Citation Mustang

Cessna's non-VLJ delivers on all its promises.

By Fred George

At NBAA 2002, Cessna Aircraft Co. announced development of the Citation Mustang, a $2.295 million entry-level light jet that would cruise as fast as 340 KTAS and be able to fly a single pilot plus three passengers 1,150 nm, arriving with 100-nm NBAA IFR reserves. Russ Meyer Jr., then company chairman and CEO, promised the aircraft would be certified in third quarter 2006.

Well that time has arrived and Cessna has delivered on its promises. Jack Pelton, Meyer's successor as chairman and CEO, will beam proudly at the NBAA convention in Orlando this month with the Mustang's FAA type certificate in hand. Notably, this TC comes with virtually no IOUs except for flight into known icing certification. That approval awaits natural icing tests later this year. All other systems, including all avionics functions, are "go." By the time deliveries to customers begin in the fourth quarter, the Mustang should fully be ready for entry into service.

Cessna folk are quick to say and to repeat that the Mustang "is no VLJ". But it's quite doubtful that its lightest of jets would have been launched, let alone achieved TC by now, had it not been for all the excitement about the new class of aircraft generated by Eclipse Aviation's VLJ. Initially, Cessna looked at the Eclipse 500 as a passing fad, perhaps a niche player at best. But as more entry-level jet prospects started looking seriously at the Eclipse and other VLJ programs, Cessna realized it would have to offer a new and lower priced Citation if it wanted to compete in this emerging market segment.

The Wichita airplane maker originally intended to price the Mustang at $1.95 million, but that was dependent upon wringing out half the cost of building the least expensive Citation in the 2002 model lineup, the CJ1. The firm came close to its pricing goal. At NBAA 2002, Cessna announced that the Mustang would be priced at $2.295 million in 2002 year dollars.

Two new essential and rapidly emerging technologies would help to drive down costs and keep the program on schedule. As always during a century of powered flight, new engine technology would be the first breakthrough needed to make possible a new generation of aircraft.

Pratt & Whitney Canada provided this critical leap forward. In

2001, it launched development of the PW600, a new family of turbofan engines in the 1,000- to 2,500-pound-thrust class having substantially lower manufacturing and overhaul costs than any of its legacy light turbine engine products, most particularly the PT6A and JT15D. The PW600 significantly lowered the purchasing cost for OEMs and also provided far lower operating costs for owners. Raytheon initially was slated to be the launch customer by ordering the PW525F, a 2,500-pound-thrust version of the PW600. That program later was cancelled. However, Cessna recognized the engine's potential, so it became P&WC's launch customer by ordering the 1,350-pound-thrust PW615F for the Mustang.

Garmin's G1000 integrated avionics suite was the second major advancement that would make possible a much less expensive Citation. The Olathe, Kan.-based avionics firm was looking for its first jet aircraft application, a move up-market that would put Honeywell and Rockwell Collins on notice that now there were three major players in the turbine business aircraft avionics market. Garmin's G1000 package for the Mustang, following the trend in consumer electronics, would be smaller, lighter and more powerful than any previous avionics suite in its price range. When the advanced features and functions of the G1000 for the Mustang were revealed, it was apparent that Garmin was ready to play in the business jet league.

With highly capable and reputable engine and avionics suppliers on board the Mustang program, Cessna's two biggest risk factors were under control. Most other technologies aboard the Mustang are evolutionary, if not directly carried over from earlier Citations. The low-risk approach to Mustang design minimized the remaining challenges regarding development, certification and delivery of the aircraft on time.

A Classic, But Innovative 'Simple Citation'

The original Fanjet 500 had a classic high-lift, low pitching moment 23000 series airfoil that dated back to the Twin Beech. It had excellent low-speed, high-lift characteristics, but it also had a relatively low drag divergence Mach number of about 0.65 Mach. In layman's terms, it ran into an aerodynamic brick wall above such cruise speeds, well below its 0.70 MMO. And thus the snipes about bird strikes from the rear.

Cessna created an entirely new airfoil for the Mustang, one with an 8.5:1 aspect ratio, 0.45:1 taper ratio and 8.5 degrees of sweep at quarter chord. This wing has good high-lift and low pitching moment characteristics and it doesn't run into Mach-induced drag divergence until 0.02 to 0.04 above the aircraft's 0.63 MMO. Thus, it's apparent that the new wing's drag rise starts at about the same Mach number as the original wing. But the drag increase isn't nearly as steep. These characteristics are the keys to the Mustang's 340 KTAS maximum cruise speed and 88 to 93 KIAS landing reference speeds.

Photography courtesy of Cessna Aircraft Co.

First-generation Citations had very large windows up front, providing excellent outward visibility. The Mustang's steeply raked windshield and relatively small side windows, in contrast, limit cockpit visibility.

Constructed of aluminum, as are the fuselage and empennage, each wing is a classic ladder design with three, one-piece CNC milled spars and several chord-wise ribs. The upper and lower skins are hydroformed into the desired contours and then bounded to chord-wise rib caps. All the components then are shipped to Cessna's Independence, Kan., facility where the wing and the rest of Mustang are assembled.

The Mustang's fuselage also is anything but classic Citation design. It's the Citation line's first non-cylindrical fuselage, one that optimizes the available cabin space for passengers. It has relatively flat sidewalls and it's bowed out at the bottom to increase leg and foot room. The cabin section is built from upper left, upper right and bottom subsections. The outside stressed skins are reinforced by bonding in extra skin laminations and longitudinal stringers where needed for strength. The right and left fuselage subsections then are sucked into precise aerodynamic shapes in vacuum fixtures and the internal frames are attached, thereby assuring precise external, aerodynamic contours to minimize surface drag. The bottom section, completely covered by the wing and fairings, is built from the inside-out. All three sections then are joined to form the cabin cross section. After assembly, a special door frame alignment fixture and routing tool cuts a hole in the left side of the fuselage for the entry door. Such precision door frame construction makes cabin entry doors virtually interchangeable.

