Cessna CJ1

Next-generation Collins Pro Line 21 avionics, plus more range/payload flexibility than the original CJ.

By Fred George

Photography by Paul Bowen

Since its production debut in 1993, Cessna's second-generation, entry-level business jet, the CE-525 CitationJet, sold well. The 359th production unit rolled off the assembly line early this year and there are more than 350 CitationJets in service as of late April. As B/CA reported in the April 1996 issue, operators lauded the aircraft's fuel efficiency, quiet cockpit and cabin, systems simplicity and Cessna's top-ranked product support.

The original CitationJet, though, lacked range/payload flexibility, according to operators. The Honeywell SPZ-5000 avionics package, while being easy to use and having excellent maintenance access, came in for its share of gripes. The autopilot had wing rock palsy, the AlliedSignal radar wasn't reliable and the optional GNS-Xsc FMS lacked capability, operators said.

In 1998, Cessna responded by announcing the CJ1, an improved version of the original Model 525 CitationJet. Now being delivered, the CJ1 has a 200-pound increase in MTOW, complementing the 300-pound boost in max zero fuel weight and 100-pound increase in max landing weight incorporated into late model CitationJets. The goal is to improve the CJ1's range/payload flexibility compared to the original Model 525.

The CJ1 also has a new Rockwell Collins Pro Line 21 avionics package, featuring 10-by-eight-inch flat-panel displays as standard equipment, with a third screen being an option. The CJ1 is the first production business aircraft to be fitted with PFD and MFD flat-panel screens, with the notable exception of the Boeing Business Jet.

Deliveries of the CJ1 began in March, with the acceptance of serial number 368 by Commercial Envelope Manufacturing Co., Inc., a 76-year-old, family owned firm with five manufacturing facilities in New York, Pennsylvania and South Carolina. The firm traded up from a Cessna Conquest II that it acquired three years ago.

"The CJ1 is much quieter and more comfortable than our turboprop," explained Steve Kristel, the firm's executive vice president. "It has all new avionics, the latest generation out there. It has [the optional Honeywell] TCAS that we need in the busy New York airspace environment."

Other aircraft were considered when the firm was deciding on its next new aircraft. "We looked at the King Air 200, which was about the same price," Brad Whaley, the firm's chief pilot, told B/CA. "But we didn't need the extra cabin and the CJ1 moves us up into an entry-level jet. And we don't miss having the noise of the props," he commented.

Commercial Envelope also wanted a proven airframe, engines and systems. "The CitationJet's list of mandatory service bulletins is dwindling. It's mature," Whaley commented about the CJ1's predecessor. The firm also wanted a relatively quick order-to-delivery lead time. "We wanted an aircraft now, not three years from now," he continued. Unproven technology and long delivery lead times were drawbacks when looking at the Raytheon Premier 1 and Cessna CJ2, according to Whaley.

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The CJ1 fits Commercial Envelope's travel needs. The typical mission is 250 nm to 700 nm and its average load is one to three passengers, much the same as other CitationJet operators. The accompanying charts show that the CJ1 is well suited to such missions.

While Cessna intended for the 200-pound increase in MTOW to increase the CJ1's range/payload flexibility compared to the CitationJet, in reality it preserves the earlier Model 525's load carrying characteristics with the complement of optional equipment now being ordered by most operators. As shown by the accompanying Range/Payload Profile chart, the CJ1, similar to the CitationJet, is designed for firms that don't need the tanks-full, seats-full capability offered by some turboprops and larger business jets.

Structure and Systems

The CJ1's airframe, systems and engines are unchanged from the original CitationJet. The 500-series, 58-inch inside diameter, circular cross-section fuselage is made from conventional aluminum alloys, using rivets, fasteners and adhesive bonding.

The CJ1's natural laminar flow wing, a first for the Citation series aircraft, delays the onset of flow separation until 30 percent MAC, thereby improving lift to drag characteristics 10 to 15 percent compared to the first-generation Model 500's NACA 23000 airfoil, Cessna engineers claim. The results are a smaller wing, less drag and better fuel efficiency. The wing features front-, main- and rear-spar construction, integral 3,220-pound capacity fuel tanks and leading edges heated by engine bleed air for anti-ice protection.

The CJ1 has trailing-link, main landing gear for soft landings and a smooth taxi ride.

The wing is mounted below the fuselage for less interference drag at the wing root junction. Similarly, the engines are mounted high on the fuselage to reduce the interference drag between the wings and engine nacelles. The CJ1 was the first 500-series Citation to be fitted with a T-tail, resulting in virtually no wing downwash influencing the airflow over the horizontal stabilizer.

Two Williams/Rolls-Royce FJ44-1A turbofan engines, featuring a bypass ratio of 3.3:1, each provide 1,900 pounds of thrust for takeoff. Automatically actuated, hydromechanical thrust attenuators prevent static thrust at idle rpm for ground operations. Fire protection is provided by firewall shutoff of fuel and hydraulics, plus dual fire extinguishers.

