PILOT REPORT: CITATION M2

News / Business aviation

Since entering service in 2013, the $4.5 million **Citation M2** has garnered a significant share of the light jet market and even of Textron Aviation's own smaller jet series. The M2 is the newest member of the CitationJet (525) series, and 12 were delivered in 2013, even though certification was not awarded until late that year; during its first full year of production last year, 46 M2s were delivered. This year is off to a slower start, but in the first half Textron Aviation delivered 17 M2s, the most of any of the CitationJet line and 12 more than the five Mustangs that were delivered.

Although 2015 is off to a decent start for the Mustang, the last year that the Mustang saw significant deliveries was in 2013, with 20 joining the fleet. What these numbers seem to show is that the M2 has taken over as the entry-level airplane of choice for owner-pilots moving up to a light jet. The M2 program was announced in 2011, the same year that production of the CJ1+ ended.

What makes the M2 so attractive has a lot to do with the performance improvements it has over the original CJ1. The CJ1+'s and M2's 1,965-pound-thrust, dual-channel Fadec-controlled Williams FJ44-1AP introduced light jet pilots to greatly improved climb performance. The non-Fadec FJ44-powered CJ1 took about 58 minutes, including a step, to climb to FL410, while the M2 (its engine

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is the FJ44-1AP-21) can climb to FL410 (maximum altitude) directly in just 24 minutes. And while the M2 looks a lot like a refreshed CJ1+, it outperforms the CJ1+, with a maximum cruise speed of 404 versus 389 ktas, and offers more pilot leg room, touchscreen-controlled GarminG3000 avionics, a newly designed interior and winglets.

SIMPLE SYSTEMS

The M2's systems, like those of all the smaller Citations, are simple and reliable. The flight controls are cable- and pushrod-actuated, and a 1,500-psi open-center hydraulic system moves the flaps and speed brakes. Tabs on the ailerons, elevator and rudder are used for trim, and pitch trim is operated by a switch on the yoke or a mechanical wheel on the center console. Aileron and rudder trim controls occupy the aft end of the center console.

The trailing-link landing gear is held retracted by uplocks, which in a landing-gear emergency are released to allow the gear to freefall. The extended gear is then locked in place by nitrogen blow-down.

The wings hold 492 gallons or 3,296 pounds of fuel, and there is no need for fuel anti-icing additives such as Prist because an oil heat exchanger warms the fuel. Fuel filling is typical CitationJet, via filler caps on each wing (although the CJ4 does have single-point refueling).

Dual 24-volt, 300-amp starter-generators power the electrical system. Further simplifying the electrics is a second independent battery mounted in the nose. This allows M2 pilots to switch on all the avionics before engine start to set up flight plans, check weather and obtain clearances. An added benefit of the auxiliary battery is the extra power it contributes during an electrical system emergency, providing one hour instead of the typical 30 minutes. While buyers can opt for a Nicad main-ship battery, the nose aux battery is a lead-acid type.

The automatic pressurization system is easy to manage with the G3000 avionics, and it knows exactly how to schedule the cabin climb and descent when a destination is programmed into the flight plan. Bleed-air heat exchangers and a vapor-cycle air-conditioning system provide environmental control, the same as all CitationJets through the CJ3+. The air-conditioning system can be run on the ground using a ground power unit or it can be switched on as soon as the right engine starts because the compressor is mounted on that engine. The compressor shuts off briefly during left engine start. With an 8.5-psi differential, the pressurization system maintains a sea-level cabin to 21,280 feet, and at the maximum operating altitude of 41,000 feet the cabin is at 8,000 feet.

There are two external baggage compartments in the M2: in the nose 20 cu ft/400 pounds and in the tailcone 30 cu ft/325 pounds. A ski tube for the tailcone is optional. While the tailcone baggage compartment isn't heated or pressurized, it does receive some warm air from the outflow valves.

Airframe de-icing is provided by bleed-air in the wing leading edges, which helps maintain the wings' laminar flow, and rubber boots on the empennage, which saves weight in the tail. The boots work fine, according to demo pilot Tony Paolucci, and the only limitation is that they can't be switched on if the ram-air temperature is -35 degrees C or lower. "The [wing's] heated leading edge is a big selling point," he said.

Textron Aviation says it is on a mission to make maintenance easier, and the M2 incorporates features that should help drive down maintenance costs. "We talked to the service centers," said JD Terry, Textron Aviation's business leader for jets, "and asked them, 'What are the pain points?'"

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An example is the lightning diverter strips on the radome; some OEMs are embedding these strips into the composite material of the radome so it looks smoother, but bonding the strips on the outside of the radome makes repairs less expensive, he explained. The angle-of-attack vane is an all-in-one unit removable from the outside of the airplane, and thus needs no time-consuming and costly disassembly of interior panels and cabinets. “These features are based on maintenance feedback,” he said.

The nosewheel turns up to 20 degrees using the rudder pedals, then casters past that with application of power and brakes, up to 65 degrees. “You can turn around on a 50-foot-wide runway,” Terry said.

