds, achieving fuel economy unmatched by any other business jet outside of the CitationJet.

The longest distance most operators say they would feel comfortable flying is 1,200 to 1,300 miles. One very experienced operator of Learjet fleets—now in its third generation of Learjet business aircraft—told us that its pilots would fly a maximum of 1,300 to 1,400 miles, reflecting full confidence in the factory performance numbers.

On 400-plus mile trips, Learjet 31A operators told B/CA they file for the mid-forties to take maximum advantage of the aircraft's fuel efficiency and to provide passengers with the smoothest ride. Even on shorter trips, operators said they file for the high thirties or low forties, using a classic up-then-down vertical profile to which Learjet 20-series operators became accustomed decades ago.

The relatively short trips flown by most operators account for their reported average fuel consumption of 1,300 to 1,400 pph—right in line with the factory fuel economy numbers. Some operators, though, claim they can beat the factory numbers for fuel efficiency, but they slow down to do it.

Learjet 31A direct operating costs are harder to measure. Almost all the airplanes are still within the two-year factory warranty period, resulting in reported operating costs of $725 to $860 per hour. Some operators who have their own fuel farms, or who have access to highly discounted fuel, report operating costs of $100 lower per hour.

In addition to the warranty coverage, the manufacturer's optional Total Learjet Coverage (TLC) program may be helping to hold down initial operating costs for Learjet 31A operators. For $5,000 per month, TLC pays for all maintenance costs-including both rotable and consumable parts-for a period of five years or 1,750 hours after delivery, whichever comes first.

TLC also includes a provision that allows operators to buy into AlliedSignal Engines' Maintenance Service Plan (MSP), a program that allows TFE731 engine operators to pay for maintenance by the hour at a discounted price at the end of the TLC coverage period.

PRODUCT SUPPORT AND MAINTENANCE

Product support ratings generally have been good to excellent, but not without exception. One of the most experienced Learjet operators remarked that the maintenance publications fall short of what is needed for in-depth troubleshooting, but that technical support from

the factory was excellent, although time-consuming (over the telephone). These comments were echoed by another operator who said the maintenance manuals "leave a lot to be desired."

A few operators also said the maintenance information concerning the AlliedSignal avionics suite was sparse. One added, "They repaired my box when I sent it to them, but they didn't tell what caused it to break." AlliedSignal responded that all components returned to the firm for repair are sent back with an explanation of the problem and the repairs that are made.

Early serial number aircraft suffered a relatively high number of EFIS tube failures, a malfunction that AlliedSignal (Olathe) has traced to a power supply problem. According to the firm, the EFIS power supply is going to be completely redesigned this year, and boxes returned to the firm for repairs automatically will receive the upgraded power supply.

Some early symbol generators suffered an unusually high failure rate, but reliability of these parts now has improved markedly, according to AlliedSignal.

The AlliedSignal RDS 80 series weather radars have also demonstrated less than sterling performance. Many boxes have been subject to "spoking" on the display-a problem that has been traced to feedback from the transmitter to the receiver. RDS 80 radars now incorporate Mod 4 (effective October 1990), a change that adds an isolator to the microwave assembly and solves this problem.

Some RDS 80 radars have also been plagued with Sensitivity Timing Control (STC) problems. Mod 6 (effective September 1992) tightens the tolerance for the STC curve, thereby almost eliminating the change in detected precipitation density that erroneously occurred with range changes.

(Editor's Note: AlliedSignal engineers point out that precipitation absorbed by a damaged radome or improper radome repairs can drastically alter its transmissivity [radar transparency] and the radar's performance index.)

Generally, the airframe and engines got high marks for reliability, but malfunctioning fuel tank float switches were a source of irritation to some operators. Learjet officials acknowledge that these components are not as reliable as they should be and, together with the float switch supplier, the company is developing an improved version.

A broad range of minor complaints were voiced about systems problems, but we detected no generalized pattern. Most of those other gripes seemed to be related to early production growing pains rather than definable manufacturing problems.

Most operators with whom we spoke use some form of computerized maintenance records program. The most frequently mentioned program is Camp Systems' Computerized Aircraft Maintenance Program (CAMP) probably because the Learjet 31A comes with a complimentary one-year subscription to CAMP.

Long-time CAMP users generally like the program, but some operators claim that it "inundates them in a flood of paperwork." Camp Systems is aware of these comments, and it has developed a more streamlined version called LASER-short for Learjet Aircraft Status Evaluation Report. Introduced in April 1993, LASER is less expensive than CAMP, and it allows operators to fax or send photocopies of aircraft logs directly to Camp Systems, rather than filling out time-consuming forms.

Alternatively, Learjet operators may electronically update maintenance records. Learjets now are delivered with a complimentary one-year subscription to the LASER service.

LASER offers a large-scale benefit to Learjet and all operators. It allows the manufacturer to collect statistics on the fleet to plan more effectively for parts and service support.

