

# Learjet 45: \$9.84 mil, M.81, 9 seats, 2100 nm, up to FL510

**Honeywell Primus 1000 with EICAS/EFIS, Universal UNS1C FMS, 2 Honeywell TFE731-20s giving 7000 lbs takeoff thrust.**



**By Clay Lacy**  
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(L-R) Lacy and Learjet Dir of Flight Ops Bob Agostino perform low-speed maneuvers before their approach to ICT (Mid-Continent, Wichita KS).



Learjet 45's structural design includes a 47.78-ft wingspan and a 57.60-ft external length. Maximum operating altitude is FL510. A pair of Honeywell TFE731-20 engines power the light business jet, with each producing 3500 lbs of thrust.

tomers. The original steer-by-wire system needed improvement and the brakes were not ideal.

Bombardier has successfully addressed these concerns. I was looking forward to another flight test of the aircraft and learning about recent Learjet 45 product modifications.

## Aircraft development

The Learjet 45 program was launched in 1992 with first flight Oct 7, 1995—32 years to the day after Bill Lear's first flight of the Learjet 23. FAA certified the air-

craft in 1997 with RVSM certification following in 2000.

Bombardier began delivering Learjet 45s in 1998 and recently delivered its 200th unit. List price of a Lear 45 is \$9.84 million with first available delivery positions 6–8 months out.

Learjet Dir of Public Relations Dave Franson explains that the design objective for the model 45 was to maintain Learjet performance while eliminating the problems of the Learjet 35 in terms of handling characteristics and maintainability. Today, the 45 seats 8–9 passengers and flies further than any other aircraft in

**W**hen I flight tested the Bombardier Learjet 45 five years ago the aircraft was in the middle of a long, tough certification process. In my opinion, the airplane had some negatives. In terms of range and payload you could only board 3 to 4 passengers with full fuel, which was a concern to many potential cus-





Photos by Grant McLaren

(L-R) Learjet Dir of Flight Ops Agostino (L) looks on as Lacy holds an artificial ice shape used to test the aircraft's aerodynamics during its FAA certification process. Agostino points out the Learjet 45's external power connector port. Agostino explains the operation of the bizjet's trailing link landing gear and brake-by-wire systems.

**L**earjet 45 originally had a 19,500-lb MTOW but the manufacturer increased it to 20,500 lbs, which was the weight of the aircraft I flew. After months of research and man-hours of paperwork, Bombardier has won FAA certification for a 21,500 MTOW for the Learjet 45 with no added power or structural change requirements.

The 21,500-lb MTOW, APU-equipped Learjet 45 will carry 7 passengers at 1400 lbs payload with full fuel, while a non-APU-equipped airplane transports 8 passengers at 1600 lbs payload. This is a significant and welcome improvement over the original model 45. The latest gross weight improvement should change the perception that the Learjet 45 does not have adequate range and payload. Bombardier is claiming a max IFR range of 2102 nm.

## Walkaround

The Learjet 45 is a relatively compact aircraft with a length of 57 ft 7 in, a 47 ft 9 in wingspan and a height of 14 ft 2 in. The high aspect ratio, fully cantilevered, swept-back wings with winglets are of riveted construction with the exception of the upper portion of the winglets, which utilize a honeycomb core bonded to the outer skin.

Avionics racks, an oxygen service and a pressure gauge are accessed through a forward nose door. Learjet Dir of Flight Ops Bob Agostino pointed out the single-point refueling access door located on the fuselage below the right engine pylon. You can fuel the 45 in approximately 7 min at up to 55-psi pressure. There's also a gravity fuel filler access door on the upper

right side of the fuselage. Doors located on the forward outboard side of each engine nacelle provide access for oil servicing.

The Learjet 45 is powered by 2 Honeywell TFE731-20 turbofan engines producing 3500 lbs of thrust each. The turbofans are equipped with clamshell-type Dee Howard TR5045 thrust reversers. Tandem, trailing-link main landing gear is fitted with carbon brakes guaranteed for 1100 landings.

I was impressed with the 45's spacious baggage compartment, which passengers and crew can access through a 33-in-wide hinged door on the port side. Pressurized luggage capacity is 51 cu ft with no C of G restrictions and there's another 15 cu ft of internal luggage storage. The tailcone door, located aft of the right engine, provides access to electrical, environmental, hydraulic and engine fire extinguishing system components.

I've always liked the Learjet clamshell entry door and the model 45 offers a comfortable 30-in door width. Our flight test aircraft had a standard double club seating arrangement, a spacious aft lav, a nice forward galley and a 10.4-in flat panel forward-bulkhead-mounted LCD screen for displaying Air-show video and DVD inputs.

Cabin height, at 52 in from the flat floor, is adequate, although not stand-up for most people. But I always remember what Bill Lear said when people asked him why Learjets did not have stand-up cabins: "Remember, you can't stand up in a Cadillac either."

