CJ2 debut

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...res make Cessna's CJ2 a step up from entry level

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PHOTOGRAPHY BY MIKE FIZER

Things are happening fast at Cessna these days. That goes double for the company's CitationJet (CJ) product line. No sooner had certification and deliveries of the company's CJ1 (see "CJ Step-Up," August 2000 *Pilot*) begun last March than flights of the CJ1's bigger brother—the CJ2—started, and certification of that model followed in June 2000. Now the CJ2 order book is up to 170 airplanes. Add that number to the 360 original CJs, the 40 CJ1s now in service, and the CJ1's July 2002 production backlog, and you've got a resounding confirmation of the enduring popularity of Cessna's "baby jets."

If the CJ and the CJ1 were the entry-level jets in the Citation line, then the CJ2 is yet another step up. A big one. In many areas, the CJ2 shares the same features as the CJ1, but in terms of power, speed, and interior room the CJ2 is everything the earlier CJs aren't.

Power and speed

CJs and CJ1s are powered by 1,900-pounds static thrust, Williams-Rolls FJ44-1A turbofans; the CJ2 has 500 more pounds of thrust per side thanks to its Williams-Rolls FJ44-2C powerplants. This gives the CJ2 two-engine climb rates in the area of 3,800 feet per minute, single-engine climb rates of about 1,100 fpm, and a maximum potential cruise speed of 416 knots—at light weights and a cruise altitude of 29,000 feet. Under similar conditions, CJs and CJ1s max out somewhere around 388 knots in cruise and have maximum all-engine and single-engine climb rates of approximately 3,300 and 850 fpm, respectively.

Cessna is hoping that some of the service experience accrued by the CJ and CJ1 engines will apply toward the CJ2 from its first delivery. As it stands now, the -1A engines have 2,400-hour recommended time between overhauls (TBOs). With enough satisfactory time in service this TBO will reach its mature target of 3,000 hours by later this year. As for the CJ2, its mature TBO is projected to be 3,500 hours. But inasmuch as its engines have yet to prove themselves, the CJ2's initial TBO has yet to be posted. Cessna is hoping it can begin deliveries with the 3,500-hour TBO already in place.

The FJ44s will come with a three-year/1,500-hour warranty. Cessna's PowerAdvantage parts support program can further protect owners facing both scheduled and unscheduled maintenance. This program requires that you set aside a fixed $52.22 per engine per hour payment in exchange for what amounts to free engine parts.

Fuel heaters are standard equipment in the CJ2, which means that Prist (a fuel additive used to kill bacteria, fungi, and prevent fuel icing) isn't needed. This may seem like a small thing—unless you have to buy all those spray cans of Prist, stash them, and fool with attaching their lines to fuel nozzles during refueling. With fuel heaters, fuel lines are routed through oil sumps, and it's the heated oil that keeps the fuel lines from freezing up at altitude.

Bigger outside...

To accommodate a much-requested two-inch cockpit extension for additional cockpit legroom and the CJ2's standard, six-seat interior, the airplane has been given a 33-inch fuselage stretch over the CJ/CJ1 fuselage dimensions. Another 17-inch tailcone stretch gives the CJ2 a much larger aft baggage compartment—large enough to obviate the need for a ski tube—compared to its predecessors. It's capable of holding 600 pounds in 50 cubic feet of space—almost twice as much as the CJ/CJ1 aft baggage compartment.

A three-foot wing stretch helps the CJ2 to fly faster at altitude, and so do the 20-degree sweep, wider span, and greater area of the horizontal stabilizer. Natural laminar flow over the wing surfaces—which extend to 30 percent of the wing chord (same as the CJ/CJ1)—also helps performance at both the top and bottom ends of the performance envelope.

For ice protection, the leading edges of the horizontal stabilizer use inflatable deice boots. These boots can be cycled manually or set to inflate automatically at a preset interval. Hot engine bleed air keeps the engine nacelles and wing leading edges ice-free, and a combination of bleed air, alcohol spray, and an extendable rain door keep the windshield free of contamination.

