King Air

A MAGAZINE FOR THE OWNER/PILOT OF KING AIR AIRCRAFT

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Timeless

1980 King Air F90 Still Has Game

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Nostalgic

EC Source Aviation builds department with distinctiv

by MeLinda Schnyder

Just a few months after taking a chief pilot position flying helicopters for EC Source, Tim Brown was promoted to director of aviation. This new title meant that not only would he fly the aircraft in support of the construction of new power lines, he also would manage and build a complete flight department. For the lifelong aviator with experience as a residential and commercial contractor, the job was the perfect blend of aviation and construction.

Flair

flight
ve aircraft

A beautiful paint job and meticulous maintenance hides the age of EC Source's 1980 Beechcraft King Air F90, shown here in Beaver, Utah. The company uses the King Air to support helicopter-aided construction work, and expects to fly the airplane, based out of Glendale, Arizona, about 300 hours per year.

EC Source chose the Beechcraft King Air F90 because of its dependability/reliability, cost of acquisition and direct operating costs. It helped that the 1980 model with 13,000 flight hours wasn't showing its age.

EC Source (ECS) is headquartered in Mesa, Arizona, with offices in Nevada, Texas, Wyoming, Utah and Iowa. It was founded in 2006 to provide heavy equipment leasing services to the energy infrastructure industry and expanded three years later to become a turnkey provider of extra high voltage electrical transmission systems. In 2011, ECS became a subsidiary of MasTec, Inc., a national infrastructure construction company serving the energy, water/sewer/civil, communications and government sectors.

After spending some time evaluating the needs of the company and the flight department, Brown was excited to find that EC Source President Brian Bratton and MasTec management supported his ambitions and ideas. He was able to acquire an additional helicopter and move forward in designing and growing EC Source Aviation to match his vision. Life only got better when the flight department received the go-ahead, in 2014, to add a fixed-wing airplane to the fleet.

Two MD600N helicopters support construction activities and a King Air F90 supports the helicopter operations. "We use the King Air to support crew changes; transportation of needed parts, materials and maintenance personnel; as well as providing VIP transportation to meetings and job sites," Brown said. The King Air operates out of Glendale, Arizona, and the helicopters operate from either the base in Arizona or remote bases established near projects.

Nearly five years into the job, Brown is proud of the team he has assembled at EC Source Aviation, that the company depends more and more on the aviation division to support a multitude of operations and that his group has one of the best safety records in the industry. He's also pleased that they are accomplishing all of this with unique aircraft.

"We fly 2000 and 2007 MD600N helicopters and a 1980 Beechcraft King Air F90," Brown said. "These are older and different than what you'd see in any other flight department."

A nostalgic flair

Brown was born to parents who met in a flying club in 1957 in Chicago, where his mother and father flew for the Civil Air Patrol. He grew up wanting to fly helicopters like his mother and in 32 years as a pilot he's accumulated more than 9,000 hours in fixed- and rotary-wing aircraft and acquired ATP ratings in both categories.

EC Source, with offices in Nevada, Texas, Wyoming, Utah and Iowa, operates two MD600N helicopters. Tim Brown, EC Source's director of aviation, said McDonnell Douglas only built 82 of the 600-series. "They sold thousands of the 500-series airframes, but the 600 is a really unique aircraft; it's an awesome aircraft," he said.

EC Source's aviation team has 15 employees, including four mechanics. Its in-house maintenance personnel, along with the team at Honest Air of Boulder City, Nevada, maintain the Beechcraft King Air F90 to FAR Part 135 standards although they operate it under Part 91.

Besides the two helicopters and King Air F90, EC Source Aviation has 22 support vehicles (trucks, SUVs, fuel trucks, support trailers, fuel trailers), 15 employees and the necessary infrastructure of tools and specialty equipment to maintain the fleet.

"Aviation's been in my blood my whole life," said Brown, 52, "and I think that's why some of this nostalgia sticks to my core. The other reason is expense. Aviation is so expensive. My thoughts are: be humble, be modest. Take care of your gear and it takes care of you."

That explains why Brown, who has owned several businesses during his career, including a pilot supply shop, drives a 21-year-old truck that looks like it's in show-room condition. It also explains why his ECS aviation team put the energy and money into revamping a 30-plus-year-old tug. "I could've gone out and bought a brand-new, top of the line tug," he said. "But I bought a 1978 six-cylinder gas engine tug, and now it's one of the prettiest you've ever seen."

It also explains why Brown purchased a 1980 Beechcraft King Air F90 as ECS Aviation's first fixed-wing aircraft in 2014.

"I was fortunate that the company is capitalized enough that we could've bought whatever we wanted, I just have a hard time spending money we don't need to spend," Brown said. "This airplane does absolutely everything we need it to do for less than a quarter of what it would've cost to buy a new King Air. It's nice that we can get what we need done with an older bird.

"Companies get so caught up in buying new, they tend to overlook used aircraft – not just King Airs, but used aircraft in general. You really don't need to buy new. There are a lot of great aircraft, both helicopters and airplanes, out there in the market that need to be valued and appreciated."

Building a flight department

Besides nostalgia, Brown has solid business motives to spend money wisely and purchase older aircraft to perform the required tasks. "Other than tax incentives, older aircraft are a better deal and your dollars go a lot farther. That is why we decided to go the route that we did. Our fleet is top of the line and a person would never know the age of our aircraft," Brown said.

While Brown admits to falling for the look of the King Air F90 when he saw a brand-new one more than three decades ago, he shopped all types of 90-series models on the market in 2014. "As luck would have it, the best one for the best price turned out to be an F90," he said. "With the F90, anyone who knows their King Airs will look and go, 'Oh, nice F90.' It's kind of an eclectic group – the T-tail, the dual main wheels instead of just the single

By operating MD600N helicopters, Tim Brown, EC Source's director of aviation, says, "We're not maxed out on temperature or torques doing what we do, pulling wires or putting buggies on the wire, lifting materials to people in limited-access areas."

balloon wheels and the four-bladed props make the airplane look sporty. King Airs are like Corvettes, there are certain years that just stick out."

According to AOPA, Beechcraft produced about 200 King Air F90s from 1979-1983. The model combined the fuselage and wings of the King Air E90 with the King Air 200's T-tail.

"McDonnell Douglas only built 82 of the MD600N helicopters, and we operate two of them. They sold thousands of the 500-series airframes, but the 600 is a really unique aircraft; it's an awesome aircraft. It's bigger than the 500-series and has more than twice the horsepower, it's heavier and has six blades instead of four or five blades. It's the best-kept secret in the industry," Brown said.

Tim Brown, EC Source's director of aviation and chief pilot, in the company's 1980 King Air F90. In 32 years as a pilot he's accumulated more than 9,000 hours in fixed- and rotary-wing aircraft as well as his ATP ratings in both categories.

"We fly it because we have more horsepower and better margins for safety and performance; we're not maxed out on temperature or torques doing what we do – pulling wires or putting buggies on the wire, lifting materials to people in limited-access areas."

The MD600N helicopters give EC Source a competitive advantage over construction companies that outsource their helicopter-aided construction. "Since we've been running a flight department, we can do everything that our vendors were doing and we've actually gotten better at it because we custom-made some equipment, tooling and rigging and we've been really safe in using it," Brown said. "In the four-and-a-half years since I've been running ECS Aviation, we've actually received a reduction in our insurance premiums every year because they believe in our program, our safety protocols and our culture. And, the company's really happy with the aviation department."

That happiness shows up in the growth afforded the flight department. When Brown joined the company in 2011, they had one helicopter, one fuel truck, contract maintenance, on-call fuel truck drivers and they rented space in a hangar. Today, they have two helicopters, the King Air, 22 support vehicles (trucks, SUVs, fuel trucks, support trailers, fuel trailers), 15 employees and the necessary infrastructure of tools and specialty equipment to maintain the fleet.

"We built a lot of stuff in-house. It's custom proprietary equipment to make the maintenance functions go easier and faster, like engine hoists and transmission lifts," Brown said.

