

**BEECHCRAFT KING AIR
90-SERIES**

EPIC PERFORMANCE FOR THE ENTIRE KING AIR 90 FAMILY...

...utilizing Swept Blade Technology



- FAA-Certified increased performance
- Truly quiet environment
- Stunning ramp presence

Simply more of what you bought your King Air for!



THE ELEMENTS OF RAISBECK'S 90-SERIES EPIC PERFORMANCE PACKAGE *(Elements available separately)*

SWEPT BLADE TURBOFAN PROPELLERS



BENEFITS

- Stunning ramp presence
- Quiet and virtually vibrationless operation from takeoff to touchdown
- Certified around the world to meet the most stringent regulations and noise requirements
- Inherently improved performance in all phases of flight
- Made of affordable aluminum
- Trouble-free operation between 6-year, 4,000 hour overhauls

TECHNOLOGY

- Swept-wing technology enables larger (96") diameter for more thrust while decreasing noise and vibration
- Unique combination of aerodynamic technology and computer-aided manufacture
- Lightweight aluminum hubs and blades
- Oversized hydraulic power piston for lock-in propeller synchrophasing
- Manufactured by Hartzell Propeller, Inc.

DUAL AFT BODY STRAKES



BENEFITS

- Passenger ride quality is improved
- Pilot control and handling qualities are enhanced
- Air Minimum Control Speed is reduced
- Decreased drag results in increased climb and cruise performance
- Standard on new King Air 350s and C90GTx

TECHNOLOGY

- The shedding wing/body vortices are captured under the aft fuselage, pressurizing and reducing aft-body drag
- Resulting coanda-effect attaches the aft-body airflow
- Equivalent vertical tail area is increased

FAA-APPROVED PERFORMANCE & GWI



BENEFITS

- Gross Weight Increase (GWI) to 10,500 lbs MTOW; 9,700 lbs landing weight (LJ-527 through LJ-2020; LW-1 & subs.)
- Greatly improved FAA-Certified takeoff and landing field-length performance
- Greater payload/fuel/range capability from shorter runways and hot-high scenarios
- Includes full FAA-Approved Airplane Flight Manual Supplement

OPTIONAL CROWN WING LOCKERS



BENEFITS

- FAA-certified to carry 600 pounds total cargo in 17 cubic feet of luggage space
- Returns your cabin to your passengers
- Handles skis, snowboards, camping and hunting equipment as well as golf bags and luggage
- Fully certified for FAR Part 135 Operations
- Provides lock-and-key security
- Factory-installed on all new King Air 350s; optional on 250s & C90GTx

TECHNOLOGY

- Lightweight composite construction provides infinite-life structural certification
- Aerodynamically area-ruled to minimize drag
- Fully self-contained for a clean and dry locker interior
- Removable in minutes for any airplane maintenance or inspections

RAISBECK C90GTx / C90GTi / C90GT EPIC

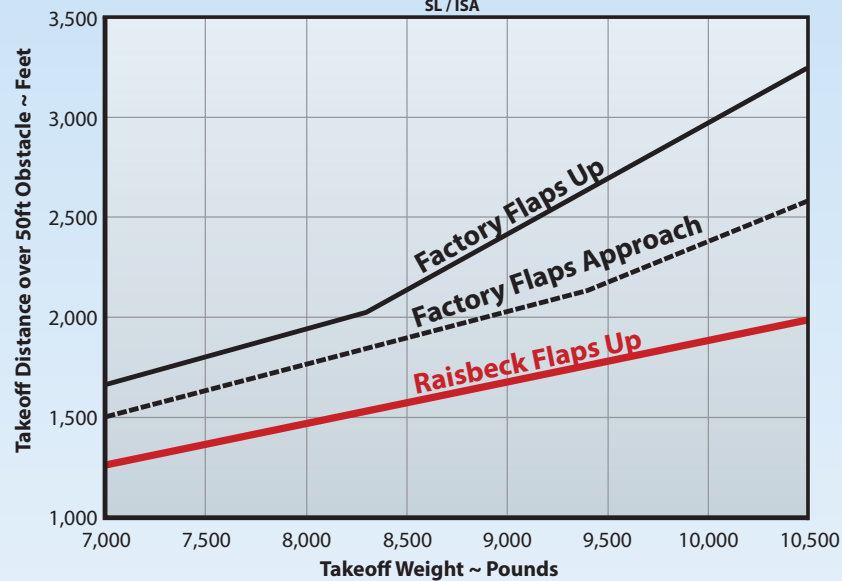
Includes Blackhawk C90s with -135 ENGINES



