TURBINEPILOT

A SPECIAL SECTION FOR THE TURBINE OWNER-PILOT

the ultimate Hawker

Power, automation, and luxury top the Hawker Beechcraft line

BY THOMAS A. HORNE

Way back in 1996, what was then Raytheon Aircraft Company committed to building the biggest, most advanced business jet it had ever conceived. Raytheon called it the Hawker Horizon, and it was designed to fit in the "super-midsize" category—meaning a jet that would fill the niche between Raytheon's mid-size Hawker 800s and 1000s of the day and the 4,000-nm-plus large-cabin jets built by Bombardier, Falcon, and Gulfstream.

The Horizon would be a first in many ways. It was to have been the launch airplane for Honeywell's new Epic avionics suite, an ambitious open-architecture system capable of expanding with new technologies (including voice-activated commands), boasting loads of automation and four large-screen displays. Its fuselage would be built of a carbon fiber composite, using techniques pioneered by Raytheon's Premier 1 light jet—a Part 23, 451-knot, six-seat hot rod already in

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development. The goal was to certify the Horizon to FAR Part 25 standards, giving its systems and manufacturing processes the extra redundancies necessary to meet Transport-category safety standards.

From the start, the Horizon had teething pains. Such an aggressive new project meant complying with scads of new certification rules, and brought manufacturing and other challenges that delayed the airplane's progress. The projected 2001 entry into service didn't happen. Instead, the Horizon—renamed the Hawker 4000—had its first deliveries in late 2008. Along the way, in 2006 Raytheon Aircraft was bought for $3.3 billion in cash by Hawker Beechcraft Inc., a company owned by Goldman Sachs and Onex Partners. So it's been a rocky road for the Hawker 4000, but now it's in production and in the hands of 55 customers. By the end of 2012, HBC says that 25 more airplanes will be delivered.