CABIN COMFORTS

The M2’s cabin width (58 inches) and height (57 inches in a drop-aisle) haven’t changed from the CJ1 throughCJ4, but compared with the Mustang the M2 is 15 inches longer, three inches wider and three inches taller, which adds comfort for passengers, especially in the four-club main seating area. A belted toilet seat is available, as is a side-facing seat up front, for a total of six passengers plus two pilots or seven passengers and one pilot. The flushing lavatory must be serviced from inside the airplane.

An acoustic buffer seal around the entry door keeps noise levels low, and bagged insulation installed on the fuselage interior also helps hush the ride.

The cabin entry stair is equipped with three steps instead of the typical two, which makes climbing on board easier for pets and for passengers wearing high heels. This entry stair is also found on newer CitationJets. The steps fold in half as the stair is pulled up, and a gas spring keeps the steps from banging down when the top half of the stair is lowered after opening the door, with rubber insulators protecting parts from banging together. There is no weight limit for the steps.

The lavatory area can be enclosed by an optional dual-side hard wall or a curtain. With the curtain option, the right rear-seat occupant can recline the seat farther. Both sides of the club seating area are equipped with 115-volt power outlets. Next to each passenger seat is a headphone and microphone plug to tap into the intercom, although the noise levels are so low that this is rarely necessary. Textron Aviation’s Clairity wireless cabin management system is an option for the M2.

Galley cabinets on the front left side of the cabin are available in two sizes. The larger cabinet can accommodate a coffee pot, while the smaller cabinet provides more space for the pilot seat to move.

COCKPIT FEATURES

CitationJets and particularly the M2 are designed for owner-pilots and pilots flying without a copilot, and the Garmin G3000 flight deck is particularly well suited to that mission. Comparing the M2 cockpit to that of the CJ1+ illustrates some key differences, particularly the shrinking center console. In the CJ1+ the console dominates, with a large FMS taking up a lot of space between the seats, flanked by knobs and switches. The Rockwell Collins Pro Line 21 displays, in portrait orientation, don’t fill that much panel space on the CJ1+, and there is a lot of empty area.

In the M2, the center console is considerably smaller, primarily a place to house the power levers, flap lever and trim controls. At the front end of the console where it meets the instrument panel,

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two Garmin GTC 570 touchscreen controllers are angled for easy reach from either front seat. The G3000 FMS is essentially incorporated inside the avionics, and the interface is the much more intuitive touchscreens.

With most systems controls embedded in the G3000 avionics, many knobs and switches are eliminated, for a much cleaner cockpit. Each pilot has a GCU 275 display controller mounted under the glareshield, with a single flight director/autopilot mode controller in the center. An L-3 Avionics ESI-1000 Trilogy standby display is mounted next to the pilot's GCU 275. The display controller is somewhat redundant in that most of its capabilities are mirrored in the GTC 570 touchscreen controllers, although it is handy to use the GCU 275 to manage theG3000 primary flight display (PFD) inset display. The GCU 275s also act as mechanical backups for the touchscreens.

Three 14.1-inch displays with WXGA (1,280- x 800-pixel resolution) fill the available instrument panel space, with a PFD for each front seat and a multifunction display (MFD) in the middle. Reading charts without zooming is easier on the higher-resolution G3000 displays in the M2 than on the lower-resolution G1000 displays in the Mustang. The G3000 screens can be split to show a two-thirds and one-third screen on the PFD or two half vertical strips alongside the engine indicating strip on the MFD, giving pilots a lot of flexibility for display formatting. Pilots can save their favorite profiles, including a choice of male or female annunciations and screen layout choices, and call them up with a simple preferences selection on the touchscreen controller.

The G3000 displays not only offer higher resolution than the G1000 displays in the Mustang, but their sizes differ, too. In the Mustang a 15-inch MFD is flanked by two 10.4-inch PFDs, and this gives the Mustang's glareshield a taller look than in the M2. Visibility in the M2 is excellent; the glareshield is a smooth curve from side to side, in marked contrast to the Mustang glareshield's bulging center.

The solid-state Garmin GWX 70 radar and Sirius XM WX in the M2 provide pilots with more flexibility, in that it's possible to overlay weather radar or Nexrad imagery onto the moving map (but not both at the same time). Or the pilot can display Nexrad on the PFD and weather radar on the MFD to compare the strategic and tactical views simultaneously. With two pilots up front, each can independently control the GWX 70's tilt and range.

The M2 has two angle-of-attack indicators, one above the glareshield in the center with the green "donut" indicator for ref speed and another small indicator on the PFD below the airspeed tape.

FLYING THE M2

When I climbed into the left seat of the M2, Paolucci showed me how the smaller center console makes entry easier. Compared with the console in the CitationJets equipped with the Pro Line avionics, the M2 console is four to six inches shorter, but it is also sculpted to be smaller where possible, and I was thus able to slide my feet between the bottom of the console and the seat, instead of having to step over to get my feet in front of the seat. This is a welcome feature and shows great attention to detail.