The nose section, including the cockpit and forward pressure bulkhead, is built as a separate assembly. The windshields are glass for abrasion resistance and electrically heated for defog and anti-icing. They also meet FAR Part 23 Commuter Category certification requirements for bird strike protection. The cockpit side windows are conventional stretched acrylic panels, defogged with air-conditioned flow to the cockpit. The tail section also is built as a stand-alone assembly, that later is joined to the fuselage along with the nose section. The wing is joined to the completed fuselage as the aircraft continues down the assembly line.

The Mustang's tail cone assembly is designed for the new safety standards of Part 23 Amendment 54. There are no flammable fluid lines in the tail cone except for the fuel lines, which are shrouded with coaxial tubes vented to the wing-to-fuselage fairing. NASA scoops in the aft tail cone assure that the aft equipment bay and aft baggage compartments always will have a slightly higher internal pressure than the fuel line shrouds, so if a leak were to occur, it wouldn't flow into the tail cone.

Composites are used sparingly aboard the Mustang and carbon fiber isn't used at all. The wing-to-fuselage fairing, engine nacelles and all control surfaces are aluminum. The radome, wingtips, wheel well fairings and forward fuselage fairing are composite construction and a few aluminum panels are reinforced with composites.

All other systems in the "dry" tail cone are electric, pneumatic or mechanical, except for the halon 1301 in the engine fire extinguisher bottle and non-flammable R-134 refrigerant in the air conditioner.

The Mustang's other systems are classic Citation and well proven, with few

Cessna Citation Mustang

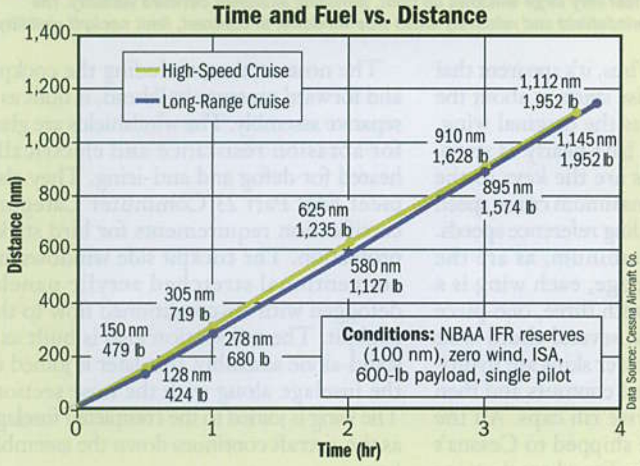
These graphs are designed to illustrate the performance of the Citation Mustang under a variety of range, payload, speed and density altitude conditions. Do not use these data for flight planning purposes because they are gross approximations of actual aircraft performance.

Time and Fuel vs. Distance — This graph shows the relationship between distance flown, block time and fuel consumption for the Citation Mustang at long-range cruise and high-speed cruise. High-speed cruise is flown at about 300 to 310 KTAS and long-range cruise is flown at just under 300 KIAS. Both profiles assume a FL 410 cruise altitude. Note well: Single-pilot operators are required to use supplemental oxygen above FL 350.

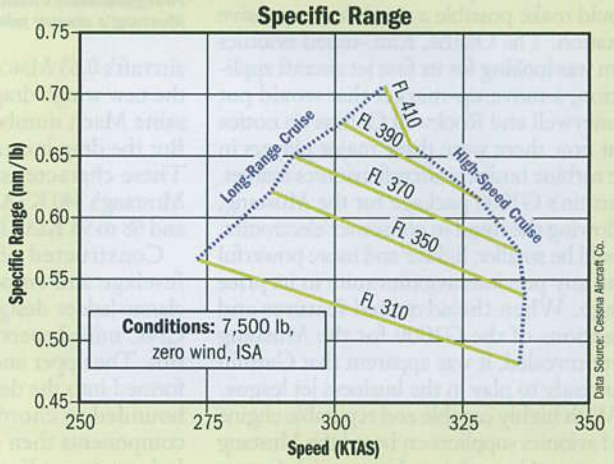
Specific Range (Mid-Range Weight, ISA) — This graph shows the relationship between cruise speed and fuel consumption for the Citation Mustang at representative cruise altitudes from FL 310 to FL 410. Notably, the aircraft can climb directly to FL 410 at MTOW, even on warm days. *B&CA* believes Cessna's performance estimates are conservative, based upon our demonstration flight observations.

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 four payload/range lines was plotted from multiple data points by Cessna's performance engineers, ending at the maximum range for each payload condition. If you interpolate the graph, it's apparent that the Mustang can fly a single pilot and three passengers 1,150 nm. FAR Part 25 takeoff field lengths are shown. When departing *B&CA*'s 5,000-foot elevation, ISA+20°C airport, takeoff weight must be reduced by about 245 pounds so that the aircraft can meet Part 25 one-engine-inoperative climb gradient requirements.