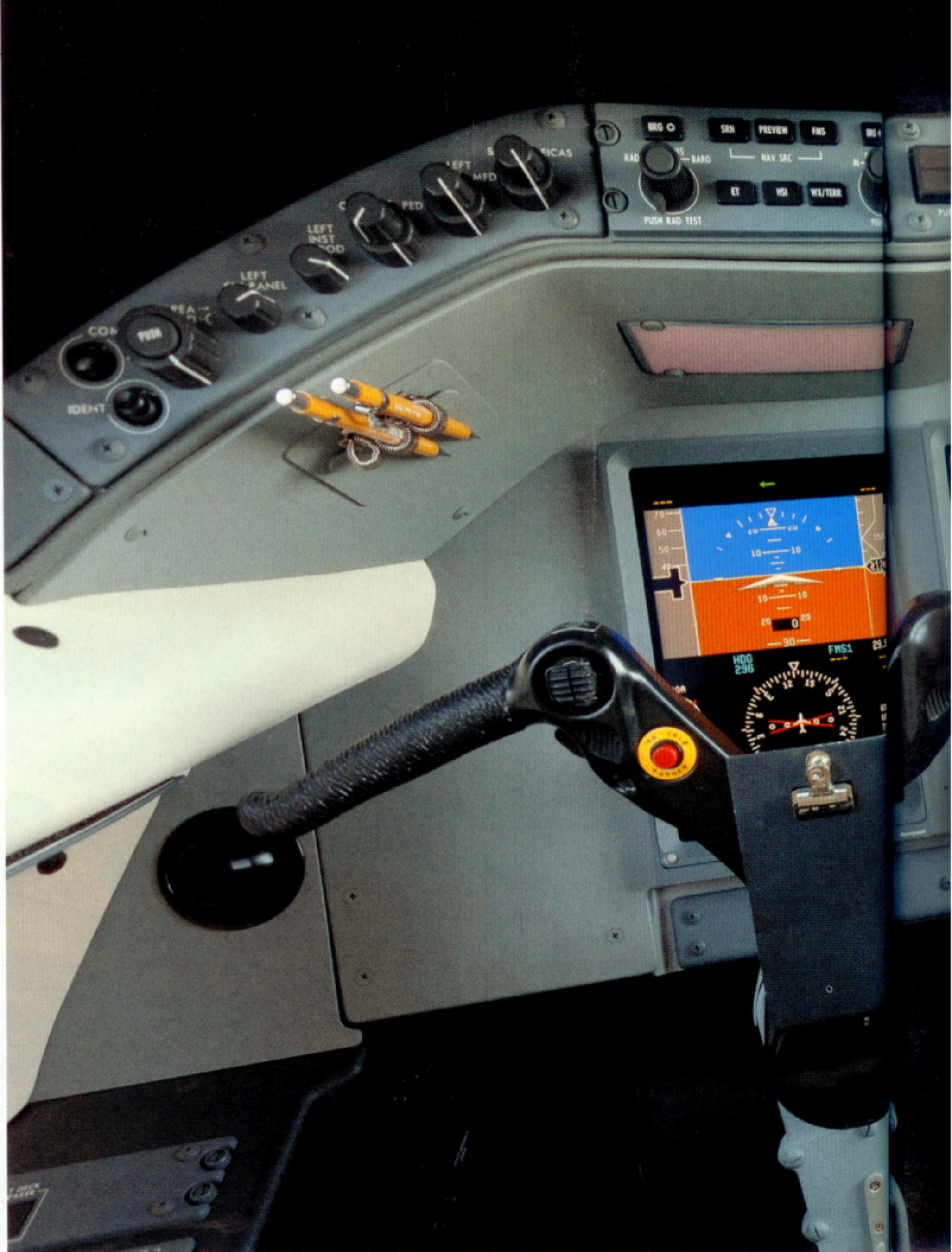
First impressions

Walking up to the 4000 you can't help but notice the sheer size of the airplane, as well as the massive airstair door. If the goal is to give the 4000 the same ramp presence as a global-range jet, then HBC has succeeded. The wings, which have a 28.4-degree sweep, have supercritical profiles, meaning that their cross sections are designed to minimize the shock waves created by the airplane's Mach 0.84 (482 KTAS) max-speed cruise and move them aft along the wing chord, thus reducing drag. To make for low approach speeds (in the 100 KIAS range at light weights) and shorter runway requirements, much of the 4000's wing trailing edges are taken up by flaps.

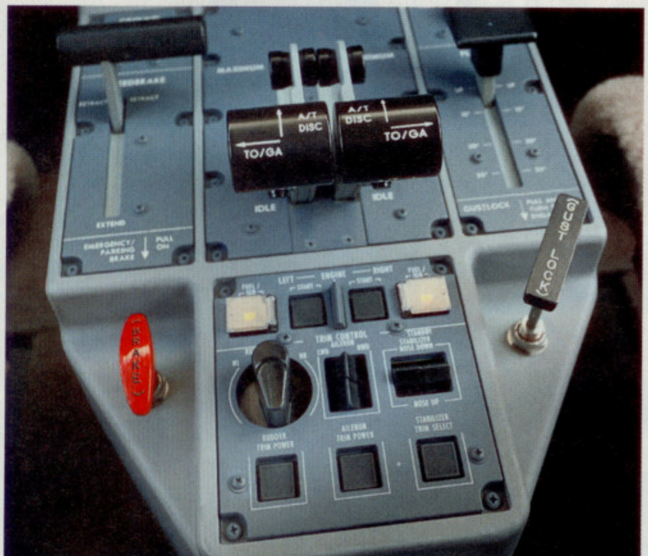
This leaves little room for the ailerons, but HBC compensates for that by augmenting roll inputs with three spoiler panels on each wing. The spoilers serve multiple functions. In flight, two panels deploy for roll inputs. The same two serve as speed brakes for steeper descents and quickly shedding airspeed. After landing—or during a rejected takeoff—all of the spoiler panels deploy to a total of 60 degrees for maximum braking and lift-dumping.

The 4000's ailerons and elevator are controlled by conventional cable-and-push-rod assemblies, but the rudder has a fly-by-wire system that electrically boosts dual hydraulic rudder actuators. This rudder boost is needed in single-engine operations, should the 13,800 (total) pounds of thrust from the airplane's Pratt & Whitney PW308A engines go asymmetric.

At first glance the landing gear are unremarkable, but the nosewheel and main gear brakes are controlled by electrical commands to hydraulic actuators, not by mechanical connections. The steer-by-wire nosewheel can be deflected by up to 70-degree steering angles and is controlled by a tiller. The dual-wheel, trailing-link main gear assemblies come with carbon brakes, a brake temperature monitoring system, wheel speed sensors for the ship's antiskid system, and hydraulic accumulators for emergency braking.



