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Cessna Citation CJ4

The Citation Encore's successor has Learjet-like performance.

By Fred George

Cessna Aircraft just released the final performance numbers on the $8.75 million Citation CJ4 and the results are turning heads in São José dos Campos, Brazil, as well as back home in Wichita. Compared to Cessna's original projections, the aircraft weighs less when empty, has more thrust, needs less runway, cruises faster and flies farther.

In light of the new data, one might be tempted to forego the usual comparisons between the Citation CJ4 and the Embraer Phenom 300, assumed to be its most direct competitor, and instead do a head-to-head comparison with the Learjet 45XR. Indeed, if both the CJ4 and LR45XR are loaded with two crew and five passengers and then race between San Diego and, say, Savannah, the Learjet would arrive only seven minutes sooner.

The main difference between the CJ4 and the Learjet 45XR is that the Citation can fly back from Savannah to San Diego with the same passenger payload against 40-knot headwinds, assuming FL 450 is available from ATC. Meanwhile, the Learjet crew will have to plan a time-consuming refueling stop.

The strong competition between Cessna and Learjet is not new. It dates back to 1988 when Cessna introduced the CE 560 Citation V. That aircraft had a top cruise speed of 427 KTAS, putting it within 20 knots of a 30-series Learjet.

The Citation V, however, needed less runway length than either the short-range Learjet 31A or long-legged 35A, and its cabin was more spacious. It also had an external baggage compartment that the Learjets lacked. The 30-series Learjets had real-life cruising speeds that were 50 knots faster than the Citation V. The Learjet 35A also had more range, assuming relatively moderate density altitude conditions at the departure airport. The Learjet's maximum allowable takeoff weight was restricted when departing many general aviation airports with high runway elevations on warm days — conditions that were less problematic for the Citation V.

Successive Citation 560 models — such as the Ultra, Encore and Encore+ — and Learjet 40/45 series aircraft heated

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up the competition. Cessna maintained its runway performance advantage. Meanwhile, Learjet offered more speed, tanks-full payload and range.

Now the CJ4 is making its debut, closing much of the historical performance gap between the two marques. On 300-nm to 1,000-nm missions, the Learjet 45XR still arrives up to five minutes sooner. The CJ4, though, has nearly 200 nm more range with five passengers and its long-range block times are virtually identical with those of the 45XR.

The CJ4's main shortcoming is its cabin cross section. Cessna engineers carried over the basic circular fuselage barrel of the late 1960's-vintage FanJet 500, an aircraft that was considered roomy compared to first-generation Learjets.

However, Embraer and Learjet, Cessna's two main competitors in this market niche, changed that paradigm with their most recent models. They created clean-sheet fuselages that aren't circular and that offer considerably more head, shoulder and elbow room than 500-series Citations, including the CJs. The CJ4, though, makes the most of its fuselage cross section by using external frames in the floor area of the center cabin to increase available floor width by two inches compared to older CJ models. Even so, the Phenom 300, Learjet 40XR and Learjet 45XR still have substantially larger cabin volumes.

The competition between the CJ4, Phenom 300 and 40-series Learjets is closer that it appears at first glance. The CJ4 is a far more advanced aircraft than the CJ3, embracing several new airframe technologies, plus it has better cabin systems and more baggage volume. Ninety percent of the aircraft is "clean sheet," according to Norm Baker, CJ4 program manager. Those differences may change its position in the upper-end light-jet competition with Embraer and Learjet.

Structure and Systems

The CJ4's wing, similar to that of the Phenom 300 and 40-series Learjets, is a clean-sheet design that benefited from the latest computer tools. It's essentially scaled down from the wing of the Citation 680 Sovereign, with subtle changes in leading edge contours that improve low-speed lift-to-drag characteristics. Refining low-speed wing aerodynamics helped Cessna's engineers beat the original runway performance projections. Only the Citation Mustang and Embraer Phenom 100 have better runway performance, albeit by razor thin margins.

The CJ4's wing features 12.5 degrees of sweep at quarter chord, marking the first time Cessna has used a swept wing on a narrow-body Citation. The wing has front and rear main spars, plus sub spars used to support the aft attach points for the landing gear. It has an area of 330 square feet and it is fitted with three-position, long-span, high-lift Fowler flaps.

High-speed lift-to-drag characteristics are equally impressive, even though the wing doesn't have the same rooftop, aft-loaded pressure distribution as the Sovereign's wing. MMO has been increased to Mach 0.77, comparing favorably with the Phenom 300's 0.78 MMO and the Learjet's 0.81 MMO. More importantly in everyday operation, the wing's high-speed drag divergence Mach number is well above redline, enabling the aircraft to cruise efficiently close to the barber pole. Notably, Cessna quotes all maximum range numbers at high-speed cruise, including its 2,002-nm NBAA (notably, 100-nm alternate) IFR range with two crew and five passengers. Slowing to long-range cruise increases range performance by slightly more than 8 percent, as shown by the accompanying performance charts.

The t-tail empennage is adapted from the CJ3. The vertical fin has a longer chord to enhance directional control and the horizontal stabilizer is larger to improve longitudinal stability, a particularly important asset considering the CJ4's higher cruise speeds.