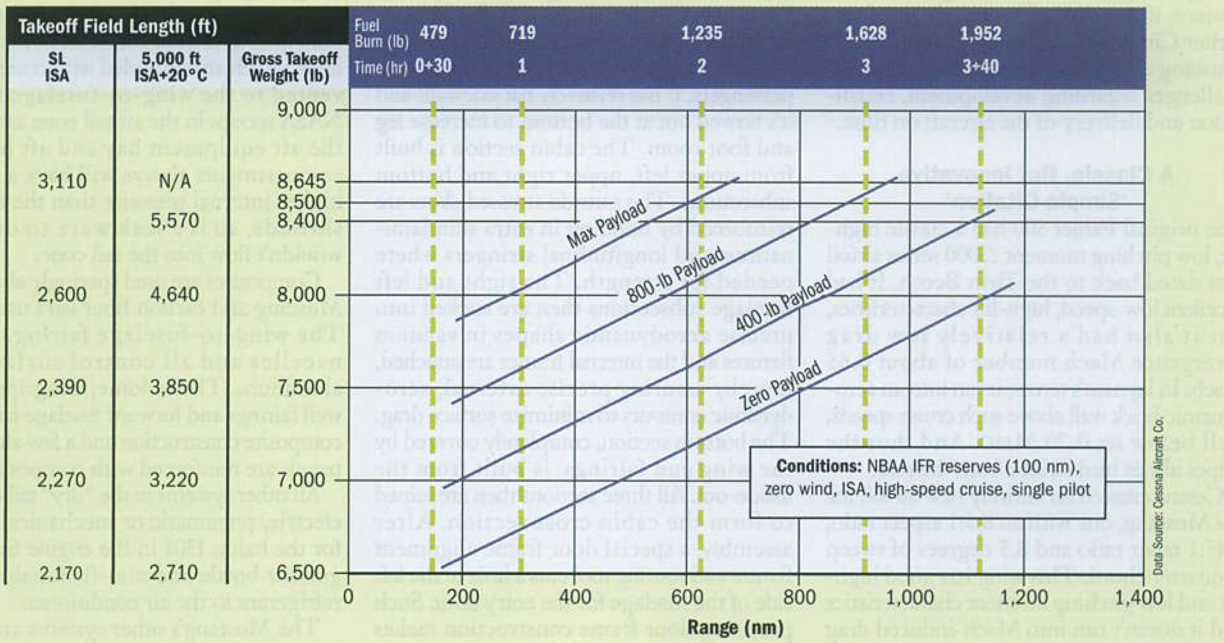
Time and Fuel vs. Distance



Specific Range



Range/Payload Profile



exceptions. The fuel system, for example, has left- and right-side 1,290-pound capacity wet wing tanks refilled through over wing ports. Five fuel quantity probes in each tank measure fuel level and temperature. Left- and right-side jet pumps in the sumps, powered by motive flow from the engine-driven fuel pumps, normally supply the engines. Separate scavenge jet pumps in the wing tanks keep the sump tanks full. The engines have fuel/oil heat exchangers that eliminate the need for using anti-icing fuel additives.

Electrically powered boost pumps provide fuel pressure for engine starting and tank-to-tank transfer, plus they act as backups for the jet pumps. The boost pumps are not enclosed in canisters. Changing a boost pump requires draining all fuel from the associated wing tank.

The DC electrical system has a 28 AH lead-acid battery mounted in the tail cone, that's easily accessible through a door in the aft baggage compartment. A separate, 1.2 AH standby battery powers the standby instruments. The electrical system uses the well-proven CJ-series parallel bus architecture, with left- and right-side operating independently under normal conditions, each supplied by a 200-amp starter/generator. Each generator is regulated by a solid-state GCU mounted on the aft side of the rear pressure bulkhead. The main power-distribution junction boxes also are mounted on the aft pressure bulkhead.

The two sides of the electrical system are tied together only in the event of a generator failure. For crew and passenger convenience, there are 12-VDC outlets in the front and rear of the cabin to power laptops and recharge cell phones.

The Mustang has a 1,500-psi hydraulic system, but it's not powered by engine-driven pumps. Instead, it's mounted in the forward bay behind and below the baggage compartment. An electric pump supplies the pressure that operates both the landing gear and anti-skid wheel brakes. All hydraulic lines are routed outside of the pressure vessel and tail cone for added fire protection. The reservoir is filled with bright red PRF-87257 fluid, the synthetic successor to MIL-H-5606 mineral oil. The liquid has a wide temperature operating range and it won't corrode paint or irritate human skin, like some other synthetic hydraulic fluids. The system has an accumulator that maintains a pre-charge to prevent foaming and to damp out shocks, but all pre-charge pressure may be relieved to refill the reservoir. Twin pneumatic bottles provide pressure for emergency landing gear extension and wheel brake actuation in the event of a pump failure.

The primary flight controls are actuated by mechanical cable, bell crank and pushrod linkages. There is no rudder boost or bias system. An externally accessible rudder gust lock enables ground crews to tow the aircraft without entering the cabin. The gust lock for the elevator and ailerons is in the cockpit. If you forget to release the rudder gust lock on preflight, it automatically disengages when you check elevator travel before takeoff.

The elevator and ailerons use single linkages and the rudder has dual linkage for engine rotor burst protection. An aileron-rudder interconnect helps keep the aircraft in coordinated flight and it improves control harmony. Aileron fences enhance dihedral effect to improve spiral stability. Three-axis electric trim is provided, along with a pitch trim wheel on the left side of the console, a welcome feature retained from legacy straight-wing Citations. The flaps are electrically actuated, as are the speed brakes.

The Mustang has an aural stall warning system, but no stick shaker or pusher, in

Cessna Citation Mustang

Price as Equipped $2,600,000

Characteristics

Seating	1+5
Wing Loading	41.2
Power Loading	2.96
Noise (EPNdB)	*Not Available*

Dimensions (ft/m)

External

See Three-View

Internal

Length	9.8 / 3.0
Height	4.5 / 1.4
Width (Maximum)	4.6 / 1.4

Power

Engines	2 P&WC PW615F
Output (lb)	1,460 ea.
Flat Rating OAT°C	ISA+10°C
TBO (hr)	3,500

Weights (lb/kg)

Max Ramp	8,730 / 3,960
Max Takeoff	8,645 / 3,921
Max Landing	8,000 / 3,629
Zero Fuel	6,750 / 3,062
BOW	5,550 / 2,517
Max Payload	1,200 / 544
Useful Load	3,180 / 1,442
Executive Payload	1,400 / 635
Max Fuel	2,580 / 1,170
Payload With Max Fuel	600 / 272
Fuel With Max Payload	1,980 / 898
Fuel With Executive Payload	1,780 / 807