The CJ1's systems have been designed to be as simple as possible without sacrificing reliability or redundancy. The fuel system uses jet pumps in the wing fuel tanks to supply the engines, augmented by DC electrical boost pumps for engine start, jet pump failure and cross feed. The all-DC 29-volt electrical system has left- and right-side 300-amp starter-generators, plus a standard 25-amp-hour nicad battery for engine starting and emergency power. The optional 44-amp-hour nicad battery is popular with operators. A low maintenance "gel cell" battery is an option to the nickel cadmium batteries.

An engine-driven, open center, intermittent use hydraulic system powers the landing gear, wing flaps, speed brakes and engine thrust attenuators. The hydraulic reservoir, located in the right over-wing fuselage fairing, can be refilled with a can and a funnel. A second, electrically driven hydraulic system powers the anti-skid brake system. Both Model 525 systems use non-corrosive "Braco" hydraulic fluid, not the paint-peeling Skydrol 500B used in Model 500 Citations. A pneumatic bottle provides pressure for emergency landing-gear extension and wheel braking in the event of hydraulic failure.

The primary flight controls — ailerons, rudder and elevators — are manually operated. Three-axis trim is provided by conventional tab surfaces. The CJ1, being a normal category FAR Part 23 aircraft and not a transport category Part 25 aircraft, does not have separate left- and right-side control systems that can be isolated in the event of a control jam.

The Model 525 has trailing-link, main landing gear for soft landings and a smooth taxi ride. Bungee linkage, operated by the rudder pedals, provides nosewheel steering.

Engine bleed air is used for wing leading edge and engine anti-ice protection, windshield anti-ice and rain removal, and cabin pressurization and heating. Low-pressure service bleed air inflates the main door seal and pressurizes the hydraulic reservoir to prevent foaming. A vapor-cycle air conditioner cools the cabin. Cabin pressurization is regulated by a digital control system, eliminating most of the associated workload. A standard 22-cubic-foot (50 cubic foot optional) emergency oxygen system, with quick-donning pilot masks and automatic deployment passenger masks, protects the occupants, if cabin pressurization should be lost.

The CJ1's airframe, systems and engines are unchanged from the original CitationJet.

An alcohol spray system provides back-up anti-ice protection for the pilot's windshield. Ice protection for the horizontal tail is provided by pneumatic deice boots controlled by an automatic cycling system. The highly swept, vertical tail does not

The main passenger door measures 50.7 inches high by 23.5 inches wide.

Cessna CJ1

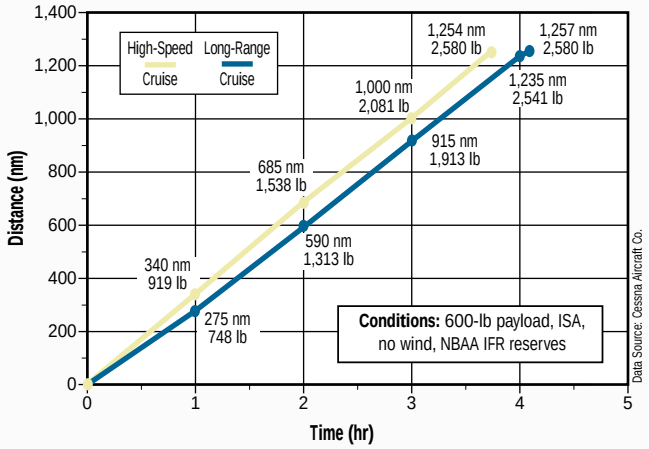
These three graphs are designed to be used together to provide a broad view of CJ1 performance. Do not use these data for flight planning. For a complete operational analysis, use the Approved Aircraft Flight Manual and flight planning data supplied by Cessna Aircraft Co.

Time and Fuel Versus Distance — This graph shows the performance of the CJ1 at long-range cruise and high-speed cruise. The numbers at the hour lines indicate the miles flown and the fuel burned for each of the two cruise profiles. Each of the hour points is based upon specific mission data supplied by Cessna. While flying the CJ1 for this report, we found Cessna's flight planning data to be very accurate, taking into account the non-standard ambient conditions on the day of the demonstration flight.

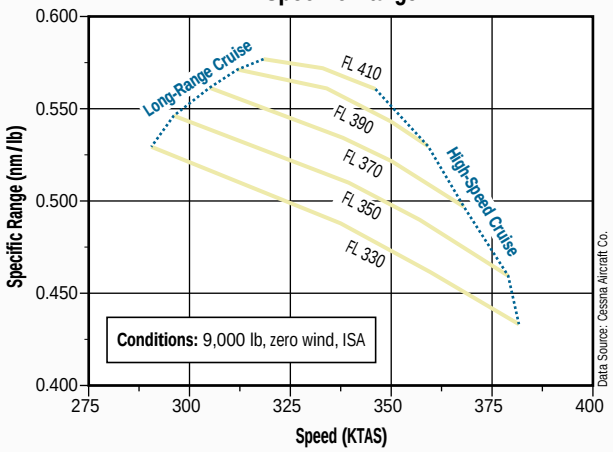
Specific Range — The specific range of the CJ1, the ratio of miles flown to pounds of fuel burned (nm/lb), is a measure of fuel efficiency. The lines on this chart, being based on four to five data points between long-range and high-speed cruise, are approximations of the change in specific range between the endpoints. Similar to other turbofan aircraft, the spread between the CJ1's long-range and high-speed cruise specific range narrows at maximum cruise altitude. However, the CJ1's maximum cruise speed drops off sharply with increasing cruise altitude.