Brown expects to add a third helicopter in the next year or two, and possibly a second fixed-wing aircraft.

A timeless King Air

Typical EC Source projects are brand-new construction and last about two years. The aviation department will rent a hangar at a nearby airport in which to park a trailer, support truck and helicopter for the duration of the job. Routine maintenance for the helicopters and rare, but urgent, AOG situations led to adding a fixed-wing aircraft to the ECS fleet.

"The biggest reason we bought the King Air was to support the helicopters. You get a helicopter on a job and suddenly it doesn't start. You're in a field, likely in the middle of nowhere, so what do you do? Grab a mechanic, grab the part, jump in the King Air and fly to the closest airport. Someone meets us with a truck, we drive out to the helicopter, pop in the new part, then everybody goes home," Brown said. "It's not only to service the customer by getting the helicopter back to working condition, but also to protect our asset – leaving a helicopter in the open overnight is just not good."

There are also the instances of scheduled maintenance, when the airplane allows the team to haul all their mechanics and tools, including those

that are too heavy or bulky to ship. Or the times an information technology team member is flown to a job site to fix network connectivity or computer issues in the field, saving an 18-hour round-trip drive. Executive travel has become an important role for the King Air, too.

"We had an issue in Utah, and our vice president based in Texas needed to go up there and meet with the customer and some technical advisors," Brown said. "It was a last minute deal, and trying to get airline tickets just didn't work with the window that the customers had to meet with our guy. He flew commercially from Houston to Phoenix, drove to Glendale and literally got out of the car, walked through the hangar onto the airplane and we zipped him up to Utah. He made the meeting. If we didn't have the King Air, we would've had to charter an airplane. It was a meeting that he *had* to attend.

"There are a ton of examples of times the King Air has come through and been phenomenal for us."

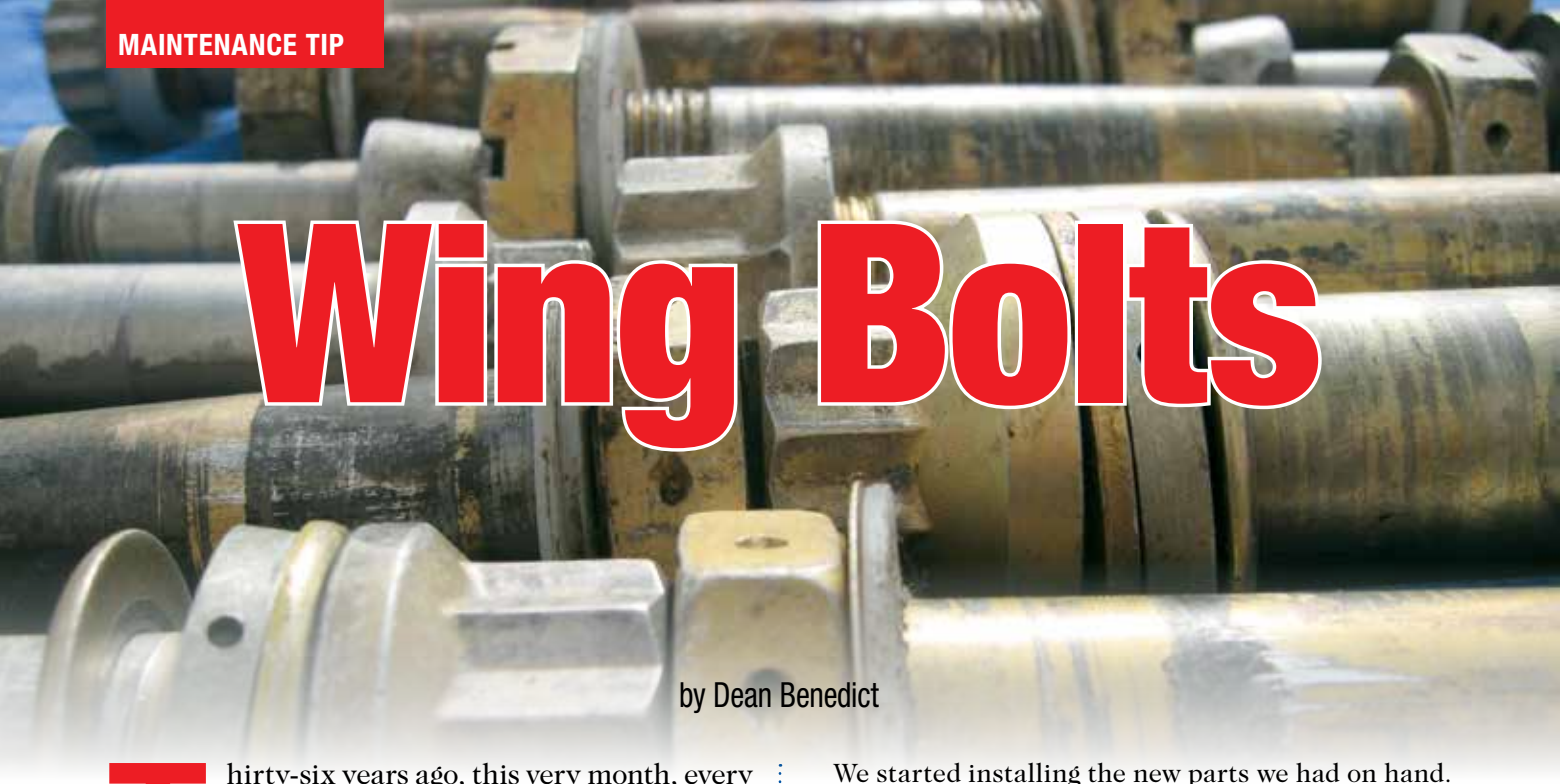
EC Source Aviation expects to fly the King Air F90 about 300 hours per year. The company chose the F90 because of its dependability/reliability, cost of acquisition and direct operating costs. It helped that the 1980 model with 13,000 flight hours wasn't showing its age.

"Our aircraft is probably one of the nicest high-time King Air F90 models flying today. The paint job was done about a year before we bought it and it's the new GTi or GTx style, which is one reason it looks so nice," Brown said. "The interior had been updated in 2007, but the previous operator had it pulled out to do EMS [emergency medical services] work, so when they put the interior back in, it was essentially new."

The previous owner had recently rebuilt the landing gear and upgraded the old engines to the new PT6-135A engines. ECS had Honest Air, in Boulder City, Nevada, install new Hartzell propellers, conduct phase inspections and tweak small items to make the aircraft safe and efficient. "We are helicopter guys and we are detailed oriented on the little things," Brown said.

Honest Air, together with EC Source Aviation's in-house maintenance personnel, maintain the aircraft to FAR Part 135 standards although they operate it under Part 91.

"We're slowly restoring it. Instead of maintaining what we've got, we're making it better," Brown said. "The only thing we haven't really touched is the avionics. We're probably going to put a couple of different Garmin products in the panel, but as far as the steam gauges go, we're not going to go crazy. I kind of like the nostalgia of it instead of going to an all-glass cockpit." KA



Wing Bolts

by Dean Benedict

Thirty-six years ago, this very month, every King Air 200 in existence was grounded by an emergency Airworthiness Directive (AD) on wing bolts. Back then, ADs were sent through the mail. This one had a really short window for compliance; by the time it was received by owners, they had to act very fast if they were going to get their 200 to a shop before the deadline.

I was managing Beech West in Van Nuys, California, (KVNY) at the time. In the previous weeks, I had heard some hints and rumors about a possible AD coming out on wing bolts for the King Air 200s. The facility's parts department checked availability and found about 20 sets at the factory; we bought them all. Shortly thereafter, the AD hit. Ferry permits were not allowed, and if you didn't comply in the timeframe specified, your 200 was grounded where it sat. My office staff contacted every 200 customer we had, then using an FAA directory, we reached out to owners of 200s within an hour of flight time to our facility. Many of them scrambled to get their King Air over to Beech West before the deadline. Most people had 24 hours, or less, notice.