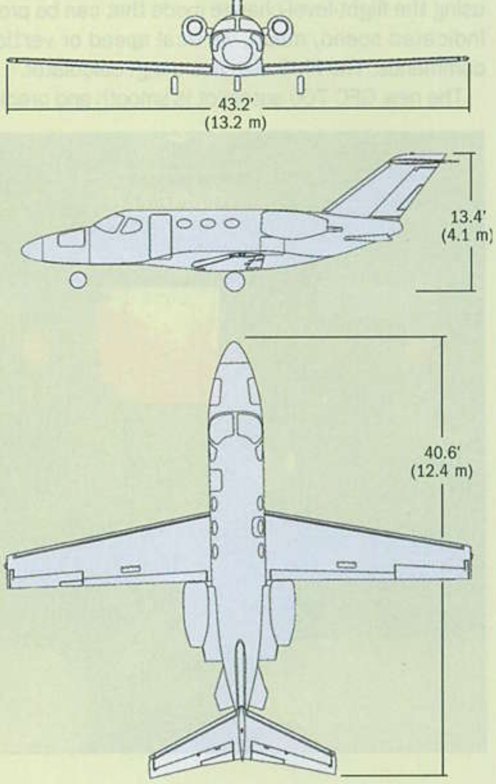
Limits

MMO	0.63
FL/VMO	FL 271 / 250
PSI	8.3

Ceilings (ft/m)

Certificated	41,000 / 12,497
All-Engine Service	41,000 / 12,497
Sea Level Cabin	*Not Available*

Certification ....FAR Part 23



spite of its T-tail configuration. Instead, Cessna reinforced the tail cone and fitted it with anhedral fins to assure a nose-down pitching moment and positive stall recovery in any configuration.

The main landing gear have trailing-link struts to improve the ride on the ground and help the pilot make flawless touchdowns. The nose gear has Cessna's well-proven bungee-spring linkage nosewheel steering that provides up to 20 degrees of steering authority through the rudder pedals and up to 75 degrees of steering using differential thrust and braking. Look closely at the nosewheel strut. There's no external shimmy damper. Instead, there's an elastomeric collar inside the nose strut that dampens rotational movement. It's simple and requires virtually no maintenance.

The rudder pedals are directly linked to the power brake valve ahead of the forward pressure bulkhead by means of short cable assemblies. This both eliminates hydraulic master cylinders in the cockpit and slop in the brake linkage.

For cabin pressurization, bleed air from the left engine supplies the cockpit and the right side supplies the cabin. No separate emergency pressurization system is needed because of the dual cabin/cockpit systems. Should one bleed-air source be lost, the source can provide twice the output to maintain cabin pressurization. The 8.3-psi pressurization differential is maintained by twin electronically modulated, outflow valves in the aft pressure bulkhead. Cabin altitude is 8,000 feet at FL 410, the aircraft's certified ceiling. System operation is virtually automatic, with the crew only needing to set in landing field elevation through the MFD.

The Mustang has two-zone temperature

Garmin G1000

The Mustang's avionics package sets new standards for situational awareness, performance features, packaging efficiency and maintainability in turbine aircraft costing $10 million and under. With glass cockpits, bigger is better and the G1000 fills the bill. The 15-inch MFD is the largest in this class of aircraft and it's flanked by 10.4-inch left- and right-side PFDs. All displays are daylight readable, high-contrast, wide viewing angle, active-matrix LCDs backlighted by long-life, low-heat LED arrays.

The Mustang has most of the avionics features and functions you'd expect to see in the cockpits of the most modern business jets regardless of price. Among these are full lateral and vertical FMS guidance on all published departure/cruise/arrival/approach procedures. The FMS accommodates all currently published ARINC 424 procedure leg types, including multiple vertical waypoints, holding patterns, procedure turns and headings to course intercept. Climbs and descents are easy using the flight-level-change mode that can be programmed with indicated speed/mach, vertical speed or vertical angle path commands. The FMS also has a c.g. calculator.

The new GFC 700 autopilot is smooth and precise. It has overspeed protection, an emergency descent mode and half-bank for high-altitude turns. Mustang pilots still must take off and land using good hand skills, but after that the G1000 can handle almost all other normal flight chores.

SafeTaxi is a Garmin exclusive. It shows precise aircraft position on an electronic airport diagram on the MFD with labels for the names of all taxiways and runways. This safety advancement makes it tough to get lost even on the most convoluted large airport taxi routes and greatly decreases the chances of an inadvertent runway incursion.

Most line replaceable units (LRUs) are housed in panel-mount cabinets behind the displays, including dual solid-state AHRS, dual digital air data computers, dual integrated COM/NAV/WAAS-capable GPS sensors with integral flight directors, dual engine/systems interface units and a dual-channel, fail-passive autopilot, along with a single Mode S diversity transponder, plus second basic Mode S transponder having TIS-B traffic advisory functionality, single XM radio weather receiver, single remote-mounted DME and color weather radar. XM radio weather is the next best thing to having a videocam inside the nearest Flight Service Station. Functions include NEXRAD weather, text and graphical METARs, TAFs, cloud tops and movement, precipitation density, winds aloft forecasts, graphics AIRMETs and SIGMETs and lightning strikes, among other features.

The system also features left and right audio control panels with digital clearance delivery recorders and FMS keyboard, plus a Class B TAWS function on the MFD. All the LRUs in the cabinets behind the displays are designed for "hot swapping." There's no need to power down to remove and replace an LRU. Just unscrew four fasteners from the associated display and remove it from the cabinet by pulling out its ribbon cable connector. Replace the LRU, reinstall the display and you're off and flying. Budget five minutes for each LRU swap and 10 minutes to make the logbook entry.

Above the MFD are the standby attitude indicator, electromechanical airspeed indicator and altimeter, all powered by a stand-alone emergency battery. An Artex three-channel ELT is included. A $12,300 ADF receiver, an HF transceiver (cost TBD), $28,475 Honeywell traffic advisory system (TAS) and $3,400 electronic chart package are virtually the only avionics options. TIS-B provides spotty traffic awareness coverage at best, so we recommend upgrading to the Honeywell TAS box.

control, with one air-conditioning evaporator for the cabin and another for the cockpit. The vapor cycle air-conditioning compressor has a variable displacement pump, enabling it to run continuously and pump refrigerant through the system in proportion to cooling requirements. The system has virtually the same cooling capacity as the air conditioner on the CJ3, so folks inside the Mustang should be comfortable during the warmest summer months.