Range/Payload Profile — The purpose of this graph is to provide simulations of various trips under a variety of payload and airport density altitude conditions, with the goal of flying the longest distance at high-speed cruise. The four payload lines are plotted from individual mission profiles with four to five data points, ending at the maximum range for each payload. The time and fuel burn dashed lines are based upon the high-speed cruise profile shown on the Time and Fuel vs. Distance chart. The runway distances, computed using FAR Part 25 rules, are based upon a flaps 15 degree takeoff configuration, with the exception of the 10,600-pound takeoff at 5,000 feet, ISA+20°C, which requires a no-flap configuration so that the aircraft can meet second-segment, one-engine-inoperative climb performance.

Time and Fuel vs. Distance

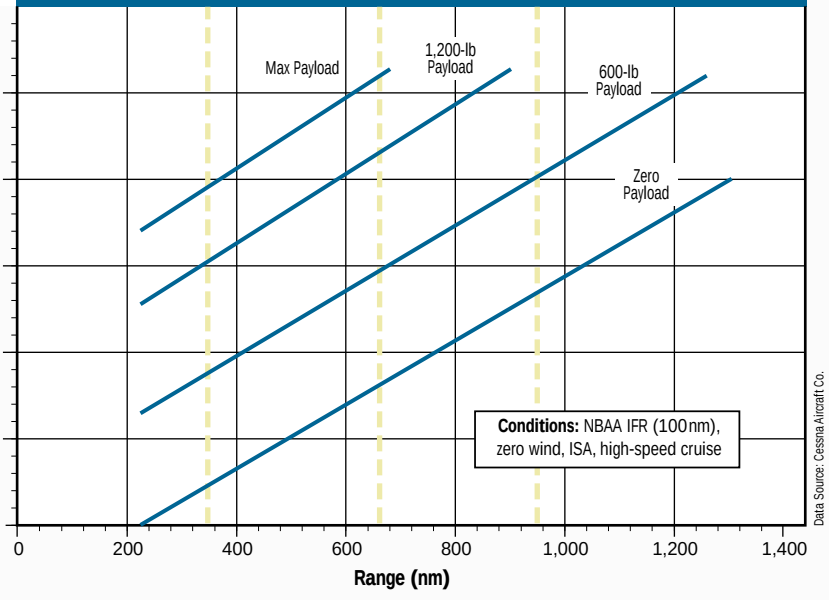


Specific Range



Range/Payload Profile

Takeoff Field Length (ft)			Fuel Burn (lb)	919	1,538	2,081
SL ISA	5,000 ft ISA+20°C	Gross Takeoff Weight (lb)	Time (hr)	1	2	3
3,280	8,170	10,600				
3,180	5,840	10,500				
2,740	5,210	10,000				
2,520	4,590	9,500				
2,320	3,970	9,000				
2,250	3,350	8,500				
2,180	2,770	8,000				



The standard configuration includes a side-facing passenger seat opposite the entry door.

require leading edge ice protection.

The CJ1's Type Certificate No. A1WI, dated October 15, 1992 and amended February 15, 2000 indicates that the aircraft is certified in accordance with Part 23 to Amendments 1 through 38 and 40. Special conditions were imposed for requiring Part 25 runway and emergency descent performance, plus resistance to high intensity radiated fields (HIRF) and lightning. The CJ1 also meets Part 25 bird-strike protection and fail-safe construction standards. The FAA granted an exemption from the Dutch roll damping characteristics required by Part 23.181(b). Flight into known icing certification is in accordance with Part 23.1416 and Part 23.1419.

Notably, the aircraft's single-pilot certification requires that all changes to cockpit layout, avionics or systems controls be approved by the appropriate FAA Aircraft Certification Office. Operators won't be able to re-configure the panel with avionics options using a simple STC or field approval process. In addition, the type certificate data sheet prescribes specific rules that must be followed when re-upholstering the crew and passenger seats to preserve seat strength and crashworthiness.

Passenger Cabin

The main passenger door, measuring 50.7 inches high and 23.5 inches wide at the maximum width near the bottom, has an active, primary seal inflated by low-pressure service bleed air and a passive, secondary seal, inflated by cabin pressure. The vault-like door fastening system, well proven during three decades of Model 500-series operations, uses 12 retracting pins to secure the door to the frame. A three-step, folding boarding ladder provides access to the cabin.

A plug-design emergency exit, essentially the same size as a Part 25 Type III exit, on the right side of the full-width, aft lavatory and over the right wing, provides an alternate means of egress.

The low-mounted wing allows the cabin to have a full-length dropped aisle, similar to that of the Citation Encore, providing 57 inches of headroom in the center of the cabin. The main cabin measures 11.2 feet in length from the cockpit divider to the aft pressure bulkhead. The maximum width of the cabin is 58 inches. All measurements are with the upholstery installed.

The standard configuration includes two crew seats, a side-facing passenger seat across from the main entry door, four club seats and a non-belted potty seat over a non-flushing toilet. The four club-section seats can be tracked fore and aft and inward toward the aisle for increased shoulder room.