Virtually all of the primary fuselage, similar to the Phenom 300 and current production Learjets, is a conventional monocoque aluminum structure using hoop frames, longerons and stressed skins. The CJ4's fuselage is built from the outside in, with the skins first held in place by vacuum molds to assure precise aero loft contours. Next, the internal framework is installed. Cessna extensively uses structural adhesives to bond together various components, a process that's been refined during the past three-plus decades of Citation production.

Structural adhesives have the potential to reduce manufacturing time. Their use can result in smoother exterior contours, thereby reducing drag. But adhesives also can add considerable empty weight compared to mechanical fasteners.

That downside risk didn't afflict the CJ4. Cessna's final empty weight projection for typically equipped aircraft actually dropped 18 pounds, to 10,242 pounds, including two crewmembers.

The nose of the CJ4 was given a major makeover that includes a lower drag profile and conical-section, higher-strength glass windshields that enable VMO to be raised to 305 KIAS. That's slower than the 320 KIAS limit of the Phenom 300 and 330 KIAS for 40-series Learjets, but it does enable the CJ4 to keep up with most jetliner traffic when descending into busy commercial jetports.

Compared to earlier CJ family members, the CJ4 has substantially improved airframe systems, with the electrical system's changes the most impressive. It has unprecedented redundancy for a member of the narrow-cabin Citation family. There are two engine-driven starter-generators and two AC alternators. Similar to model 40 Learjets, the three-phase alternators primarily are used to power electric windshield heaters for anti-ice protection. Aboard the CJ4, the alternators also provide two additional power sources, by means of transformer rectifiers, to power the 28 VDC essential bus. That provides quad-redundant power to all avionics equipment, including the autopilot. And if all four power sources are lost, the CJ4's main aircraft battery still can support both the pilot's side PFD and the integrated standby instrument system (ISIS).

The Phenom 300 and Learjet 40-series

Cessna Citation CJ4

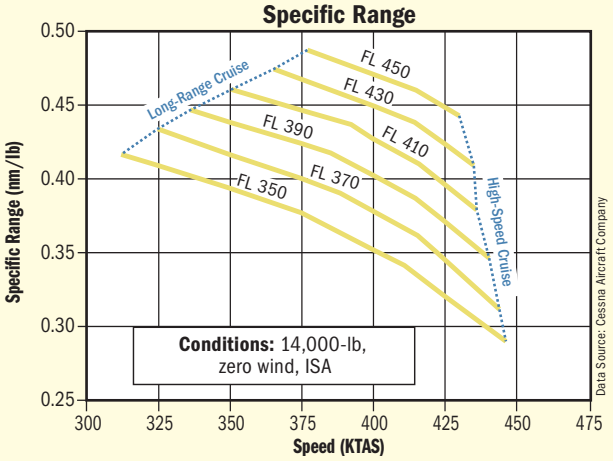
These graphs are designed to illustrate the performance of the Citation CJ4 under a variety of range, payload, speed and density altitude conditions. Do not use these data for flight planning purposes because they are gross approximations of actual aircraft performance.

Time and Fuel vs. Distance – This graph shows the relationship between distance flown, block time and fuel consumption. The CJ4 has an average long-range cruise speed of about Mach 0.63 that yields about 8-percent better fuel efficiency than cruising at an average Mach 0.71 cruise speed. Most operators are likely to cruise at high speed because that's the profile Cessna uses in its Flight Planning Guide. Cessna's 10,242-pound estimated BOW is representative of a typically equipped aircraft with six seats in the main cabin, a single right-hand, side-facing seat across the entry door and a belted potty seat. Other configurations and optional equipment can have a substantial impact on the aircraft's 1,000-pound tanks-full payload.

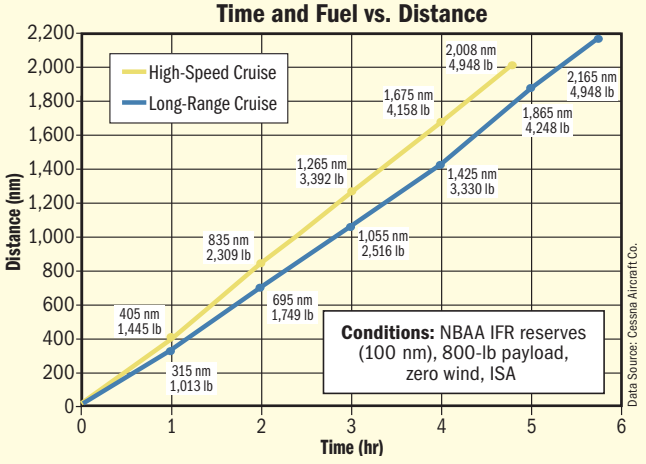
Specific Range (Mid-Range Weight, ISA) – This graph shows the relationship between cruise speed and fuel consumption for the CJ4 at representative cruise altitudes for 14,000-pound, mid-weight aircraft. We did not have the opportunity to verify all these data during our evaluation flight.