Engine bleed air supplies the cabin heat. There is no cumbersome hot/cold mixing valve assembly in the tail cone. Instead, fresh air flow across the left and right bleed-air heat exchangers in the engine pylons is modulated to achieve the desired air temperature in the cockpit and cabin. A 22-cubic-foot oxygen bottle, mounted in the forward bay, is standard and a 40-cubic-foot bottle is optional.

Ice protection is the Mustang's strong suit. The FAA has toughened its flight into known icing certification standards, so the Mustang has deice boots on the leading edges of the wings and horizontal and vertical tail surfaces. It also has eight rubber vortex generators on each wing boot that enhance roll control at high angles of attack in icing conditions. The pitot tubes, static ports and angle-of-attack probe are electrically heated for ice protection.

With the single exception of the left-side, halogen ice detection light, all exterior lights are either LED or HID units. There is a flashing red LED beacon atop the tail, and wingtips have combination LED strobe, position and tail lights. Dimming HID taxi/landing lights in the forward fuselage fairing produce as much light as the CJ2's incandescent bulbs, but very little heat so they consume much less power and have a 5,000-plus-hour service life. LEDs also are used extensively for cockpit and cabin lighting. The exceptions are the cockpit overhead and map, plus cabin reading, halogen lights. Two cabin lights, powered directly from the hot battery bus, function as emergency exit lights when needed. All these interior lights should be upgraded to long-life, low-heat LEDs, in our opinion.

Passenger Accommodations

Cabin comfort and baggage storage volume are excellent for this class of aircraft. Gone is the oblong door, fitted to on 500-series Citations for three decades. Occupants enter the cabin up a two-step folding airstair and through a newly designed 3.8-foot-high by 2.0-foot-wide cabin door.

Directly across from the entry door, there is an occasional-use-only lavatory intended to allay the concerns of some about having the required "facilities" aboard the aircraft.

The cabin has a constant cross section. The forward-facing, aft seats in club configuration provide excellent comfort for passengers.

The toilet is non-flushing. The lavatory compartment is closed off from the cockpit with a sliding curtain and blocked off from the cabin with a somewhat awkward, folding drape that attaches to the overhead, cabin walls and floor by a series of magnets. The folding curtain is stored in a pocket in the toilet lid. A better solution, in our opinion, might be forward and aft tracks with sliding drapes, such as those installed on Falcon 10 and legacy Learjet aircraft. In addition, the 17-inch-wide by 24.5-inch-deep lavatory seat is not fitted with seat and shoulder belts, so it's not certified for full-time occupancy. Most folks are likely to use it as a perch while using the forward refreshment center or as a storage area for catering. Cessna furnishes a luggage restraint net for the potty seat.

The forward non-flushing lav, across from the entry door, has a folding front privacy curtain.

The cabin is 4.5 feet high, measured from the four-inch-deep, 11.0-inch-wide, 6.6-foot-long dropped aisle, and 4.5 feet wide at the top of the side ledges. The cabin cross section is constant from just aft of the cockpit to the rear pressure bulkhead. Left and right 10-inch-wide side storage cabinets separate the cockpit from the cabin. Both cabinets taper in at the top to provide more room for cockpit access. The right cabinet serves as the refreshment center, providing storage for canned and bottled beverages, cups and trash bags. The lower section of both cabinets also can be used for flight manual storage. The left cabinet has a drawer that holds the cabin fire extinguisher.

Cabin length, measured from the cockpit/cabin dividers to the aft pressure bulkhead, is 9.2 feet. No part of the wing structure intrudes into the cabin. The floor is 3.2 feet wide below the seats. The four passenger chairs, arranged in club configuration, have seat cushions that are 18 inches wide and 17 inches deep and 2.4-foot-tall seat backs. Each seat has an overhead reading light and automotive-inspired air outlet, plus dual beverage container holders. The forward, aft-facing seats have telescoping inboard armrests that retract to increase aisle width for easy access to the main seating section. These seats also recline about 25 degrees and have seat back pockets for light magazines or passenger instruction cards. They have a broad, fold-down armrest in the middle and a handy console with top storage bin, plus two more beverage container holders and a bottom drawer. There are sturdy, but plain fold-out

The aft baggage compartment holds 37 cubic feet of equipment, weighing as much as 300 pounds.

21.0-inch-long by 14.7-inch-wide worktables between the seats. Cessna may offer portable inflight entertainment units as options at a later date. For now, the view of the 15-inch MFD in the cockpit is so good from the back seats that an additional moving map display may be unnecessary.

Three 15.3-inch-wide by 10-inch-tall elliptically shaped cabin windows, positioned close to eye level for seated passengers, provide ambient light into the cabin. The middle window on the right side is in the over-wing, emergency exit. The windows are deeply tinted and each has a pull-down opaque window shade.

Drop-down oxygen masks are provided for the four club seats and lavatory.

The Mustang is available with a choice of three interior color schemes — bronze, platinum and sterling — each of which meet Part 25.853 standards for burn resistance. All cabinetry has a durable matte finish that's easy to clean. There are no cabin furnishing, covering or cabinet finish upgrades. An XM radio entertainment system and an Iridium phone external antenna connection are optional.

The Mustang has the most external baggage storage volume in its class. There's a forward 20-cubic-foot, 320-pound capacity baggage compartment in the nose bay with left- and right-side doors and another 37-cubic-foot, 300-pound capacity aft baggage compartment, accessible through a door under the left engine pylon. Skis or golf clubs will fit into the aft compartment. The external compartments are lighted, but not pressurized or heated. Another six cubic feet of luggage can be packed into the cabin.

