



# Embraer Phenom 300

## With its light jet Embraer delivers on original performance promises

by Robert P. Mark

I didn't need to see the metar for São Jose dos Campos Airport (SBSJ) northeast of São Paulo, Brazil, to know I couldn't have picked a much worse day to fly Embraer's new light jet, the Phenom 300. The ceilings were ragged, perhaps only 300 to 400 feet, although the constant moderate rain made it impossible to be sure. At least there was no convective activity forecast. A circling approach—tough even in good weather because of nearby hills—was impossible, not to mention the V<sub>1</sub> cuts that are a normal part of every training and demonstration flight.

Preflighting meant the extra effort of balancing an umbrella across my shoulders so I wouldn't drip water into the new airplane—PP-XVM. Despite the rain pouring down off the Phenom 300's sleek fuselage, the standard pumpkin orange paint with accents of black and white stripes reminded me of an aircraft already moving quickly although it was still on the ground. And the Phenom 300 is fast, so fast in fact that like the Cessna CJ4, the light jet moniker seems out of place. The Phenom is a 450-knots-plus airplane that seats eight comfortably and will fly nearly 2,000 nm. That means Chicago from LAX is an easy trip, as is Miami to Denver, with an aircraft almost full of people.

The Phenom 300's swept wing is one of the first indications

that this aircraft is not simply a stretched version of the 100. The Phenom 100 seats four, flies more slowly and has shorter range (1,200 nm). Despite the sweptwing, the 300's slow approach speeds and hefty brakes make it capable of operating from short runways. At high altitudes—service ceiling is 45,000 feet—the pressurization delivers a 6,600-foot cabin. And the Phenom 300 is certified for single-pilot operations to boot. All of this capability comes with just a single pilot up front.

What else could anyone ask for? That's precisely the question Embraer hopes buyers are asking about now. Cessna is watching the Phenom 300 closely because this \$8.14 million Brazilian jet has the \$9.04 million Citation CJ4 squarely in its sights. At 53.25 feet in length, the Citation CJ4 is three feet longer than the Phenom 300 but is slightly smaller in wingspan at 50 feet, 10 inches versus the Phenom's 52 feet, 2 inches. The Phenom is only slightly taller than the CJ4 at 16 feet, 9 inches versus 15 feet, 4 inches. The Phenom 300's 17-foot, 2-inch-long cabin is within an inch or two of the CJ4's. Baggage capacity on the CJ4 is 76 cu ft while the Phenom's is 74 cu ft. The Phenom 300 operates with a pair of 3,360-pound-thrust Pratt & Whitney Canada PW535Es versus the CJ4's 3,400-pound-thrust Williams FJ44-4As. Both

aircraft offer single-point refueling ports, important when stopping for a quick turn-around. Embraer claims 14 service facilities in the U.S., while Cessna's network in the U.S. includes eight company-owned centers and 37 authorized Citation service centers. Other than price, the competition is close.

During a recent trip to Brazil, I got to see just how closely the new airplane—a clean-sheet design—matched the company's plans from 2005. Embraer's initial estimates called for an eight-seat aircraft capable of flying 1,800 nm with an MMO of Mach 0.78 and a maximum cruise speed of 450 knots at 45,000 feet. The company wanted the Phenom 300 to use no more than 2,950 feet on landing and no more than 3,700 feet at maximum takeoff weight. On a typical 1,000-nm trip, Embraer targeted a maximum fuel burn of 2,564 pounds with engines producing approximately 3,200 pounds of thrust. It would also be critical that the 300 meet Stage 4 noise requirements.