The CJ2 is built under the provisions of FAR Part 23, which allows Cessna to certify the airplane for single-pilot operations—like the rest of the CJs. But many of its systems and structural features go way beyond the Part 23 rules and comply with Part 25, Transport-category strictness. The wings have three spars, for example, and dual, redundant load paths to bear the extra loads should any one spar or attach point fail in flight. Windshields are beefed up to take an eight-pound bird strike head-on. Dual sets of inflatable door seals are another safety feature. If one door seal fails, the other is able to maintain cabin pressure.

...and inside

The standard CJ2 cabin is a six-place setup (CJ/CJ1s have five-place cabins), with a forward refreshment center, forward club seating, and two forward-facing aft seats. Seats swivel, and they track fore, aft, inboard, and outboard for optimum headroom and reclining space. An aft toilet is optional, with nonflushing, nonbelted versions going for an extra $3,200 and a flushing, belted (certified for use during takeoffs and landings—as a passenger seat, that is) model costing $15,575.

All passenger seats are fireblocked, and there's an aft cabin baggage area capable of holding as much as 100 pounds in its four cubic feet of space. Together with the 400 pounds/20 cubic feet of baggage capacity in the nose, this gives the CJ2 a total maximum baggage capacity of 1,100 pounds.

The standard CJ2 panel includes a single PFD and MFD; a copilot's PFD is a popular option, though—even with its $118,000 price tag. Overall, the CJ2 airframe is larger than its predecessors, with its bigger engine nacelles and swept horizontal stabilizer being the quickest ways to single out a CJ2 on the ramp.


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CJ2's cabin comes with a six-seat setup and the option of a seventh seat in the form of an aft, belted potty seat. There's a refreshment center up front, as well as a side-facing bench seat.

Payload/range

The CJ2 is a heavier airplane than its forebears—its maximum takeoff weight is 12,375 pounds vs. the CJ1's 10,600 pounds—and its full-fuel payload is listed as 868 pounds. CJs and CJ1s really suffer in this latter department, with full-fuel payloads around 675 pounds (say, one pilot, three slim passengers, and their bags). With the CJ2 you can theoretically load four passengers and two pilots, plus their bags, and still launch with full fuel.

A look at the CJ2's payload/range graph says it all: At high-speed cruise power and zero wind, standard conditions, one pilot can load every seat in the house (yes, including that belted toilet), fly 1,100 nautical miles nonstop, and land with IFR fuel reserves. That's just the basic, 45-minute IFR fuel reserve requirement, mind you, and doesn't represent NBAA IFR fuel reserves. NBAA IFR fuel reserves factor in allowances for a missed approach, a climb to 5,000 feet, a five-minute hold, another climb to a cruise altitude, a diversion to designated alternate airports at long-range cruise power, and a descent and landing with 30 minutes' worth of holding fuel. Complying with these very conservative fuel reserve requirements will necessarily reduce any airplane's range below the maximum trumpeted by most manufacturers.

Even so, the CJ2's expanded payload/range envelope advertises almost a 300-mile advantage over the CJ's and CJ1's. It all boils down to more flexibility in the trade-off between fuel weight and passenger weight, which is what the payload/range chart is all about.

A Pro Line panel

Like the CJ1, the CJ2 uses the Rockwell Collins Pro Line 21 avionics suite. The standard configuration is the same as the CJ1, which gives you two huge, eight-by-10-inch displays—one a primary flight display (PFD) and the other a centrally mounted multifunction display (MFD). A copilot's PFD is a $118,150 option.

You really can't say enough about the intuitive nature of this integrated system. Line select keys along the edges of the PFD and MFD let you call up course arrows or bearing pointers, a V-speed selection menu, weather radar, and route displays. Rotating knobs to the right of the PFDs are for entering altimeter settings, dialing in V-speeds, or working the radar antenna tilt. Vertical tapes show airspeed, altitude, and vertical speed, and purple trend lines predictively identify the altitude and airspeed you'll realize in 10 seconds—a feature that lets you anticipate and control these variables with a pro's touch. Afraid you'll set off the overspeed warning during a steep descent? The purple line will confirm it, in which case you yank back on the thrust levers—or exert aft-stick pressure—and the trend lines will show you exactly how much you'll slow down.

