King Air E90: E Is for Extra

Take the cabin from a C90 and the turbines and flight deck of the A100 — mix and stir — and it's the King Air E90 where the E stands for extra horsepower, extra speed, extra payload.

By Arnold Lewis

Competition in the hotly contested twin-turboprop business-airplane market has intensified with the introduction of the Beechcraft King Air E90. By combining the range and performance of the King Air A100 with the smaller C90 cabin and. a price tag $100,000 under that of the A100, Beech hopes to maintain the competitive edge it gained in this class with introduction of the first King Air 90 in 1964. It has serious challengers, such as the fast new Turbo Commander 690 from North American and the MU-2J and K from Japan's Mitsubishi Heavy Industries, as well as the Swearingen Merlins.

The King Air E90 is a hybrid, It combines the six- to 10-place fuselage and cabin configuration of the C90 with the more powerful 680-shp United Aircraft of Canada PT6A-28 engines flat-rated at 550 hp. It also has the A100's capacitance fuel system and instrument panel.

B/CA flew the E90 briefly from Washington's Dulles International Airport. Few changes Are evident in the E90. The paint scheme is new, as might be expected. However, probably only a King Air expert would notice that the exhaust stacks of the E90 are larger than those of the C90. Equally difficult to spot is the new location of the pitot masts — moved from under the -wings to each side of the lower portion of the nose section, just behind the radome. The uninitiated might notice that the landing lights are now on the nose gear rather than on the wing leading edge, but this change actually occurred prior to, the E90. According to Beech, it allows full-length boots and improves wing aerodynamics.

Cabin area of the E90 is the same as the C90 — four reclining chairs in club configuration, jump seat atop the refreshment compartment opposite the airstair doorway, and a jump-seat/ lavatory combination aft of the door and adjacent to the 350-pound-capacity baggage area. Polarized circular passenger windows — optional on the C90 — are standard equipment on the E model. Beech is going more and more to vinyl upholstery rather than leather because it is more durable and easier to clean. Leather is still available at the customer's option.

The front office of the E90 is virtually identical to the A100. Most noticeably different from the C90 is the arrangement of engine instruments vertically between the pilot's flight instruments and the avionics panel. Another difference is in the capacitance fuel-system. The panel is still at the pilot's left elbow, but this new system provides the crew with readouts in pounds of fuel remaining on each side. It is corrected for both density and temperature and said to be accurate to within three percent. The C90 — in standard configuration — has a float system that provides a readout in gallons of remaining fuel in relationship to the size of the tanks.

The E90's $518,750 price tag includes a standard avionics package: RCA navcom, King ADF, transponder and DME, RCA weather radar, Sperry compass system, dual AC inverters and Beech audio system. Published empty weight with this package is 5,800 pounds. The Beech demonstration aircraft, however, boasted a Sperry STARS IVB flight director, King Gold Crown navcom and ADF, King H-14 autopilot, RCA AVQ-55 Brite Tube Display weather radar, King area nav, Bonzer radar altimeter and RMI, as well as the Sperry compass system. This resulted in an empty weight of 6,280 pounds. Adding 2,800 pounds of fuel and two persons totaling 360 pounds, brought the ramp weight for this flight up to 9,440 pounds. Maximum ramp weight is 10,160 pounds. Price tag for the aircraft as it sat on the ramp was $595,000.

FROM THE AUGUST 1972 BUSINESS & COMMERCIAL AVIATION.

Thoughts of mounting larger turbines on the King Air 90 series date back to 1968 and development of the 15-passenger Beech 99 commuter airliner. The first production 99s were powered by the 550-shp PT6A-20 turboprop, as were all previous King Airs. A growth version of the 99 — the 99A — was introduced four months later, powered by PT6A-28s rated at 680 shp to satisfy commuter demand for improved performance during the summer and at higher elevations.