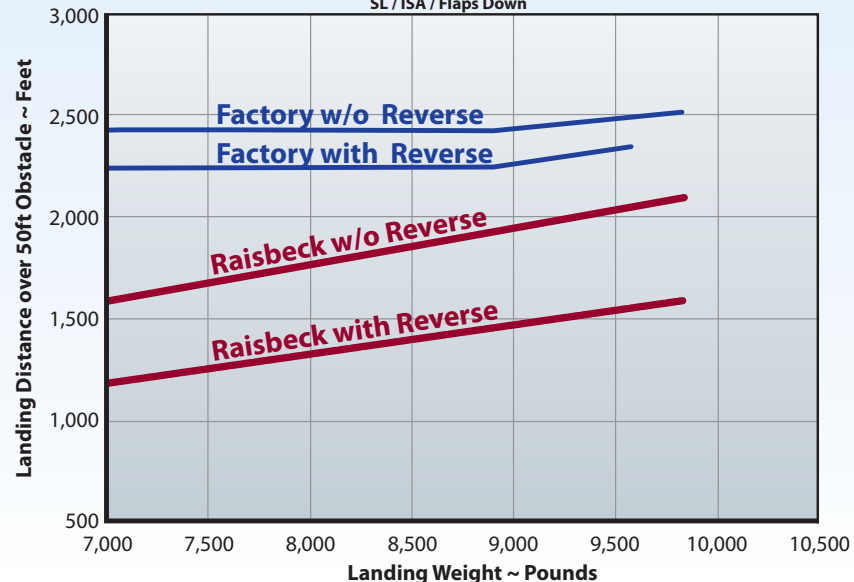
CONFIGURATION →	RAISBECK EPIC C90GT	Factory C90GT	IMPROVEMENT
TAKEOFF PERFORMANCE (MTOW, Flaps UP)			
Takeoff Distance (SL, ISA)	1,980 ft	3,240 ft	1,260 ft less runway
Takeoff Distance (5000 ft, 25° C)	3,370 ft	4,600 ft	1,230 ft less runway
Accelerate-Stop (SL, ISA)	3,690 ft	4,200 ft	510 ft less runway
Accelerate-Go (SL, ISA)	3,110 ft	4,390 ft	1,280 ft less runway
CRUISE			
Cruise RPM	1,750 RPM	1,900 RPM	150 RPM less
LANDING PERFORMANCE (MLW, SL, ISA, Flaps DOWN)			
Landing Distance w/o Reverse	2,100 ft	2,510 ft	410 ft less runway
Landing Distance with Reverse	1,600 ft	2,350 ft	750 ft less runway
Noise (Part 36 / ICAO) ~ dB(A)	74.8	76.0	1.2 dB(A) quieter
Propeller Diameter	96 inches	90 inches	6 inches larger
OTHER			
Propeller	96" Raisbeck/Hartzell Swept 4-Blade	90" Hartzell/Beech 4-Blade	<ul style="list-style-type: none"> • Exceptional performance • Stunning ramp presence

A large number of smaller airports are now safely available to use!