All Mustangs are painted Matterhorn (refrigerator) white with landing gear painted gray. Five stripe schemes are available, but custom paint work isn't on the factory-standard option list. However, Cessna will sell you a Mustang with just the white base coat and you're free to take it to your favorite paint shop for custom striping.

The forward baggage compartment holds another 20 cubic feet of gear weighing as much as 320 pounds. It also provides ready access to oxygen filler, hydraulic reservoir and hydraulic accumulators.

Let's Go Flying

Quite candidly, the Mustang is the easiest to fly Citation yet built — and that's in comparison with the notoriously docile Fanjet 500, Citation I and II, and CJ models. Preflight inspection is easy, requiring no ladders or special equipment. The engine oil reservoirs have sight glasses that can be viewed readily through access doors. All other system fluid levels, pressures and functions can be checked by opening the forward and aft baggage compartments.

The folding airstair is held down or up with magnets, so it won't fall into the entry door when opening or closing it. A large push button releases the catch on the entry door so that it can be closed. Only gentle pressure is needed to actuate either the outside or interior door closing handle.

Entering the cockpit is very easy because the control yokes are mounted on shafts in the instrument panel, thus eliminating foot well obstacles. The center console is short so that it doesn't block the path from aisle to foot well. The cabinet dividers aft of the crew seats don't impede cockpit access.

Once seated, the pilot(s) attaches the shoulder/lap belt clip into the buckle with a single diagonal movement, as one would in any modern automobile. The oxygen mask is stored just below the shoulder belt attachment, in easy reach of the crew.

Visibility from the cockpit is not as good as in other straight-wing Citations we've flown, particularly the original Fanjet 500 and Citation I, II and V. The Mustang has a steeply raked windshield and relatively high glareshield, so the pilot must move up the seat for adequate forward visibility. Doing so, however, cuts off the view out of the low and small side windows, thus you'll need to move your head down to see out laterally. The excellent cockpit field of view in legacy small fuselage Citations set a high standard that's not equaled by the Mustang.

Cessna advertises a 5,550-pound BOW for the Mustang. Production unit 2, the aircraft we flew for this report, had a 5,545-pound BOW. We wanted to load it up close to MTOW for evaluation purposes. With Peter Fisher as safety pilot in the right seat, 2,600 pounds of fuel and Troy Lawson, Mustang product marketing manager, along as a passenger, the aircraft weighed 8,550 pounds, about 180 pounds less than MTOW (see accompanying Specifications table). Cessna recently increased MTOW to 8,645 pounds to preserve the Mustang's tanks-full, three-passenger payload capability. P&WC also bumped up takeoff thrust to 1,460 pounds of thrust per engine, thus assuring that the aircraft would meet its promised 3,120-foot takeoff field length (TOFL).

Pre-start checks are simple and straightforward, much the same as they are on any entry level Citation built during the past three decades. One touch of an engine start button turns on the associated boost pump and begins engine rotation. The throttle lever may be advanced at any time thereafter because the FADEC handles all other starting chores. After both engines were running, we disconnected ground power, checked the generators and turned on the air-conditioning. It was only 73°F (23°C) outside on the Kansas ramp, so we didn't have a chance to test the full capabilities of the air conditioner. But it did cool down the cabin quite rapidly.

Half the challenge of earning the Citation Mustang type rating no doubt will be mastering the Garmin G1000 avionics system. While the Mustang's G1000 system is fairly intuitive, following the conventions of the GNS430, GNS 530 and G1000 systems for piston-engine aircraft, this version is far more powerful than any previous Garmin system. The Mustang G1000 pilot's guide is nearly 450 pages long, a tome that is needed considering the system's prodigious capabilities (see "Garmin G1000" sidebar).

After we programmed in the flight plan, we taxied for takeoff on Runway 1R. Fisher computed the TOFL at 3,630 feet, based upon an 8,500-pound takeoff weight, flaps 15 degrees, Wichita-Mid Continent Airport's 1,330-foot elevation, an outside air temperature of 23 degrees, barometer setting 30.11 and 11-knot headwind. The V_1 decision and rotation speeds were 93 KIAS, the V_2 one-engine-inoperative takeoff safety speed was 97 KIAS. Flap retraction and final segment speeds were 118 KIAS. Note well: The Mustang's TOFL, as with all Citations, is based upon the greater of the accelerate-stop or accelerate-go distance assuming an engine fails at decision speed. For the Mustang and most other straight-wing Citations, Cessna chose to compute balanced field lengths with equal accelerate-stop and accelerate-go distances. None of the takeoff distances for any Citation, including the Mustang, are based upon Part 23 all-engine operating criteria.

The wheel brakes seemed a bit touchy during taxi. The nosewheel steering was nicely responsive. Some practice is needed to master braking technique so your passengers won't view you as a rookie.

We advanced the throttles to the third detent for takeoff and the FADECs set the appropriate thrust. Takeoff acceleration was moderate. Rotation forces were light, but as the aircraft accelerated they became somewhat heftier. Roll control force was light, but nicely harmonized with pitch control force. We retracted the flaps and pulled back the throttles to the climb detent, marking the last time we had to touch the throttles until level off at FL 410.

The normal climb schedule calls for a constant 180 KIAS until intercepting 0.44 Mach. We used the maximum performance climb schedule, which starts at 171 KIAS and decreases one or two knots per thousand feet until arriving at FL 410 at 124 KIAS. That results in a seven- to 10-degree nose-up attitude, making it challenging to see over the nose in the climb. Outside air temperatures that day ranged from ISA+15°C at lower altitudes to ISA+5°C at FL 410.

Thirty-five minutes after takeoff, including an 80-degree turn at FL 405 for air traffic control spacing, we leveled off at FL 410, having burned 550 pounds of fuel in the climb. We started to accelerate and nine minutes later, the aircraft was cruising at 310 KTAS while burning 470 pph at a weight of 7,980 pounds in ISA+5°C conditions.