As King Airs streamed into the Van Nuys airport, we grabbed every square inch of ramp space we could and lined them up nose-to-tail. It was a memorable sight – like a mini-Oshkosh AirVenture just for 200s! I had never seen so many King Airs in one place before or since.

As I recall, the AD offered two methods of compliance: (1) Replace the wing bolts, nuts and washers; or (2) Remove the bolts, bake them for 23 hours at 350-400°F, allow them to cool slowly, then perform non-destructive testing (NDT) by eddy current. If the bolts passed the NDT, they were OK.

We started installing the new parts we had on hand. In other cases, we removed bolts and put them through the second method. I had purchased two ovens so we could have more than one batch in process at a time. After baking, the bolts had to cool down in still air, which meant turning the oven off and waiting for them to cool completely before performing the NDT. This method took a couple days.

During that time, the factory called; they wanted to buy back their bolts. I was sympathetic, but the Van Nuys airport was clogged with King Airs. I had no choice but to respectfully refuse the factory's request and press on with the job at hand.

I don't remember the exact date, but the AD kicked in at midnight and by 9 or 10 a.m. the next morning, the first 200 was done and ready to go. The tower, having just learned of the AD grounding all King Air 200s, denied permission to take off. I had to explain to the tower what we were doing, and eventually the word got around that 200s out of Van Nuys were in compliance and OK to fly.

Not to Worry

It was a wild and crazy time with that AD, mainly because it happened so suddenly. If you're wondering whether we found any problems with the hardware we removed, baked and inspected, the answer is no. Furthermore, I never heard that anyone else found any problems either. My recollection is that a cracked nut was found on a 200 somewhere and this emergency AD was a pro-active antidote to a *potential* problem.

Product manufacturers recall defective merchandise all the time. Such recalls are usually a reaction to the discovery of numerous problems or injuries or worse. This AD, on the other hand, was more akin to preventative maintenance on steroids. In other words, if there *might* be a problem, this AD would surely nip it in the bud.

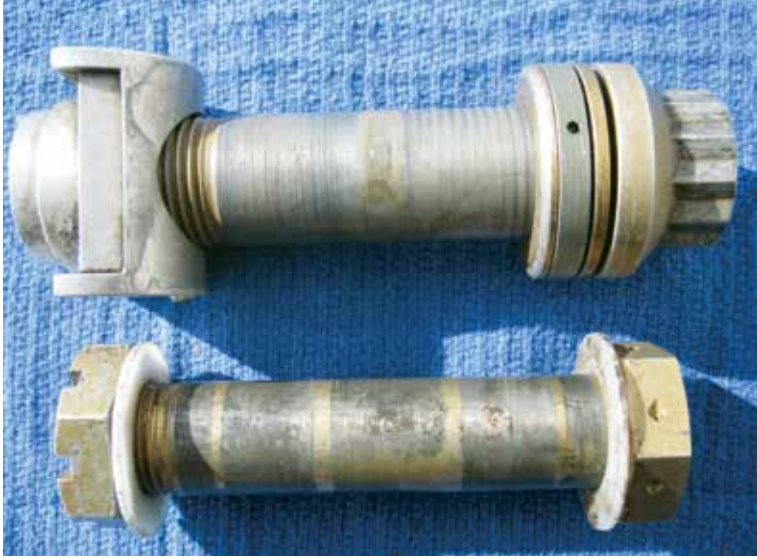
Spar Straps

Way back when, there was some concern about wing bolts in the 90 series King Airs, and it was handled in a similar fashion to the 200s. Around that time, Dave Saunders of Avidesign, who had designed spar straps for a variety of aircraft, came up with a spar strap STC for older King Airs (if this sounds familiar, it was discussed in Tom Clements' article in the December 2015 issue of *King Air*). It was marketed as an added safety feature and became popular enough to prompt Beech to design their own spar strap for the 90 series. Bear in mind, it was not required equipment, it was an *option*. There are plenty of 90s, many of them 30 or 40 years old, still flying safely without spar straps.

If your King Air has a spar strap, you are probably acutely aware of it. They are subject to periodic inspections which are labor-intensive. From a maintenance perspective, they are a real pain to deal with, but I have yet to find a way to remove one and "undo" the STC.

Wing Bolt Inspection and Maintenance

Preventative maintenance is vital to all aircraft. Many years ago, news surfaced of a King Air wing bolt that was severely corroded. The 12-month wing bolt lube was added to the inspection regimen and has proven a very effective remedy. Even though wing bolts are now made with inconel instead of steel, lubing the wing bolts every year is a small price to pay for the peace of mind it provides.



An example of a wing bolt "in shear." The orientation of the bolt is parallel to the fuselage and is clasped with evenly spaced "fingers" that are at 90 degrees to the bolt.

The various King Air models have different calendar requirements for inspection and replacement of wing attachment hardware. The inspection (a three-year or five-year occurrence) includes not just the hardware itself, but also the bathtub fittings, counter bores and flat surfaces.

I bring an NDT specialist in for the required eddy current testing during these inspections. We've never found an anomaly in all the wing bolt inspections we've done over the years, but the NDT guys I work with have their share of horror stories. Whenever they find bad news, it always seems to involve aircraft that have been greatly neglected; and not surprising, the price required to bring things back up to par is a hefty one. Do it right and pay now, or defer it and pay a bunch more later.

In Tension or in Shear?

The wing bolts in older King Airs are "in tension." Here, the orientation of the bolt is perpendicular to the fuselage and parallel to the leading edge. If you grasped the head of the bolt with one hand, and the nut with your other hand and tried to pull your hands apart as if to stretch the bolt lengthwise, it would be a crude example of a bolt in tension. The maintenance manual is very specific on how the nuts should be torqued because of the stress being placed upon them. Most of the King Airs coming through my shop have wing bolts in tension.

Beech later switched to wing bolts "in shear," where the orientation of the bolt is parallel to the fuselage. The bolt is clasped with evenly spaced "fingers" that are at 90 degrees to the bolt. I have a collection of old wing bolts in my office. It's easy to tell the ones in shear because the "fingers" have worn a shiny stripe at even intervals.

All wing bolts, whether in tension or in shear, are subject to periodic replacement. The lower forward bolts are replaced every five or 15 years depending on the King Air model. Lower forwards in shear have a five-year replacement, but also must be replaced any time they are removed, no matter the reason. Wing bolts in the other positions are replaced every 15 years for all King Airs.

Reputation for Safety

Safety has long been a hallmark of the Beechcraft King Air. Their safety record was a key selling point in 1980, as it is today. Proper and prudent operation coupled with good maintenance is a winning combination that will keep any King Air flying for many more years to come. KA

Dean Benedict is a certified A&P, AI, and has 40 years of experience in King Air maintenance. He is president of Honest Air, Inc., which specializes in Beechcraft King Air maintenance and repair.

If there is a particular maintenance issue you would like Dean to address in a future issue, please email Editor Kim Blonigen at *kblonigen@cox.net*.

NTSB Announces Most Wanted List for 2016

by Kim Blonigen

The National Transportation and Safety Board (NTSB) recently named its Most Wanted List for this year. This list, published every year, "highlights safety issues identified from the NTSB's accident investigations to increase awareness about the issues and promote recommended safety solutions."

All modes of transportation are included in the study to create the list and some of the points crossover more than one mode; one was specific to general aviation (GA) and six of the 10 included aviation. Those are listed below with the NTSB's explanations.

Prevent Loss of Control in Flight in General Aviation

While airline accidents have become relatively rare in the United States, pilots and passengers involved in general aviation operations still die at alarming rates. Between 2008 and 2014, about 47 percent of fatal fixed-wing GA accidents in the United States involved pilots losing control of their aircraft in flight, resulting in 1,210 fatalities. Pilots can reduce these accidents through education, technologies, flight currency, self-assessment, and vigilant situational awareness in the cockpit.

