Business & commercial Aviation
PILOT REPORT

Inflight Report: Beech's Super King Air 350

A new, top-line Super King Air makes its debut this month, reaffirming Beech's commitment to its traditional engineering roots.

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The Super King Air 350, the newest member of the Beech turboprop family, makes its debut this month. Certificated under the new commuter category rules of FAR Part 23, the King Air 350 will replace the popular King Air 300 as the company's model-line leader.

To be sure, Beech still bases much of its future plans on present and follow-on versions of the uniquely configured and fabricated Starship, but introduction of the KA-350 represents a continued commitment to more-traditional engineering.

The -350's design is a response to a wish list put together by current King Air users, particularly operators of earlier -200 and

-300 models. At the top of that wish list was a desire for more cabin space. A King Air 300 can carry only five passengers (plus two crewmembers) in full-size-seat comfort. A one-place, side-facing bench, a belted potty and optional cargo-area jump seats are available to KA-300 passengers, but these special-use seats don't measure up on long trips.

The new King Air 350 is 34 inches longer than the Model 300. This cabin stretch-14.4 inches forward of the wing and 19.6 inches aft- provides room for a dual club interior that seats eight passengers in comfort. The belted potty and optional jump seats still are available for short-haul, high-density missions.

The next item on the wish list was performance. Airport and cruise performance would have to remain at least as good as that of the KA-300 despite increases in cabin size and aircraft weight limits. Of course, operating economies had to stay at KA-300 levels too.

Another wish-list item had to do with handling characteristics. While King Air 300 handling characteristics certainly are within acceptable ranges, some operators believed control pressures were a little heavier than optimum and that control harmony needed a bit of tweaking. Other Model 300 operators believed that propeller surging during the takeoff maneuver required more pilot compensation than is typically necessary with a Beech product. Improvements in these areas were desirable.

The final wish-list item was generated by Beech itself. The Model 300 is certificated under SFAR 41C. That's the interim certification document that enabled manufacturers to license heavy (over 12,500 pounds MGTOW) airplanes under Part 23 rather than the more stringent Part 25.

Airplanes cannot be manufactured under SFAR 41C after October 1991. Instead, the class of airplanes typically certificated under SFAR 41C in the past will have to meet the tougher requirements of the new "commuter category." Specifically, certification under Part 23, through amendment 34, will be required.

Plans for the Super King Air 350 took shape in early 1988. The first test article flew in September of that year. By January 1989, FAA pilots were on board for certification flight tests. As summer ended the flight envelope had been thoroughly explored, basic performance had been confirmed and test flight teams were

working on clean-up items-cross wind demos, flight with simulated ice shapes and the like.

It was at this point that Beech opened a window in its certification schedule to show the King Air 350 to B/CA's aircraft evaluation pilots. We had the opportunity to fly the airplane (N120SK) and, more important, to talk with the engineering/flight test/marketing team that made the project happen.

Before we get into the nitty-gritty, however, we should point out that it appears the Beech team met its project goals and fulfilled the wish list. The KA-350's cabin is comfortable light and airy; the airplane's initial performance numbers seem close if not identical to those of the smaller, lighter Model 300; and handling characteristics are much improved over the KA-300.

As you can see from the photos accompanying this article, the King Air 350 looks significantly different than its predecessor. Its fuselage is longer by 34 inches and has two extra cabin-area windows on each side; its wing span is wider by some three feet; and it is outfitted with 24-inch high, graphite-composite winglets. A closer inspection discloses dual actuators on all control tabs (a commuter-category certification requirement) and physically minor but aerodynamically important changes to the flight control surfaces that we will discuss later.

The King Air 350's engines are the familiar P&W PT6A-60A turboprops used on the Model 300. These engines are rated at 1,050 pounds shp in both installations. The only external difference between the powerplant installations on the two aircraft are the King Air 350's longer, sharper propeller spinners and new automatic ground-fine-pitch selection subsystem.

Landing gear, fuel system and inspection/maintenance access panels are all identical to the Model 300.