Range/Payload Profile – The purpose of this graph is to provide simulations of various trips under a variety of payload and two airport density altitude conditions, with the goal of flying the longest distance at high-speed cruise. Each of the five payload/range lines was plotted from multiple data points by Dave Champley, a senior sales engineer with Cessna Aircraft, ending at the maximum range for each payload condition. The time and fuel burn dashed lines are based upon high-speed cruise data taken from the Time and Fuel vs. Distance graph. Runway distances for sea-level standard day and for *BCA*'s 5,000-foot elevation, ISA+20°C airport accompany the takeoff weights, using the optimum flap configuration in light of FAR Part 23 Commuter Category runway and second-segment OEI climb performance requirements.

Specific Range

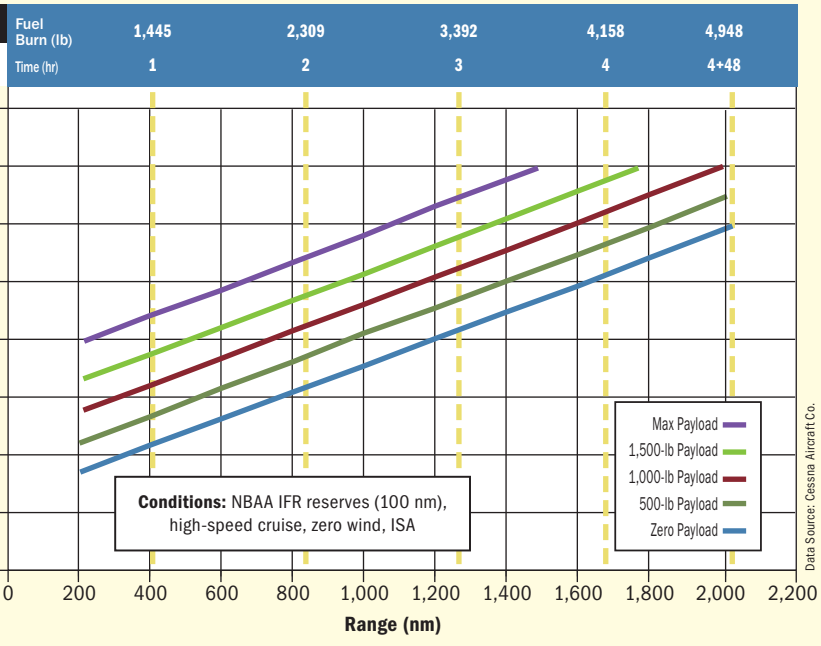


Time and Fuel vs. Distance



Range/Payload Profile

Takeoff Field Length (ft)		
SL ISA	5,000 ft ISA+20°C	Gross Takeoff Weight (lb)
		18,000
3,130	5,000	17,000
2,810	4,300	16,000
2,550	3,680	15,000
2,450	3,210	14,000
2,430	2,810	13,000
2,420	2,530	12,000
2,420	2,450	11,000
		10,000



aircraft, in contrast, have two power sources for their essential electrical systems. However, the Phenom 300's main battery will supply the left-side PFD and ISIS for 45 minutes.

The CJ4's 44 amp-hour battery is a lithium ion design, jointly developed by Cessna and A123 Systems. This is the first use of a Li-ion battery in a business jet. It saves about 30 pounds compared to a nicad battery and it offers better performance. Gulfstream also is using similar Li-ion batteries in its newly developed products. Embraer and Learjet use more conventional lead-acid and/or nicad batteries.

The new Cessna's full-time 3,000-psi hydraulic system is another first for a narrow-cabin Citation, but similar to the 3,000-psi systems used aboard the Phenom 300 and 40-series Learjets. Left- and right-side engine-driven pumps supply the landing gear, flaps and speed brakes. A separate electrically powered hydraulic pump supplies the wheel brakes. The CJ4 and Phenom 300 use MIL-H-87257 synthetic red hydraulic fluid while the Learjets use the older MIL-H-5606 red hydraulic fluid.

Both the Phenom 300 and Learjet 40 series aircraft have more client subsystems than the CJ4. The Phenom 300 uses its main hydraulic system for rudder boost, wheel brakes and the stall-barrier stick-pusher in addition to landing gear and spoilers. Aboard the Learjet, client systems are similar, but they also include thrust reversers and spoilerons. Learjets also have electrically driven aux hydraulic pumps that provide backup power for landing gear, wheel brakes and flaps. There is no such backup aux system aboard the CJ4 and Phenom 300.

All three models feature single-point pressure refueling. The CJ4 and Phenom 300 have receptacles ahead of the right wing leading edge, reducing the risk of airframe damage if the refueling adapter accidentally is dropped. Learjet 40 models, in contrast, have SPPR receptacles aft of the wing. Line service personnel must be careful not to drop the hose to avoid damaging the trailing edge of the right wing flaps of the Learjets.

The three aircraft also all use engine bleed air for wing leading edge ice protection. The Phenom 300 and Learjet 40 series aircraft also use engine bleed air to heat the leading edge of the horizontal stabilizer. The CJ4 retains Cessna's long-standing pneumatic deice boot system to protect its tail-plane.