Access to the left seat is easy and I was impressed with the Learjet 45's flightdeck. It is larger than the Learjet 35 with better visibility. Seats and armrests are comfortable, controls are within easy reach and I like the electrically adjustable rudder pedals.

Our aircraft was equipped with dual Universal Navigation UNS1C FMSs, Honeywell EGPWS, TCAS II and a MagnaStar digital phone system. Glareshield controls, much like those on modern airliners, were well thought out. The standard Honeywell Primus 1000 integrated avionics suite includes 4 large 8 x 7-in EFIS screens.

## Flying the Learjet 45

After engine startup, which was straightforward, Agostino and I taxied out for takeoff on 19R at ICT (Mid-Continent, Wichita KS). Our takeoff weight with 3610 lbs of fuel and 2 passengers was 17,900 lbs—or 87.3% of the aircraft's 20,500-lb MTOW.

During taxi-out I was impressed with the 45's improved steer-by-wire system, which is smooth and responsive. For low-speed ground operations, 60° of steering authority on either side of center is available. As groundspeed increases, maximum wheel deflection is reduced to zero. I tried a couple of 360s on taxi-out and found that this airplane really turns tightly on the ground.

With V1, Vr and V2 of 105 kts, 112 kts and 121 kts, respectively, we had a balanced field length of 3714 ft at our weight. Agostino suggested a standard climbout at 270 kts to Mach 0.70. We climbed to FL330 with a couple of level-offs.

At FL330 I did a couple of 60 bank turns. Agostino and I then tested the Learjet 45 roll disconnect system. In case of jamming, the ailerons may be disconnected from the pilot control wheel. After disconnection, bank angle is controlled from the pilot control wheel by the spoilers.

With Agostino holding his control wheel hard right, representing



Bombardier's depiction of the Learjet 45's operating radius from various US cities.

about 2/3 of the 18 max aileron deflection, I turned my control wheel hard left. It took me less than half spoilers to fly level and I was able to roll the aircraft into a 45 bank in the opposite direction of ailerons using the spoileron roll disconnect system. As the spoiler system is totally fly-by-wire—like on the Lockheed Martin F16 fighter—there is little feedback from the controls when using spoilerons.

We tested the Learjet 45's manual pressurization system and maintained a sea level cabin to FL260 and a 3300-ft cabin at FL330. Although we did not climb above FL330, Learjet 45s have an inherently large buffet boundary envelope, so even at FL450 you can do 60 banks with ease.

Agostino suggested we try a modified emergency descent. With spoilers out, engines idle and speed increased from 230 kts to 300 kts, our rate of descent pegged out at 6000 fpm. The 45 comes down in a hurry. It only took us a minute or so to descend to FL240 where we were cleared down to 16,500 ft and cancelled IFR.

Agostino then had me reduce thrust for some slow-speed and stall work. At Mach .48, or about 139 kts indicated, I did some 45 banks and the airplane handled them well.

Slowflight characteristics are

wonderful. Our first approach to stall was in clean configuration with stick shaker at 103 kts and full aerodynamic stall at 97 kts. Aerodynamic buffet was gentle with no pitch down or wing drop. With flaps 40 and gear down and a weight of 16,850 lbs, we experienced stick shaker at 100 kts and full aerodynamic stall at 91 kts. Again, even with full aft stick, we never broke into a nose-down attitude.

Heading back to ICT, Agostino and I entered the circuit for 19R to perform a series of 4 landings. For our first landing, I did a normal touch-and-go at a Vref of 110 kts. Even at Vref, if you hold off, the 45 tends to float.

After a quick pattern we planned an approach with a max braking effort stop. Using flaps and spoilers but no thrust reverse, we stopped in just 1500 ft. Coming around again, I set up for a no-flap landing at a Vref of 132 kts at our approach weight of 16,741 lbs.

### Brakes have been improved

On the 1st landing I deployed spoilers and used heavy braking but no thrust reverse. For the 2nd landing we used brakes with reverse. The brakes on the 45 work so well that a no-flap landing is absolutely

no problem. In emergency braking mode you still have 92% of normal braking—even with an inoperative antiskid system.

Our last landing was with maximum braking and thrust reverse to a turnoff on a taxiway about 1500 ft down the runway. Getting out of the airplane I checked the brakes and detected no noticeable heat. The 45 truly has brake overkill.

Learjet 45 Diagnostic Product Specialist Peter Levy hooked up a laptop computer to the 45's diagnostic system after the flight to show us how easy it is to download information in real-time from various databases. This simple diagnostic procedure gives the operator a great overview of the aircraft's systems on a spreadsheet. Levy explained that these 2nd-generation diagnostic capabilities allow Learjet 45 operators to reduce downtime and trim maintenance costs.