Reduce Fatigue-Related Accidents

Human fatigue affects the safety of the traveling public in all modes of transportation. Twenty percent of the 182 major NTSB investigations completed between 2001 and 2012 identified fatigue as a probable cause, contributing factor, or a finding. Combating fatigue requires a comprehensive approach focused on research, education and training, technologies, treatment of sleep disorders, hours-of-service regulations and on- and off-duty scheduling policies and practices.

Disconnect from Deadly Distractions

Since 2003, the NTSB has found [portable electronic device] PED distraction as a cause or contributing factor in accidents across all modes of transportation. A cultural change is needed for drivers and operators to disconnect from deadly distractions. In regulated transportation, the strict rules minimizing the threat of distraction must be embraced by every operator on every trip. Removing unnecessary distractions is the first step in safely operating any vehicle.

Expand Use of Recorders to Enhance Transportation Safety

Transportation operators and investigators must have an accurate picture of an accident to prevent future accidents. No single tool has helped determine what went wrong more than recorders. Yet, certain categories of aircraft, trains, ferries, and buses are still not equipped with these critical technologies.

End Substance Impairment in Transportation

In the last 15 years, data shows that one-third of highway deaths involved an alcohol-impaired driver. Our new reality is this: impaired driving now involves drugs – including prescribed and over-the-counter medicines – that can affect your ability to drive or operate any vehicle. More and better data will help us understand the scope of the problem and the effectiveness of countermeasures.

Require Medical Fitness for Duty

When safety-critical personnel, such as public vehicle operators, have untreated or undiagnosed medical conditions preventing them from doing their job safely, people can be seriously injured or die. However, medical certification for safety-critical personnel varies across the modes of transportation. The NTSB has recommended comprehensive medical certification systems for safety-critical transportation personnel to ensure that these professionals are medically fit for duty before operating a vehicle.

The National Business Aviation Association (NBAA) commented on the NTSB's Most Wanted List and said it is "in step with the safety focus areas of NBAA's Safety Committee, and that alignment between government and industry efforts to address these issues best contributes to improved flight safety."

Mark Larsen, NBAA's senior manager for safety and flight operations, said that preventing loss of control inflight is also among the NBAA Top Safety Focus Areas, as business aviation loss of control accidents are a subset of the 47 percent fatal fixed-wing GA accidents mentioned in the NTSB's list, and "the alarming consistency of catastrophic outcomes in this type of accident compels an effort to better understand and control loss of control inflight risks."

The NBAA's Top Safety Focus Areas list also includes hazard of distraction and technology management, which correlates with NTSB's point of "disconnecting from deadly distractions." The NBAA's point reiterates the need to "focus on the primary task at hand in lieu of non-mission-critical information, and to be fully trained and proficient with mission-related technology, so that managing it while performing safety-sensitive tasks does not itself become a distraction."

The organization also highlights reducing fatigue-related accidents, requiring medical fitness for duty and ending substance impairment in transportation in its *fitness for duty foundation for safety*. In a physically and mentally demanding environment, a clear mind and healthy body are essential to safe business aircraft operation, maintenance and management. Operators must address fatigue, sleep apnea, improper use of medications and many other physical and psychological aeromedical issues.

The NBAA pointed out that "expanding the use of recorders to enhance transportation safety" is new to the NTSB's list this year, and said "with the growing use of data as part of aviation safety programs, recorders play a critical role in helping operators to validate processes and identify trends before problems occur."

NBAA President and CEO Ed Bolen concluded by saying, "A proactive safety culture that seeks input from all facets of the operation is key to improved business aviation safety. NBAA remains dedicated to our collaborative working relationship with the NTSB to help improve business aviation safety." KA


OUT WITH THE OLD...
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Propeller Speed in Climb, Cruise and Descent

by Tom Clements

This week I flew with an owner-pilot of a beautiful, late-model King Air 300, doing a bit of in-aircraft recurrent training. He mentioned that when he received his Initial training in this plane a few years ago the instructor emphasized, often and forcefully, that the propeller speed must be reduced back to 1,500 RPM (from the takeoff speed of 1,700 RPM) at 400 feet AGL on every departure. "How important is that?" he asked.

In my opinion, it is not important at all and I cannot understand why the instructor would have taught that it is! The intent of this article is to discuss the pros and cons of our selection of propeller speed in climb and cruise. For many King Air pilots this is neither confusing nor controversial in any way. They merely follow the manufacturer's checklist procedures. Other pilots consider this a matter of technique and vary the RPM based on conditions. Please read on to gain a deeper understanding of why we choose the propeller speed that we do.

I will begin by reviewing the basic formula for the power that is being delivered to the propeller shaft. Bear with me here as I make sure you understand the exact definition of *power*.

Power Formula

The dictionary defines torque as "A force that produces a twisting or rotational effect." And what is a force? Merely a push or a pull, measured in pounds (lbs) in the typical American system of measurement. Work is done, energy is expended, when a force moves through a distance. Let's say that we want to push a heavy chair from one side of a room to the other. It seems to most of us that work would be done when the force is applied, when we bent our arms and gave the chair a good shove. Although I agree that our muscles would get tired if we kept this pose for a lengthy period of time, technically work is not done until the chair moves. You see, we could go find some heavy board or cabinet, tilt it so that it is lying against the chair, and now the chair is still experiencing the same pounds of force as if we were still pushing, yet we could go take a nap! But when the chair actually moves, then the board or cabinet falls off and if more motion is desired someone has to do the work of repositioning the force-producing object. Better yet, why don't we just push hard enough to get the chair moving and then walk to the desired new location?

It is obvious that the amount of work we did depended on the force (lbs) we used and the distance we traveled (feet). It could take the exact same expenditure of energy to move a heavy chair a shorter distance or a lighter chair a longer distance. It is the product of *force* multiplied times *distance* that determines the amount of *work* that was done. Thirty pounds moved 10 feet requires 300 ft-lbs of work, the same as 20 pounds moved 15 feet.

Power is the *rate of work* being done. In human terms, you can think of it as how quickly you get tired. If we meandered across the room and took a minute to move that chair, we would not get as tired as if we sped across the room in 10 seconds.

Instead of the linear motion of the chair, visualize a manual ice cream maker being used at a Fourth of July picnic. Before the milk/sugar/flavoring concoction starts to gel, a little torque is required to turn the crank handle. Even Grandma won't get her heart rate elevated much while she turns the crank rapidly. Lazy Uncle John takes over after the handle gets stiff but he, too, doesn't start panting since he is only making one complete revolution of the crank every minute or so. Not much power is being applied and the ice cream is slow in forming. Finally, Cousin Sam – a 6-foot 4-inch football player who can't wait to show how strong he is at age 16 – steps in. He spins the handle even faster than Granny did, overcoming the heavy resistance at the same time… in other words, applying lots of power!

I hope by now that it seems logical to you that the power applied to anything that rotates – be it the ice cream maker or the King Air's propeller – is the product of *torque (ft-lbs) times speed (RPM – Revolutions Per Minute)*. In the case of the King Air, maximum power can never be achieved unless torque and Np (propeller speed) are *both* at their maximum, redline values.

Power = Torque X Propeller Speed

A minor challenge appears when we choose to measure power in the common unit of horsepower (HP) and yet we measure torque in ft-lbs and Np in RPM. Although the formula is not in error, the answer will not be correct until conversion factor, K, is included. One HP is equal to 5,252 ft-lbs-RPM so the constant conversion factor needs to be the reciprocal of that, or 0.0001904. For our purposes, 0.00019 is close enough. Thus, the power at the propeller shaft (SHP – Shaft Horsepower) becomes:

Power (SHP) = Torque (ft-lbs) X Propeller Speed (RPM) X K (0.00019)

By the way, the 300-series are the only domestic King Airs that present torque in units of percent, not ft-lbs. For these, 100% = 3,244 ft-lbs.