Standard furniture includes a forward, left-side refreshment center, left- and right-side work tables in the club section, pleated window curtains, a two-book navigation chart case behind the copilot's seat and a coat rack in the lavatory.

Baggage capacity is one of the aircraft's strong suits. The 24.4-cubic-foot, unpressurized, unheated forward external compartment holds 400 pounds, 100 pounds of luggage can be stowed in the four-cubic-foot lavatory storage area, and the 30.2-cubic-foot aft, external, unpressurized luggage compartment accommodates 325 pounds of baggage.

Flying Impressions

Cessna's CJ1 demonstrator, 525-0361, has a generous amount of optional avionics equipment, including three-screen Pro Line 21 avionics and a UNS-1K FMS. The demonstrator also has a belted seat, flush toilet, deluxe refreshment center and aft cabin divider with mirror, among other options, resulting in a basic empty weight of 6,694 pounds, 39 pounds heavier than the average of the first 10 CJ1 orders. As a result, the demonstrator has a 586-pound available payload with full fuel, assuming a single pilot.

CJ1 aircraft tend to be slightly tail heavy. Most production aircraft require 75 to 100 pounds of removable ballast to be carried in the nose baggage compartment when flying single pilot. However, adding cockpit or cabin seat occupants eliminates the need for ballast, thus preserving the aircraft's published range/payload performance.

Cessna demonstration pilot Michael Mawhirter walked around the CJ1 with B/CA, pointing out many of its ease-of-use features. Compared to early Citation 500 models, the CJ1 is easier to inspect on preflight, has better baggage access and better routine maintenance ergonomics. We also noted the CJ1 has noticeably better metal work and exterior paint than early CitationJets.

Opening the forward baggage compartment doors, it's easy to check windshield alcohol, brake fluid and pneumatic pressures by means of sight and pressure gauges on the aft bulkhead. However, we also noted there is no orange or red color coding on the inside of the latches to help identify when they are not secure.

Standard furniture includes a forward, left-side refreshment center and left- and right-side tables in the club section. Reading lights, air outlets and emergency oxygen masks are provided to each of the passenger seats.

Dual landing lights, faired into the belly pan, provide excellent runway and taxiway illumination. The navigation lights, though, are single bulb units, offering no redundancy in case of a burned-out bulb.

Only the bottom half of the horizontal stabilizer deice boots can be inspected on preflight. When necessary, the top half of the boots, exposed to the sun and most likely to wear first, must be inspected with a tall ladder or hoist.

The CJ1 has no dedicated aft equipment bay. The battery, fire bottles and external circuit breakers are located in easily accessible compartments adjacent to the aft, external baggage compartment. Notably, the engine duct covers fit into a vinyl storage case that occupies less than one cubic foot of baggage compartment volume.

Once the preflight inspection was complete, I strapped into the left seat with demonstration pilot Dale Carter in the right seat. Mawhirter, as safety pilot, occupied the right front passenger seat. The demonstrator's actual zero fuel weight was 7,294 pounds. With 2,000 pounds of fuel, the start weight was 9,294 pounds and the takeoff weight for computations was 9,200 pounds.

Climbing into the CJ1, it immediately became apparent that the cockpit has no surplus legroom for tall pilots. While Cessna claims it has identical cockpit dimensions to the original Model 500, the CJ1 seems more cramped in today's era of more generously sized aircraft. As an $11,900 option, Cessna offers a recessed bulkhead behind the pilot's seat back and a seat track extension that allows the pilot's seat to be tracked aft an additional two inches for increased legroom for tall pilots. The downside is a loss of some storage volume inside the left-side refreshment center, according to Commercial Envelope's Whaley.

The CJ1, in our opinion, is a model of single-pilot ease-of-use features. For example, in keeping with Citation design, the CJ1's left-side circuit breaker panel controls engines and system functions; the right side is for avionics and instruments. The controls are arranged logically by function and the anti-ice switches are color-coded green, as they have been for three decades of Model 500-series aircraft.

Almost every knob, switch or button is easily reached. Tactile feel and over-center switch designs help prevent inadvertent operation of the wrong control. There are three exceptions, in our opinion, to the ease-of-use design features. The standard-fit Puritan-Bennett "sweep on" oxygen masks do not come with smoke goggles and they are somewhat difficult to don with one hand if the pilot is wearing eyeglasses. We believe the optional Eros quick-donning masks with inflatable harness straps and separate smoke goggles are a better choice.

Next, the standby Smiths HSI has heading and course knobs without positive-click detents for each degree of movement. This attribute requires excessive head-down time to verify the desired input. In our opinion, the standby HSI knobs should be modified to have positive-click detents, in keeping with the ergonomic design of the Collins Pro Line 21 avionics system.

And third, the console-mount position of the PFD course, altitude pre-select, and heading knobs isn't optimum for single-pilot operation, in our opinion. B/CA would prefer to see these controls mounted close to the PFD for improved hand/eye coordination for single-pilot operations.

