

PHENOM 100

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A SPECIAL SECTION FOR THE TURBINE OWNER-PILOT

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Phenom 100 and Citation Mustang head to head

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Until the HondaJet, Cessna's new Citation M2, the Cirrus Vision SF50,

the Diamond D-JET, or the new Eclipse 550 enter the light-jet arena, there will be just two serious competitors in the market for new light jets under \$4 million: Cessna's Citation Mustang and Embraer's Phenom 100.

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Cessna launched the Mustang in 2002, putting the Eclipse 500 squarely in its crosshairs and beating it to the FAA-certification milestone. Embraer saw an opportunity to expand its executive jet division, and followed shortly with the announcement of its Phenom 100 and 300 jets in 2005. Mustang deliveries commenced in spring 2007, and about 400 airframes have been delivered since then. Just fewer than 300 Phenom 100s have been produced since December 2008.

Seen from the ramp, the Mustang doesn't make any excuses. It looks exactly like what it is: a small and modern jet with its heritage confirmed by a classic, low-slung Citation look. The Mustang's wingspan is 43 feet, 2 inches; tip-to-tail length is 40 feet, 7 inches; and the height from the ground to the top of the tail is 13 feet, 5 inches.

> Taking a quick walk around this aircraft,

you will notice modern features, such as LED position and anticollision lights. The wing is slightly swept (the planform looks quite a bit like a scaled-down version of the mid-size Sovereign wing), and it incorporates boots for ice protection. The main cabin door is operated with one hand by pulling down on a single lever, and opening the door reveals a set of familiar folding steps, straight out of 500-series Citations of the past 40 years.

Embraer went to great lengths to give the Phenom 100 the ramp presence of a larger airplane. The Phenom's external dimensions are 42 feet, 1 inch long; 14 feet, 3 inches tall at the tail; and it has a wingspan of 40 feet, 4 inches, so its footprint is just about the same as the Mustang's. However, the Phenom's taller stance and full airstair door make a strong impression. Like the Mustang, the Phenom has rubber deice boots, but they're silver. This may fool casual observers to believe the Phenom has hot-wing anti-icing, but the color comes at the expense of reduced ability to identify slow ice accretion from the cockpit. Some believe that the two large aerodynamic fences on each wing spoil the Phenom's looks a bit.

The Phenom and Mustang both have very sizeable external baggage areas, considering the overall size of the aircraft. The Phenom's aft baggage compartment has a volume of 53 cubic feet, and the baggage area in the nose will hold seven cubic feet of small stuff. Cessna quotes 37 cubic feet for the Mustang's aft baggage area and 20 cubic feet for the nose compartment. Both aircraft should accommodate skis. Limited baggage space is available inside the pressurized cabin of the Mustang by lashing items to the potty seat with the provided net. Cabinets in the Phenom's cabin will hold a respectable amount of soft goods, although many operators use the larger forward wardrobe cabinet as a refreshment center.

Moving about in the Mustang's cabin, it will be apparent that the fuselage cross-section is comparable to



The Mustang may have a bigger nose baggage compartment (far left) than the Phenom 100's (left), but the Phenom's cabin (below left) is 16 inches wider, five inches taller, and has an aft flushing potty. The Mustang cabin (below) has a center arm rest for the aft seats, and its side-facing potty is opposite the cabin entry door. In flight, the Phenom 100's wings may look swept (opposite page), but they're not. And unlike the Mustang, the Phenom 100's wings have stall fences.





that of some twin-piston aircraft. It's not cramped, but tall passengers will definitely develop a case of "inboard lean syndrome." The cabin is configured in a four-seat club, with the two aft seats up against the rear bulkhead (they do not recline). These seats have a shared, fold-down automotive-style arm rest, and the aft-facing seats have stowable arm rests and a great deal of recline range.

The sideways-facing potty seat, opposite the main door, is not belted (and therefore cannot be used as a passenger seat for takeoff and landing), but it makes a great place to observe the cockpit in smooth air. The lavatory under this seat is a simple "honey bucket," meaning that there is no fluid inside, and one must put up two curtains to provide a small amount of privacy—it's really an emergenciesonly affair. Philosophical differences between Cessna and Embraer become apparent when you sit in each airplane's left seat.

Rounding out the Mustang's cabin appointments are stowable writing tables, slim cabinets behind the cockpit with an ice drawer, and an abundance of cup holders throughout.

