

Big Data
THE FUTURE OF MAINTENANCE

It's a Race
10 AIRPORTS IN TWO HOURS

Portfolio
THE POWER OF WEATHER

AOPA PILOT

TURBINE EDITION

The Voice of General Aviation

www.aopa.org/pilot | \$6.95

NEXTANT G90XT

Next-Gen King Air

GE POWER, GARMIN GLASS FOR THE C90 p. T-10



TBM Taxi

FLYING A ONE-MAN CHARTER p. T-2

Mission Ready

C-130 HAULS IT ALL p. 50

| TURBINE PILOT |

A new KING

Single-lever power controls, and more

IS BUYING NEW ALWAYS BETTER? For those wanting to boost the value of their current turboprop, instead of writing a megamillion-dollar check for a factory-fresh model, there are alternatives. The most recent example is Nextant Aerospace's G90XT, a project that takes Beechcraft's popular King Air C90A series of airplanes and transforms them into modernized designs via a bundle of supplemental type certificates.

BY THOMAS A. HORNE
PHOTOGRAPHY BY CHRIS ROSE

When it bought Walter Aircraft Engines, GE was gunning for Pratt & Whitney, whose PT6 line of turboprops has been the uncontested ruler of the market for 60 years.

The stock, 550-shaft-horsepower Pratt & Whitney PT6A-135 engines are yanked, and replaced with GE's H75 engine. The panel gets a complete upgrade, featuring a three-screen Garmin G1000 avionics suite, including Garmin's GFC 700 autopilot and flight control system; single-lever power controls eliminate the original prop levers; the fuel and pressurization systems are simplified and digitized; and Raisbeck's wing lockers and dual aft-body strakes are also part of the basic deal, which is priced at \$1.9 million. A revamped interior can also be ordered, which will bump the price up to \$2.4 million.

GE'S DEBUT

In 2008 General Electric bought Walter Aircraft Engines, a Czech turboprop engine manufacturer. Walter's background was in making engines for the Eastern European market during the Cold War era. More recently, its 750-shp M601E engine was used in Lancair's Propjet, a sleek, 325-knot, pressurized kitplane that was discontinued in 2012. But GE didn't have kitplanes in mind when it bought Walter. It was gunning for Pratt & Whitney, whose PT6 line of turboprops has been the uncontested ruler of the market for 60 years.

Nextant and GE partnered to come up with the G90XT's vastly improved engine. Although the engine case may trace its roots to the M601, it's about the only component that bears any resemblance. And while the G90XT's new H75-100 is a reverse-flow engine (air enters the engine from the rear, and exhaust leaves via a pair of forward-mounted stacks) that's about all it shares with the PT6 engine design.

The combustor/hot section was beefed up with new alloys to prevent the cracking and thermal stresses that plagued the M601. A computational fluid dynamics examination led to a redesign of the compressor section, which involved changes to the compressor wheels' airfoil cross sections from tip to root that produced a more efficient, constant flow of air across the length of each blade. Instead of fuel nozzles, the fuel system uses a centrifugal slinger ring to deliver fuel to the combustion chamber, obviating the need for fuel nozzle maintenance and eliminating hot spots in the combustor, which in turn eliminates the need for hot section inspections. Recommended time between overhauls is set at 4,000 hours, although Nextant Executive Vice President of Global Sales and Marketing Jay Heublein said this may eventually be increased.

Because the combustor can withstand higher temperatures and the compressor section is so efficient, Nextant says the H75-100 burns less fuel than the C90A's stock PT6A-135 engines at any given speed, has an 11- to 12-percent better specific fuel consumption (SFC, the mass of fuel needed per mile), and 10 percent lower direct operating costs. At FL240 and standard conditions, Nextant says the H75-100s also push the G90XT to cruise speeds

of 250 knots, or about 19 to 20 knots more than the standard airplane.