Twin-Engine Takeoff Distance Comparison Raisbeck EPIC C90GTx vs Factory C90GTx SL/ISA



Landing Distance Comparison Raisbeck EPIC C90GTx vs Factory C90GTx SL/ISA/Flaps Down



RAISBECK C90B / C90A / C90 / E90 EPIC

CONFIGURATION →	RAISBECK EPIC C90 (ALL)	Factory C90 (ALL)	IMPROVEMENTS
TAKEOFF PERFORMANCE (MTOW, Flaps UP)			
Takeoff Gross Weight	10,500 lbs	9,650 - 10,100 lbs	400 - 850 lbs more
Takeoff Distance Over 50' @ MTOW	2,190 ft	2,710 ft	22% shorter
Accelerate-Go Distance	3,000 ft	3,650 ft	18% shorter
Accelerate-Stop Distance	3,785 ft	3,600 ft	11% longer at 400 lbs heavier
Takeoff Climb Gradient	4.8%	4.8%	Same at 400 lbs heavier

CLIMB

Single Engine Rate-of-Climb	525 fpm	495 fpm	6% better
-----------------------------	---------	---------	-----------

CRUISE

Cruise RPM	1,750 RPM	1,900 RPM	150 RPM less
Maximum Cruise ITT	695° C	635° - 695° C	All upgraded to C90A/B

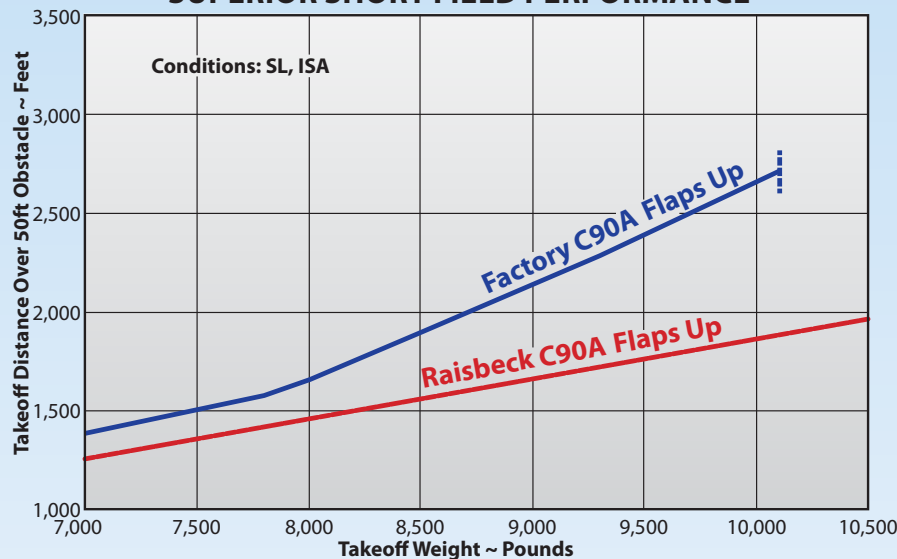
LANDING PERFORMANCE (MLW, SL, ISA, Flaps DOWN)

Landing Gross Weight	9,700 lbs	9,600 lbs	100 more lbs
Landing Distance w/o Reverse	2,160 ft	2,290 ft	6% less runway

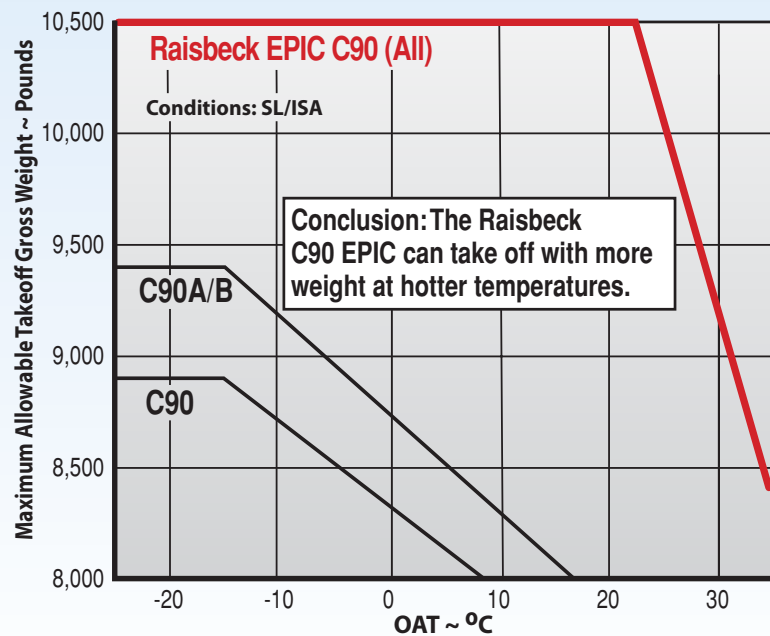
OTHER

Propeller	96" Raisbeck/Hartzell Swept 4-Blade	90" Hartzell/Beech 4-Blade	<ul style="list-style-type: none"> • Exceptional performance • Stunning ramp presence
-----------	-------------------------------------	----------------------------	---