IF OPERATORS HAD THEIR DRUTHERS

Learjet 31A operators are well aware that the aircraft's performance and fuel efficiency are largely due to its compact fuselage size. "We knew that cabin size was a design limit going in to our purchase. The goal was performance, not [all out] passenger comfort."

But that realization didn't prevent others from complaining about passenger room. "It's a four-passenger airplane with eight [or nine] certificated seats," said one operator. Another echoed, "Four or five passengers is the max for all but the shortest trips."

Baggage space and access was another complaint. Many thought that Learjet should have designed the aircraft with an aft, side baggage access door similar to that of the Learjet 55 and 60. In addition, some complained that the aft baggage compartment was only large enough for four or five persons' belongings on overnight trips. And all the luggage has to be moved through the cabin from the front door to the rear baggage compartment, subjecting the upholstery to plenty of wear and tear.

The need for a second external baggage compartment also was frequently mentioned. Others wished for an aft lavatory, a larger cockpit, fewer obstructions in front of the EFIS screens, a higher wing loading and more fuel. But all of those improvements would extract a price of decreased performance since they involve more internal volume (more form drag), more weight (more power loading) and less wing area (more wing loading). Those are tradeoffs most Learjet 31A operators aren't willing to make, as evidenced by their enthusiasm for the aircraft.

When asked if they would buy the Learjet 31A again-knowing then what they know now-most operators voted yes with no hesitation. "It offers a lot of airplane for the money. It goes fast. It gets good fuel economy."

Here are some of the naysayers' comments. One said, "I would buy a Learjet 35A because of the increased range." Another commented, "Buy a used Learjet 55C or a used Hawker."

Comments such as those were rebutted by others who remarked that other aircraft lack the short field performance and operating efficiency of the Learjet 31A. Many Learjet 31A operators, however, are strong candidates for the Learjet 45. That aircraft, according to them, will combine docile handling characteristics, traditional Learjet performance and one of the roomiest cabins in the light-jet class.

On balance, Learjet 31A operators said, "Know your mission. Plan on legs no longer than 2.0 to 2.5 hours for the comfort of your passengers. And limit the number of people in the cabin to four or five except for the shortest trips."

The Learjet 31A is very much a niche aircraft. No other manufacturer builds a quicker light jet. The Learjet 31A, however, ranks second only in fuel economy to the smaller CitationJet. Its runway performance also rivals the best of the straight wing Citations. The 31A simply is the quintessential light Learjet by any measure. **B/CA**

Flying Impressions

We filed for FL 470 on a flight plan from Monterey, California to Sacramento Metro via Point Reyes and Red Bluff. With a delay for basic airwork at low altitude and a few approaches at Sacramento, we planned to be back at Monterey in two hours, so we loaded the airplane with 3,000 pounds of fuel for the trip and reserves. With two passengers, our ramp weight was 14,710 pounds.

Strapping into the left seat of the Learjet 31A doesn't feel all that different from the cockpit of the original Learjet 23, but the newest small Learjet is not designed to be flown solely from the seat of your pants.

That became apparent as soon as the avionics masters were flipped on and an array of five AlliedSignal EFS 50 screens illuminated. The tubes, part of the most advanced avionics system yet installed in a 30-series Learjet, are the most obvious sign that Learjet 31A technology is decades ahead of its 20-series progenitors. For example, an optional GPWS is installed in the aircraft we flew and TCAS now is available as an option, among other advanced avionics.

The avionics aren't the only systems that have been upgraded on the reinstalled to improve high-speed pitch stability, and now the indicated max Mach number is 0.81 versus 0.78 IMN. The 31A's V_{MO} also was raised to 325 KIAS versus 300 KIAS for the Learjet 31.

The aircraft has full-time, speed-proportional nosewheel steering, a second generation digital system quite similar to the system fitted to the Learjet 60. An electrically heated windshield eliminates the need for bleed air defogging. External bleed air ports, though, are retained for windshield anti-icing and rain removal.

Instrument panel switches are now arranged by function, and many are color-coded to make them easy to locate. A new electrical systems monitor—identical to the one in the Learjet 60—centralizes all AC and DC power display functions. And a takeoff configuration monitor warns the crew if the throttles are advanced and the spoilers, thrust reversers, wing flaps, pitch trim or parking brake handle are in the wrong position prior to departure.

Airframe options include single-point refueling, fuel heaters and thrust reversers. The extended range fuel tank option has been deleted.

Going through all the pilot-initiated tests and avionics preflight procedures took a few minutes, so we taxied eastbound to Runway 28L at a modest pace. Technology also has its price, and in the Learjet 31A, it is measured in a couple of minutes more pre-takeoff preparation. In addition, we had to re-program the Universal Navigation Systems UNS-1B for changes in our flight plan received from clearance delivery. Allowing for a little over 100 pounds of taxi fuel, we computed the takeoff weight at 14,600 pounds.

We elected to use the simplified takeoff data sheet that allows V_1 and V_R to be pegged at 118 KIAS and V_2 to be set at 122 KIAS instead of using the slightly lower calculated AFM values. The predicted a takeoff distance of just under 3,000 feet.