### System simplicity

The Learjet 45 features a cabin with an oval-shaped cross-section, measuring 19 ft 9 in from the flight-deck divider to the aft pressure bulkhead. A simple fuel system consists of 2600 lbs in wing tanks and 1000 lbs in fuselage tanks. Fuel is supplied to engines via engine-driven fuel pumps, jet pumps and 2 DC standby pumps.

A 3000-psi hydraulic pump on each engine provides hydraulic power for operating the wheel brakes, landing gear, flaps, spoilers and thrust reversers.

An electric aux pump provides backup power to the main hydraulic system to operate landing gear, flaps and brakes only. The landing gear is trailing-link with the dual main gear wheels common to all Learjets, nosewheel steering and a brake-by-wire brake control with independent antiskid systems on all 4 wheels.

Ailerons, rudder and elevator are controlled manually through cables, bellcranks, pulleys and push-pull tubes. Two engine-driven generators supply a DC electrical system. Two main batteries and an emergency battery supply power for engine starting and essential avionics.

AC electrical power is supplied by 2 engine-driven alternators for





(L) The Learjet 45's Honeywell Primus 1000 integrated panel includes four 8 x 7-in EFIS displays, a Universal UNS1C FMS and a Honeywell Primus 600 weather radar. Aircraft are delivered RVSM capable. Other options include a second Universal FMS, Honeywell EGPWS and TCAS II. (R) A double club passenger configuration is the aircraft's most popular seating arrangement.

## Learjet 45 specifications

### Price

Basic equipped (\$ mil US) \$9.84

### Powerplants (2)

Honeywell  
TFE731-20

Thrust at takeoff 3,500 lbs

### Dimensions

Wingspan (ft) 47.78

External length 57.60

External height 14.13

Internal cabin length 19.75

Cabin max width 5.12

Internal cabin height 4.92

Baggage (cu ft) 65

Total volume 410

Normal seating, crew/pax 2/9

### Weights and loading

MTOW (lbs) 21,500

Zero fuel weight 16,000

Basic operating weight 13,695

Max payload 2,367

payload full fuel (lbs) 1,954

Max fuel load (lbs) 6,062

### Performance

Balanced field length  
(SL, ISA, MGTOW) (ft) 4,350

Landing distance (SL)  
@ max landing weight (ft) 2,660

Max operating altitude (ft) 51,000

Pressurization dif PSI 9.4

Max range, IFR, ISA (nm) 2,102

High-speed cruise (kts) 464

Normal cruise speed 457

Figures supplied by Bombardier

windshield heating. The cabin environment is regulated by electronically controlled air conditioning and pressurization systems.

The environmental control system uses bleed air supplied from the engines or APU. An optional freon air conditioning system—about 160 lbs installed—is available in place of the optional Honeywell RE100 APU—about 250 lbs installed.

Learjet 45's Honeywell Primus 1000 integrated avionics suite features 4 8 x 7-in EFIS displays, full engine indicating and crew alerting system with synoptics and an integrated UNS1C flight management system. The standard Learjet 45 flightdeck also offers Honeywell Primus 660 weather radar, dual air data computers and dual fiber optic attitude heading reference systems. The aircraft is fully Cat II certified and RVSM capable.

Popular options for the Learjet 45 include an auxiliary power unit, dual FMS, TCAS II and EGPWS. More than half of all Learjet 45 buyers order APUs, Bombardier says.

Purchase price of a Lear 45 include training slots for 2 pilots and two maintenance technicians. Warranty coverage is 5 years on the airframe, avionics and vendor items, 5 years or 2000 hrs on the engines and 2 years for paint and interior furnishings.

### DOCs are down

Direct operating costs on the Learjet 45 now run \$849.45 per hr, according to Franson. A 5-year Smart Parts program is available at \$54 per hr and the Honeywell

maintenance service plan is available at \$101.69 per hr, per engine.

Recent reductions in maintenance requirements include an overall decrease of approximately 20% in inspection man hours over each 2400-hr primary inspection cycle, plus a reduction of approximately 40% on 300-hr 12-month inspections. With these figures in mind, Bombardier says maintenance downtime is thus reduced by 2 days at each 300-hr inspection event.

### A potent package

All in all, the Learjet 45 successfully combines the best of traditional Learjet performance with a large cabin and easy handling characteristics. I'd like to see more range, however. Improvements notwithstanding, the twinjet does not fly any further than the Learjet 35 it replaced.

Still, the challenge is understandable when one considers today's requirements for APUs, large cabin volume, sophisticated integrated avionics suites and complex cabin entertainment systems.

But aside from the challenges of expanding range, Bombardier's improvements to the Learjet 45 are impressive. As long as you don't



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live on either coast you're likely to have nonstop capabilities with full passengers anywhere in the continental US. Range and payload are the best in its class, operating costs are low and the aircraft is easy to fly. I think Bill Lear would have been proud of what Bombardier has done with the model 45.