### Inside the Cockpit

During the walk-around I had to spend a few minutes examining the world-class airstair door on the Phenom 300. Well balanced, it is easy to open and features a handrail for ease of entrance. Also necessary was a look at the 300's baggage space, 66 cu ft/464

Phenom 300 Specifications and Performance	
Price (typically completed and equipped)	\$8.14 million
Engines (2)	Pratt & Whitney Canada PW535E, 3,360 lbs each
Passengers (typical)	1 crew + 8 pax
Range (w/NBAA reserves, 200-nm alternate)	1,971 nm
High-speed cruise speed	453 ktas/Mach 0.78
Long-range cruise speed	391 ktas
Fuel capacity	5,352 lbs
Max payload w/full fuel	1,142 lbs
Ceiling (certified)	45,000 ft
Cabin altitude at ceiling	6,600 ft
Max takeoff weight	17,968 lbs
Balanced field length at mtow (sea level, standard)	3,136 ft
Landing distance	2,621 ft
Length	51 ft 4 in
Wingspan	52 ft 2 in
Height	16 ft 9 in
Cabin	Volume: 325 cu ft Width: 5 ft 1 in Height: 4 ft 11 in
Length (seating area)	17 ft 2 in
Baggage capacity	74 cu ft/530 lbs
FAA certification (basis, date)	FAR Part 23, 12/14/2009
Number delivered	5 (6/10/10)

pounds in the rear area accessible from the outside only, as well as another 8 cu ft in the nose for 66 pounds of crew bags.

There is a knack to getting into the left seat of the Phenom 300: slide the seat all the way back when you exit the airplane at the end of the previous flight. Once that's accomplished, a modest sized pilot can climb in easily. I like the wide-open feel of the triple 12.4-inch display screens of the Prodigy Flight Deck 300 system, especially the big-aircraft-like FMS keyboard for data entry. The Prodigy system is based on the Garmin G1000 system, so pilots transi-

tioning from some late-model single-engine aircraft already running the G1000 will feel at home rather quickly.

The takeoff configuration button gives the pilot a quick check to be certain he hasn't left the aircraft unprepared for takeoff before the power levers are pushed forward. This feature is particularly useful for a single-pilot-certified airplane. Finally, I appreciated the single-unit backup flight display that sits at pilot-eye level on the left side of the central glareshield. Like a primary flight display (PFD), it incorporates an entire attitude, airspeed and altimeter



The swept wing of the Phenom 300 is one indication that the light jet is a clean-sheet design, rather than merely a stretched version of the Phenom 100.



The interior, designed by BMW DesignWorksUSA, features fully reclining seats for the eight passengers.

in a single unit. It uses the same standard symbology as the PFD and because it's digital, rather than analog, Embraer believes it is just one less area for confusion if any of the primary electronic displays begin shutting down. The unit also functions as a third source of AHRSS data should the others fail.

The synoptics available on the center multifunction display are easy to read, with diagrams that don't look like an engineer's drawing. The crew alerting system (CAS) prioritizes critical red messages at the top of the screen, followed by yellow caution messages and finally the lowest-priority white informational messages. Typical of other Embraer products, the aural CAS messages feature a woman's voice calling your attention to "Fire, Fire." The Prodigy system also includes a synthetic vision option. The weather radar, of course, now includes both a lateral and a vertical scan to make thunderstorm avoidance that much easier.

On the ground, the Phenom 300's central maintenance computer (CMC) allows the downloading of all aircraft systems or avionics fault data to an SD card for review. The troubleshooting system tells a technician precisely which LRU needs to be pulled for minimal ground time after a problem pops up. Although it is not installed just yet, the Phenom 300's CMC will soon be set to download data in real time via a datalink while the aircraft is in flight or on the ground.

The layout of the ram's horn control was something I liked in the Phenom 100 because, unlike the control used in most of today's jets, it is not connected to a tall post sticking up from the floor. It's merely pulled from the bottom of the instrument panel as might be found in most light training aircraft. Visibility through the cockpit windows is nice, but I wouldn't

call it great. To me, the window side and center posts eat up too much real estate that could easily hide approaching traffic.