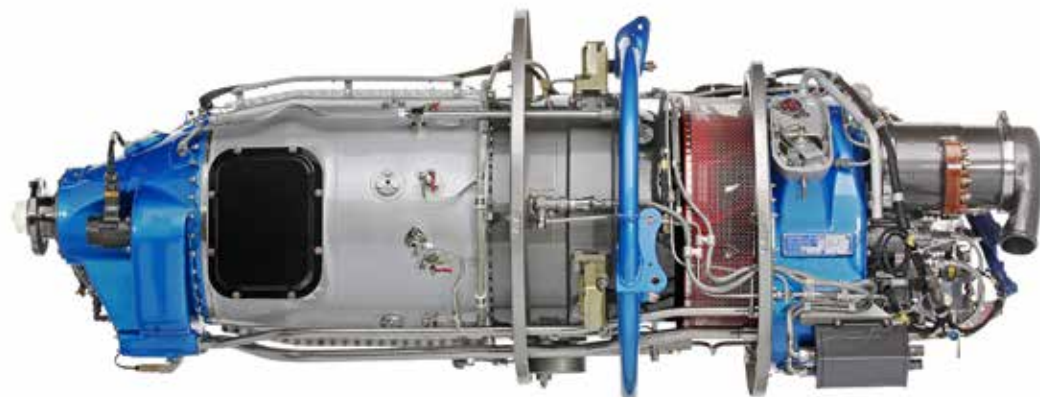
To comply with the C90A's type certificate, the H75-100, although certified at 751 shp, is derated to the same 550 shp that the PT6A-135 produces.

SINGLE LEVERS AND ELECTRONIC CONTROLS

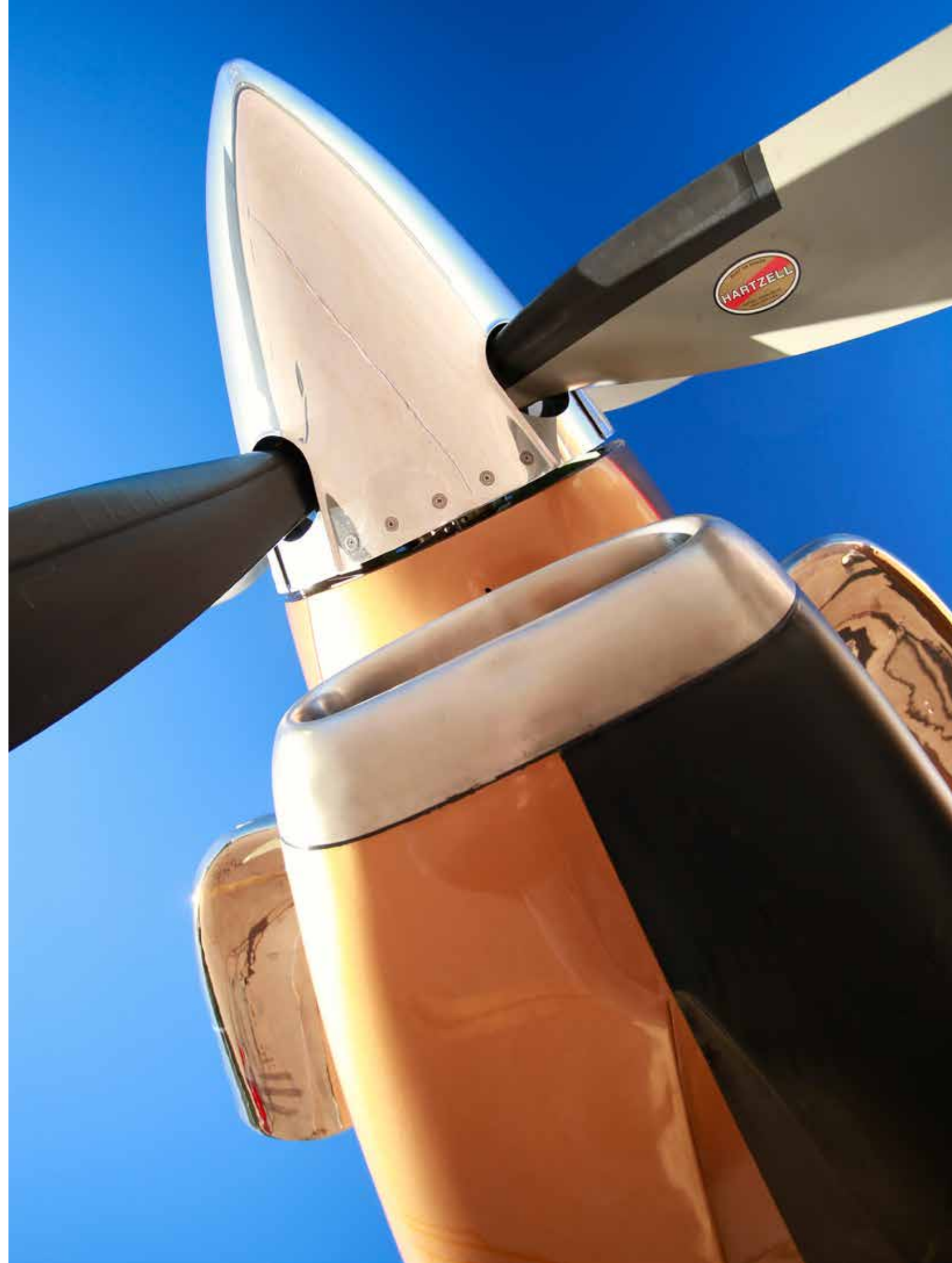
"We wanted to make an airplane that would be so safe and easy to fly that anyone stepping up from a piston twin—or even a complex single—would feel comfortable in the G90XT's cockpit," Heublein said. Thus the decision to equip the airplane with electronic engine controls (EECs) and electronic propeller governors. Together, they permit single-lever power control.