Climb RPM

Time for a pop quiz. What, if any, model King Air has a time limit for operation at maximum, redline, propeller speed? Yes, there are limits for when the redline is *exceeded* – due to Primary Governor failure and proper operation of the Overspeed Governor – but, you're correct, no other propeller time limit exists. It is completely permissible to operate with the propeller levers full forward all the time. What is the disadvantage of doing so? Only one – noise. It is the desire to reduce both exterior and interior noise that causes the Beechcraft checklist writers for most King Air models to specify a cruise climb RPM that is less than takeoff RPM. The F90-series is the exception here, with the checklist keeping takeoff RPM throughout the climb. However, the F90's maximum Np is only 1,900 RPM, already 300 less than previous 90-series models.

Years ago, before the B200 made its appearance in 1982, few King Air models were capable of maintaining maximum rated power while climbing. To get that maximum power, remember, *both* torque and Np had to be at their maximum values. This was impossible, however, because so much power would cause ITT to get uncomfortably toasty. Only at rather low altitudes, on cooler days, could early King Airs enjoy their rated power capability. Even on cooler days, it was rare to be able to maintain full power above about 5,000 feet.

As most of our readers have experienced hundreds of times, torque goes up as RPM goes down when the power levers are not touched, and ITT changes not enough to observe. This means that reducing RPM for improved noise levels in climb rarely actually results in a power decrease, since the rise in torque will compensate for the fall in RPM. Since we are ITT-limited, torque has already fallen below redline, so there is room for it to increase as Np decreases. (Bigger bite of air, slower RPM, more rotational resistance…more torque.)

A simple example: A -20-powered A90 is climbing through 6,000 feet and, due to ITT constraints, torque has fallen to 1,000 ft-lbs, while the propellers are still turning at redline 2,200 RPM. Our power formula shows that 418 SHP is being produced. If the prop levers are now pulled back, bringing RPM down to 2,000, torque will automatically rise to about 1,100 ft-lbs and SHP won't change. (Actually, it may change a tiny amount. The explanation for that will come later in this article.)

It is my educated guess that the main reason most King Air checklists specify a lower cruise climb RPM than redline is that power changes little, if any, when this is done – since we have become ITT-limited and torque is not at redline – yet the noise situation improves.

In the last few years, however, both Blackhawk and Beech have offered STCs or introduced new models that enjoy exceedingly flat-rated engines that can develop their full-rated power well up into the high teens or even low flight levels. ITT is never of concern until very thin air at high altitude is reached. The -135A conversions on C90s and E90s, the C90GT-series, the B200GT series and those 200s modified with -52 or -61 engines…all are in this category in which ITT is never a restraint on power until the airplane climbs quite high.

In these models, if we bring the propeller speed to anything less than redline, we give up some power and some climb performance, while we gain less noise inside and outside. Is the loss of performance worth it?

In many cases, the answer is "yes." Why not give the passenger a slightly quieter cabin at the expense of only a 5 or 10 percent reduction in climb performance? On the other hand, maybe those same passengers would prefer climbing above the low altitude turbulence, or icing, or mountainous terrain more rapidly, but with a slightly louder cabin. In that case, leave the prop levers full forward to enjoy the extra power. Or maybe it's just the crew onboard, wearing noise-cancelling headsets, who desire a little more oomph in the climb; then leave the props at takeoff RPM.

To summarize: When ITT is *not* a limiting factor, realize that any reduction in propeller speed will yield an identical reduction in power. That is, if we pull props back to 1,900 RPM from 2,000 RPM – a 5 percent reduction, since 100 is 5 percent of 2,000 – then our shaft horsepower has also taken a 5 percent hit. On the other hand, when we are ITT-limited and we have been forced to accept a drop in torque, the noise reduction comes with no significant change in performance since torque has the room to rise as RPM falls.

Cruise RPM

It is the rare King Air – probably a B200GT, 250, or a 200-series member modified with Blackhawk -52 or -61 engines – that is not ITT-limited by the time it levels off at typical cruise altitudes. As the climb reached the higher levels, eventually the power levers could no longer be advanced to compensate for the decreasing torque due to an ITT constraint. From that point in the climb, torque and hence power were decreasing.

For ease of discussion, let's presume that we are flying a B200GT and by the time we level off at FL260 and accelerate into cruise speed, the torque is down to 1,600 ft-lbs with the propeller still at its maximum value, 2,000 RPM. Since 1,600 ft-lbs at 2,000 RPM multiplies out to the same power as 2,000 ft-lbs of torque at 1,600 RPM, why not just pull the props all the way back to 1,600, watch the torque rise to 2,000 ft-lbs automatically, and enjoy the same speed but in a significantly quieter cabin? In many cases, you can do exactly that! But not in all, especially not in the -135 and -135A-powered airplanes (F90s and modified C90s and E90s) or even in E90s, 100s, or A100s that sport Raisbeck-Hartzell four-blade propellers. Here I need to discuss two things: Power Turbine (PT) efficiency and Propeller Efficiency.

Power Turbine Efficiency and Propeller Efficiency

Most of the readers of this magazine know that it is possible to start a PT6 and operate at Low Idle while someone holds the propeller stationary. Doing this makes the Power Turbine have zero efficiency. It is obvious that the engine is developing power – it's running, the generator may be supplying electricity, the gas generator may be providing bleed air – yet with the prop speed at zero, there is no horsepower being delivered to the propeller shaft. Any amount of torque, times zero RPM, still yields zero SHP. No power is being extracted from the exhaust gases when they flow across the blades of a stationary Power Turbine.

Although in no way as extreme, a similar action takes place when the Power Turbine turns slower than its designed optimum speed. And what is that optimum speed? It is the one that results when the propeller is turning at redline, takeoff RPM. For example, for members of the model 200 family, takeoff RPM is 2,000 and the Reduction Gear Box (RGB) between the propeller shaft and the Power Turbine shaft has a 15:1 ratio. When the Power Turbine rotates 15 times, the propeller rotates once. At takeoff RPM, it follows that the PT speed is 30,000 RPM. At a prop speed of 1,600, now the PT rotates at 24,000 RPM. The extraction of exhaust gas energy is a little less efficient at the slower speed, but only marginally so.

On the other hand, when Raisbeck props are put on an E90, for example, the 15:1 RGB is not changed but the propeller governor is adjusted so that maximum RPM is no longer 2,200, but instead is 1,900. The bottom end of the primary governor's range is "re-clocked" for 1,600 from the old minimum of 1,800. The Power Turbine that was designed to be most efficient at 33,000 RPM (2,200 × 15) becomes significantly inefficient when turning at 24,000 (1,600 × 15). That is more than a 27 percent speed decrease!

Here is how to see this change in PT efficiency to prove it to yourself. On a deadhead leg or a test flight, set a realistic cruise torque with the propeller levers full forward giving redline Np. Set a round number, such as 1,500 or 900 ft-lbs – something realistic for your exact model. Now, without changing altitude or touching the power levers, reduce Np to the minimum value you can comfortably set. Go to the calculator on your smartphone and work a simple math problem: Multiply the original torque value by the ratio of old to new prop speed. Here's the formula:

New Torque = Old Torque X (Old Np/New Np)

This new torque value presumes engine SHP did not change. Since power lever position and fuel flow and ITT did not change, we would logically believe that SHP would also not change. But it does. It goes down. In some cases, quite dramatically so.

As an example, if we had been using 900 ft-lbs at 1,900 RPM in our Raisbeck-modified E90, then came back to 1,600 RPM, the new torque should be 900 × (1900/1600), or 1,069 ft-lbs. Is it? Look at the torque gauge and see what it reads. It will be less than 1,069, perhaps 980 or so. If that is the number, we have lost over 8 percent of our SHP, even though we are burning the same amount of fuel. How can this be? Simply because the slow speed of the PT limits its efficiency, its ability to extract useful power from the exhaust gases flowing across its blades. Is the noise reduction worth that much loss of fuel efficiency? Each pilot/owner needs to decide that for him or herself.