Embraer claims the Phenom 100 has the tallest and widest cross-section in its class (the Phenom 300 has the same cross-section). The Phenom's cabin measures 5 feet, 1 inch at the widest point and 4 feet, 11 inches tall from the bottom of the dropped aisle, compared to 4 feet, 7 inches wide and 4 feet, 6 inches tall in the Mustang.

The standard Phenom 100 comes with the traditional four-seat club arrangement, a flushing potty seat behind a divider in the aft cabin, and a large wardrobe cabinet with a roll-up door opposite the entryway. The seats have stowable arm rests and limited recline; adding the optional solid lavatory door to the rear divider (replacing a curtain) will eliminate all recline in the forward-facing seats.

There is now an optional belted potty seat and also a belted side-facing seat (in lieu of the large wardrobe cabinet opposite the entryway), providing total accommodations for up to six passengers in the cabin. Large windows, LED upwash lights, and blue lights on

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the sidewalls beneath the folding tables lend the Phenom's cabin a bright and stylish feel.

Featured prominently in the business end of the Mustang is the ubiquitous Garmin G1000 suite. Each primary flight display (PFD) is a 10.4inch LCD unit-the size commonly found in Cessna piston singles-but in the center of the panel is an almost theatrically huge 15-inch LCD multifunction display (MFD). Interaction with the MFD is performed via a keypad located aft of the thrust levers. A mode control panel (MCP), front and center under the glareshield, is used to operate the GFC700 autopilot and flight director. A trio of electromechanical standby instruments above the MFD rounds out the ergonomically straightforward layout of the Mustang cockpit. Fans of precise hand-flying will be relieved to find a manual pitch trim wheel on the throttle quadrant (an item sorely missed in the pitch-sensitive

While developing the Phenom series, Embraer opted to push for an unprecedented level of aircraft systems integration with the G1000 platform. The company believed the resulting avionics

Phenom).

The Phenom 100's cockpit was designed with simplicity and ergonomics in mind. The pilot side panel (below) has just a few controls. The Phenom 100's Prodigy avionics suite (bottom) is basically a Garmin G1000 system tailored specifically for the Phenom. It includes system synoptic pages, as shown on the central multifunction display, as well as engine gauges and information readouts.







The Mustang's panel (top) also incorporates Garmin's G1000, plus tilted subpanels fitted out with a number of switch groupings. Unlike the Phenom 100's panel-mounted FMS keypad, the Mustang's is located on the center console (above), below the thrust levers. had advanced far enough from an off-the-shelf G1000 installation to dub it something completely different: Prodigy. The most notable feature of Prodigy is its synoptic display of the Phenom's main systems (electrical, fuel, environmental, and ice protection), modeled after those found in Embraer's family of regional airliners.

In all other respects, Prodigy will be completely familiar to any pilot with previous G1000 experience. The PFDs and MFD are interchangeable 12-inch units,

and the same Garmin keypad from the Mustang makes an appearance just below the MFD. GFC700 brains run the Phenom's autopilot and flight director as well, but a different MCP is used; this one does not have mode-active lights next to the buttons, so pilots are forced to cross-check mode selections with the "scoreboard" on the PFD.

Philosophical differences between Cessna and Embraer become apparent when you sit in each airplane's left seat and begin the before-start checklist. Cessna set out to build a pilot's airplane with the Mustang; it has tried-andtrue systems and plenty of switches to keep you busy. Embraer focused on ergonomics and automation; the Phenom approach to switchology is best described as "all switches: AUTO or NORM."



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For every bit of operational simplicity gained in the Phenom, electronic complexity was added. The Mustang's systems must be checked; the Phenom's are just monitored by a computer. Pushing the envelope indeed comes with risks. For instance, the Phenom's electric flaps and "brake-by-wire" systems gained an amount of notoriety during the first year of operation and resulted in a slew of service bulletins to correct problems with overzealous monitoring logic.

The factory-standard Mustang comes with a high level of equipment, especially in the avionics department. Embraer prefers that buyers choose exactly what they need and nothing they don't, but this forces them to pay for very common equipment, such as TCAS, weather radar, DME, ADF, or a second Mode S transponder. Syn-

The Phenom 100 and Cessna Mustang (below) are comparable in many respects, but the Phenom 100's cabin is slightly larger, and its high-speed cruise is almost 30 knots faster than the Mustang's. On the other hand, under many conditions the Mustang's takeoff and landing distances are shorter than those for the Phenom 100. In the full-fuel payload department, the airplanes are virtually identical.



