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The good news from Melbourne

Phenom update

BY THOMAS A. HORNE

THE RECESSION HAS TAKEN ITS TOLL ON ALL BUSINESS JET MANUFACTURERS,

but Brazil's Embraer appears to have felt its sting the least. For example, since the first Phenom 100s began delivery in December 2008, more than 300 of the 390-knot, 1,178-nm six-seaters have been sold—with 30 of them in 2013. And sales of the Phenom 100's big brother, the Phenom 300, have recently topped the 200 mark. It's worth noting that the 200th Phenom 300 was sold to fractional operator NetJets as part of a firm order for 50 additional 300s, plus options for another 75. That translates into \$1 billion in sales if all those options are converted into sales. And in 2013 alone, the Phenom 300 was the best-selling "light" jet (if you consider its 17,968-pound max takeoff weight as light) of all, with 60 deliveries.

PHOTOGRAPHY BY CHRIS ROSE

Compare these numbers with those of what many consider to be the Phenom 100's closest competitors. Cessna delivered 20 of its Mustangs in 2013, and just three in the first two quarters of 2014, according to the General Aviation Manufacturers Association (GAMA). In the same period, a total of 31 Citation M2s have been delivered. The Phenom 300's principal competitor—the Citation CJ4—turned in 33 sales in 2013 and 12 in the first two quarters of 2014.

So first things first: The Phenoms are a pleasure to fly, sophisticated yet simple to operate, economically competitive, with ever-innovative and roomy interior designs and an exemplary service network and philosophy. That helps explain their success. The fact that they've made a significant investment in a final assembly facility in Melbourne, Florida, doesn't hurt either.

Another reason for the Phenoms' strong sales is a series of improvements over the past few years. *AOPA Pilot* recently

A POPULAR PHENOM 100E option is the single, side-facing seat aft of the cockpit (below). Standard seating in new Phenom 100Es feature the BMW-designed interior with articulating seats (bottom). An AC-charging port is at the right of the number-three "boss's" seat, and a satphone is also available (below right). Phenoms, like all Embraer jets, have "ram's horn" style control yokes (below far right). The Phenom 100E cockpit (bottom right) uses the Garmin G1000-based Prodigy avionics suite, now with the ability to fly holding patterns at user-defined waypoints.



visited Embraer's new assembly, engineering, and design facility in Melbourne, Florida, to have a firsthand look at the latest versions of the Phenoms 100 and 300.

PHENOM 100E

The 201th Phenom 100 carried the "E" (for enhanced and efficient) suffix in order to highlight a new feature in its standard equipment list: multifunction spoilers. Activated by a two-position toggle switch on the center console, these are inboard panels on the wing trailing edges used for reducing airspeed and increasing descent rates. After landing, the same panels deploy automatically to put more weight on the wheels, increase brake effectiveness, and produce shorter landing distances.

There's a good reason why Embraer added spoilers. The Phenom is slippery, and before the 100E it had no spoilers. Moreover, its 1,695-pound static thrust (lbt) Pratt & Whitney PW617 engines have no reverse





thrust. This adds up to a requirement for precise airspeed control on approach. At the Embraer/CAE Phenom training facility at Dallas-Fort Worth International Airport, trainees are taught to cross the final approach fix fully configured for landing, and to fly down the final approach course at V_{REF} . This is 91 to 105 knots, depending on weight. Any faster, and the airplane could float far down the runway.

Of course, the Phenoms have powerful brake-by-wire systems to minimize stopping distances, but the initial brake systems proved troublesome to some. They were *too* powerful, others said, and had little in the way of progressive control feel or feedback through the pedals. For many, the experience was the sensation of either full braking or none at all. This led pilots to try to modulate braking by pumping them, which could—and did—lead to swerving, as well as longer landing distances.

A spate of landing accidents were attributed to pilots flying too high and/or too fast on final. In one especially dramatic May 2011 accident, a Phenom 100 ran off the end of the runway at Sedona, Arizona, then went 200 to 300 feet down an embankment;



THE PHENOM 300'S big news is its optional Prodigy Touch avionics, based on Garmin's G3000 (top). The displays are bigger than stock screens, have better resolution, and can show split-screen views. For \$400,000 you can retrofit your plain-Jane Phenom 300 with the Touch system, which uses controllers closely resembling those of Garmin's GTN 750 and GTN 650 (above). These replace the keypads of the standard Phenom 300 avionics. Phenoms look as good in the air as they do on the ramp (top right), and their interiors are also from BMW DesignWorks USA (opposite page, left). At the Melbourne assembly plant, a 100E interior comes together (opposite page, far right).



resulting in minor injuries to the five aboard. In a February 2013 runway excursion after a landing at Berlin's Schoenefeld Airport, a Phenom 100's landing gear collapsed but all three aboard were uninjured. In two other cases, both main landing gear tires blew after pilots landed without brakes and stopped using the very powerful, yet sensitive, emergency braking system—which also serves as a parking brake. The landings were preceded by "Brake Fail" annunciations.