The 200-series is probably the best in this area. Had we set 1,500 ft-lbs at 2,000 RPM in our 200 demonstration, then reduced the props to 1,600, the formula would say that the new torque should be 1,500 × (2,000/1,600) or 1,875 ft-lbs. I bet the actual value will be very close to that, probably 1,850 or even more, so there was insignificant efficiency loss. That is why most operators of 200-series models that have been modified with Raisbeck props usually climb at 1,800 RPM and cruise at 1,600 RPM, instead of the standard checklist-suggested values of 1,900 and 1,700.

On to propeller efficiency…

Just because we may be delivering the same torque to a propeller shaft turning at the same speed as another, there is no guarantee that both propellers are delivering the same thrust. Instead of a carefully-designed and manufactured propeller, what if a wooden club of some shape were bolted to the shaft? We might not get any useful thrust at all, even though we could spin that club at a high RPM with lots of torque.

As you know, the propeller blade's cross-section is an airfoil and its thrust is derived by generating lift, much as a wing does. Like a wing, if the propeller blade's angle-of-attack (AOA) with its relative wind becomes too great, the airfoil starts to stall and loses its lifting/thrusting ability. The lower the airspeed, the lower the propeller speed, and the greater the torque, the greater the tendency of the blade is to reach its stall AOA.

The propeller designer attempts to optimize the propeller's efficiency for both takeoff and cruise situations. The higher takeoff RPM combined with the relatively low takeoff speeds work well, as does the lower cruise RPM combined with relatively fast speeds. (It is my experience that some propellers seem to excel at this better than others!)

Working only from the power formula, it would seem that whenever torque is less than redline due to an ITT constraint, it would be silly not to reduce RPM, increase torque, keep SHP the same, and enjoy a quieter ride. This sometimes goes by the term "Chasing the Torque." As torque falls in the climb, chase it with a decrease in RPM to force it back up and…lose nothing? Well, without a change in Power Lever position, the formula would certainly lead one to conclude that there is no downside risk to this operation. We can make it quieter, yet never lose performance. What a win-win situation!

Throw in recognition of Power Turbine and propeller efficiency losses that can occur at lower prop speeds and lower airspeeds, however, and we find that we do in fact lose enough performance that the cost is often not worth the benefit of less noise.

Personal Flight Testing

Okay, the ball is coming back into your court. On your own individual airplane, with all of its modifications and options, with its standard three-blade, standard four-blade, or after-market four or even five-blade propeller, you should do your own investigation and conclude what is optimal for that exact machine.

Cruise performance optimization is easy. At your typical cruise altitude, set power your usual way at your usual RPM during a longer flight in smooth air. Record parameters carefully – especially RPM, Torque, ITT, Fuel Flow, and IAS – then select a different RPM and let everything totally stabilize. Record the new values. Keep doing this throughout the range of propeller speeds you feel comfortable using. While you are waiting for stabilization, it might be a good idea to use the formula here to see what the new torque should be for equal power and note if there is any deviation.

Climb optimization is more subjective, but after you are high enough that torque has decreased, try both higher and lower propeller speeds, letting the torque float down and up as it will, and see if the climb rate changes enough to be noticeable.

I will even offer some typical "answers" of what some of you will find. First, in C90s with Raisbeck props, as you bring RPM down from 2,200 to 1,900, I will wager torque rises exactly as it should to maintain power and that IAS does not decrease at all, but maybe even creeps up a knot or two. But back at 1,600 – wow, do we lose it! The torque rise is not nearly what the same-power formula says – we are losing PT efficiency – and the IAS probably drops off by 10 knots or more. That is why Raisbeck Engineering decided to limit their recommended cruise RPM to 1,750. At that value, you will start to see a minor drop in Power Turbine and propeller efficiency, but you will likely conclude that the two or three knot loss in speed is worth it for the significantly quieter interior.

For you F90 pilots and C90-series/E90-series with Blackhawk -135As, you will probably conclude that cruising at 1,700 instead of 1,900 RPM offers so much better cabin noise level for a very small loss in speed that it's worth it. On the other hand, the efficiency bugaboo really shows up down at 1,500 RPM.

The 200-series? You probably have it best of all – 1,700 RPM cruise is great, and with Raisbeck props installed, 1,600 probably yields no noticeable performance loss but is a bit quieter. (If you have the passive noise-cancelling "tuning forks" in your interior, you may decide that 1,700 still sounds the best.)

With the 300-series, your governor range is so relatively small – 1,700 down to 1,450 – that both PT and propeller efficiency changes are tiny. Now's a good time to use max RPM until torque starts to fall, then chase the decreasing torque with RPM reductions until you reach 1,500 and stay there for cruise.

Descent RPM

During the descent, approach, and landing, it is no longer best power and performance we are after. Instead, safety (still) and comfort are probably the main goals. Quite early in the descent, we can make the cabin more quiet – it already got a little noisier due to the extra IAS we picked up as we descended – by bringing the props back to the lowest possible governing speed. Even with noticeable PT and propeller efficiency losses that may show up, the low or medium power settings we will be using on our way to the airport can still easily be reached. Of course, we must remember to select high RPM for a balked landing or missed approach as well as to run the prop levers full forward before using Beta or Reverse.

Do many pilots bring the RPM lower for descents? No. Is the noise difference significant? Not usually. So if you choose to leave props alone for the descent, that is 100 percent acceptable and you are in the vast majority. But if you choose to use a lower RPM, that is also okay, and not hurting a thing.

Thanks for reading this lengthy presentation. Now, if you feel like it, plan to do a little experimentation on your next few flights. Have fun! KA

King Air expert Tom Clements has been flying and instructing in King Airs for over 43 years, and is the author of "The King Air Book." He is a Gold Seal CFI and has over 23,000 total hours with more than 15,000 in King Airs. For information on ordering his book, go to *www.flightreview.net*. Tom is actively mentoring the instructors at King Air Academy in Phoenix.

If you have a question you'd like Tom to answer, please send it to Editor Kim Blonigen at *kblonigen@cox.net*.

Air Capital of the World: Travel Air Days

In the wake of E.M. Laird's departure from Wichita, Walter H. Beech, Lloyd C. Stearman and Clyde V. Cessna joined forces to create the city's first major airframe manufacturer – the Travel Air Company

by Edward H. Phillips

When Billy Burke resigned from the E.M. Laird Company Partnership in 1920, Matty Laird lost a key mediator between himself and Jake Moellendick. Burke kept the company running smoothly and provided a welcome buffer against Jake, whose bullish and sometimes irascible personality was the exact opposite of the soft-spoken Laird. Whereas Matty avoided confrontation, Moellendick welcomed it. Jake was by nature impetuous, occasionally outright pompous, often authoritarian, and always believed that his way was always the best way to run the company. With Burke's departure, the two men agreed to reincorporate the business as the *Wichita Laird Airplane Corporation*.

Under the new arrangement, Laird split his duties between the North Hillside flying field and the downtown factory. As sales of the Swallow slowly increased, Matty began to focus his energies on reducing the amount of time required to fabricate and assemble the biplanes. Laird's small workforce, however, included men who gradually devised innovative methods that promised to expedite construction of the entire airframe. In addition, Laird was interested in the cross-application of mass production techniques already in widespread use by America's automotive industry. As a result of these initiatives, early in 1922, Laird was able to lower the price of the Swallow to $4,700 from $6,500, and sales increased.[1]

It is interesting to note that in 1921 there were only 21 airframe manufacturers officially registered with the United States Department of Commerce, and not all of those were building commercial aircraft. Some were tied almost exclusively to military contracts, which after the war were extremely difficult to obtain because Congress axed funding for new aircraft. In Sedgwick County where Wichita was located, officials recorded only one company – the Wichita Laird Airplane Corporation, along with six biplanes and six pilots. The manufacturing activity in Wichita, however, did attract the attention of an organization that expressed interest in using the North Hillside flying field. The facility often received praise from civil and military pilots as one of the best aerodromes west of the Mississippi River. Examples included the Aerial Navigation and Engineering Company of Denver, Colorado, the Roosevelt Air Line in New York City, Larsen Aerial Navigation, Inc., and the United States War Department.[2]