SPECSHEET

Citation Mustang Typical factory price: \$3.3 million

Powerplants	(2) P&WC PW615F
Engine flat rating	
Length	40 ft 7 in
Height	13 ft 5 in
Wingspan	43 ft 2 in
Wing loading	41.2 lbs/sq ft
Seats	
Cabin length	9 ft 9 in
Cabin width	4 ft 7 in
Cabin height	4 ft 6 in
Standard empty weight	5,755 lb
Max ramp weight	8,730 lb
Max takeoff weight	
Useful load	3,155 lb
Zero fuel weight	6,750 lb
Payload w/full fuel	
Max landing weight	
Fuel capacity (usable)	.385 gal (2,580 lb)
Baggage capacity, internal	6 cu ft
Baggage capacity, external	57 cu ft

Performance

Takeoff field length	
Sea level @ 15°C	3,110 ft
5,000 ft @ 25°C	6,600 ft
Landing distance (MLW, SL, 15C)	2,390 ft
NBAA IFR range	1,150 nm
Max high-speed cruise speed	365 KTAS
Service ceiling	41,000 ft

Limiting and Recommended Airspeeds

V _{FF}		
V _{LE}		
VLO		
Extend		
Retract		
V _{M0}		
M _{M0}	0.63M	0.70M
V1/VB/V2@MTOW/SL		
V		

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

Phenom 100 Typical factory price: \$4 million

(2) P&WC PW617F-E	
9.766 lb	
7 cu ft	

2,695 f

thetic vision and electronic charts for the G1000 are available for both aircraft.

The satellite radio option for the Mustang adds a headphone jack and volume control at each of the four club seats in the cabin, as well as a remote that lets the passengers browse channels. The Phenom has standard headset jacks at every passenger seat, but they are the LiMo type (Linuxbased software), so adapters must be purchased in order to use consumer headphones.

For all their physical differences, these two airplanes have a lot in common. The Mustang is powered by two Pratt & Whitney Canada PW615F turbofans and the Phenom 100 by a slightly uprated version of that engine, the PW617F-E. Both airplanes incorporate full authority digital engine controls (FADEC). Both also have electric hydraulic pumps in the nose to power brakes and landing gear extension/ retraction; conventional flight controls; electrically actuated flaps; and electric vapor-cycle air conditioning. Both are stable hand-flyers and incredibly easy to land (especially with their trailinglink landing gear).

The primary, objective disparity is price and performance; put simply, the Phenom is bigger, faster, heavier, and pricier—\$700,000, or about 20 percent, more expensive. The Phenom is able to take off at gross weights up to 10,472 pounds, compared to 8,645 pounds for the Mustang. A Mustang's typical zero-fuel-weight-limited maximum payload is 1,175 pounds, with a full-fuel payload of 575 pounds. For the Phenom 100, these numbers are 1,312 pounds and 578 pounds respectively.

The Phenom is an average of 35 knots (true airspeed) faster, with a corresponding decrease in fuel efficiency; it is capable of high-speed cruise in the range of 360 to 395 KTAS, versus 320 to 345 KTAS. However, when the Phenom is slowed to the Mustang's high-speed cruise airspeed at the same altitude, the specific fuel consumption is equivalent (at altitudes in the mid-30s, anyway). NBAA IFR range (high-speed cruise at

FL410) for the Mustang with two, four, and six occupants, respectively, are 1,175 nm, 999 nm, and 716 nm in zero wind. The Phenom's numbers are 1,211 nm, 1,070 nm, and 785 nm. Hot-andhigh takeoff and climb performance will always be problematic for jets in this class, so quibbling over 15 pounds of payload and 30 feet of runway is semantic.

So, which will it be? In my experience, most buyers shopping for an entry-level, single-pilot light jet try and fly both of these airplanes. For some buyers, the key is the price difference. Many have been flying Cessna airplanes for years and are loyal to the company's products. Others prefer the comfort and space of the Phenom's cabin. But, for most, the real clincher is that one or the other is just more satisfying to own and fly, plain and simple.

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