Having completed the pre-start checks, we were ready to start the engines. Starting the CJ1's FJ44 turbofans is as easy as turning on the battery switch, pushing each engine start button in sequence and advancing the thrust lever at the proper time. All the engine gauges, displayed on the MFD, have "smart" color coding to alert the crew of abnormalities.

During taxi, it became apparent that the engine thrust attenuators were very effec-

Rockwell Collins Pro Line 21 Avionics

The CJ1's standard avionics package includes a left-side, eight-by-10-inch PFD; left-center, eight-by-10-inch MFD with engine gauge display; and right-side, five-by-five-inch Smiths flat-panel EADI and EHSI, flanked by conventional air data instruments. Collins also supplies the RTA-800, 24-watt, solid-state weather radar; a single ALT-55B radio altimeter; a single solid-state AHC-3000 attitude-heading reference system; a single ADC-3000 digital air data computer; and an FCS-3000 digital flight guidance system. Electromechanical ADI and air data, along with flat-panel N1 and standby HSI displays, are mounted high in the center of the instrument panel.

Honeywell Bendix/King Silver Crown panel-mount communication/navigation/surveillance radios are installed mainly in the instrument panel to the right of the MFD, including dual VHF comm transceivers, dual VHF nav receivers, a single DME (remote mount), a single ADF receiver, dual Mode S transponders and KLN-900 GPS (console mount). The standard package also includes dual Avtech audio panels.

Thirty-five percent of CJ1 buyers are opting for the third, right-side, eight-by-10-inch LCD functioning as a PFD. The three-screen configuration comes with a second AHC-3000 AHRS, enabling the CJ1 to meet RVSM requirements in Europe or over the North Atlantic. Installing the optional right-side Honeywell AM-250 altimeter with integral DADC also meets RVSM requirements.

Sixty-five percent of buyers are upgrading to the optional UNS-1K FMS and 10 percent are opting for the Honeywell GNS-XIs. Forty percent of buyers are ordering TCAS 1, but only 18 percent are opting for Enhanced GPWS. Other options include dual Silver Crown ADF and/or DME radios, KHF-950 high frequency transceiver or provisions for installing the radio later, cockpit voice recorder, BFGoodrich Stormscope lightning detection system and a Safe Flight N1 thrust computer — not linked to the engine displays on the MFD.

tive. For tight turns, using differential braking, it's necessary to leave the outboard power lever above idle to retract the attenuator in order to have enough thrust to continue the maneuver without stopping. During prolonged taxi, especially uphill or when the aircraft is heavy, a thrust attenuator stow switch allows the automatic deployment feature to be overridden at idle, thereby preventing the need to jockey the thrust levers to maintain taxi speed.

Our computed V speeds for the flap 15 degrees takeoff were 96 KIAS for the V1 decision speed, 100 KIAS for rotation and 102 KIAS for the V2 one-engine-inoperative takeoff speed.

The takeoff field length was 2,600 feet. Flap retraction speed was 116 KIAS. The Safe Flight thrust computer advised setting 97.6 percent N1 for takeoff.

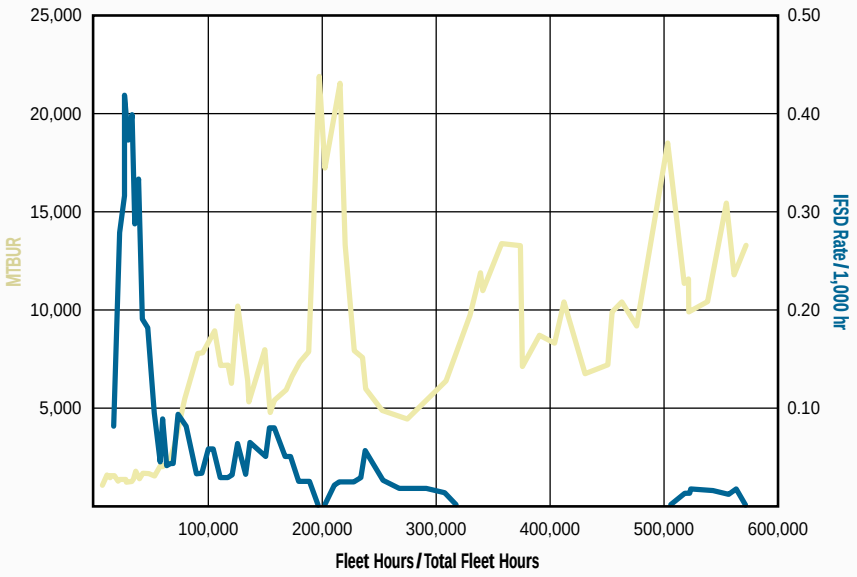
On takeoff, the first sensation in the cockpit was lack of engine noise at takeoff thrust. Acceleration was brisk and we rolled less than 2,000 feet before reaching V1. On rotation, the pitch forces were light. During the climb to FL 410, the CJ1 exhibited excellent short- and long-period pitch damping, as well as very little adverse yaw in full aileron deflection rolls. Yaw deflections were well damped at low to mid altitudes. Roll control forces are moderate and rudder control forces are substantial, but not excessive, from a subjective standpoint.

Engaging the autopilot function proved that the Collins FCS-3000 is one of the smoothest and most-precise flight guidance systems installed in any turbine aircraft, regardless of price, in our opinion. It's also linked to the air data computer for indicated speed/Mach and vertical speed functions.