### A Few Systems

The Pratt & Whitney Canada engines are flat rated to provide their full 3,360 pounds of thrust to ISA+15, one of the strongest engine margins in this category. That also provides the 300 with more than sufficient bleed air to heat the wings, engine inlets and tail to shoo away the ice before it even has a chance to form. Like the Williams engines on the CJ4, the Pratts—also dual Fadc controlled—offer a TBO of 5,000 hours (10 years' worth of flying for a 500 hours-per-year flight department). The Phenom 300 includes an airframe useful life of 35,000 hours, reflecting the airframer's airliner heritage. Embraer says two mechanics can easily replace an engine in two to four hours, minimizing downtime almost anywhere. One mechanic can also replace a complete windshield in two hours.

The carbon brakes of the Phenom 300 are brake-by-wire, just like those on the Phenom 100. Having flown the Phenom 100 last year, I was not looking forward to another brake-by-wire experience. The factory people told me the Phenom 300's brakes work much better than the 100's brakes, which were in the midst of a software upgrade thanks to more than a few complaints about their tenderness.

Hawker Beechcraft (on the Hawker 4000) is the only other manufacturer to offer a carbon brake on a brake-by-wire system, so Embraer is either at the head of the pack or about to learn some interesting lessons about why the other manufacturers have stayed with more traditional systems. If it all works properly, however, Em-

braer believes the new carbon brakes will be much less susceptible to heat-related control issues, weigh 20 percent less than standard brakes, demand 60 percent less component replacement and cool off much more quickly, translating into less time on the ground cooling the brakes when operating from short fields.

The Phenom 300 should run slightly more than \$1,200 an hour to operate based on fuel costs of about \$4.50 per gallon, according to a Conklin & de Decker study of the airplane's direct operating costs. This estimate was a bit low by AIN's gauge. The factory believes these numbers will also prove their claim that a Phenom 300 can be operated for less than the running cost of a Beech King Air 200GT.

A few interesting systems on the Phenom 300 include two Goodrich Smartprobes. They look like standard pitot tubes beneath the cockpit windows, but are really true digital speed data transducers. All airspeed



The Phenom 300's Prodigy flight deck is based on Garmin's all-glass, fully integrated G1000.

calculations are performed inside the Smartprobes themselves—the air data computer is integral to the design—and transmitted to the PFDs for display. That means no tubes to fuss with when the system needs replacement. It also eliminates the need for an angle of attack indicator. The Phenom 300 joins the Falcon 7X and the Embraer Lineage in offering this system.

### Flying the Phenom 300

The startup procedures are worth noting in the Phenom 300 because they're so simple. Embraer planned it that way all along to conform with the goal of single-pilot crew. Once the batteries are turned on, engine start requires a quick twist of the start knob while the pilot monitors. Ignition and fuel flow are automatic, as is temperature monitoring and even the shutdown should a hot start occur. It can't get much easier than that. The philosophy behind the electrical system is pretty simple too. If a breaker pops, the pilot simply leaves it alone. All switches are within easy reach of the left-seat occupant.

Embraer instructor pilot Marcio Miranda and I were soon on our way toward 10,000-foot Runway 15 for departure. Early during the taxi I noticed something wonderful about the 300: Embraer really had gotten the message about those brake-by-wire stopping devices on the Phenom 100 that caused so many pilot complaints. The 300's brakes are wonderful, with no tendency toward the jerkiness of the 100's brakes.

As I took the runway at SBSJ, the weather was about 500 feet overcast and perhaps a mile-and-a-half visibility in light rain. I was mindful of the hills that surround the airport as I brought up the power and the Phenom sped down the runway. There were three of us aboard and not quite a full load of fuel,

which produced a weight of just over 16,300 pounds, well under the maximum of 17,968 pounds. Cloud tops were reported at about 10,000 feet so the plan was to break out and try some airwork since the weather limited our ability to shoot approaches.

On takeoff, the ground run was brisk and we were soon climbing at 140 knots to put some distance between us and those big nearby hills. By 7,000 feet I'd accelerated to 245 knots with a rate of more than 3,500 fpm. ATC stopped us at 10,000 feet and the airspeed climbed to about 320 knots indicated. ATC continued climbing us in jumps so a time to climb was impossible to capture. So much for the 10,000-foot cloud tops, I thought, as we passed through FL180. We finally broke out into the blue at FL270 as we headed for the Embraer practice area.