As soon as you climb on board the King Air 350 you can sense the success of the 34-inch cabin stretch. The extra windows, and light-gray overhead and side panels provide plenty of light, keeping the interior from feeling too tubular.

Beech turned to Toisington for the fully articulated passenger seat frames, but completed them in its own facilities. The cabin stretch not only provides enough room for a dual club arrangement, but actually increases the knee room in the aft club compared with the same seating section in the Model 300.

Beech interior designers have put new beef in table hinges and other cabinetry items-an improvement that will please some operators who grumbled about the design of earlier King Air club tables.

FLYING THE KA-350

Tile layout of the KA-350 cockpit is similar to the King Air 300 except for the crew alerting system annunciator panels. You'll notice in the accompanying photo that pressurization system gauges have been moved above the advisory light panel. Red lights are all located on the glare shield. All other caution and advisory lights (amber, green and white) are located on the quadrant panel.

Beech human factors specialists have taken a new approach to CAS light colors in an attempt to create a more logical presentation. We think they've done well.

For example a red light indicates a critical hazard requiring immediate crew alerting and corrective action. When a red light appears the crew must do something immediately.

An amber light indicates a fault (not a hazard) that requires immediate crew alerting and possible future action. A green light indicates a normal system configuration, one that is crew-initiated by movement of a switch or control.

White CAS lights are new to Beech panels. White lights indicate a status (normal or abnormal) that does not require immediate crew action and that probably occurred on its own. There are five on the King Air 350- two of these white lights indicate that the propellers have arrived at their low-pitch stops (ground fine), a normal condition after landing, one indicates that the landing/taxi lights are on with the gear retracted; another indicates that the passenger oxygen lines are pressurized, and the fifth indicates that N1 is too low for air conditioner operation.

The new certification standards require two green lights to help the crew monitor normal operation of the pneumatic deice system. Essentially these lights come on to indicate that the tail surface boots-which are not visible from the cockpit-have pressurized in their normal cycle.

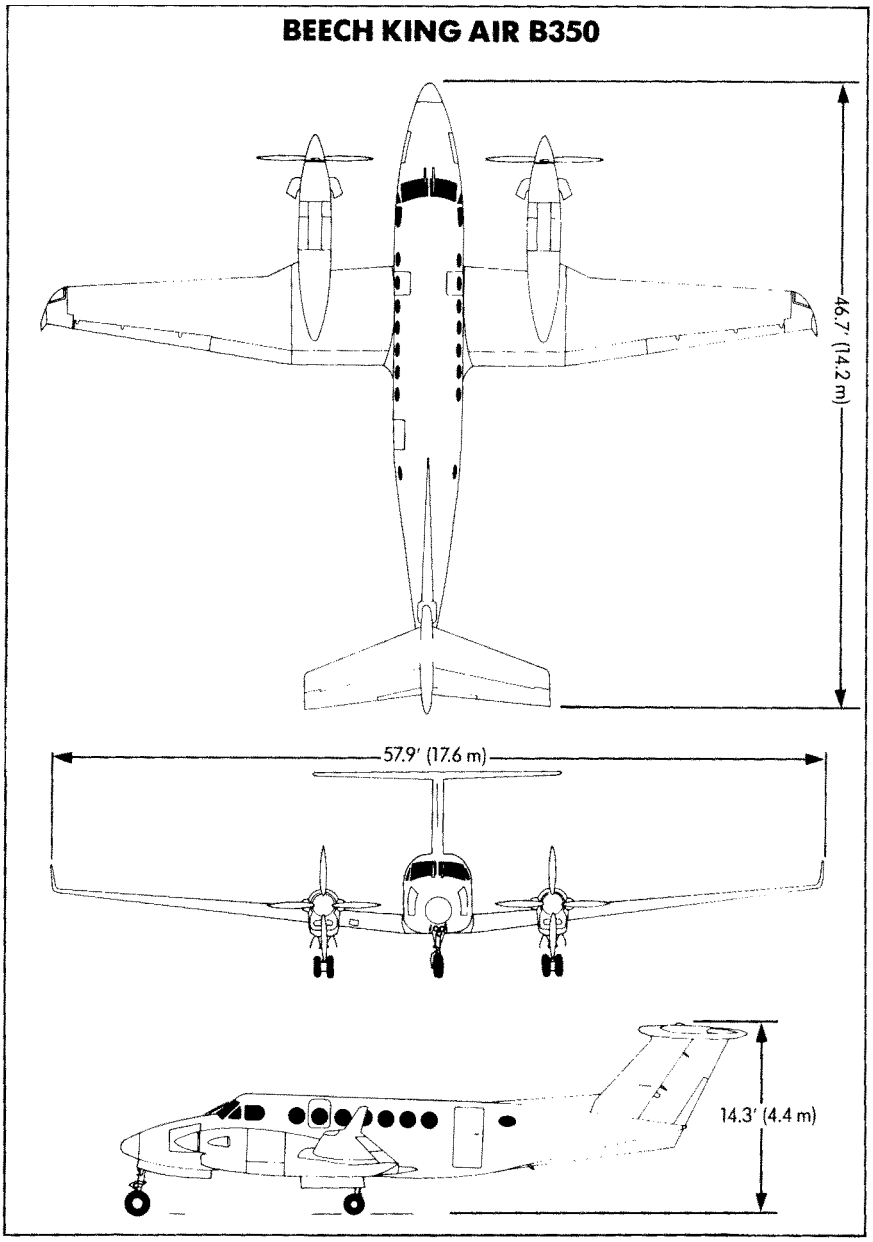
An over-speed warning system also is required by the updated regulations.