Using a cruise climb speed schedule, we reached FL 410 in 31 minutes and burned 500 pounds en route, matching Cessna's flight planning guide predictions.

In ISA-6°C conditions, though, the

Williams/Rolls-Royce FJ44-1A Turbofans Mature



FJ44-1A Engine MTBUR
Six-Month Rolling Average vs. Fleet Hours

FJ44-1A IFSD Rate
Six-Month Rolling Average vs. Fleet Hours

After its entry into service in early 1993, the FJ44-1A had some significant teething pains on its way to maturity. In mid-1994, overload problems with the number-two engine bearing resulted in four inflight shutdowns. To remedy the problem, Cessna, Williams and the FAA developed a Service Bulletin upgrade that was incorporated into the fleet during a five-month period.

Subsequently, in third quarter 1996, there were two inflight shutdowns caused by high-pressure turbine (HPT) wheel disk failures, resulting in the issuance of AD 97-01-05 requiring eddy current inspection and eventual installation of an upgraded HPT disk. Two years later, the FAA issued AD 99-07-04, imposing a 1,900-cycle life limit on the upgraded HPT disk. Essentially, the AD requires HPT disk replacement at the 1,750-hour, mature state, hot-section inspection interval to eliminate the need for engine teardown between HSI and TBO.

As shown by the accompanying graph, these improvements have resulted in a sharp decline in the Inflight Shut Down (IFSD) rate and a steady increase in the Mean Time Between Unscheduled Removals (MTBUR). There has been only one IFSD event in the last 330,000 flight hours, according to Cessna and Williams/Rolls-Royce. CitationJet operators rank Williams number one in product support, Cessna claims.

Cessna CJ1

Specifications

B/CA Equipped Price	$3,716,000
Characteristics	
Wing Loading	44.2
Power Loading	2.79
Noise (EPNdB)	73.4
Seating	1+6/7
Dimensions (ft/m)	
External	
Length	42.6/13.0
Height	13.8/4.2
Span	46.8/14.3
Internal	
Length	11.0/3.4
Height	4.8/1.5
Width	4.8/1.5
Thrust	
Engine	2 Wms RR FJ44-1A
Output/Flat Rating OAT°C	1, 900 lb ea.
Inspection Interval	3,500t
Weights (lb/kg)	
Max Ramp	10,700/4,853
Max Takeoff	10,600/4,808
Max Landing	9,800/4,445
Zero Fuel	8,400/3,810
BOW	6,825/3,095
Max Payload	1,575/714
Useful Load	3,875/1,758
Executive Payload	1,200/5,441
Max Fuel	3,220/1,461
Available Payload w/Max Fuel	655/297
Available Fuel w/ Max Payload	2,300/1,043
Available Fuel w/Executive Payload	2,675/1,213
Limits	
MMO	0.700
Trans. Alt. FL/VMO	FL 305/260
PSI	8.5
Climb	
Time to FL 370	26 min.
FAR 25 OEI Rate (fpm)	540
FAR 25 OEI Gradient (ft/nm)	292
Ceilings (ft/m)	
Certificated	41,000/12,497
All-Engine Service	41,000/12,497
Engine-Out Service	22,500/6,658
Sea Level Cabin	22,027/6,714
Certification	FAR 23, 1992/2000

maximum cruise performance was off compared to standard day conditions for an 8,600-pound aircraft. We achieved 342 KTAS on 630 pph, 11 KTAS slower and 10 pph higher than book predictions primarily due to the prevailing colder than standard conditions at altitude.

During the descent back into the Wichita area, a check of the speed brakes revealed virtually no pitching moment associated with extension or retraction. At MMO or VMO, the aircraft will descend at 6,000 fpm-plus with the speed brakes extended. Gear extension and flaps 15 extension also produce very little pitching moment. Extending the flaps from 15 to 35 degrees produces a mild nose-down pitching moment. Bright ambient light conditions, on the day of the demonstration, revealed that the optional UNS-1K's full-color LCD is difficult to read in direct sunlight. Carter had to shield the box with a checklist in order to see the screen while he reprogrammed the box. This problem results in part from the CJ1's relatively large windshield and side windows that provide excellent visibility for single-pilot operations.

Notably, the UNS-1K, while being a powerful FMS, demands that it be completely mastered before attempting to fly single-pilot. New pilots may need to spend equal time mastering the aircraft and the FMS during initial CJ1 training. Essentially, the UNS-1K is an electronic copilot, if used optimally.

We requested a VOR RNWY 21 approach at Hutchison for our first approach. The procedure involves intercepting an arc to the final approach course inbound. The Pro Line 21/UNS-1K package does not completely display the approach graphically on either the PFD or MFD in the FMS mode. To prevent disorientation, we switched to the VOR mode and flew the approach using a conventional "steam gauge" HSI display.