So the spoilers, and progressive improvements to the braking system, were

Embraer's answer to these issues. Currently, Phenom 100s are on their ninth brake control unit (BCU) upgrade. The upgrades are provided by Embraer free of charge.

My flight in N531EE, Embraer's P100E demonstrator, gave me the chance to experience the new features firsthand. Thanks to a simple, well-designed panel, Embraer's Prodigy flight deck (based on Garmin's G1000 avionics suite), automated systems, and full authority digital engine controls (FADEC) starting is a breeze—rotate the start switches to the Start position, and

A SELECTION of Phenom interior elements at the Melbourne design center (below left); a hall with cabin mockups of the Legacy 450/500, Phenom 300, and Phenom 100E (below center); and a ventral tail logo (below right) show off Embraer's increased presence in the American market. A new Phenom 300 (bottom) is about to enter the Melbourne delivery center hangar.



 **EMBRAER**



SPEC SHEET

EMBRAER PHENOM 100E

PHENOM 300

Base Price:

\$4.1 Million

\$8.995 Million

SPECIFICATIONS

Powerplants	2 Pratt & Whitney Canada PW617F-E, 1,695 lbst ea	2 Pratt & Whitney PW535E, 3,360 lbst ea
Length	42 ft 1 in	51 ft 4 in
Height	14 ft 3 in	16 ft 9 in
Wingspan	40 ft 4 in	52 ft 2 in
Wing area	202 sq ft	306.8 sq ft
Wing loading	51.8 lb/sq ft	58.6 lb/sq ft
Power loading	3.08 lb/lbst	2.67 lb/lbst
Seats	2 + 5	2 + 7/9
Cabin length	11 ft	17 ft 2 in
Cabin width	5 ft 1 in	5 ft 1 in
Cabin height	4 ft 11 in	4 ft 11 in
Max takeoff weight	10,582 lb	17,968 lb
Max zero fuel weight	8,444 lb	13,999 lb
Basic operating weight	7,220 lb	11,583 lb
Max useful load	3,384 lb	6,495
Max payload	1,312 lb	2,416 lb
Max payload, full fuel	578 lb	1,142 lb
Max landing weight	9,766 lb	16,865 lb
Fuel capacity	419 gal (1,403 lbs)	799 gal (5,353 lb)
Baggage capacity, forward	66 lb	66 lb
Baggage capacity, aft	353 lb, 55 cu ft	463 lb, 66 cu ft

PERFORMANCE

Takeoff field length	flaps 1 3,400 ft	3,138 ft
Cruise speed/range w/NBAA fuel rsv, @ max cruise setting	33,000 ft 390 kt/ 1,178 nm	30,000 ft 453 kt/1,177 nm
Cabin altitude	41,000 ft 8,000 ft	45,000 ft 6,600 ft
Max operating altitude	41,000 ft	45,000 ft
Landing distance	flaps 3 2,699 ft	2,621 ft

LIMITING AND RECOMMENDED AIRSPEEDS

V _R (rotation)	flaps 1 104 KIAS	108 KIAS
V ₁ (takeoff decision speed)	flaps 1 102 KIAS	108 KIAS
V _{MC} takeoff (min control w/one engine inoperative)	97 KIAS	97 KIAS
V ₂ (takeoff safety speed),	flaps 1 107 KIAS	119 KIAS
V _{FE} (max flap extended)	10 degrees 200 KIAS	180 KIAS
36 degrees	145 KIAS	275 KIAS
V _{LO} (max gear operating)		
Extend	180 KIAS	250 KIAS
Retract	180 KIAS	
V _{REF} (reference speed, final approach)	flaps 2 105 KIAS	104 KIAS
V _{MO} (max operating speed, SL to 28,000 ft)	275 KIAS	320 KIAS
M _{MO} (max Mach number, above 28,000 ft)	0.7 M	0.78 M
V _{SI} (stall, clean)	100 KIAS	100 KIAS
V _{SO} (stall, in landing configuration)	77 KIAS	89 KIAS

FOR MORE INFORMATION

Contact Embraer representatives online (www.embraerexecutivejets.com).

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.

EXTRA

The Phenom 100 can be ordered with a one-place, side-facing forward divan.

The Phenom 300's interior designs are not limited to prepackaged themes; you can mix up carpet, sidewall, and seat colors and materials.



NEXT ON DECK is the Legacy 500, with its fly-by-wire control system, and Rockwell Collins Pro Line Fusion avionics (above). The Legacy 500 cabin (right) promises to redefine the mid-sized category, with its flat floor, six-foot, 10-inch-width, and six-foot-high dimensions. The cabin can be ordered with up to 12 seats. An aft, three-place divan is an option.



wait for lightoff. Any anomalies? Then the FADEC will shut the engine(s) down.

Taxiing was easier than I recall in earlier Phenom 100s. Embraer made newer rudder springs, pedal pivot design changes, and other software modifications to help tone down the brakes' grabbiness. The trick, I was told, is to keep your heels on the bottom of the pedals and steer with the nosewheel as much as possible. The temptation is to fall back on old habits and steer relying on differential braking. You want to keep that to a minimum to avoid those jerky steering responses by the BCUs.