The CJ4, Phenom 300 and Learjet 45 all have digitally controlled, anti-skid brake systems. The Phenom 300 and Learjet 40 series aircraft have true brake-by-wire systems with no mechanical links between the foot pedals and brake control system. The CJ4 uses a cable-operated brake controller and its wheel brakes use steel disc heat packs. The Phenom 300 and 40-series Learjets are fitted with carbon brakes.

Pressurization systems are similar for all three model lines. The CJ4's 9.0-psi system provides a 7,800-foot cabin altitude at FL 450. The Phenom 300's 9.2-psi system lowers maximum cabin altitude to 6,600 feet at the same altitude. And the Learjet's 9.4-psi system, designed for operating as high as FL 510, provides a 6,450-foot cabin altitude at FL 450.

The CJ4 and Phenom 300 have standard vapor-cycle air-conditioning systems that can chill the aircraft prior to engine start by using ground power. Vapor-cycle air-conditioning is optional aboard the Learjet. However, the Learjet 45XR comes standard with a Honeywell RE100 APU that, prior to main engine start, provides autonomous aircraft operation, including heating, air-conditioning by means of an ACM pack and electrical power for cabin services and avionics. An APU is not available on the CJ4 or Phenom 300.

Cabin Comfort and Amenities

The CJ4 has less cabin volume than the Phenom 300 or 40-series Learjets, but that's only one measure of passenger comfort. The main seating area, having a four-seat club section and two forward-facing chairs in the aft cabin, is about four inches longer than the equivalent section of the Phenom 300's cabin. This affords more than one inch of additional legroom for each passenger. Both the CJ4 and Phenom 300 have dropped aisles to increase headroom along the centerline of the cabin.

The CJ4 has a standard, seventh seat positioned across from the main entry door. A two-place divan and nine-inch-long storage locker are available as no-cost options to replace the right-hand forward 22-inch-long storage closet and seventh chair. The switch increases seating capacity in the main cabin to eight passengers and shaves 24 pounds from aircraft empty weight. The CJ4 also can carry a ninth passenger on the standard belted potty seat in the lavatory. But those additional three seats aren't as comfortable as the six pedestal-mount chairs in the main cabin.

The Learjet 45XR has a flat floor and thus more usable cabin cross-section. The main seating area is 16.5 feet long, providing room for an extra row of seats. The Learjet 45XR seats eight in the main cabin. With only 17 inches more length than the CJ4, the extra row of seats might appear to cramp legroom. However, the main cabin entry door is positioned closer to the cockpit bulkhead than in the CJ4 or Phenom 300, freeing up additional legroom for the seventh and eighth passengers.

The CJ4 has a 21-inch-longer cabin than the CJ3, but it has three fewer windows, with five on the left and six on the right. The Learjet 40 has 14 windows and the Learjet 45 has 16 windows, affording bright ambient light in the cabin. The Phenom 300 has four windows on the left and five on the right of the main cabin, plus two more in the lavatory. These windows are larger in area than those of the CJ4 or 40-series Learjets.

All three model lines feature long-life

Cessna Citation CJ4 Specifications

BCA Equipped Price $8,7500,00

Characteristics

Wing Loading 51.4
Power Loading 2.35
Noise (EPNdB) . . . . . NA
Seating . . . . . 1+8/9

Dimensions (ft/m)

External

Length 53.3/16.3
Height 15.3/4.7
Span 50.8/15.5

Internal

Length 17.3/5.3
Height 4.8/1.5
Width (maximum) 4.8/1.5
Width (floor) 3.2/1.0

Thrust

Engine . . . . . 2 Wms FJ44-4A
Output (lb each) 3,600
Flat Rating OAT°C . . . . . ISA+11°C
TBO . . . . . 5,000 hrs.

Weights (lb/kg)

Max Ramp 17,070/7,743
Max Takeoff 16,950/7,688
Max Landing 15,500/7,031
Zero Fuel 12,360/5,606
BOW 10,242/4,646
Max Payload 2,118/961
Useful Load 6,828/3,097
Executive Payload 1,600/726
Max Fuel 5,828/2,644
Payload With Max Fuel 1,000/454
Fuel With Max Payload 4,710/2,136
Fuel With Executive Payload . . . 5,228/2,371

Paul Bowen

CJ4's nose has been recontoured and it features new stronger, albeit smaller, conical-section, glass windshields that enable V_{MO} to be increased to 205 KIAS.

LED interior lighting, dual zone temperature control, foldout worktables and forward refreshment centers with heated beverage containers, ice compartments and provisions for stores.

The CJ4's main entry door has been redesigned from earlier 500-series Citations. It hinges outward from the forward edge and it measures 24 inches wide and 48 inches tall. A fold-down boarding ladder affords access to the cabin.

The CJ3's low noise level cabin at cruise set the bar for the CJ4. Notably, Learjet 40 series aircraft cabins also have impressively low noise levels. Based upon our experience aboard the relatively noisy Phenom 100, Embraer's Phenom 300 will be hard-pressed to equal the low sound levels of the U.S.-built light jet competitors.