The CJ1 is stable, docile and, most of all, slow on approach. At 8,000 pounds, our VREF landing speed was 98 KIAS. It's easy to compensate for crosswind with a

Cessna CEO Gary Hay Is Committed to New Product Development

About 18 months ago, Cessna simultaneously announced development of four new models — the CJ1, CJ2, Ultra Encore and the Sovereign. The CJ1 is the first of those aircraft to complete certification, and the CJ2 is following rapidly on its heels. However, despite all the investment in new models over the last several years, the company is not standing still.

Paul Bowen

Cessna CEO Gary Hay

In fact, CEO Gary Hay says the company is as committed as ever to new product development, and is paying particularly close attention to the entry level market, where aircraft like the Eclipse 500 are generating a lot of buzz, and where Cessna has a wide gap in its offerings between the piston-powered 206 and the new CJ1.

"We are looking hard at that segment of the market today and have been for some period of time, and I would say there is a pretty good probability that we will do something in that category of airplanes whether it's turboprop or turbofan or dual pac," says Hay. "There is clearly a market there that is being underserved right now. And if we want to continue employing our step-up strategy, we've got a disconnect before we get someone into a CitationJet."

However, Hay's view of what's possible in the segment are less dramatic than claims being made by some of the new companies attempting to break into producing small business jets. For one, he sees the price of a small twin turbofan at something close to $2 million, nowhere near the $775,000 Eclipse is claiming for its aircraft.

"We know what the cost of those engines is, we know what the cost of material is, we know what the cost of labor is, we have some sense of the extent of time required to do these kinds of things in terms of FAA certification and so forth and so on. We know what it costs for brick and mortar and those kinds of things. And if they can do that, they certainly should be applauded and will have written themselves into the history books, because my belief would be that price-point wise, they've missed it to the point of about 100 percent."

However, he says Cessna is not being complacent, and that it would be a mistake to dismiss programs like the Eclipse out of hand. "When business is good and the economy is as strong as it is, we see these companies come in with new concepts, and I think it's helpful for us, because invariably there are good ideas that come out of those unconventional kind of approaches to doing product design and doing business, and we can all learn from those," says Hay. "Having said that, when I think about the success stories, then it becomes a little more suspect. However, it is absolutely in my opinion the wrong thing to do to discount out of hand intelligent people with money behind them who have a new idea."

Hay also believes that there is room for new turboprops in the market, primarily because of the field lengths likely to be required by light jets, compared to the modest takeoff distances for small turboprops. However, he says the company would undertake a great deal of market research before betting on a turboprop.

Cessna 2020

One of Hay's first acts as CEO was to roll out Cessna 2020, a vision and mission for his tenure and beyond. The "high five" of the document include total customer satisfaction, setting the quality standard for aviation, achieving breakthrough operating performance, becoming one of the top 10 companies to work for in the United States and achieving superior financial performance.

It's noteworthy that being a technology leader doesn't appear in the top five. That's not because the company doesn't believe in technology, but rather reflects its conservative stance. "We may not be always at the cutting edge — or the bleeding edge as it's sometimes described — of technology," says Hay. " What we really prefer to do is take technology, or cutting-edge technology and progress our understanding of it as far as we can take it. Then we like to take one step back, and that's where we start to produce airplanes. We think it's inappropriate, unfair and perhaps even irresponsible to apply cutting-edge technology on our customers when in fact it is not yet proven, because they get to help engineer the product that way, and that doesn't always produce a lot of customer satisfaction."

One technology the company is assessing in detail is composites. "We're taking a hard look right now in a number of areas of composites in a real cutting-edge definition, rather than the old definition that's kind of gotten captured as composites, when in fact, it's pretty dated technology," he says, referring to composite light aircraft that get a lot of attention for using advanced materials, despite the fact that they are essentially laid up by hand. And it's at that end of the market — the single-engine pistons — where Hay says composites look most attractive right now.

"In a perfect world, I'd love to be able to have Cessna introduce a family of single-engine piston products that had true, high-tech composite components, if in fact that makes sense," he says. Starting at that end of the market not only would help the company shake the skeptics who say its singles are really 1950s aircraft at 2000 prices, it also would require less investment — and less risk — than developing composite jet aircraft.

"We will be very evolutionary with new materials and processes, rather than trying to abruptly migrate it across the product line aggressively," he says. **Perry Bradley, in Wichita**

little wing-down, top-rudder cross-control when landing the CJ1. The long-travel, trailing-link main landing gear soak up imperfections in pilot technique, even when landing on the upwind gear alone. The CJ1's flaps manually activated, 60-degree flaps/speed brake extension lift dump system, coupled with automatic thrust attenuator deployment, makes short work of stopping, even with light application of wheel brakes. However, we found the anti-skid braking system to be jerky during a maximum effort stop.

During simulated one-engine-inoperative flight, the CJ1 proved to be easy to control, albeit with substantial rudder pressure to counteract asymmetric yaw. At moderate weights, the aircraft easily can be flown in the pattern at 115 KIAS to 125 KIAS on one engine, speeds that would be uncomfortable in cabin-class piston twins or most turboprops, especially when turning into the dead engine. After the nearly two-hour flight, we landed at Wichita Mid-Continent Airport, having burned 1,600 pounds of fuel.