Then it was power to the TO detent, a short wait for the V_1 and V_R of 91 knots, and off we went in a 2,000-fpm climb to altitude. Once level at FL340, it was time to sample yet another, much-anticipated upgrade. The Prodigy avionics' latest software ("load 63," I was told) includes the ability to hold at any fix or position. Before, the autoflight system would only execute holding patterns associated with missed approaches. Now it's a matter of highlighting any fix or location,

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hitting the “menu” button, then entering the inbound course, direction of turns, leg length or time, and pressing the Enter key. Now the airplane will automatically fly the holding pattern. Before, you had to manually fly around a holding pattern using the heading bug.

Leaving the hold, it was time to descend using the spoilers—which do carry some limitations. One is that indicated airspeed must be above 182 knots. Thrust lever angles have to be less than the Max CRZ position, flaps can’t be deployed, and there must be no aural overspeed warnings. European Aviation Safety Agency (EASA) has allowed spoiler use with flaps extended to all but the full down (flaps 4) position, but FAA approval for this is pending.

At idle power I popped the spoilers, set the airspeed at 255 knots, and lowered the nose five degrees below the horizon. There was virtually no aerodynamic “rumble” with the spoilers out, and our descent rate hovered around 4,700 fpm. So attention all Phenom 100 pilots: Are you tired of creeping toward V_{MO} as you’re getting



THE MELBOURNE assembly plant takes components shipped from Brazil, then assembles them using remote-control, laser-guided technology. If working high up, workers are tethered to protect them against falls (left). Mating the wings to the fuselage (right) takes just one hour.



slam-dunked to lower altitudes? Then the 100E solves the problem. The spoilers are available as a retrofit to earlier Phenom 100s. Cost: \$300,000 and an extra 110 pounds added to your basic empty weight.

For the landing I flew at a V_{REF} of 98 knots with flaps 4, gear down, and an N_1 of approximately 60 percent, with the result being a descent rate of about 600 fpm. Just before the threshold of Runway 9L at

Melbourne International Airport I pulled the thrust levers back about half way, then went to idle as we crossed the numbers. I flared ever so slightly, the main gear touched down, followed by the nosewheel, and then I got on the brakes.

I was trying for a nice, smooth braking action and that's pretty much what I got. I can't say the braking pedal force was linear, but then again the system is designed to be

very businesslike about slowing the plane down, if you get my drift. Welcome to the world of brake-by-wire!

I was careful not to revert to differential brake steering, but old habits didn't have much of a chance to really kick in. That's because the multifunction spoilers deployed automatically when they sense weight on wheels, further slowing our landing roll. While this ground spoiler, or lift-dump, function is very effective at increasing the braking force, the airplane receives no FAA "credit" for shorter landing distances. In the airplane flight manual you'll see the same landing distances as those posted for a non-multifunction-spoiler airplane. Taxiing back to the Embraer ramp was fairly smooth—just remember to steer with your heels as much as possible.

PHENOM 300

The front office is the Phenom 300's big news. Certified late last year, the new, optional Prodigy Touch avionics suite uses two Garmin G3000 touch-screen controllers for data entry, and anyone

familiar with Garmin's GTN 750 or GTN 650 operating methodology will have no problem whatsoever in making peace with these units. Touch the icon representing the functions you want to perform, and an interactive menu appears to customize the entry or view you want.

Along with the controllers come three interchangeable 14.1-inch display screens—two primary flight displays and one multifunction display. Standard screens are slightly smaller, at 12.1 inches. The new, wider screens have 16:9 aspect ratios and much higher, 1280 x 800 ppi (pixels per inch) resolution, and it shows. Non-Touch displays have 800 x 800 ppi resolutions.

In addition, the Prodigy Touch system screens can be set up in a split view that can put two screen views in each screen, for a total of six different views. By the way, the Prodigy Touch suite can be retrofitted to standard-equipped cockpits through a service bulletin; prices vary nation by nation and existing airplane equipage.

The Phenom 300's BCUs have been updated (they are up to the sixth design change), although I've always thought the 300's brakes had a more conventional feel. One Embraer demonstration pilot put that down to the airplane's almost 8,000-pound weight difference over the Phenom 100, presumably meaning that brake-by-wire's sensitivity and effectiveness is a better match for heavier airplanes.

Embraer officials say they are working on a plan to earn FAA approval for a common type rating for both the Phenom 100 and 300. Under the terms of this type rating, a pilot typed in one airplane could earn a type rating in the other after training in the differences between the two.

LEGACY 500

Next up is the debut and FAA certification of Embraer's Legacy 500, the company's first fly-by-wire executive jet. Designed with the intent to redefine the mid-sized market niche, the Legacy 500 can cruise as fast as 466 knots, and as far as 3,125 nm, thanks to its Honeywell HTF 7500E turbofans of 7,036 lbst. With its eight- to 12-seat interior floor plan, the \$20 million Legacy 500 is poised to take market share from its closest competitor, Bombardier's new Challenger 350. Stand by for a future report on this promising new development. **AOPA**

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