Wing performance at high altitude is one of the Mustang's best assets. We commenced a windup turn and the wing remained buffet free up to two g's at 60 degrees angle of bank. As it slowed down due to drag, we encountered low-speed buffet approaching the stall, but never any high-speed buffet.

We then descended to FL 350 to check high-speed cruise performance. On the way down, we noted that extending the speed brakes causes a moderate nose-down pitching moment, along with a mild right

Eight vortex generators affixed to each wing deice boot assure that the Mustang has plenty of roll control authority at high angles of attack carrying a full load of accumulated ice.

Long-travel, trailing-link landing gear, a characteristic of all modern Citations, make for very soft landings.

roll in this aircraft, highlighting the need for some fine-tuning of the spoiler actuation.

Leveling off at FL 350 in ISA+10°C conditions, the Mustang eked out a 337 KTAS cruise speed at a weight of 7,920 pounds while burning 580 pph. Extrapolating the numbers clearly confirms Cessna's predictions of a 340 KTAS cruise speed in ISA conditions at mid-cruise weight. In our opinion, the 340 KTAS cruise estimate may be conservative.

Descending below Class A airspace for air work, we checked the aircraft's emergency descent capability. VMO and landing gear operating speed both are 250 KIAS. Pulling the throttles to idle, extending the speed brakes and the landing gear results in descent rates in excess of 8,000 fpm. Extending the gear at high speed, though, creates plenty of wind noise in the cockpit as the airstream rushes around the nose gear and wheel well. We leveled off at 15,000 feet about three minutes after initiating the descent from FL 350. The Garmin autopilot also has an automatic emergency descent mode that turns the aircraft 90 degrees off heading and starts a rapid descent down to 15,000 feet if the cabin altitude exceeds 14,500 feet and cruise altitude is above 30,000 feet. Thus, if you lose cabin pressurization, just don the O_2 mask, chop the throttles to idle, extend the high-drag devices and the G1000 will take you down to a safe altitude, assuming you have required terrain clearance.

Steep turns are flown at 200 KIAS, just as they are in a Fanjet 500. A little additional back pressure rolling through 35 degrees bank and a percent or so more N1 freezes the aircraft on altitude and speed. Stalls, though, are far gentler than they ever were in first-generation Citations.

The oxygen mask is in the ready position right next to your outside shoulder.

We continued to explore the Mustang's handling characteristics, noting that increasing thrust causes a very modest nose-down pitching moment until the aircraft accelerates. Reducing thrust causes the opposite effect. Extending the flaps to 15 degrees for approach results in some modest ballooning, plus a need for a nose-down pitch adjustment and retrimming. Extending the flaps to the 35 degrees landing setting causes more of the same. There is substantially less drag with gear and flaps 35 degrees extended, so it's easy to make corrections to glidepath with power and pitch changes. The Mustang easily could be certified for steep approach procedures, in our opinion.

At a weight of about 7,800 pounds, we flew a series of stalls in clean, approach and landing configurations. Heavy pre-stall buffet occurred at 88 KIAS clean, 76 KIAS with flaps 15 degrees and 70 KIAS with gear down and flaps 35 degrees for landing, accompanied by a mild right wing rolling moment. While we easily could counter the wing rolling moment with left aileron input, we elected not to push the aircraft to the full aerodynamic stall. Actual stall speeds were 85 KIAS clean, 74 KIAS at flaps 15 degrees and 69 KIAS in the landing configuration. During each stall recovery, the aircraft flew out of the maneuver with no hesitation as soon as back pressure on the yoke was reduced and power was increased.

Returning to Wichita, we were able to sample some of the G1000's advanced capabilities. Our first approach was the RNAV (GPS) 1L. We selected it from a list of available approaches from the FMS, activated the vectors-to-final mode and then pressed the approach button on the glareshield control panel, once cleared for the approach. The 3-D FMS provided both lateral and vertical guidance right down to the 1,620-foot minimums, just as one would expect when flying the latest generation of $5 million to $50 million business jets.

Our VREF landing speed for the first approach was 92 KIAS at a weight of 7,650 pounds. Cessna actually padded the published VREF speeds by one to two knots over 1.3 VSO, just for extra stall margin protection. The Mustang, like all other Citations, is stable on approach. But its lower mass requires a little more attention to thrust and pitch management in gusting wing conditions.

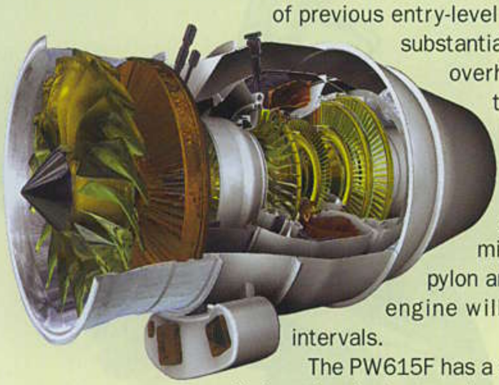
Like most other narrow-body Citations, the Mustang is prone to float in the flare, especially because of the extra pad in VREF speeds for safety margins. In addition, the PW615F engines decelerate slowly when the throttles are pulled to idle. We found that we could chop the throttles to the idle stops over the runway threshold and let the aircraft start to decelerate during the flare. The long-travel, trailing-link main landing gear makes any pilot look like an old pro at touchdown.

Fisher checked pitch trim in the takeoff band and set flaps to 15 degrees during the roll-out. We advanced the throttles to the forward stop and flew a touch-and-go. Wichita tower handed us off to approach control and we returned for a Runway 1L ILS full-stop landing.

Regarding G1000 approach guidance, the only major difference during the ILS

Pratt & Whitney Canada Power for the Mustang

Two next-generation, FADEC-equipped 1,460-pound-thrust PW615F engines provide the power for the Citation Mustang. These engines were designed with half the parts of previous entry-level turbofan engines, resulting in a substantial reduction in manufacturing and overhaul costs. P&WC earned initial type certification for the engine in December 2005, paving the way for full certification in time for Mustang deliveries. The engines are designed for 1,750-hour midlife hot-section inspections on pylon and 3,500-hour TBOs. Notably, the engine will enter service at mature TBO intervals.