Rockwell Collins' new Venue Cabin Management System (CMS) is installed aboard the CJ4, claimed by Cessna to be the first such package fitted to a business aircraft. The CMS is used to control cabin lighting, window shades and entertainment systems. This is the first narrow-cabin Citation to have a temperature controller in the main cabin and the first small Citation to have electrically powered window shades.

Collins took an avionics approach toward system architecture, making it substantially more robust and reliable than previous generations of CMS. The system uses distributive processing for controllers at each seat position and an Ethernet ring to connect various components. If one controller fails, another can assume its functions, thereby preventing single-point failures. The system features extensive built-in diagnostics to speed troubleshooting.

The CMS package includes a bulkhead-mounted, 10.6-inch HD monitor, two side ledge-mounted, 10.6-inch HD monitors, an XM satellite radio receiver, an Aircell Axxess II Iridium satcom phone and various data/audio ports, including MP3 connectivity, plus VGA ports on the cabin monitors for laptop computers. An Airshow moving map system is standard equipment. The cabin also features left- and right-side 110 VAC power outlets. The Phenom 300 has five 110 VAC power outlets in the main cabin.

Paul Bowen

The main section of the cabin has a forward club and two forward-facing seats in the aft cabin. These seats have the standard "summit tailoring" stitching pattern.

Cabin options include upgrades of upholstery, carpet and cabinet finish, plus swiveling passenger seats at each of the six pedestal seat locations and custom seat tailoring, along with passenger seat lumbar supports, iPod docking stations, high-fidelity cabin speaker system, additional audio input ports and various upgrades for the Airshow display system.

The CJ4 and Phenom 300 have similar external baggage capacity. The Embraer has a 66-cubic-foot compartment in the tail and another five cubic feet of storage in the nose. The CJ4 has a 55.6-cubic-foot aft baggage compartment and another 15-cubic-foot compartment in the nose.

Flying Impressions

In mid-December outside Cessna's Wichita headquarters at Mid-Continent Airport (ICT), we strapped into the left seat of N525NG, Cessna CJ4 prototype CE525C-0001, accompanied by David Lewandowski, senior experimental test pilot. The aircraft was loaded with orange flight-test equipment, instead of a production interior. Thus its EOW was 711 pounds heavier than a production airplane. BOW was 10,953 pounds with two crew, and loaded with 5,850 pounds of fuel, ramp weight was 16,803 pounds. Lewandowski computed takeoff V speeds of 102 KIAS for V_1, 104 KIAS for rotation, 116 KIAS for the V_2 takeoff safety speed and 140 KIAS for one-engine-inoperative en route climb speed, based upon a 16,700-pound takeoff weight, 1,330-foot runway elevation, 30.53 inch Hg altimeter and -12°C OAT. Computed no-wind takeoff field length was 2,960 feet.

The CJ4's virtual clean-sheet cockpit is considerably more ergonomic than previous members of the CJ family. Frequently used controls are located near eye level. Most system controls are on a new tilt panel below the flight displays, making switches and knobs easier to reach. Seldom used controls, such as exterior light switches and trim controls, are in the center console. The new tilt panel makes it easier to reach switches and knobs as well as the twin multifunction CDUs used to program the FMS and tune

the radios. LEDs in annunciator switch buttons provide clear recognition of on/off status.

Cessna eliminated dozens of stand-alone gauges by creating systems indications on the MFDs. However, engineers chose not to incorporate graphic systems synoptic diagrams in the EICAS. Numerical digits, bars and needles indicate engine and systems status. Clearly worded CAS messages alert the crew to abnormalities.

The new Li-ion battery provides considerably more power than either a nicad or lead-acid battery having the same 44 amp-hour rating. Production aircraft will be certified for battery starts down to -40°C. At -9°C, cranking speed was brisk and maximum temperature on the first engine start was 605°C.

With both engines running, we taxied out to Runway 1R for takeoff. Tight turns on the ramp were impressive. If you lock up a brake, use differential and pivot on the inside main landing gear, the aircraft has a 31.6-foot turning radius.

Cleared for takeoff, we aligned the aircraft on the runway and advanced the thrust levers to the third detent. With 7,200 pounds of thrust, the aircraft had a sporty 2.32:1 weight-to-thrust ratio. Acceleration was brisk. Rotation forces were light. Nearly 20 degrees of nose-up pitch was required to hold airspeed to the 200 KIAS Class D airspace limit.

The aircraft's docile handling qualities are immediately impressive. It's easy to hand-fly with smoothness and precision. Pitch trim speed is ideally tailored for all speeds and configurations. Engine thrust/pitch coupling is almost imperceptible.

Wichita Approach and Kansas City Center provided us with an unrestricted climb to FL 450. Using a 240 KIAS/0.64 IMN climb schedule the aircraft reached FL 450 in 23 minutes after takeoff in slightly warmer than ISA average conditions, although OAT at takeoff was ISA-23°C. Climb performance above FL 300 was less than optimum because the flight guidance system chased the 0.64 IMN recommended climb speed with 1- to 2-percent errors. However, the time to climb still was four minutes faster than predicted by the CJ4 Flight Planning Guide.