Driving all this wizardry are two small digital quartz AHRS (attitude heading reference systems). No spinning gyros here. This extremely sensitive equipment detects changes in roll, pitch, and yaw in milliseconds, and is reliable, to boot. Mean times between failure are rated at 10,000 hours.

Engine and fuel information is displayed across the top third of the MFD, and groundspeed, true airspeed, ram and static air temperature, and status with regard to standard atmosphere appear along the bottom of the MFD.

A Honeywell Bendix/King KLN-900 serves as the standard-issue flight management system, but most customers have ordered their CJ2s with either the Honeywell GNS-X_{ls} ($36,800) or Universal Avionics UNS-1K ($30,775). The latter two units have built-in fault detection capabilities and meet FMS specifications for flight in European airspace.

Speaking of European compliance, another CJ2 option (at $4,100) is a set of communications radios with 8.33 kHz fre-

quency spacing. And for the trip across the pond, the addition of a second air data computer, installation of a Honeywell AM-250 altimeter, and the customers' skin mapping of the fuselage area around the static ports let the CJ2 fly in the North Atlantic's reduced vertical separation minimums (RVSM) airspace—the altitudes between Flight Level 290 and FL410.

A Honeywell TCAS I ($87,375) and EGPWS ($86,375) are two more factory-installed options. All avionics are covered by a five-year warranty with no hourly limits.

Price and operating economics

The first 170 CJ2 orders were placed at a base price of $4.2 million; by 2004 Cessna is expecting a sales price escalation to $4.8 million. To this, add another $300,000 to $400,000 for a typically outfitted airplane, which includes TCAS and the copilot's PFD. Not so surprisingly, 25 of the first 40 CJ2 orders came from existing CJ operators, and 70 percent of all CJ2 depositors are current or former Citation owners.

Operating costs of any airplane vary greatly, particularly with regard to the price of fuel. Based on 500 hours of flying per year and a fuel cost of $2.25 per gallon (those days are long gone) Cessna guidebooks give a year-one direct operating cost of $527.19 per hour. This breaks down to include $344.25 for fuel, $45.50 for labor reserves, $11 for Cessna's ProParts airframe parts reserve program, and $126.44 in engine reserves. Cessna says this boils down to a per-mile operating cost ($1.46 per nautical mile) that beats that of any turboprop twin—something that Citation salesmen harp on a lot. (See, it really *is* cheaper to fly a jet than a turboprop!)

For landing, expect to use approach speeds in the 105- to 113-knot range. After touchdown, the last, 60-degree flap setting will raise the spoilers, dump a lot of lift, and help braking.

As for fixed costs, Cessna figures a pilot will cost $75,000 a year in salary and benefits, hangar rental will come in at around $12,000 a year, hull insurance will cost $31,500, liability and medical insurance will be another $6,500, and recurrent pilot training at FlightSafety International (initial training is included in the purchase price) will run $7,100 per year. This gives you $132,100 in annual fixed costs.

Add the fixed costs to the direct costs and Cessna comes up with a total first-year annual cost of $388,595. Subsequent years are pricier primarily because maintenance costs tend to increase over time. This is just a Cessna-provided budget estimate, remember, and it was made when Jet-A was less expensive than it is today.

Flying the CJ2

Starting a CJ2, like any other Citation, is a matter of pushing a button and watching the engines' interturbine temperatures (ITTs) rise. If they threaten to go into the red arc, then pull the appropriate thrust lever up and out of its detent, then pull it back to the idle cutoff position to prevent any heat-related engine damage. Like most, my starts are uneventful, and soon we're taxiing away from the Cessna ramp at Wichita's Mid-Continent Airport, bound for a two-hour, 20-minute flight to AOPA's home field at the Frederick Municipal Airport in Maryland.