Other design details revealed themselves, including a cellphone holder forward of the power levers and the leather-wrapped yoke that has become standard in Citations.

We crafted a flight plan to take us west of Wichita and up to FL410. At a basic operating weight of 7,239 pounds and with 2,550 pounds of fuel and no passengers, our taxi weight was 9,789

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pounds. Less 50 pounds of fuel for taxi, takeoff weight was 9,739 pounds, nearly 1,000 pounds below the 10,700-pound maximum takeoff weight.

To start the FJ44s, push the button on the center console, then move the throttle off the cutoff gate and back to idle. We had to set the speed bugs because the performance software is not available yet for the G3000. Paolucci said this feature will be added in an upcoming software update. Paolucci prefers to use the M2's simplified criteria for basic performance calculations, but iPad apps are also available for more detailed performance information if needed. At this weight, V1 was a low 105, Vr 107 and V2 111 kias.

The wind was from 170 at 13 knots, and I taxied the M2 to Runway 19L. The outside air temperature was warmer than normal, ISA +15 to +13 through the mid-thirties, so the climb was slower than it would have been at lower temperatures.

From the left seat the M2 wears comfortably, one of those airplanes that makes the pilot feel instantly at home. The nosewheel responds crisply and the steel-disc anti-skid brakes, powered by a separate electrically powered hydraulic pump, are solid.

Fadec makes it easy for a single pilot to set power on takeoff: just find the takeoff detent for the power levers and leave them alone until it's time to pull back to climb power, one detent below the takeoff setting. The engines gave us a quick push and it wasn't long before it was time to rotate and accelerate to the initial climb speed of 220 kias. Takeoff field length at our weight was just over 3,000 feet, according to the planning guide.

It took about 12 minutes to climb to FL230, where we had to turn on the wing/engine heat while penetrating some clouds, and this took the climb rate below 1,000 fpm. The rate built back to 1,200 fpm after we emerged from the clouds at FL280, even with the OAT at ISA +14 degrees C.

We decided to level off at FL400, a level we reached 29 minutes from takeoff. The OAT had dropped to ISA +2 degrees C. With power set at max cruise, the M2 settled down to 394 ktas and Mach 0.683, burning about 720 pph. This was about four knots faster than the book numbers. There is no detent to set the power levers in long-range cruise, but the book showed that pulling the power back would yield 318 ktas and about 500 pph. Paolucci said that it's hardly worth flying so much slower to save 200 pph of fuel, and most M2 pilots stick with the high-speed cruise detent, unless more range is truly necessary.

After the performance check at FL400, we descended to 13,500 feet. I flew steep 360-degree turns to the left and right, which are made easier by positioning the flight path vector on the G3000 PFD right on the horizon line. TheM2 handles like most other Citations, which means it is never too light on the controls and enjoyably comfortable to hand fly.

I slowed down for a clean stall and recovery; the M2 has a stall shaker, and I held the stall into the shaker, and the ailerons were still effective, thanks to stall strips on the wing leading edges. There was no tendency for either wing to drop. Adding 50 percent N1, extending full flaps and deploying the landing gear, I slowed down to try a simulated approach-to-landing stall, and it was similarly uneventful.

Returning to Wichita, I hand-flew the ILS to Runway 19L. With relatively low approach speeds, the M2 in the terminal environment feels like a much smaller airplane, and this is part of its attraction as a move-up airplane for owners of high-performance piston singles and single- and twin-engine turboprops. Vref was about 104 kias, and the M2 felt like it was on rails once trimmed.

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Paolucci explained that the straight-wing M2 is a little more tolerant of not being exactly on ref speed during the landing, but it is important not to let it float after leveling off in the flare. I hardly felt like I had to raise the nose at all before the mains touched down gently, then after lowering the nose, he raised the flaps to the takeoff position and I added power for the touch-and-go. The second and final landing was just like the first, and the anti-skid brakes helped me slow quickly to make the turn back to the Textron Aviation hangars. We could have used theM2's 60-degree ground-flap setting and speed brakes to shorten the rollout even further, and this can be done as soon as the mainwheels touch.

After flying the M2 for 1.5 hours, I felt it wouldn't take much more training to feel safe in this capable jet. While theM2 is one of the smallest Citations, it manages to deliver a lot of performance and flexibility for a sub-$5-million jet that can carry up to seven passengers. The ability to climb quickly to FL410 is helpful for getting on top of weather, although the top speed of 404 ktas comes at FL330. With full fuel, maximum no-crew payload is 704 pounds, and that allows a range of 1,300 nm (NBAA IFR, 100-nm alternate) or 1,580 nm at long-range cruise speed.

More than 1,600 CitationJets have been delivered since the first one entered service in 1993, and new versions like the M2 will undoubtedly keep the series flying long into the future.

13 OCTOBER 2015

SOURCE: AIN
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https://ids.50skyshades.com/news/business-aviation/pilot-report-citation-m2

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