The Hawker 4000 panel is uncluttered, yet loaded with information. The five-screen Primus Epic avionics suite (above) is the heart of the cockpit, and screens can be configured to show system synoptics, electronic charts, navigation views, and datalinked weather. The glareshield contains flight control system switches in the center, plus controls for the primary flight displays (PFDs) above each respective PFD. While the Epic may be new, some old-school Hawker touches remain—such as the ram's-horn control yokes and the pencil holders under the glareshield. The center pedestal (right) has spoiler, thrust lever, and flap controls, plus a pull-to-set gust lock. The overhead panel (far right) features APU, electrical, anti-ice, and other systems controls.



system sends electrical signals from the rudder pedals to the brake assemblies for brake actuation. Although some brake-by-wire systems can be grabby, the Hawker 4000's are smooth and linear. The standard interior (right) is a double-club arrangement.

A tour of the cabin gives lucky passengers a true big-airplane impression. It's high (six feet) and wide (six feet, five inches), has a flat floor, two closets, a large forward galley, and an aft flushing lav, and lets passengers access the large aft baggage compartment in flight. A double-club, eight-seat configuration is standard, but you can order an optional setup that gives you a nine-seat capacity using an aft three-seat, side-facing divan. All that interior room comes thanks to the airplane's carbon-fiber fuselage, which combines light weight with exceptional strength to permit thinner fuselage barrel walls.

You want connectivity? Aircell's ST3100 Iridium telephone system gives you worldwide phone coverage, and it's standard equipment. So is Rockwell Collins' Airshow 4000 cabin entertainment system. Aircell's ATG-4000 high-speed Internet systems are optional, and allow passengers to use Wi-Fi devices to surf the Web, send and receive email, and access corporate virtual private networks (VPNs).

Up front

Grab the overhead grip, lower yourself into the 4000's cockpit, and behold an impressive array of the most advanced equipment. The tiller is over on the left sidewall, as is an audio panel, along with a keypad for controlling the two multifunction displays' various screen views and calling up various functions and actions. The Honeywell Primus Epic's five eight-by-10-inch LCDs are front and center; the glareshield has primary flight display, lighting, and flight control system/autopilot controls; the overhead panel contains APU, fuel, engine, ice protection, and other systems controls; and the center console is home to thrust levers, trim, engine start, flap, speed brake, and the dual flight management system (FMS) installations. Of course, front and center are the signature Hawker ram's-horn control yokes. "We couldn't change that. Our market research proved it," said Patrick Buckles, an HBC Hawker sales engineer.

My demonstration/instructor pilot for the day, HBC's Mark Danin, guided me through the 4000's highly automated features. Engine start amounted

Trailing link landing gear (above) are a first for Hawker Beechcraft, and help make face-saving landings. A brake-by-wire system sends electrical signals from the rudder pedals to the brake assemblies for brake actuation. Although some brake-by-wire systems can be grabby, the Hawker 4000's are smooth and linear. The standard interior (right) is a double-club arrangement.

Viper power

The Hawker 4000's fuselage and vertical and horizontal stabilizer skins are made from carbon fiber tape pre-impregnated with epoxy resin. Using an automated, robotically controlled tool built by Cincinnati Milling Machine and called the "Viper," the tape is placed on a special mold called a mandrel in HBC's Plant Three. The amount of tape placement depends on the fuselage's strength requirements. More tape is placed in areas where stresses are highest: around the windshield and windows, for example. Less tape is needed for smoother surfaces.

After the tape is placed, the composite components are essentially baked in an oven called an autoclave to cure the material. After that, the windshield, door, window, and access panel openings are precisely cut out. Then all the assemblies are tested to meet quality assurance standards. When they pass, they're sent on to Plant Two, where the 4000 goes down the final assembly line. It takes about three weeks to make an entire fuselage. *—TAH*

The 4000's carbon fiber fuselage is made in three sections (left) in Hawker Beechcraft's Plant Three. The carbon fiber is applied in tape form by the company's "Viper" tape-placement robots (below). Depending on the location of stress points, more or less tape can be applied to areas such as window frames. The Viper requires a single operator, and the machine rides back and forth on a track while the tape-placement head—the yellow box-like structure at the end of the orange arm—applies the tape.

to two button pushes—one to start the auxiliary power unit (APU) and generate the bleed air to turn the engines; the other to initiate the start sequence, which was automatic and uses the ship's full authority digital engine control (FADEC) logic. A flight plan was loaded, our weights were loaded, and so was the altimeter setting for Beech Field—HBC's airport at the factory. The airplane's onboard sensors provided the rest of the information and the V-speeds for takeoff automatically appeared on the airspeed tapes.