The EECs compare compressor speed and fuel scheduling, as selected using the power levers, and then send this information to rotary variable differential transformers (RVDTs). The RVDTs, which act much like potentiometers, send linear signals that electrically govern propeller rpm and blade angle. The result is a linear delivery of power and propeller synchronization throughout the power band. From flight idle through maximum take-off power, the power lever throw is quite short—maybe four inches.

"With the standard configuration, you get maybe 80 percent of the engines' total power in the last 20 percent of the power levers' travel," said Nathan Marker, Nextant's vice president of flight operations and chief pilot. "There's that sudden surge of power during the takeoff run, so you end up 'walking' the power levers up to full power for a smooth acceleration,



THE H75-100 (left) is based on the Walter M601 design. Intake air enters the rear of the engine, at the screened area, and exhausts through forward-mounted stacks. A slinger ring sends an even mist of fuel to the hot section. The propeller is a four-blade Hartzell (opposite), but a composite MT propeller is being considered, as well as other prop designs.





and to prevent a torque exceedance. With the XT it's a smooth acceleration." By the way, torque, interstage turbine temperature (ITT), and prop rpm exceedances are automatically prevented by the limiting functions of the EECs. You could, Marker said, slam the power levers all the way forward during takeoff, and torque would not blow past redline. Not a good habit to cultivate, but it's nice to have the protection. At altitude, the EECs will also keep ITTs away from reaching redline.

Although any single-lever power control system is apt to be labeled as full authority digital engine control (FADEC), the G90XT's is not. True FADEC systems have dual digital channels; the XT's power levers have what can be considered single channels. While there's no mechanical connections between the power levers and the engines, there are digital connections, chiefly the EECs. Redundancy comes in the form of the red condition levers at the right of the power quadrant, one for each

engine. These are mechanically connected to the engines.

In the event of a fuel control unit malfunction, an EEC failure, or a power rollback, the condition levers are used like the manual override (MOR) levers found in single-engine turboprops. Moving a condition lever will allow the pilot to advance or retard power. There are no high or low idle detents like true condition levers, but there are fuel cut-off positions.

As for propeller feathering, this automatic feature kicks in when the bleed air output of the bad engine drops, creating an imbalance that's sensed by a shuttle valve. Autofeathering takes the offending engine's propeller to feather, although guarded switchlights on the center pedestal can be used to feather manually.

All this may sound complicated, but the engine systems operate in the background, and normally require little pilot management other than monitoring the



gauges. And moving the single-lever power controls.

WALL-TO-WALL GLASS

Those gauges are located on the G1000's multifunction display, along with other system information. Gone are the analog gauges traditionally found in King Airs. Garmin's GFC 700 autopilot and flight control system, mounted on the glareshield, provides all the usual autopilot functions—along with the flight envelope protection features that are becoming so popular on recent-model airplanes. Roll or pitch the airplane past predetermined limits and the autopilot servos automatically apply corrective force. Fight the controls, and the servos fight back. The harder you fight, the harder the servos fight back. Keep this up and the autopilot will automatically engage to right the airplane. There's also under-speed and overspeed protection to keep you away from a stall, or exceeding V_{NE} .