However, larger turbines on the 90 series would have required additional fuel capacity, with a resulting increase in gross weight (or decreased payload), and expensive structural changes. These considerations — as well as the phenomenon of horsepower dissipation with altitude — led to a decision to flat-rate the 680-shp dash 28s at 550 shp. To pull the full 680 shp would have meant increasing tail-surface area — a major modification that was considered "not worth it."

Other changes were inevitable. Gross weight was increased from 9,650 pounds for the B and C models to 10,100 pounds for the E. The new ramp weight is 10,160 pounds. Accomplishing this required a strengthened nose gear, a switch to 10-ply tires all around, a beefed-up horizontal stabilizer spar and additional stringers for more strength just forward of the horizontal stabilizer. The only other structural change was the addition of heavier skins to accommodate the partial wet wing, which, combined with the normal bladder tanks, makes up the aircraft's main-tank system outboard of the engine.

One major benefit of flat-rating the dash 28s at 550 shp is that they operate 40 to 60 degrees cooler than the same engines on the A100. As a result, Beech anticipates that the current time between overhaul of 2,100 hours will be increased to 2,400 hours within perhaps six months. Normal TBO increase increment is 300 hours, and the C90's dash 20s are at 2,400 hours.

In the certification program for the E90, Beech obtained several speed improvements over the C model. Vmo has been increased from 208 to 226 knots, the same as for the A100. With the faster aircraft, Beech felt it would be helpful, and would improve block speeds, if the pilot did not have to reduce power quite so soon during descents. In practice, he simply pushes the nose over to red-line speed and holds it there until reducing to traffic-pattern or vectoring speeds. To obtain FAA certification of the increase, Beech had to conduct new flutter and dive-certification tests.

In addition, Vmc has been decreased from 92 knots for the C model to 88 knots for the E, owing to a change in certification criteria. While Vmc on the B and C model King Airs was based on a failed engine at liftoff — in essence, single-engine stall speed — Vmc now is based on a failed engine in flight, at a 50-foot altitude. As a result, the takeoff ground roll is less for the E model.

Beech is careful to explain that the dash 29s are not de-rated and are not flat-rated by any mechanical means. Rather, the amount of torque foot pounds per engine is limited to 1,315 at above 2,000 rpm and to 1,520 at below 2,000 rpm. The torque meters are red-lined at those settings.

On takeoff at Dulles, we advanced the throttles until the torque needles coincided with the solid red lines on the meter at the 1,315 foot-pound mark, and then, after rotation, brought the props back to 1,900 rpm. This automatically caused the torque to increase to the dotted red line at 1,520 foot pounds. By using this procedure, it was unnecessary to make any further power adjustments until reaching cruising altitude.

Another important aspect of flat-rating the dash 28s at 550 shp is that they will pull the full 550 right on up to FL 210. Beech says the E90's speed-curve line goes almost straight up compared to the fall-off with altitude normally expected with a turboprop engine. As an example, top published cruise speed between 12,000 and 14,000 feet is 249 knots. This drops slightly to 247 knots at 16,000 feet and 245 at FL 210. In addition to being able to obtain the full 550 shp over a

much wider temperature and altitude range, Beech also attributes the improved speed curve in part to the extended and more aerodynamically efficient wingtips, which the, A100 does not have.

Initial climbout to 16,500 feet was at 2,200 fpm with an indicated airspeed of 110 knots to clear the Dulles traffic area. At gross weight, however, the book calls for an initial two-engine climb of 1,870 fpm at sea level with a 113-knot IAS. At 5,000 feet msl, the book lists a climb of 1,750 fpm with the same 113-knot IAS. Two-engine service ceiling is 27,620 feet at gross, but goes on up to 30,000 feet with fuel burnoff. The book specifies a single-engine climb of 470 fpm with 111 knots IAS at sea level, dropping off to 418 fpm with 111 knots IAS at 5,000 feet. Single-engine service ceiling is 14,400 feet, increasing to 18,000 feet with fuel burnoff.