At this writing Beech had asked the FAA for approval to install a white light that would indicate to the crew that the cabin had gone above 10,000 feet (a normal situation when cruising at FL 350) and a red light that would indicate the cabin was above 12,500 feet (an abnormal situation within the approved altitude limits of the airplane).

The test article we flew was equipped with electromechanical flight instruments, but EFIS will be available as a customer option.

Beech expects to receive single-pilot certification for the King Air 350 and also believes that one type rating will cover both the 300 and the 350. The airplane systems are identical except for the warning systems discussed above, the wiring of the hot battery bus, a requirement that both inverters remain on in all flight modes and the automatic ground-fine system.

The hot battery bus wiring is simple to understand. The new regulations require that the crew be able to



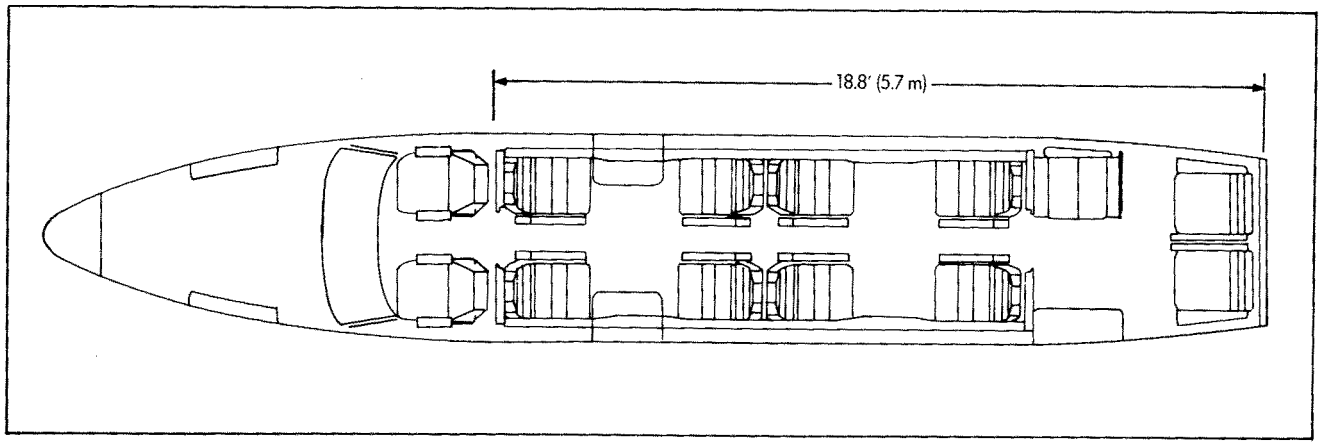
remove all power from the aircraft in an emergency. Beech engineers have placed a guarded switch on the pilot's electrical panel that enables the battery to be disconnected from the hot battery bus. (This switch is carefully guarded to prevent the crew from accidentally dumping all the data typically held in FMS and other nav gear volatile memory.)