Remember the King Air's sidewall-mounted fuel control panel, with its large gauges? In the G90XT that's gone. Nextant put the fuel controls on the center pedestal, forward of the power levers, and the

quantity gauges on the G1000's MFD. And remember the three traditional pressurization dials and gauges? They're gone too, replaced by a digital pressurization system that gets its information from the G1000's flight plan and other information. There's a new air conditioning system, too. One with dual evaporators that Nextant says can move three times the volume of air than the stock airplane, and is powerful enough to draw down cabin temperatures from 125 degrees to 75 degrees in five minutes.

In other words, nearly everything about the XT's panel is new. Except for the sub-panel switches. They have the same old King Air look and layout, but have a more modern look to their labelling.

INTERIOR MAKEOVER

Want a new interior to go with all that new hardware? Nextant offers an optional redo of the cabin that includes bigger, thicker insulation for noise reduction. Because the insulation can be compressed, the cabin's composite shell has been expanded, giving the cabin three more inches in width and 1.5 more inches of headroom over stock C90As. New seat designs are also available,

THE G90XT SUBPANEL retains the switches of the original airplane, but has spiffed-up, backlit lettering (opposite, top). Autofeather is standard with the G90XT, but prop feathering is finalized by using guarded switchlights (opposite, middle). The XT's panel features the G1000 and a new fuel control panel located forward of the power quadrant (opposite, bottom). Add one of Nextant's custom interiors to the standard modification and you can have a club seating layout like the one above. Nextant is no stranger to radical airframe and engine mods. Its 400 XTi, a Williams-reengined Beechjet with 74 sales, undergoes a 9,000-man-hour remanufacturing process. The G90XT goes through the same process, including compliance with all airworthiness directives and mandatory service bulletins, replacement of all life-limited components with new or zero-timed units, and a landing gear overhaul.

and so are mechanically or electrically operated, pleated sunshades.

A NO-SURPRISE FLIGHT

Nextant is closing in on the G90XT's certification—expected in the first quarter of 2017—so I took a brief flight in the company's flight test airplane. Beside me was Marker who, in his eagerness to show off the EECs at work, the smooth acceleration and the single-lever simplicity, was lobbying for me to just fling the power levers to the stops for takeoff. So I did. Off we went, without that sudden delay, then surge, of torque and noise you often get when flooring a turboprop. A glance at the MFD showed everything in the green, and the PFD registered a 1,400-feet-per-minute climb on the ISA +11 day. Our takeoff weight with two passengers and 1,848 pounds of

fuel (about 277 gallons) was 9,398 pounds. Maximum takeoff weight is 10,100 pounds.

As you might expect, it acts just like a King Air—solid, predictable, and stately. Yes, the ailerons are a tad heavy, but that's a complement to the airplane's aura of substance, and can be a good thing in instrument conditions. After levelling at 10,500 feet and setting a modest, 71-percent torque, we saw 208 knots true, burning 260 pph/39 gph per side. The envelope protection worked as advertised, and soon it was time to return to base. Like most “baby” King Airs at our weight, V_{REF} worked out to be 100 knots, and the airplane needed a fair amount of nose-up trim to get a decent flare.

Anyone with time in a conventional King Air would have to agree that Nextant has hit the mark when it comes to ease of

pilot workload and simplicity of engine management. But the G90XT brings another message. GE has launched its challenge to Pratt & Whitney. Nextant's first King Air reengining and modification package may not be its last. “The GE engines and other improvements are scalable to other models in the post-1983 C90 King Air fleet, like the C90B and C90GT,” Heublein said. “And our certification could expand to the earlier C90 models if we choose to, and probably will.”

Textron has also heard the GE call. Its upcoming Cessna Denali single-engine turboprop will feature GE's 800-shp H80 engine. Here's betting that Pratt & Whitney is already at work on a FADEC version of the PT6.

AOPA

EMAIL tom.horne@aopa.org