Taxiing took a little getting used to. The nosewheel steering is sensitive, and the new digital antiskid braking system really grabs when you make even slight steering pressures. With the thrust levers at the Flight Idle position, small, scoop-shaped thrust attenuators (TAs) aft of the engine pylon automatically deploy. TAs are the CJ family's answer to thrust reversers. They deflect and diminish engine thrust without the complicated assemblies bound up in conventional thrust reversers. For long or uphill taxis you can manually stow the TAs for faster taxi speeds or extra oomph.

With help from my demonstration pilot, David Bodlak, I program our route into the airplane's Universal UNS-1K, then go to the unit's fuel pages to add up our weights, which come to a 12,109-lb takeoff weight. Of that figure, 4,070 pounds is fuel.

We plug in our takeoff V-speeds and soon we're in position for takeoff. I run the power up to 98.9-percent N_1, release the

brakes, and wait for our V_1 of 102 knots. That behind us, we settle into a 3,500-fpm climb on our way to 5,000 feet and Butler VOR, our first fix. Then will come the Bellaire, Ohio, VOR, then good old FDK—a remarkably direct route.

Thirty minutes after takeoff we're in a high-speed cruise at FL370 (we had a few ATC-issued step climbs along the way), doing 403 knots true airspeed. Thanks to a healthy tailwind our groundspeed is 458 knots. Occasionally, our airspeed creeps up to 227 knots indicated, which gives us a 410-knot true airspeed, or Mach 0.718. The fans are set at 101.2 percent N_1, we're burning 900 pph of Jet-A (about 134 gph), and our static air temperature is minus 55 degrees Celsius, or ISA plus 2 degrees. You can see all this in an instant across the lower edge of the MFD.

The CJ2's panel layout is worth mentioning in some detail. Up on the glareshield you find the annunciator lights and engine fire detection and extinguishing switches. The emergency gauges (attitude indicator, combination airspeed/altimeter, N_1 gauge, and slaved EHSI with course arrow and bearing pointers) are lined up along the top of the MFD for easy reference during difficult times. The Honeywell Bendix/King CNI-5000 avionics panel includes dual nav/coms, ADF, and dual transponders, and sits just to the right of the MFD. The environmental and pressurization controls are on a tilt panel just below the MFD. All ice-protection switches are green, and all electrical system switches are white. An angle-of-attack (AOA) gauge is to the immediate left of the pilot's airspeed vertical tape readout, which simplifies your scan on approach. Below the AOA is the audio panel, below it are gauges for reading voltage and amperage, then come the battery, generator, and avionics master switches. Fuel boost and transfer switches come next as you move down the panel, followed by the engine start and ignition switches. Finally, you come across the ice-protection and lighting switches. It's all well organized and intuitive.

Same thing with the pressurization controls. You just set in the destination airport's elevation, and the system does the rest—automatically. By the time you descend to 200 feet agl, the cabin has depressurized. Of course, there's a means of manually changing cabin pressure should the automatic system fail.

We reach mid-Ohio in one hour, 50 minutes, having burned some 1,627 pounds of fuel in the process. As a result we're truing out at 411 knots, and a 59-knot tailwind (shown on the PFD, complete with an arrow depicting wind direction) gives us a 471-knot groundspeed. Soon, we'll need to descend.

After a bout of furious tapping at the FMS, we set in our next fix. This involves us crossing a point 15 nautical miles west of the Morgantown, West Virginia, VOR at 15,000 feet. Using autoflight and the FMS' VNAV mode, the FMS brings us down with precision not once, but three times before we finally spot Frederick.

We have had absolutely beautiful VFR weather all the way, and for good reason. A massive high-pressure system moved over the entire eastern half of the United States the night before the flight. That's great for visibility, but not so good for low-level turbulence and gusty winds. The mechanical man in Frederick's AWOS gives the news: winds 20 knots out of the northwest, gusting to 30 knots.