Taxiing with the tiller was smooth (after a couple of turns for the learning curve), as was the braking—something you don't always experience with brake- and steer-by-wire in some airplanes. Line up and wait, the departure procedure active, trims set, command bars up, flaps at the 12-degree takeoff setting, and it was time to launch. That meant calling up the autothrottles—a system I had never used.

It takes a certain level of trust to come to terms with autothrottles—at least, if you're new to the idea. Autothrottles automatically adjust power for a desired flight profile, using the FADECs and either FMS commands or manually entered airspeeds. It's as though an invisible hand moves the thrust levers, leaving you to watch as they adjust to absolutely nail an exact airspeed. Right now, for takeoff, it was time to put them in action. They're activated by clicking an On-Off push button on the thrust levers. So it was advance the levers slightly, then allow them to move the rest of the way—until they automatically reach the proper engine speed for the ambient conditions.

The drill for takeoff in this two-crew airplane is for the left-seater to use the tiller to steer up to 80 KIAS, while the pilot not flying corrects for crosswinds using the control yoke. At 80, it's hand off the tiller and on the yoke. The 4000 stormed down the runway, and it wasn't long until it was time to pitch up into the command bars after rotating at 112 KIAS and climbing away at the V_{FTO} (final takeoff speed) of 145 KIAS doing 4,000 fpm. Below 10,000 feet, the autothrottles moved aft to keep us from breaking the 250-knot speed limit. Once out of 10,000, they advanced, giving us a climb speed of 280 KIAS.

Even with some level-offs for traffic, the 4000 climbed to FL400 in just 12 minutes. And at our takeoff weight of 30,500 pounds (max takeoff weight is 39,500 pounds), the 4000 needed just 3,200 feet of runway to take off. Now, at FL400 we selected high speed cruise on

Cruise range

HBC says the 4000 will fly 3,007 nm at high-speed cruise, assuming standard conditions, four passengers aboard, no wind, and landing with NBAA IFR fuel reserves. This makes it a true coast-to-coast airplane, and even lets it fly from New York to London and Los Angeles to Honolulu, nonstop. Perhaps more impressive is the airplane's hot-and-high performance, thanks to the 4000's powerful, flat-rated engines. When temperature and elevations are higher than standard, range and payload can suffer as weight must be shed in order to be able to stop the airplane on the runway in the event of an engine problem during takeoff. But HBC says that a 4000 with six passengers and their bags can take off from Aspen, Colorado (elevation 7,820 feet, with a 7,006-foot-long runway), on an 82-degree-Fahrenheit day and still be able to carry enough fuel to fly nonstop to St. Johns, Newfoundland, or Anchorage, Alaska—and land with NBAA IFR fuel reserves—assuming 85-percent probability winds aloft. *—TAH*

Supercritical wing profiles and a 28.4-degree wing sweep let the Hawker 4000 cruise at 470 knots and cover 3,000 nm in style. Long-span flaps and three large spoiler panels on each wing cover the other end of the flight envelope by permitting slow approach speeds and short landing distances. A weight-on-wheels system automatically deploys spoilers upon landing, which dumps lift and helps maximize braking efficiency.

the FMS and the autothrottles put us at Mach 0.82 on our way to Salina, Kansas, then Dodge City, Kansas, burning some 1,950 pph, or about 291 gph.

As for airwork, the 4000 required somewhat heavy roll and pitch inputs in steep turns, but nothing you wouldn't expect from an airplane of this size. For stall recognition, the airplane has a stick-shaker/pusher to provide plenty of advance warning.

For the landings at Wichita's Mid-Continent Airport and Beech Field, a descent profile was entered into the FMS and down we went. Passing through 10,000 feet, the autothrottles slid back to flight idle and we slowed below 250 KIAS. For the WAAS/LPV approach to Wichita's Runway 19L, the approach was loaded into the FMS, and the system automatically entered the target reference speed for landing—117 KIAS.

As the flaps and gear were lowered, the autothrottles adjusted back and forth to keep the desired speed—as it did all the way down final. But on short final the autothrottles are punched off and you're on your own to follow the command bars, then go to flight idle, flare, and land. The flare attitude is somewhat flat, so without Danin's coaching I would have easily felt the need to flare more aggressively. But the landing went well, and we stopped in a surprisingly short distance. This was thanks to the trailing-link gear, the powerful brakes, the effectiveness of the reverse thrust, and the lift dumping of all those spoiler panels.