The PW615F has a 16-inch, single-piece fan powered a high-work, single-stage low pressure turbine. Bypass ratio is about 3:1, but P&WC officials are mum about actual performance specifications. The high-pressure section features single axial flow and single centrifugal flow compressors, a reverse flow annular combustor and single-stage high-pressure turbine. A deep-fluted mixer nozzle both reduces exhaust noise and increases high-altitude thrust output.

approach was a change in the color of the azimuth and glidepath guidance cues from magenta to green. At a weight of 7,610 pounds, our VREF landing speed was 91 KIAS.

After landing, we taxied back for a simulated one-engine-inoperative takeoff. Fisher bugged the takeoff speeds at 89 KIAS for V1 and rotation, 93 KIAS for V2 and 118 KIAS for flap retraction and OEI climb speed. Rolling down Runway 1L, Fisher chopped the left throttle to idle. It was easy to control yaw with a healthy push on the rudder. At rotation, there was virtually no tendency for the aircraft to roll into the left or "dead" engine. The right engine provided enough thrust for a 1,000-fpm rate of climb at V2.

We continued using just the right engine for a simulated OEI landing. We flew the maneuver to touchdown at flaps 15 degrees and increased VREF by seven knots to 98 KIAS. The aircraft seemed easier to fly in this configuration because of the reduced drag.

Our last circuit was a VFR maneuver using right turns to align with Runway 1R. We noted the aircraft can be flown at 120 KIAS clean in VFR traffic patterns and as slow as 110 KIAS with flaps 15 degrees, allowing plenty of stall margin for turns. We found no difficulty in sequencing with an arriving Cessna Skyhawk. Watching for traffic and proximity to the runway in right patterns isn't overly difficult, if you crane your head forward and look out the right side of the windshield along with using the right cockpit side window.

We elected to perform a maximum performance landing at touchdown. Using hard pressure on the brakes, the aircraft decelerated strongly and smoothly with no sign of tire chirp or chatter. Stopping distance appeared to be about 1,250 feet.

With the brakes warmed up from the landing, it was easier to modulate braking action smoothly as we taxied back to the Cessna plant.

Conclusions? The Citation Mustang is an entry-level turbofan aircraft that cruises far higher, faster and quieter than propeller-driven business aircraft. The Mustang is so slow and docile in the landing pattern that it makes most turboprops and piston twins seem challenging in comparison, particularly with one engine inoperative. And only Part 23 Commuter Category and Part 25 turboprops costing millions more can match the Mustang's OEI takeoff performance, particularly when departing hot-and-high airports.

The aircraft's G1000 avionics suite compares favorably with high-end systems produced by Honeywell and Rockwell Collins. The PW615F engines deliver unprecedented fuel economy in a Citation and the FADECs take all the work out of thrust management. The computers eliminate the need to fine-tune the throttles to avoid over-torque, over-temp or over-boost excursions. Folks transitioning from propeller-driven airplanes won't miss having to manipulate pitch, condition, cowl flap and mixture levers, among others.

Price and Value

The Mustang, being the first aircraft in the emerging light, entry-level turbofan aircraft segment to be fully Part 23 certified (except for flight into known icing), doesn't yet have any direct competitors. So when we went to press, we couldn't create a Comparison Profile that would enable our readers to gauge its performance and specifications relative to other aircraft in class. Such comparisons won't be available until later this year and beyond.

With the Mustang, Cessna has created an ideal step-up aircraft to welcome new customers into the Citation family by lowering the price of admission. There are a lot more folks who can afford a $2.6 million Citation Mustang than a $4.6 million Citation CJ1+, even if it means they have to give up 25 to 50 knots in speed and 200 miles in range. And with the Mustang, Cessna is betting that new customers will recognize they're buying into a company that's been making business jets for more than three decades with an industry-leading support network. More than 4,500 Citations now have been delivered and Cessna has stepped up to the task of supporting them without equal. Cessna marketing folks claim that a factory or authorized Citation service center is within 500 nm of any airport where a Citation is based in the United States. "Team Mustang," a dedicated model-specific tech support group similar to Team X that assists Citation X operators, will be up and running to help the Citation Mustang make a smooth entry into service when initial deliveries begin later this year. The Mustang's airframe and engines come with a three-year/1,000-hour warranty. A two-year warranty covers the avionics package.

The Mustang's maintenance schedules and tasks have been fine-tuned to lower operating costs. The aircraft already has been tested to five lifetimes and it's a damage-tolerant design without hard life limits. The aircraft will be subject to a continuous airworthiness program. Although the Mustang won't be an MSG 3 compliant aircraft, its cost per flight hour should be significantly less than that of any previous Citation. Phase 1 inspections, for example, are scheduled at 450-hour intervals. The first major inspection comes at 12,000 hours or 40,000 cycles, whichever comes first.

Cessna has developed a pay-per-hour parts and engine reserves program, with fees initially ranging from less than $12 per hour for parts and $56 per engine for aircraft in warranty. More comprehensive pay-per-hour programs are available, providing full aircraft coverage.

FlightSafety International is in the final stages of completing ground and flight training syllabi for the Mustang and finishing up the full-motion simulator at the Cessna Learning Center in Wichita. A second simulator will be installed at FlightSafety's Farnborough facility outside London in 2007. Both centers also will be furnished with Level 4 flight training devices.

Cessna has signed more than 250 orders for the Mustang, with six of 10 being slated for delivery outside the United States. The next available delivery slot is in late 2009. The Mustang is off to a strong start in the VLJ race. But this group of upcoming quarter horses hasn't even reached the first turn. Eclipse Aviation, Embraer and perhaps Adam Aircraft, among others, soon will be in close pursuit. This is going to be one of the hottest contests that the business aircraft industry has ever witnessed. **B&CA**