Once level, the aircraft accelerated to 0.722 IMN, resulting in 414 KTAS in ISA conditions. Aircraft weight was 16,000 pounds. Fuel flow stabilized at 1,020 pph. The book performance prediction was 409 KTAS with a 942 pph fuel flow.

We performed a wind-up 180-degree turn to head back toward Wichita. The aircraft was buffet free up to 52 degrees angle of bank, resulting in a 1.8-g high-speed buffet boundary.

Down at FL 430, we checked long period pitch stability. We pulled back on the stick to slow to 10-percent slower than the aircraft's 194 KIAS trimmed cruise speed. The phugoid cycle was 58 seconds and pitch oscillations were strongly damped.

Descending to FL 310 for a high-speed check, we deployed the speed brakes. There was a very slight nose pitch-up with extension. The upper and lower panels produce considerable drag at full extension, but very mild buffet. Partially extending the speed brakes produces almost no buffet.

The prevailing ISA-3°C temperatures at FL 310 proved to limit top speed to 453 KTAS at a weight of 15,770 pounds. The aircraft would have flown faster, but we were up against the Mmo redline. Fuel flow was 1,800 pph. Both values were slightly better than book predictions.

Descending to 16,000 feet, we performed a couple of 45-degree of bank turns at 250 KTAS. The aircraft was easy to control within +/- six knots and 40 feet of altitude, even without using trim to relieve pitch forces.

Rockwell Collins Pro Line 21 Cockpit

Pilots climbing into the CJ4 may not recognize it as a member of the CitationJet family because the flight deck redesign has been so thorough. Four, eight-by-ten inch portrait-configuration AM-LCD screens dominate the instrument panel. The stand-alone radio tuning units have been eliminated, along with the glareshield-mounted annunciator light panel and flight guidance system controls buried in the center console.

The CJ4 has a much more contemporary and ergonomic cockpit layout that embraces business aircraft and air transport design practices. The left- and right-side display control panels, along with the flight guidance control panel, have been relocated to the top of the instrument panel, directly below the glareshield. Systems controls have been simplified. Similar to 40 series Learjets, a tilt panel at the bottom of the instrument panel provides easy access to airframe and secondary avionics systems controls. Two, center-mounted multifunction CDUs provide FMS programming and radio tuning functions.

Seldom used controls, such as interior and cockpit lighting switches and knobs and trim switches, are relegated to the center console. The result is more head-up time and better situational awareness.

The standard avionics package includes dual PFDs and MFDs, dual solid-state AHRS and DADCs, a single-channel autopilot with automatic emergency descent mode function, integrated flight information system computer that supports XM radio weather, electronic charts, electronic checklists and enhanced map graphics, dual cursor control panels and single FMS-3200 with WAAS-enabled GPS. Also included are dual comm/nav/Mode-S transponder radios with TSS-4100 traffic surveillance function, cockpit muting switch to route warnings to the headsets so that they don't alarm the passengers, pre-start avionics power switch that conserves battery power during FMS programming and radio work, a single DME, a radio altimeter, Honeywell Mark VIII E-GPWS, Collins Multi-Scan RTA-4112 weather radar with turbulence detection to 40 nm and XM radio weather. A solid-state integrated standby instrument system also is included, along with an Artex 121.5 / 243.0 / 406 Mhz ELT that transmits last-known aircraft position and a cockpit voice recorder.

Options include a flight data recorder, Collins HF-9000 transceiver with SELCAL, L3 Comm Stormscope and Universal Weather system in lieu of XM radio weather.

Stall behavior was good from 1.3 Vs_1 through stick shaker and up to airframe buffet. We attempted no full-aft stick stalls in compliance with Cessna flight operations policy. Notably, all stalls are flown only to the onset of stick shaker for check rides in the aircraft.

In the clean configuration at a weight of 15,600 pounds, the stall shaker fired at 113 KIAS and the onset of buffet was 103 KIAS. There was mild wing rock. We added full thrust and lowered the nose five degrees. We maintained angle of attack just at the edge of stick shaker. Stall recovery was not instantaneous, but the aircraft was fully controllable. Maximum altitude loss was 140 feet.

With gear and flaps extended, the stick shaker activated at 98 KIAS and buffet began at 83 KIAS. We added full thrust, lowered the nose five degrees and retracted the flaps to 15 degrees, the takeoff and approach position. As the aircraft accelerated, we raised the nose and cleaned up the aircraft in the climb. Total altitude loss was 300 feet.

For a pilot new to the CJ4, the stalls were valuable lessons. Stall recovery is almost immediate if initiated at stick shaker. There are generous angle-of-attack margins between the stall warning stick shaker and the onset of airframe buffet. And the aircraft is fully controllable throughout the high angle-of-attack maneuvering envelope.

We returned to ICT for pattern work, beginning with ILS and GPS approaches. Computed VREF was 112 KIAS at a weight of 15,300 pounds. Extending the flaps to 15 degrees near the 200 KIAS limit produced considerable ballooning. Thrust response to throttle movement during the approach was nicely proportionate. Trim response was smooth, predictable and proportionate as well. Control forces were light and the aircraft was stable.