SUPERIOR SHORT FIELD PERFORMANCE



MORE PAYLOAD/RANGE FROM MORE AIRPORTS



Conclusion: The Raisbeck C90 EPIC can take off with more weight at hotter temperatures.

CUSTOMER OBSERVATIONS

CHRISTI TANNAHILL



“Raisbeck Engineering shares our commitment ... by providing high quality products....”

“Raisbeck Engineering shares our commitment to more than 6,500 King Air operators by providing high quality products that continue to make the King Air ownership experience the best in the industry.”

**Christi Tannahill
Senior Vice President
Textron Aviation**

JEFF GORMAN

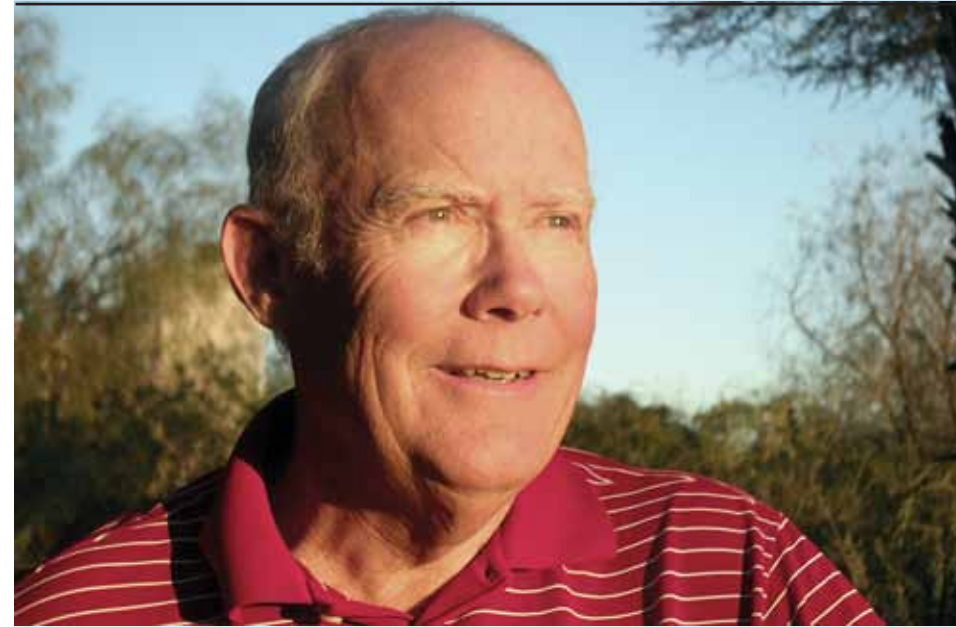


“It’s undoubtedly the quietest King Air I’ve ever been in, period.”

“We went with Raisbeck’s 90-series EPIC package. The swept design and extra diameter provide more thrust, while the swept blades keep noise down—and they look good on the ramp, too. Owing to the extra thrust, Vmc rises to 92 KIAS, up from the standard airplane’s 87 knots. With Raisbeck’s Dual Aft Body Strakes and Crown Wing Lockers, it’s better than a new C90GTx and \$2 million less. All for an airplane that’s faster, uses less runway—and looks sexy, too.”

**Jeff Gorman
Owner/Operator, King Air LJ-1387
CEO, Gorman-Rupp Company**

TOM CLEMENTS



“I am a big fan of Raisbeck’s EPIC Performance Package.”

“I’m a big believer in FAA-Approved performance, where the rubber meets the road.

“Flying the C90 with Raisbeck’s EPIC Performance Package proves the point and demonstrates a marked improvement in the airplane’s overall capabilities.”