Unlike Laird, Moellendick was always hungry for publicity, particularly the type of publicity that would benefit Wichita and its emergence as an early haven of civil aviation. Early in 1921, he informed the local press that the company was moving ahead with plans to launch an air service that would fly passengers to Tulsa, Oklahoma, and Kansas City, Kansas. It was a

In July 1921, Jake Moellendick hired former Army Signal Corps pilot Walter Herschel Beech without Laird's knowledge. Laird's irritation with Moellendick spilled over to an initial dislike of Beech, but Matty eventually appreciated Walter's ability to demonstrate and sell Swallow airplanes.
(JOAN LAIRD POST COLLECTION)

The "Laird Limousine" as it appeared in 1923 after extensive modifications to the airframe and replacement of the Curtiss powerplants with a 250-horsepower Packard engine. Large, water cooling radiators were mounted on each side of the cockpit. Note the new, single-bay wing configuration, and the conventional empennage that replaced the triple-tail arrangement. (JOAN LAIRD POST COLLECTION)

novel but premature idea, more akin to a fantasy than a viable initiative, and both Jake and Matty knew full well that the Wichita Laird Airplane Corporation lacked the means to make it a reality.

Despite growing tensions between Moellendick and Laird, the two men did agree to pursue the concept of a scheduled airline linking Wichita with the other nearby cities. Jake was ready to forge ahead with the project, but Matty was reluctant, claiming that the timing was not right for such an ambitious venture. While Jake told the press about the plans, often embellishing them to spice up their appeal to the public (and potential investors), Laird concentrated on designing and building an airplane he hoped would be worthy of the proposed airline. During the spring and summer of 1921 he completed detail design of the new airplane that he soon dubbed the "Laird Limousine." Construction was slow, proceeding as money and materials became available.

Matty was always acutely aware of the company's threadbare margin between profit and loss that depended entirely on the sale of the company's only product – the Swallow. He did his best to restrain Jake's penchant for spending money the business did not possess, as well as refuting his associate's irritating exaggerations to the press. For example, contrary to Jake's overactive enthusiasm for the new biplane, in 1962 Laird wrote that the Limousine was never intended to be a cargo transport, as Jake had proclaimed. In addition, Moellendick had told reporters that up to $1 million would be spent on the airplane – statements that Laird later condemned as not only gross exaggerations, but blatant fabrications made by Jake without any input from Matty.

The "Limousine" was only slightly larger than the Swallow, with a wingspan of 47 feet and a length of 25 feet. The pilot and one passenger sat forward of the enclosed cabin in an open cockpit equipped with a small windscreen. Passengers entered the cabin through a door on the left side of the fuselage, and sat on six thickly padded seats (arranged in club seating configuration) that were complemented by a fully upholstered interior featuring large windows on both sides. Laird calculated

Local pilot, Irl Beach, posed for the camera in 1924 with the "New Swallow" biplane. Designed by Lloyd Stearman following Laird's departure from Wichita the previous year, the airplane sold well and production could not keep pace with demand. Stearman had served as an assistant to Laird and learned the basic details of aircraft design and construction. The ship was a marked improvement over the Swallow and thrust Stearman's name upon the national aviation scene. Note the split axle landing gear and all-metal cowling surrounding the Curtiss OX-5 engine. (EDWARD H. PHILLIPS COLLECTION)

Late in 1924, Walter Beech, Lloyd Stearman and Clyde Cessna, in concert with a group of Wichita businessmen, formed the Travel Air Manufacturing Company – the city's first major airframe manufacturer. Stearman designed the Model "A" biplane that represented a significant improvement over the aging New Swallow. Both Beech and Cessna provided input to the overall design. In 1925, selling the $3,500 Model "A" proved a tough challenge in a market flooded with war surplus aircraft costing less than half that price. The airplane's attributes, however, won customers and by 1926 sales were strong. (EDWARD H. PHILLIPS COLLECTION)

that with a useful load of 1,500 pounds and 180 gallons of fuel, the airplane would be capable of flying up to 400 statute miles at a cruising speed of 90 mph. Fully loaded with passengers, pilot and fuel, the double-bay biplane weighed in at a hefty 4,000 pounds. The airplane's anemic power-to-weight ratio doomed it from the start, but Laird's design was innovative for 1921. Unfortunately, it was grossly underpowered because a tight budget left Laird with no choice but to install two Curtiss OX-5 engines that together provided a meager 180 horsepower.

It fell to pilot and employee George "Buck" Weaver to make the first flight of the much-ballyhooed Limousine, and during mid-summer he took the ship aloft and was surprised to find that its performance met, albeit barely, Matty's expectations. Weaver quickly realized that despite operating at full throttle (1,400 RPM), the two hard-working Curtiss V-8 powerplants struggled mightily to keep the airplane aloft, let alone climb to an altitude sufficient for cross-country travel. Overall, the test flights served to confirm Laird's opinion that in its original configuration, the biplane was incapable of providing passenger service. It was too heavy, too slow and too underpowered. In the end, Jake's dream of starting an air service to Kansas City was temporarily shelved.[3]

Matty placed the airplane in storage where it remained until May 1922, when he decided to replace the two Curtiss engines with a water-cooled, 12-cylinder Packard powerplant that produced 250 horsepower. Workers, under the supervision of Bill Snook, began to rebuild the airplane in August. In addition to the engine change, a number of other modifications were made to the airframe: new, single-bay wings and a conventional empennage with a single vertical stabilizer instead of three used on the original ship; two large water coolant radiators were installed, one on each side of the forward fuselage, that Laird hoped would keep the Packard cool.

One of the men involved in reworking the Limousine was Lloyd Carlton Stearman. A native of Kansas, he had been hired by Laird in 1920. Stearman proved to be a hardworking employee and a competent draftsman, thanks to Lloyd's earlier training as an apprentice architect. Although he had enlisted in the United States Navy in World War I and was accepted into pilot training, the war ended before he won his wings as a naval aviator. During the Limousine's rebirth, Lloyd had become friends with another company employee by the name of Walter H. Beech, who was hired by Moellendick in July 1921 (apparently without Laird's knowledge or approval). Born and raised in Tennessee, Beech had served in the United States Army Signal Corps during the war and eventually was placed in charge of engine overhaul and repair at Rich Field, Waco, Texas. Sergeant Beech did not earn his wings until 1919, and when he resigned from the service he worked briefly for an air

The Travel Air Company's second manufacturing facility was located on West Douglas Avenue in Wichita. As of 2015, the building still stood and looked much as it did in 1926 when this photograph was made. That summer, manufacturing was moved five miles to a new, much larger facility on East Central Avenue. (EDWARD H. PHILLIPS COLLECTION)

taxi service before relocating to Wichita. Beech was, in Laird's own words, "a pilot of limited experience" who gradually developed into an excellent salesman and demonstration pilot.[4]

When the Limousine's transformation was completed in February 1923, Walter took the ship aloft for a series of test flights. Although maximum speed had increased to 110 mph, the Packard's insatiable thirst for fuel, coupled with problems associated with the cooling systems, continued to plague the airplane. Finally, Laird exchanged the Packard for a 12-cylinder, 400-horsepower "Liberty" engine, but the new powerplant fared no better than the previous one. Beech was able to make only brief, local flights before the Liberty overheated and lost power, forcing him to make an unscheduled landing. Moellendick ordered the ship flown to Arkansas City where it would be placed in storage to await its fate.

Another pilot named Irl Beach (no relation to Walter Beech) was chosen to ferry the airplane but was forced to land soon after takeoff. He managed to put the ship down safely near Wichita's Fairmount College (now Wichita State University), and telephoned Jake for instructions. Moellendick sent a crew to strip the airplane of all useable equipment, then ordered them to burn what remained of the airframe. Thus ended the checkered existence of the Laird Limousine.[5]

Selling airplanes in 1922 was essentially the same as it is in 2016 – demonstrate the airplane to potential customers. Laird and Buck Weaver often flew Swallows in opposite directions, with Matty flying north to his old stomping ground near Chicago, while Weaver went west to California. Selling the Swallow was never an easy task, and perseverance, tempered with diplomacy and tact, became the standard *modus operandi* for both pilots in their dealings with prospects. They had plenty of competition, too, from other small manufacturers who were flying their ships to the same cities in hopes of drumming up sales to keep their business alive.