Performance vs. Price

The CJ1 is indeed a niche aircraft, as shown in the accompanying Comparison Profile. Its cabin offers somewhat less volume than its competitors, but on the average 1.1-hour mission, characteristic of the CitationJet fleet, that shouldn't be a big detractor. The Comparison Profile also shows that the CJ1 offers less maximum payload than other aircraft in the composite profile. In addition, the average BOW of the first 10 aircraft is 30 pounds heavier than the BOW shown in the accompanying Specifications table, because of extra equipment ordered by buyers.

The Comparison Profile and the Specifications table, however, do not show the difference in cabin noise and vibration levels between the CJ1 and its turboprop competitors.

Compared to turboprops, though, the CJ1 offers clear performance advantages with its FL 410 cruise altitude, certified Part 25 takeoff performance and 380 KTAS maximum cruise speed. The aircraft also has excellent fuel economy compared to the composite average.

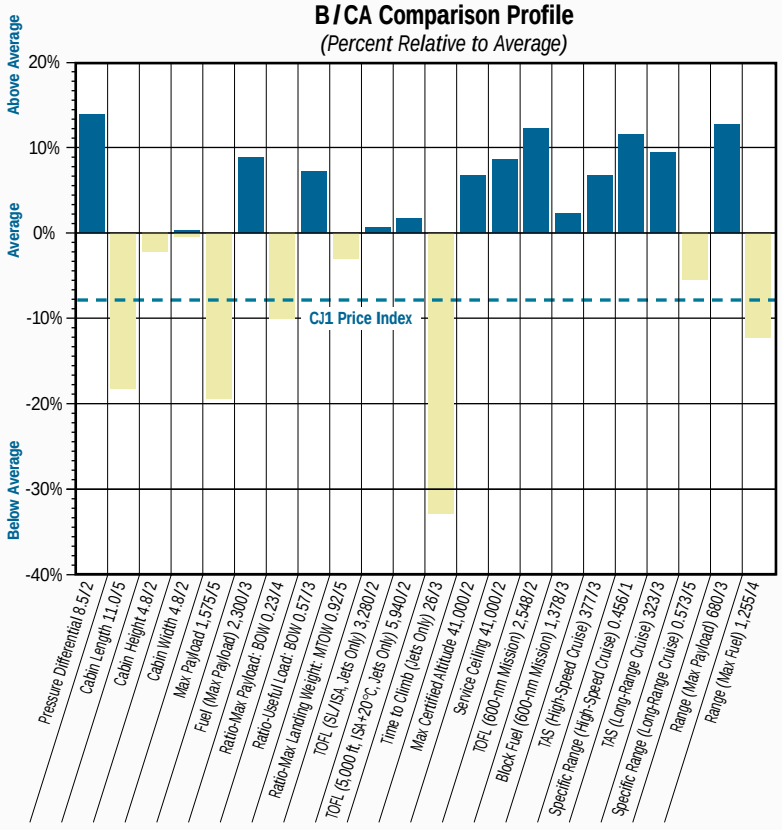
The CJ1 is the only business jet available for less than $4 million, including the most popular optional equipment, even though it is $175,000 more expensive than the CitationJet it replaces. When its eight-percent price advantage, shown in the Comparison Profile, becomes the baseline for measuring its strong points and shortcomings, the CJ1 fares well by most indexes.

Outside of the Comparison Profile factors, the CJ1 offers an advanced Pro Line 21 avionics suite and the availability of most of the avionics options offered on large business jets. It's the least-expensive aircraft in B/CA's May *Purchase Planning Handbook* to offer Part 25 takeoff safety performance margins. And its slow-speed handling characteristics almost are unsurpassed by any other business jet.

Cessna never lost sight of the original design goals its engineers established three decades ago when the Model 500 was being developed. Its third-generation, entry level business jet is faster and more fuel efficient, and it comes with substantially more standard equipment. The CJ1, similar to the CitationJet, however, does not offer the range/payload flexibility of the original Model 500.

Some buyers may need more cabin space, more speed and more range/payload flexibility than the CJ1 offers. For them, Cessna offers the CJ2 and Raytheon competes with the Premier 1. But the next step up in light business jets requires a 20- to 30-percent higher price of admission.

The CJ1's pricing, along with Cessna's claim of having the lowest operating costs of any jet or competitive turboprop, make it an attractive first step up into turbofan business jets. **B/CA**



Tradeoffs are a reality of aircraft design, although engineers attempt to optimize the blend of capabilities, performance and passenger comfort.

In order to portray graphically the strengths and compromises of specific aircraft, B/CA compares the subject aircraft to the composite characteristics of other aircraft in its class, computing the percentage differences for the various parameters. We also include the absolute value of each parameter, along with the relative ranking, for the subject aircraft within the composite group.

The CJ1 is a niche aircraft, with few peers in the entry-level jet category. As a result, we included both light turbofan and turboprop aircraft in the composite: Cessna Citation CJ1 and CJ2, and Raytheon Premier 1, King Air 90B and Super King Air 200.

Operating Expense

Hourly Operating Cost

Fuel (130 gph x $2.35/gal)	$305.50
Maintenance, Labor	65.00
Maintenance, Parts	110.50
Engine, Williams Elite Plan	169.80
TOTAL	$650.80

(Assume no warranty coverage, 320-nm average trip length)