Paul Bowen

The CJ4 has a redesigned door with a constant 24-inch width and 48-inch height.

Similar to other CJs, the CJ4 has plenty of wing, which translates into strong ground effect. Any excess speed causes prolonged float. It's essential to cross the threshold at VREF and snap back the throttles to idle to avoid excessive speed at touchdown.

During a simulated OEI takeoff and balked landing, differential rudder pedal force was surprisingly light. The CJ4 has dual bleed-air-powered rudder bias servoes. Such maneuvers are easy to fly, perhaps easier than in other members of the famously docile CJ family.

The final landing was a maximum performance stop. The CJ4's digitally controlled brakes performed flawlessly, aided by the impressively effective ground spoilers. Stopping distance was approximately 2,500 feet with no hint of wheel slip or wander off centerline.

Conclusions? In our opinion, the CJ4 quite clearly is the best narrow-cabin Citation yet built. Its handling manners are unsurpassed in this class of aircraft. Its wheel brakes now are on a par with the best brake-by-wire systems. The cockpit redesign significantly reduces pilot workload. And it meets or exceeds Cessna's newly released performance projections.

Comparative Price and Value

BCA's Comparison Profile and other charts for the CJ4 indicate that is a structurally efficient, versatile airplane that overcomes many of the legacy shortcomings of the 525 model line. It can carry five passengers, with two crew and full fuel. Fill all eight seats, or even nine seats with the optional two-place divan, and you can fly between any two cities in the continental United States with one fuel stop. As does Learjet, Cessna bases the CJ4's weight build-up on two crewmembers. Embraer assumes the Phenom 300 will be flown single pilot for its weight build-ups. The CJ4 also has the best overall runway performance of any competitive light jet.

Dig deep into the CJ4 flight planning guide and you'll find this aircraft is designed to be flown on Learjet-like vertical profiles. The combination of its relatively large wing and the Williams FJ44-4A turbofan's robust high-altitude performance favor direct climbs to FL 410 and above for any trips longer than 200 nm. Indeed, climbing directly to FL 450 from takeoff is the only way the aircraft can achieve its advertised 2,002-nm max range performance at high-speed cruise and land with 100-nm NBAA IFR reserves. Block speeds can be increased on shorter missions by flying down in the mid- to upper thirties, but fuel consumption increases considerably.

When cruising at its top speed of 453 KTAS at FL 310, the aircraft is burning 1,828 pph, resulting in a specific range of 0.248 nm/lb, the highest fuel consumption of any competitive light jet. Up at FL 450, though, cruise goes to 430 KTAS and fuel flow shrinks to 978 pph, resulting in a specific range of nearly 0.44 nm/lb. That's about 10 percent more efficient than the fuel miserly Learjet 45, an aircraft that squeezes 0.40 nm/lb while cruising at the same speed and altitude.

The dashed vertical lines of the accompanying Range/Payload Profile chart illustrate that the CJ4 has an average block speed of 417 to 419 KTAS on typical missions. The takeoff field length numbers indicate that the CJ4 can use many general

Paul Bowen

Long-span, large-area flaps assure excellent runway performance. They reflex up when retracted thereby reducing high-speed drag.


Paul Bowen

Long travel, trailing-link main landing gear assure soft touchdowns. Notably, the new wing allows optimum positioning of the landing gear.

aviation airports that have runways too short for some of its competitors, especially under hot-and-high conditions.

What's not shown in the performance charts also is worth considering. The CJ4's virtual clean-sheet cockpit has an ergonomic design that elevates it to near best-in-class, as described in the accompanying avionics sidebar.

The CJ4 is the only light jet to be fitted with Rockwell Collins' new Multi-Scan weather radar. This system takes a 3-D picture of hundreds of cubic miles of airspace in front of the aircraft to look for weather hazards. Similar systems only are found in much larger and more expensive business aircraft.