The auto ground-fine mode is a bit more complex but brings performance improvements well worth the slight complication .

The power levers of the King Air 350 have three operational zones-flight, ground fine and reverse-as is the case with the Model 300. As their names imply, the flight-power range is normal from takeoff to touchdown; ground-fine (dead zero thrust) is used for most landing rollout and taxi operations, and reverse is used only for true maximum effort stops.

The improvements made to the ground-fine rigging in the King Air 350 installation are intended to fix a takeoff engine-surging problem that exists in the Model 300 and to help give the -350 airport performance similar to that of the 1,000-pound lighter Model 300.

Model 300 pilots have to compensate for the tendency of that airplane's powerplants to surge as power is applied for takeoff. The surge occurs because the Model 300's propellers hit the governor



range (1,700 rpm) while the engines are at relatively low power- 15-percent torque.

The fix for the KA-350 was to set the ground-fine blade at a shallower angle than that of the Model 300 and to turn up the ground idle. This change keeps the -350's propellers out of the governor range during takeoff acceleration until torque has increased to between 45 and 50 percent. The surging problem has gone away.

Keeping the blade angle extra-flat on the ground also improves accelerate stop distance and related takeoff performance parameters. Setting the props coarser for flight idle lowers VMC again improving associated takeoff performance numbers.

Minor changes also have been made to the propeller test circuits to help pilots crews and maintenance personnel confirm proper operation and ragging.

In taxi mode, the -350 is a typical King Air; so too is general cockpit workload during start, preflight and taxi.

Our evaluation crew one familiar with the KA-300, the other not- made six takeoffs in the KA-350. Both pilots reported that the -350 requires no pilot compensation whatsoever during power advance. There is no surging and no returning. One of our pilots-the one familiar with the KA-300-felt he over-controlled the pitch on the first takeoff attributing that to the reduced pitch force required and the inertial of heavier bob weights. Both agreed the airplane trims out nicely on climb with good forward and side visibility.

The experienced Model 300 pilot reported that pitch and roll forces at all trim speeds and configurations have been reduced substantially in the KA-350. (The engineers who have measured those forces tell us the roll forces are reduced some 35 to 40 percent.) Our other pilot stated simply that the KA-350 is the most agile King Air he has flown (all King Air models except the 300).

Turning what could have been a heavy, trucky airplane into what arguably is the nicest-handling King Air to come out of the Wichita factory required a good deal of artful aerodynamic tinkering. For example, the mass of the elevator bob weight was increased from 10 pounds to 17.5 pounds, and the airplane retains the dual down spring installation. These changes enhanced long-term longitudinal stability while increasing the center-of gravity range.

The KA-350's forward c.g. is identical to the Model 300 (percent MAC). The rear limit is extended about 10 percent further back on the -350, so it actually has a wider c.g. range than its predecessor.

Because "nothing's for free" in aerodynamics, the more massive bob weights tended to generate higher maneuvering stick forces. Adjustments to trim tab rigging solved that problem.

The combination of springs, bob weights and trim rigging works together to retain the "personality" of the King Air pitch feel while actually reducing the control forces.