To compensate for the gusts, I use a reference speed of 120 knots on short final. Final checklist complete, Bodlak readies to put the flaps to the 60-degree, full down position as soon as we touch down. This invokes a "lift dump" feature similar to that used in Hawker jets: Spoilers deploy as the flaps reach the 60-degree position, thus killing lift and putting maximum weight on the wheels. Add in the effect of the TAs and firm braking, and the airplane stops with a minimum of fuss. The trailing link landing gear can certainly take some of the credit for whatever smoothness there was in my plant-it-now touchdown.

What niche next?

The CJ2 is more like a low-end mid-size jet than a high-end "baby jet," which proves once more that Cessna seems to be the master at finding—or inventing—new niches and subniches of aircraft. Because of its straightforward handling, simple systems, single-pilot certification, and increased capabilities the CJ2 ought to be every bit as successful as the other CJs were. Strong rumors suggest that the next Cessna might not be a jet at all. It could be a turboprop with a single propeller driven by a dual-engine installation—something to fill the niche between the Caravan and the CJs. Which would make it, what? An entry-entry level to high performance turbines? Pay attention next fall, when any new turbine aircraft worth their salt are paraded at the annual National Business Aircraft Association convention. □

Links to additional information on the Citation series may be found on AOPA Online (www.aopa.org/pilot/links.shtml). E-mail the author at tom.horne@aopa.org

Cessna Citation CJ2
(C-525A)
Base price: $4.2 million

Specifications

Powerplants	Williams-Rolls FJ44-2C, 2,400 lbst ea
Length	46 ft 11 in
Height	13 ft 11 in
Wingspan	49 ft 6 in
Wing area	264 sq ft
Wing loading	46.6 lb/sq ft
Power loading	2.56 lb/lb thrust
Seats	2 + 6/7
Cabin length	18 ft 10 in
Cabin width	4 ft 11 in
Cabin height	4 ft 10 in
Standard empty weight	7,527 lb
Maximum ramp weight	12,425 lb
Maximum useful load	5,059 lb
Payload w/full fuel	868 lb
Maximum takeoff weight	12,375 lb
Maximum landing weight	11,500 lb
Maximum zero fuel weight	9,300 lb
Fuel capacity, std	586 gal/3,932 lb
Nose baggage capacity	400 lb, 20 cu ft
Cabin baggage capacity	100 lb, 4 cu ft
Tailcone baggage capacity	600 lb, 50 cu ft

Performance

Takeoff distance, balanced field length	3,450 ft
Max demonstrated crosswind component	26 kt
Rate of climb, sea level	3,870 fpm
Single-engine ROC, sea level	1,160 fpm
Cruise speed/endurance w/45-min rsv (fuel consumption)	
@ High-speed cruise	410 kt/2.3 hr
33,000 ft	(1,165 pph/173 gph)
@ Long-range cruise	351 kt/3 hr
45,000 ft	(589 pph/88 gph)
Maximum operating altitude	45,000 ft
Landing distance	2,980 ft

Limiting and Recommended Airspeeds

V_{MCA} (min control w/one engine inoperative, air)	87 KIAS
V_{MCG} (min control w/one engine inoperative, ground)	89 KIAS
V_A (design maneuvering)	205 KIAS
V_{FE} (max flap extended), 15 degrees	200 KIAS
35 degrees	161 KIAS
V_{LE} (max gear extended)	275 KIAS
V_{LO} (max gear operating)	
Extend	185 KIAS
Retract	185 KIAS
V_{MO} (sl to 8,000 ft)	260 KIAS
V_{MO} (8,000 to 29,300 ft)	275 KIAS
M_{MO} (29,300 ft and above)	Mach 0.72
V_{REF} (reference speed @ max landing weight)	113 KIAS
V_{S1} (stall, clean)	103 KIAS
V_{SO} (stall, in landing configuration)	89 KIAS

For more information, contact Cessna Marketing; at The Cessna Aircraft Company, Post Office Box 7706, Wichita, Kansas 67277; telephone 316/517-6449; fax 316/517-6640; or visit the Web site (www.CJ2.Cessna.com).

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level conditions unless otherwise noted.