**Tom Clements
Pilot and Author of *The King Air Book***

BEN KESTER



“The higher gross weight limit...allows me to carry an additional passenger or another half hour of fuel.”

“Immediately, I noticed the difference in acceleration on takeoff, even with a heavier payload. Climb and cruise are better, too, especially at higher altitudes. Landing distances are also shorter when using the props to decelerate. Perhaps the biggest benefit to our flight operation is the higher gross weight limit, which allows me to carry an additional passenger or another half hour of fuel.”

**Ben Kester
Pilot, King Air LJ-1686**

THE RAISBECK/HARTZELL SWEPT BLADE TURBOFAN PROPELLER FOR THE KING AIR 90 FAMILY

Developed jointly by Raisbeck Engineering and Hartzell Propeller

TECHNICAL OVERVIEW

By James D. Raisbeck

SECOND GENERATION OF SWEPT BLADE PROPELLERS FOR THE KING AIR C90 FAMILY

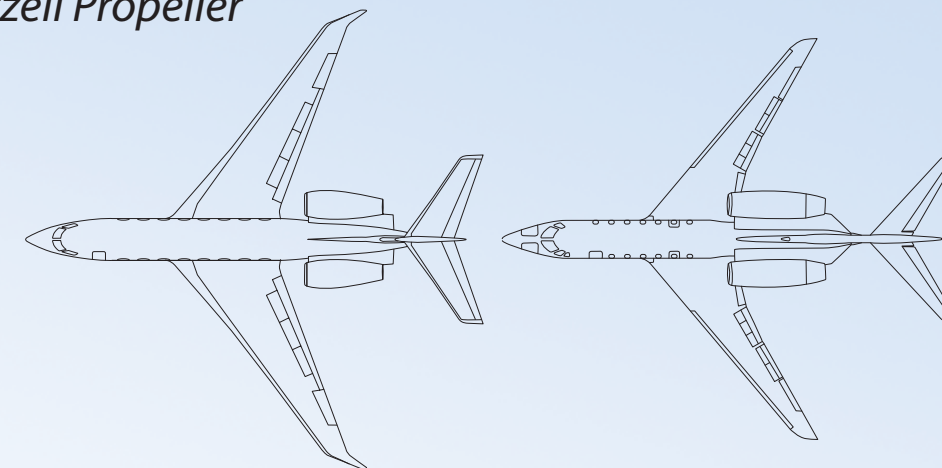
With the success of the Swept Blade Turbofan Propeller for the King Air 200 Family assured, Raisbeck engineers turned to new propellers for the King Air C90, still in continuous production since 1971.

Preliminary design studies revealed that on the 200 Swept Blade Props, further increasing the blade sweep would result in even quieter sound levels for FAA and European (EASA) noise certification. Increased sweep also allowed for a propeller diameter increase of a full six inches over the factory propeller, from 90" to 96".

With newly-earned experience and the availability of Swept Blade aluminum forgings, the C90-family program went considerably faster. Certification flight tests were completed during the early summer of 2013. Raisbeck began deliveries of C90 Swept Blade Turbofan Propellers in January 2014.

WHY SWEEP THE PROPELLER BLADES?

The newer King Air 90s can only cruise at .46 Mach (M_{MO}) at 25,000 feet. However, at a propeller RPM of 1900, the propeller tip Mach number is



Gulfstream 650

Cessna Citation X

over .9 at cruise. This same high-Mach phenomenon is also very much present during takeoff at low forward airspeeds but higher prop RPM. As an example, at 120 Knots during initial climb at 2200 RPM, the propeller tip Mach is an astonishingly high .8.

These takeoff, climb and cruise conditions are encountered on almost every King Air flight, and they push the propeller blades significantly into the transonic drag rise for airfoils and unswept wings.

As a comparative example, commercial airliners and business jets typically fly around Mach .79 to .82, and some of them are pushing .90 (747) and even as high as .92 (Gulfstream 650 and Cessna Citation X). The wing sweep on these airplanes varies from 30 to 40 degrees. The top view of any of these aircraft shows how dramatic the sweep is (see figures above).