ATC cleared us to 7,000 feet, then 11,000 feet and two other intermediate level-off altitudes before clearing us to an FL 450 to FL 500 block. The climb to FL 470, though, still took only 31 minutes.

We found the 31A's AlliedSignal KFC 3100 quite a capable digital flight control system, but hand-flying the Learjet 31A was such a pleasure that we didn't engage the autopilot until passing FL 410. The KFC 3100's glareshield control panel earns high marks for its eye-level buttons and annunciator lights that ease hand-eye coordination.

The lateral mode heading and course control knobs, as well as the EFIS control panels, are located on the pedestal. The vertical mode control knobs are incorporated in the altitude/vertical speed indicator units in the instrument panel to the right of the EADI screens.

We set 0.71 IMN hold and preset the level-off altitude to FL 470. The climb to such a relatively high altitude was justified by the change in winds we encountered. A recent cold front, propelled by an energetic jet stream, had just passed through California. The high altitude winds were as strong as 85 knots out of the west,' according to the UNS-1B FMS, but passing FL 430, they started to abate. At FL 470, the wind velocity had dropped to 28 knots.

According to Learjet test pilots, that is a disproportionately large drop, but it graphically demonstrated the efficacy of the Model 31A's high-altitude performance reserves. Our true airspeed at FL 470 was 425 knots, and the fuel burn was 872 pph. That rate is better than three nm per gallon, and we would have lost only six percent of our speed and fuel efficiency had we been directly heading into the wind.

In addition, we encountered almost continuous light turbulence in the jet stream from the high twenties through FL 430. After climbing above that altitude, we enjoyed a glass-smooth ride-much to the delight of our two passengers.

Approaching Red Bluff, we requested a descent into the area just west of Chico and Marysville for some airwork prior to pattern work at Sacramento Metro. At 12,000 feet, we made some notes about the 31A's low-speed handling: Its handling characteristics are similar to the Learjet 60's, which is high praise indeed. Its low-speed roll rate is slower, however, because it lacks the roll rate boost of spoilerons, depending on ailerons alone for roll control. The roll control forces, however, are pleasantly light.

So docile are the stall characteristics that the only artificial stall warning device is a stick shaker that activates at seven percent below stalling angle-of-attack. No stick pusher is needed. At the stall, the nose mushes down, and ailerons alone may be used for roll control. If the angle-of-attack is reduced slightly, the Learjet 31A may be powered out of the stall with a minimum loss of altitude during the recovery.

Our first approach to Sacramento Metro's Runway 16R was at 13,000 pounds. Therefore, we set the V_{REF} bug at 113 KIAS. Descending on the ILS approach, the Sundstrand GPWS voice synthesizer advised us of our radio altitude—first at the selected DH, then again at 50 feet, 30 feet and 10 feet agl.

The Learjet 31A, along with the Learjet 55C and 60, has docile landing characteristics that feel similar to those of straight-wing Cessna Citations. Over the threshold, we gradually pulled the thrust levers to idle and began a slow, flat flare. Plenty of ground effect cushioned the 31A's touchdown, but it had little tendency to float- perhaps because of its much higher wing loading compared to the Citation 500 series.

Our brief stay in the traffic pattern at Sacramento confirmed that the Learjet 31A has excellent low-speed handling characteristics that would make it easy to fly a circling approach. Limited visibility from the pilot's seat through the right side windshield, however, left no doubt that the 31A needs both pilots for circling approaches with right turns.

Returning to Monterey at an assigned altitude of 22,000 feet, we encountered plenty of low altitude turbulence. The Learjet 31A provided a well-damped ride through the chop, but it bumped around enough to remind all on board that its wing loading is lower than other current production Learjets.

(We shot the localizer-DME 28L approach into Monterey, and discovered a well-known, but highly annoying quirk in the design of most conventional GPWS boxes. Descending from 6,000 feet to 4,200 feet at CHRLE intersection (17.9 DME) on the approach, the GPWS sounded a low-altitude warning. Because we were on the 278-degree inbound course and at the correct altitude, we chose to ignore it. Such cry-wolf nuisance alarms detract from the usefulness of the current generation of GPWS boxes, and they could lead some pilots to ignore warnings in the event of bona fide low-altitude danger).

Near the end of the approach, we slowed to our final approach speed of 111 KIAS. Our computed landing distance was just under 2,400 feet. We touched down and taxied to the ramp for a total flight time of two hours and a total fuel burn of 2,246 pounds.

The flight left some strong impressions of the Learjet 31A's qualities. It is quite a stable instrument platform and a pleasure to fly by hand. It has such spirited performance that it's hard to suppress the kind of grin one used to get only from flying Learjet 23 and 24 airplanes. Yet, the aircraft is decades ahead of its predecessors in fuel economy, avionics and systems reliability, as well as cockpit layout, cabin comfort and handling ease. **FG**