Leveling at 16,500 feet, we established a maximum-power cruise configuration with a power adjustment to 1,235-foot-pounds of torque and 1,900 rpm. Result was a 253-knot TAS based on an IAS of 192 knots and an OAT of plus two degrees.

Beech is touting excellent high-elevation-takeoff performance for the E90. Calculations indicate that on a 94-degree day at an airport elevation of 6,000 feet, the aircraft, has an accelerate/stop distance of 5,302 feet, including two seconds for failure recognition by the pilot.

The company has published two typical mission profiles for the E90one at maximum-cruise power and the other at maximum-range power. Both are for a standard-equipped aircraft cruising at FL 210 with 45-minute reserve, standard day and zero wind, carrying six persons with 180 pounds total baggage and 3,084 pounds of fuel. With maximum-cruise power, the profile calls for a range of 1,265 nm at an average cruising speed of 243 knots and a mission time of five hours and 18 minutes. The same loading at maximum-range power calls for a range of 1,562 nm with an average cruising speed of 196 knots and a mission time of eight hours and one minute.

In adopting the basic King Air A100 fuel system, Beech realized a 90-gallon increase over the C90, from 384 to 474 gallons. In fact, the E90 carries four gallons more than the A100. There are four fueling points — one each for the two 196-gallon mains located near the wing tips, and one each for the two 41-gallon auxiliary tanks inboard of the engines.

Beech has gone to an engine-driven fuel pump and fuel-boost pump in the E90, with an electrically driven fuel pump as standby. Fuel is transferred from auxiliaries to the nacelle tanks via a jet-transfer pump. Offloading of fuel for greater payload at the expense of range normally starts with the aux tanks, or they simply are not filled.

Development of the E90 seems a logical step by Beech to fill the current gap between the C90 and the A100, both of which will continue in production. With a base price of $518,750, it appears to fit comfortably between the $460,150 C model and the $644,500 A100, offering what is considered a "minimum compromise" between the two. King Air E90 deliveries began in May. B/CA

King Air Comparison

	C90	E90	A100
Configuration	6-10 pl. low-wing	6-10 pl. low-wing	8-15 pl. low-wing
Powerplant	2 P&W PT6A-20 550 shp ea.	2 P&W PT6A-28 680 shp ea.	2 P&W PT6A-28 680 shp ea.
Propeller	Hartzell 3-bld. f-f	Hartzell 3-bld. f-f	Hartzell 4-bld. f-f
Exterior			
Length	35.5	35.5	39.7
Span	50.2	50.2	45.8
Height	14.2	14.2	15.3
Cabin			
Length	12.9	12.9	16.7
Width	4.3	4.3	4.5
Height	4.7	4.7	4.7
Press. Diff. (psi)	4.6	4.6	4.6
Weights (lb)			
Fuel cap.	2,573	3,176	3,149
Max gross	9,650	10,100	11,500
Useful load	4,025	4,284	4,772
Payload w/full fuel	1,416	1,108	1,623
High-speed cruise			
TAS (knots)	220	249	248
Range (nm)	1,149	1,468	1,204
Fuel flow (gph)	63	69	79
Long-range cruise			
TAS (knots)	188	201	209
Range(nm)	1,259	1,715	1,340
Fuel flow (gph)	49.3	48	61
Service ceiling			
Both engines	25,600	27,620	24,850
Single engine	14,100	14,390	9,300
Rate of Climb (fpm)			
Both engines	2,000	1,870	1,963
Single engine	555	470	452

Takeoff 50-ft. obs.	1,200	2,024	2,200
Stall speed (knots)	74	76	75
Vmc (knots)	92	88	85
Accel.-stop dist.	3,620	3,736	4,290
Basic price	$460,150 (incl. avionics anti-icing)	$518,750 (incl. Avionics anti-icing, deicing)	$644,500 (include. avionics, anti-icing, deicing)