Minor changes were made to the rudder too. The cutout for the rudder tab actuators has been covered to prevent a back flow or spillage during rudder hard-

PRELIMINARY SPECIFICATIONS BEECH KING AIR 350

ESTIMATED BASE PRICE	3,753,000
SEATING	
Required crew	1 pilot
Executive seating	8 to 11 passengers
High-density seating	15 to 16 passengers
ENGINES	
Model	2 P&W PT6A-60A
Power	1,050 shp ea.
DESIGN WEIGHTS (lb/kg)	
Max ramp	15,100/6,849
Max takeoff	15,000/6,804
Max landing	15,000/6,804
Zero fuel	12,500/5,670
BOW (approx)	9,251/4,196
Useful load	5,849/2,653
Max payload	3,249/1,473
Max fuel	3,611 /1,638
Payload (max fuel)	2,238/1,015
Fuel (max payload)	2,600/1,179
LIMITS/SPEEDS (KCAS)	
VMO	260
VA	182
VMCA	94
VXSE	114
VYSE	114
VFE	200
VLO	182
AIRPORT PERFORMANCE (ft/m)	
Takeoff (SL, ISA)	
over 50-ft obstacle	3,812/1,162
(note: accelerate/stop is less than 3,812 ft)	
CLIMB RATES/CEILINGS (MGTOW)	
All-engine ROC (fpm/mpm)	2,730/832
Engine-out ROC (fpm/mpm)	800/244
Max certificated altitude (ft/m)	35,000/10,668
All-engine service ceiling (ft/m)	35,000/10,668
Engine-out service ceiling	22,000/6,706
CRUISE PERFORMANCE (mid-weight)	
Max Speed	
TAS	311 KTAS
Fuel flow	844 pph
Flight level	FL 230
Long Range	
TAS	244 KTAS
Fuel flow	377 pph
Flight level	FL 350
RANGE AT NORMAL CRUISE	
(35,000 ft/275 KTAS)	1,725 nm
RANGE AT MAX CRUISE	
(35,000 ft/244 KTAS)	1,828

over maneuvers. The cover plates reduce VMC by three to four knots.

Airflow across the underside of the ailerons has been improved through some thoughtful metal bending. In turn, this improves aileron response. None of the KA-350 flight controls are interchangeable with the Model 300 because the KA-350's tab hinges must be parallel to the flight control surface hinge line to accommodate the dual tab actuators.

Our evaluation pilots made the following notes during their trips:

The long-term phugoid at our weight and c.g. was just on the positive side of the line, not as positive as it optimally might be. However, its period was so long-20 to 25 seconds-that crew workload should not be adversely affected.

Spiral stability is positive with yaw damp on and neutral with yaw damp off. Control harmony is good.

Slow speed flight is entirely comfortable with plenty of aileron control through the stall. The increased span and the installation of winglets has actually reduced the stall speed. For example, the Model 300 at 14,000 pounds stalls at 102 knots. The King Air 350 stalls at 98 knots at 15,000 pounds. Stall speed in landing configuration is identical to the KA-300 even at the 1,000-pound higher max landing weight.

Engine-out handling characteristics are excellent at all departure and approach speeds and configurations.

WINGLETS WORK

The purpose of winglets on this airplane (or any airplane, for that matter) is to improve the drag characteristics when the airplane is operating at relatively high angles of attack, such as those that you see during takeoff, climb and cruise at very high altitudes.

Winglets lower induced drag by reducing wingtip vortices. At low angles of attack, such as those experienced during mid-altitude cruise, induced drag already is low, therefore winglets don't have much to improve upon.

While performance numbers had not been fully developed at this writing, preliminary information suggested the winglets and other aerodynamic improvements work well enough to give the King Air 350 essentially the same cruise numbers as those enjoyed by the 300.

In fact, B/CA's pilots used King Air 300 performance charts for our sorties in the -350 and found that cruise numbers worked out item for item. We did spot cruise checks at FL 290/ ISA + 10.

The King Air 300 book anticipated that we would see a max cruise speed of 188 KIAS (304 KTAS) burning 616 pounds of fuel per hour total. That's precisely what we got. Similarly, max-range cruise power delivered the 236 KTAS promised by the -300's manual. Max range fuel flow was 390 pounds per hour.

THE BOTTOM LINE

We liked this airplane, and we bet traditional King Air operators will like it as well.

As we've seen, the King Air 350 has the capability to board a crew of two, eight passengers, 550 pounds of baggage and full tanks. Its range with NBAA IFR reserves and eight passengers should be in the 1,500-nm area.

The aircraft's base price is approximately $3.753 million, about $300,000 more than a factory standard Model 300. **B/CA**