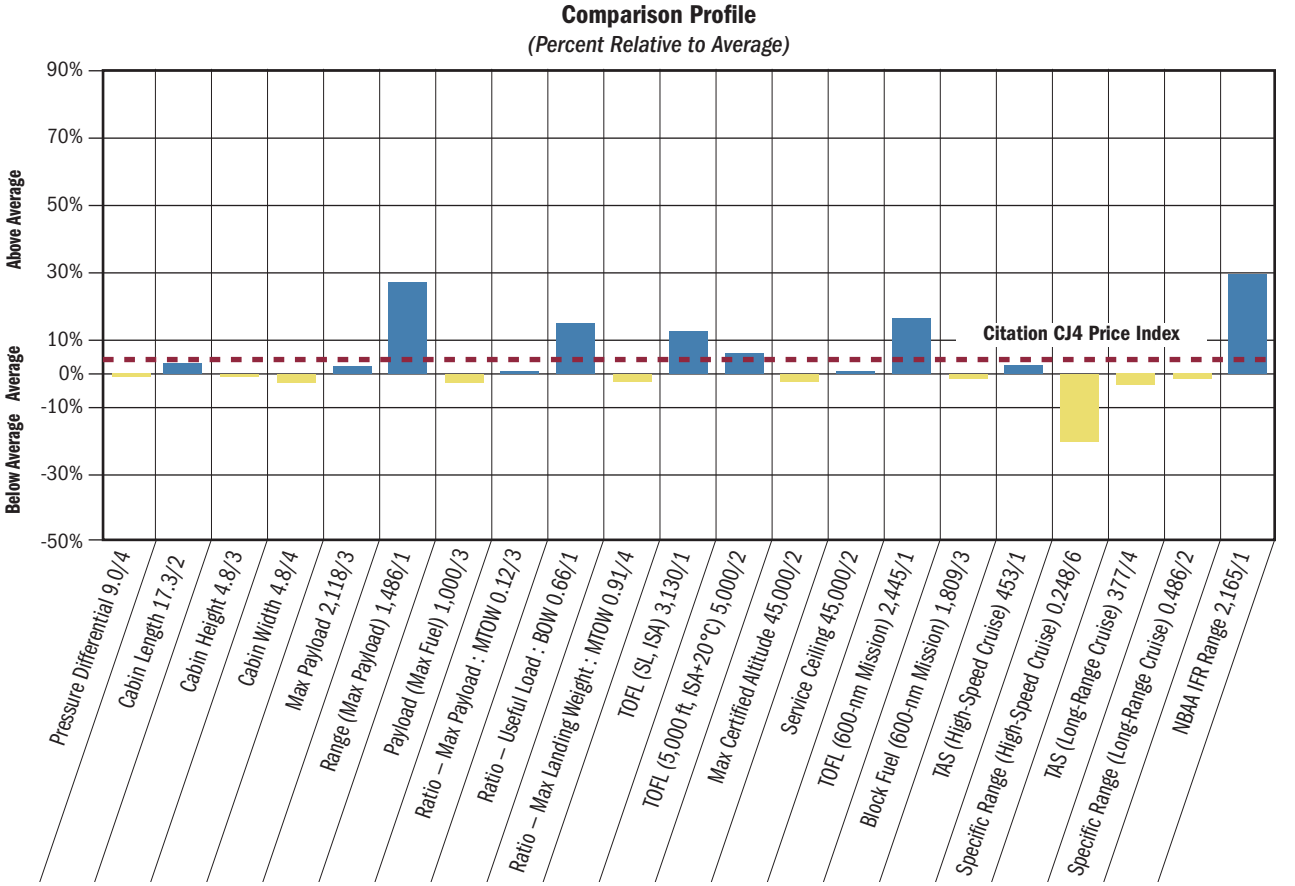
Rockwell Collins' Venue CMS is another competitive advantage. Arguably, the CJ4 has one of the most capable and robust cabin systems of any aircraft in its class.

Perhaps Cessna's strongest trump card is its world-class product support. No other light jet manufacturer has earned such consistently high ratings from customers.

No operator wants to be stranded by an AOG or be delayed by an aircraft that isn't finished by a service center when promised. Cessna is devoting the resources to prevent such occurrences. Parts inventories typically are well stocked and service technicians are prepared to tackle challenges. An AOG rescue aircraft can be dispatched to provide critical parts and technical support to get an operator back into the air when time is of the essence. So, when some competitive light jets might be grounded for unscheduled repairs, there's a good chance the CJ4 will still be flying.

There's no doubt that the CJ4 is the most capable narrow-cabin Citation yet built. It does virtually everything better than the Encore+ and it's priced nearly $400,000 less. The Hawker 450, fitted with updated avionics and PW535 turbofans, would have been competitive, had it not been canceled to slash costs. The CJ4 currently appears to nose out its archrival Phenom 300 by most performance measures. But Embraer's final performance numbers could close that gap.

While some competitive aircraft have larger cabins, the CJ4 has a nearly unbeatable blend of satisfactory passenger comfort, performance, technology and top-ranked product support. As a result, the Citation CJ4 has carved out a market niche that appears to assure its success. But Cessna, along with Hawker Beechcraft and Bombardier Learjet, is keeping close tabs on Embraer. The Wichita Big Three no longer have a guaranteed lock on the light jet market. ■



Designers attempt to give exceptional capabilities in all areas, including price, but the laws of physics, thermodynamics and aerodynamics do not allow one aircraft to do all missions with equal efficiency. Trade-offs are a reality of aircraft design.

In order to obtain a feeling for the strengths and compromises of a particular aircraft, *BCA* compares the subject aircraft's specifications and performance attributes to the composite characteristics of other aircraft in its class. We average parameters of interest for the aircraft that are most likely to be considered as competitive with the subject of our report, and then we compute the percentage differences between the parameters of the subject aircraft and the composite numbers for the competitive group as a whole. Those differences are presented in bar graph form along with the absolute value of the specific parameter for the subject aircraft and its ranking relative to others in the composite group.

For the Citation CJ4 Comparison Profile, we compared it to a composite group of aircraft with the closest prices, including the Hawker 400XP, Phenom 300, Citation CJ3, Citation CJ4 itself, Citation Encore+ and Learjet 40XR. Please note that the Comparison Profile is meant to illustrate the relative strengths and compromises of the subject aircraft, rather than being a means of comparing specific aircraft models to each other.