With a jet airplane, its entire wing is at the same Mach number. However, with a propeller blade, the farther out on its diameter, the higher

The new C90 Swept Blade Turbofan Propellers provide unparalleled performance increases across the entire flight envelope for every King Air C90 and E90 ever built. The combination of the Swept Blade Props with the C90 EPIC Package creates the best-performing C90/E90, whether built in 1971 or 2014.

Mach number. Adding additional diameter to a propeller adds to its tip Mach number, which in turn adds unwanted additional transonic drag and noise. This of course detracts from the other desirable performance increases resulting from such an increase in diameter.

Air over an airfoil doesn't know if that airfoil is part of a wing going straight through the air, or a propeller blade being whirled around in a circle. The air reacts the same to increasing Mach number. Merely adding propeller diameter doesn't necessarily add proportionate performance improvement and it can be measurably noisier because of high Mach effects at the outer parts of the blades.

Introducing blade sweep to the blades overcomes these drawbacks. Blade sweep allows you to increase diameter and performance while simultaneously reducing noise.



Airbus A400M



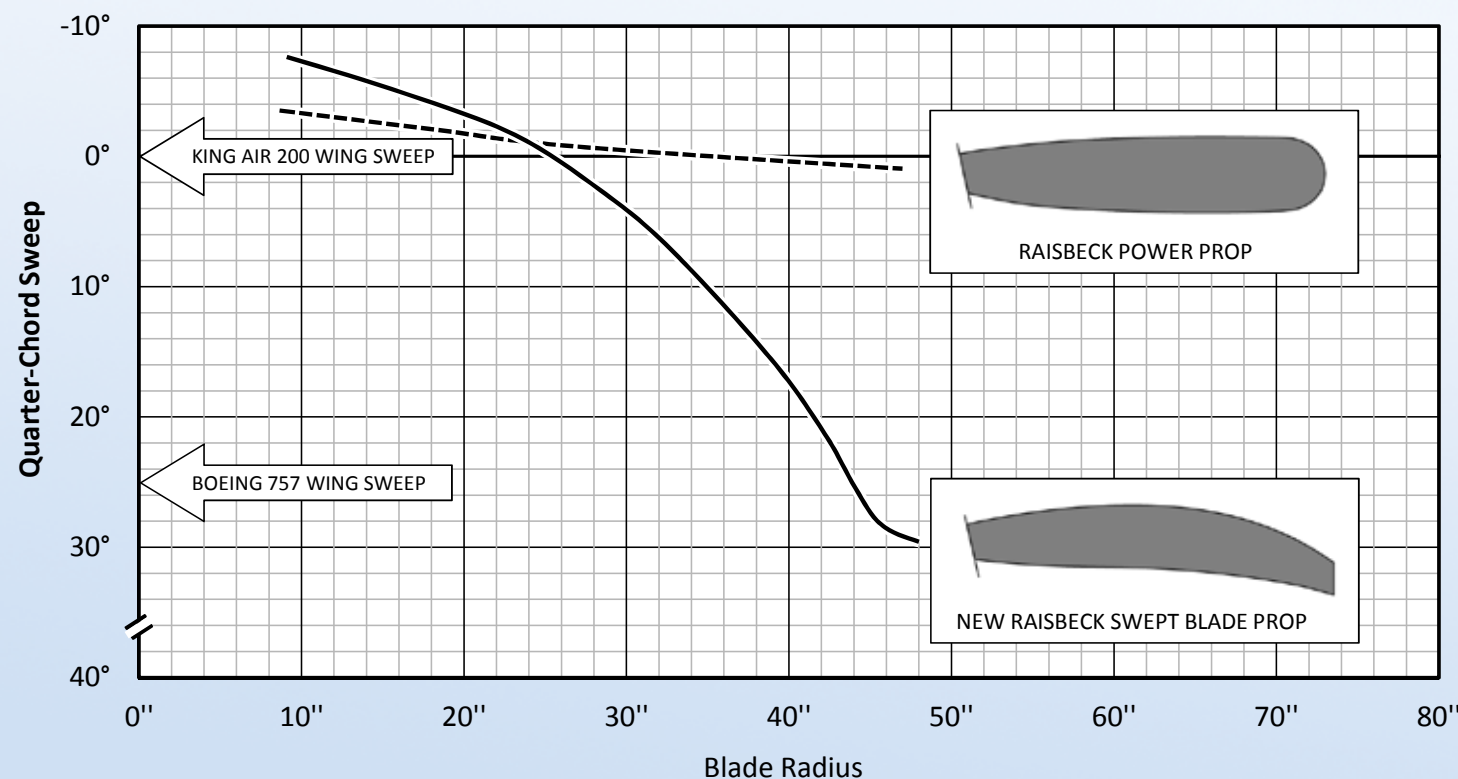
Lockheed C130J

BRIEF HISTORY OF WING AND BLADE SWEEP

The swept wing has been around since Willy Messerschmitt put it on the ME 163 in 1943, so why hasn't anybody designed swept propeller blades until now?

Actually, there have been some successful attempts to design and build true swept propellers. The European A400M cargo plane has swept wings and swept propellers (at top right). It cruises at Mach 0.72. The propeller has eight blades and is very costly for general aviation consideration.

Quarter-Chord Blade Sweep Comparison



There are other examples such as the C130J (at top right of page 10), but they are all very expensive and usually on military airplanes. As such, they inherently don't qualify for markets such as the King Air.

But to the layman, it is not obvious that sweeping the blades of a propeller installed on a King Air that incorporates no wing sweep itself and flies at cruise Mach numbers well below the transonic drag rise, makes any sense. Since no one has gone there in propeller design for airplanes like the King Air, no market has ever been developed. Market is what drives research—new products which satisfy a new market need.