During my short flight, I did try some steep turns at 200 knots and a variety of other airspeeds. This is a solid, easy aircraft to command as long as the pilot is on top of the trim button. Hands-free steep turns—my personal control barometer—were easy enough. We also had time to slow the aircraft for a few stalls to try the stick-pusher system. The shove to the wheel at low speeds is unmistakable even to pilots new to operating jet aircraft. We climbed to FL300 just to check some speeds and fuel flows before turning back for landing. We saw a top true airspeed of about 440 knots while burning about 1,400 pph total at a temperature of ISA+8.

I took a few minutes to explore the interior I'd seen on the ground at the airport. The aircraft I was flying did not have the finished interior designed by BMW DesignWorksUSA as would the finished airplanes. I liked the clean, smooth lines of

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Passengers will appreciate the substantial airstair door—complete with handrail—as they board the light jet.



Like its smaller sibling, the Phenom 300 has trailing-link main gear with brake-by-wire and an anti-skid system that should help even new pilots deliver smooth landings.





NIGEL MOLL

*The 66-cu-ft rear baggage compartment offers plenty of room for the passengers' bags and other gear.*

the aircraft seats and wall liners. I also like the idea that a light jet can offer fully reclining seats that, while perhaps a tad narrow to function as a true bed, certainly offer passengers a great opportunity to catch a little nap that doesn't include a stiff neck or the opportunity to drool while trying

to curl into a seat that doesn't recline far. The Phenom's lavatory can function as a belted seat if it's ordered that way. Even if it is used only as a bathroom, the surprising aspect is the rigid big-jet-like door and the two large windows that transform the space from what could have been a typical dark little lavatory into a space that feels much larger thanks to all the light.

The weather on the ground meant that  $V_1$  cuts were out of the question, so we tried a few maneuvers at FL270, where I slowed the aircraft as much as possible and then went full throttle to simulate another takeoff while Miranda pulled one engine back to idle. Embraer added an extra ventral fin beneath the fuselage at the tail to aid in controllability with one pulled back, as well as an automatic 5-percent power boost from the good engine. The ventral fin allows the aircraft to be dispatched with the yaw damper inoperative. To me, the 300 seemed to require a significant amount of rudder pressure to keep the nose straight, much more than I would have expected in an airplane of this

complexity. If a single pilot does lose an engine on takeoff, he'd better have some strong leg muscles at the ready.

Anyone who flies the 300 will have trouble making a bad landing thanks to the beefy trailing-link gear. The runway was wet and I was determined to experience the aircraft's stopping manners on my only landing, especially since there are no thrust reversers. I was not surprised or disappointed. With only a slightly firm touchdown I climbed on the brakes and found it quite simple to keep the aircraft tracking straight. Ground spoilers also help drain off the speed quickly. As we turned off the runway and headed back for the Embraer ramp, the rain continued.

### Measuring Up

Now that we were back on the ground, it was time to see just how well the Phenom 300 measures up against the expectations the company set in 2005. Planned range was 1,800 nm; the Phenom was certified at just a shade under 2,000 nm. High-speed cruise was planned to be 450 knots and the air-



NIGEL MOLL

*The two windows in the lavatory create the illusion of a larger space. Customers can opt to replace the lavatory with a belted seat.*

craft is certified at 453 knots. Certified landing distance is 2,621 feet versus the plan of 2,950 feet. Takeoff is 3,138 feet versus the original estimate of 3,700 feet, nearly 20 percent less than planned. Block fuel on the 1,000-nm trip came in at 2,403 pounds, compared with the ex-

pected 2,564 pounds. Finally, the Phenom 300 clocked in at 24 EPNdb below Stage 4 limits. Since the airplane comes with a price tag of nearly a million dollars less than that of the CJ4, Cessna's sales staff will have their work cut out for them trying to best the Brazilians. □