PAUL BOWEN

SPECSHEET

Hawker Beechcraft Hawker 4000

Average equipped price: $22.9 million

Specifications

Powerplants	(2) Pratt & Whitney PW308A, 6,900 lbst each
Recommended TBO	6,000 hr
Recommended HSI	3,000 hr
Length	69 ft 6 in
Height	19 ft 9 in
Wingspan	61 ft 9 in
Wing area	531 sq ft
Seats	2 + 8/9
Cabin length	25 ft
Cabin width	6 ft 5.5 in
Cabin height	6 ft
Basic operating weight	23,700 lb
Max ramp weight	39,700 lb
Max takeoff weight	39,500 lb
Max zero fuel weight	26,000 lb
Max payload	2,300 lb
Payload w/full fuel	1,400 lb
Max landing weight	33,500 lb
Fuel capacity	2,180 gal (14,600 lb)
Baggage capacity, forward closets	90 lb, 19.5 cu ft
Baggage capacity, aft	900 lb, 89 cu ft

Performance

Takeoff distance, SL, ISA, MGTOW, 12-deg flaps	5,068 ft
Rate of climb, sea level	4,000-5,000 fpm
Single-engine ROC, sea level	880 fpm
Cruise speed/range w/NBAA fuel reserves (fuel consumption, both engines)	
@ High speed cruise, FL430	470 kt/3,007 nm (1,900 pph/283 gph)
Landing distance, SL, ISA, MLW	2,995 ft
Max certified ceiling	45,000 ft
Single-engine service ceiling	28,400 ft
Sea-level cabin to	25,240 ft (9.6 psid cabin)

Limiting and Recommended Airspeeds

V_1 (takeoff decision speed)	130 KIAS
V_R (rotation)	134 KIAS
V_{MCG} (min control w/one engine inoperative, ground)	85 KIAS
V_{MCA} (min control w/one engine inoperative, air)	99 KIAS
V_2 (takeoff safety speed)	141 KIAS
V_{FE} (max flap extended; flaps 12, 20, 35)	230/230/180 KIAS
V_{LE} (max gear extended)	230 KIAS
V_{LO} (max gear operating)	
Extend	230 KIAS
Retract	210 KIAS
V_{REF} (reference speed, final approach, MLW)	128 KIAS
V_{MO} (max operating speed; SL 8,000 ft/ 8,000- 20,000 ft)	280/350 KIAS
M_{MO} (max Mach number)	0.84 M
V_{S1} (stall, clean)	131 KIAS
V_{SO} (stall, in landing configuration)	104 KIAS

For more information, contact Hawker Beechcraft Corp., 10511 East Central, Wichita, Kansas 67206; 800-949-6640; www.hawkerbeechcraft.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.

PAUL BOWEN

The block-point upgrade

Although the airplane is well-equipped with plenty of redundancy and a great warranty (10 years or 10,000 hours on the airframe, five years on the Epic avionics, five years or 3,000 hours on the engines), HBC is conducting a program—what it calls a *block point upgrade*—that will give all 4000s before serial number 52 (those built after that get the upgrades on the assembly line) a huge package of hardware and software upgrades, free of charge. These include dual, redundant electronic charts for a paperless cockpit; a redesigned circuit breaker panel that reduces to six the number of memory items for electrical emergencies; new, faster Pentium processors for the onboard file servers; required navigation performance (RNP) 0.3-nm-accuracy capability, with a growth path to RNP 0.1-nm accuracy; Category II LPV approach capability; Honeywell's RAAS (Runway Awareness and Advisory System); and compliance with the latest FAA and NTSB recommendations to prevent spark creation in fuel tanks.

The upgrade is a big package that takes 90 days to perform, and it represents about $700,000 worth of work. While the airplane is down, HBC will pay for supplemental lift in the form of charter aircraft, a demonstration Hawker 4000, or other arrangements, as long as the airplane is of an equal or better type. The company's goal is to keep loyal customers and build the airplane's value in the marketplace.

Although it will cost HBC dearly at a time when the company can least afford it, the upgrade is a wise move. The Hawker 4000's lengthy delay in coming to market gave the competition—principally in the form of Bombardier's Challenger 300—a big advantage. And Gulfstream's G280, an airplane with similar capabilities, is soon to arrive on the scene.

The upgrade makes a good airplane even better, and will no doubt help preserve its place in the super-midsize market. AOPA

Email the author at tom.horne@aopa.org.