Hartzell Propeller and Raisbeck Engineering have partnered for the last three decades to extend the dual boundaries of technology and market. The latest of these efforts is the Raisbeck Swept Blade Turbofan Propeller (SBTP).

APPLICATION OF WING SWEEP TO THE KING AIR PROPELLER

Surveying a number of recent general aviation airplane propellers, they at first appear to have swept blades. But they don't. Several examples exist like the Hartzell Scimitar propeller (below).



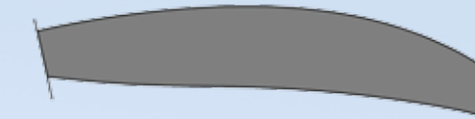
Unswept Scimitar Propeller

The blades on these propellers have cut-back leading edges, but the trailing edges remain unswept. The graph on page 10 compares the quarter-chord sweeps of the blades on our current Raisbeck Turbofan Power Prop with our new Swept Blade Turbofan Propeller. When viewed side by side (see top right), the visual effect of the blade sweep stands out in a crowd.

Raisbeck Power Prop



New Raisbeck Swept Blade Prop



DEVELOPMENT AND FAA CERTIFICATION FLIGHT TESTING

Three different propellers were evaluated on a fully instrumented King Air C90: the current Hartzell factory propeller for the C90/C90GTx (96" diameter); the current Raisbeck Turbofan Power Prop (93" diameter); and the new Swept Blade Turbofan Prop (96" diameter). Incremental increases in performance between these three were documented, with performance following increased diameter in each case.

Raisbeck's engineers went forward with full FAA certification.

MANUFACTURING CONSIDERATIONS

The large sweep on the new propeller has required new aluminum forgings for quantity production. New forgings cost money, and long lead times for new forgings are typical. However, the trade-off is lower per-unit manufacturing cost of the resulting aluminum blades as compared with the only other alternative—composite construction.

The overall advantage of a composite propeller is the weight savings over aluminum.

With all this in mind, the Raisbeck/Hartzell team opted for aluminum construction for the four-blade Swept Prop in the King Air 200 series. The benefactor of this choice is the customer—affordable new technology.

RAISBECK'S 90-SERIES EPIC PACKAGE: THE BEST PERFORMANCE *for your* KING AIR C90GTx/GTi/GT/C90B/C90A/C90/E90



info@raisbeck.com
(800) 537-7277
(206) 723-2000
www.raisbeck.com



**INTERNATIONAL
PROPELLER
SERVICE**

bob@ipsl.aero
(402) 858-6346
www.ipsl.aero