Late in 1921, Laird had tried in vain to sell the Swallow to the United States Army as a replacement for the aging Curtiss JN-4 trainer, but without success. The reason was simple: the Army had little or no budget for new aircraft, and made do with the antiquated ships already in service. Matty also flew a factory-fresh Swallow to Dayton, Ohio, where he made a series of demonstration flights to officials of the United States Postal Service. The officials were judging various airplanes for potential airmail contracts. Although Laird impressed the post office personnel with the Swallow's performance that drew their praise, no orders were forthcoming. Laird was disappointed because he firmly believed his airplane was best suited for the mission.

In addition to sales, Laird and Walter Beech participated in "aerial meets" and aerobatic competitions throughout the Midwestern United States. Both men flew a specially-modified Swallow featuring a wingspan of only 20 feet and powered by a Wright-Hispano engine rated at 150 horsepower. The little racer was fast and highly maneuverable, often achieving speeds approaching 125 mph. The chief purpose of the racer was to earn extra money and keep Laird's company in the black. By 1923, Beech had become a seasoned airman and his fame as an aerobatic and racing pilot was spreading beyond Kansas. In 1921 alone, Laird and Beech together won 14 air racing events and gave countless "joy rides" over Wichita to help meet the payroll as well as pay the bills.

Clyde Cessna built a five-place monoplane in 1926 that would form the basis of the Travel Air Type 5000 cabin monoplane of 1927. Powered by one of Cessna's pre-war horde of Anzani radial engines, the ship's interior space could be converted into an air ambulance in a matter of minutes. Walter Beech flew the airplane and was impressed by its performance and handling qualities. (EDWARD H. PHILLIPS COLLECTION)

The first serious breach between Laird and Moellendick occurred in 1921 when Matty was away demonstrating the Swallow. Jake suddenly decided to expand facilities at the flying field, chiefly by relocating production from downtown to the airfield. He reasoned that because orders for the Swallow were increasing steadily, the change was warranted and would streamline the production process. He wired Matty about his plans, and Laird quickly replied that he was against making any such capital improvements until sales increased further. In typical fashion, Moellendick ignored his associate's opinion and forged ahead with design and construction of a large building to accommodate manufacturing. In December 1921, all of the equipment and materials were trucked north to the new facility. The move, however, came at a high price: it quickly became apparent that the company would not meet existing orders, alienating customers and damaging Laird's reputation. Worst of all, the stand-down crippled the company's financial condition for the next three months.

By March 1922, the production line was beginning to regain the momentum it lost from the relocation. Fortunately, the order books swelled that winter and as the new flying season approached, customers took delivery of their ships and put them to work. During the winter, an unexpected alliance evolved between Laird and Beech that would prove beneficial for both men and the company. Although Matty had disliked Beech initially, he soon came to realize that Walter possessed talents that were sorely needed in the wake of Buck Weaver's decision to return to Chicago. As a result, Beech was appointed manager of sales and supervised operations at the flying field. Whereas Walter was gregarious, Matty was quiet and content to remain in the background, but there was never any question that he was in overall charge of the Wichita

Laird Airplane Corporation.

As with Billy Burke and Buck Weaver before him, by the summer of 1923 Laird's patience with Moellendick had run its course. Relations between the two men continued to deteriorate. After weighing his options to remain or return to Chicago, in October Laird chose to sever his business arrangement with Moellendick. That month Laird and another pilot took two Swallows and $1,500 cash and headed north. Matty allowed Jake to retain all technical drawings for the Swallow in exchange for Moellendick's promise to no longer associate Laird's name with the business. At the time of Laird's departure, the Wichita Laird Airplane Corporation had built and delivered about 45 airplanes since 1920. By early 1924, Laird had reestablished himself in Chicago and formed the E.M. Laird Airplane Company. He became a highly respected builder of custom airplanes for the wealthy sportsman pilot and commercial operators.

As 1924 wore on, Walter Beech and Lloyd Stearman began to think about upgrading the Swallow, which was beginning to show its age in the face of increasing competition from other manufacturers. The two men, with Moellendick's approval, created the "New Swallow" that featured a redesigned landing gear, single-bay wing configuration, and a cowling that completely enclosed the OX-5 engine. The ship was an improvement over the Swallow, both technically and aesthetically, and gradually replaced Laird's machine on the production line. The next step, at least in Walter and Lloyd's thinking, was to further improve the New Swallow by using a welded steel tube fuselage instead of wood. The use of steel tubing was not new, having been introduced in World War I and used in a number of German fighter aircraft, particularly the Fokker DR-1 "Dridekker" (of Baron von Richthofen fame) and the later Fokker DVII biplane. The Curtiss PW-8 and Boeing PW-9 postwar fighters built for the United Sates Army Air Service also featured a welded steel tube fuselage.

What occurred next is still subject to conjecture, but as best can be determined from sources available at the time, when Walter and Lloyd approached Jake about using steel instead of wood for the fuselage, their boss flatly rejected the idea. As far as Jake was concerned, the Swallow would continue to be built of wood. Dissatisfied with Jake's position, by December 1924 Beech and Stearman had contacted Clyde Cessna to assess his interest in forming a new company. The story goes that Lloyd, and possibly Walter as well, traveled to Clyde's home in Rago, Kansas, to make their proposal in person. Clyde agreed with their idea, and before Christmas Jake had lost two of his best employees.[6]

The Jan. 26, 1925, issue of the *Wichita Eagle* newspaper carried a small article tucked away on a back page near the advertising section. It mentioned Walter P. Innes, Jr., a longtime resident and prominent businessman in the city, who announced the formation of Travel Air, Inc. Mr. Innes was named president and treasurer, Cessna put in $5,000 and contributed woodworking equipment; Beech invested about $5,000 and Stearman injected $700 and his plans for a new, three-place biplane. The infant company's first facility was a cramped workspace at 471 West First Street in downtown, nestled close to the Arkansas River that flowed through central Wichita. That same day America's oldest aeronautical magazine, *Aviation*, published a brief article about the new company. Beech was referred to only as a "pilot in the Wichita area" but Stearman was described as a "well known aeronautical engineer." Cessna, however, was hailed as a "pioneer flier from Rago, Kansas."

The first airplane, designated the "Travel Air Model A," flew in March 1925. It featured a welded steel tube fuselage and empennage, but was powered by the ubiquitous Curtiss OX-5 engine, primarily for the same reason Laird chose it in 1920 for the Swallow: cost and availability. Just as Matty Laird knew in 1920 that it

In 1926, the emergence of static, air-cooled radial engines such as the Wright Aeronautical J-4, slowly began to replace aging, pre-war powerplants, particularly the Curtiss OX-5. Radial engines were expensive, but their advantages in weight, horsepower and reliability outweighed the cost. Lloyd Stearman redesigned the Model "A" to accommodate a nine-cylinder, 200-horsepower J-4, creating the Travel Air Model "BW." (EDWARD H. PHILLIPS COLLECTION)

would be difficult to sell an expensive, new airplane in a postwar market crowded with war surplus aircraft, Beech faced the same challenge in 1925. Using the sales skills he had learned and polished selling the Swallow, Walter sold the first Travel Air to a businessman in St. Louis, Missouri. As word of the Model A's performance spread from coast to coast, the company's new secretary, Olive Ann Mellor, was busy trying to keep pace with a flood of orders for the "Model A." During its first year in business, Travel Air had sold 19 airplanes and held orders for more. By the beginning of 1926, the company was firmly established as one of the leading manufacturers of small commercial aircraft in the United States. Its chief competitor was the Weaver Aircraft Company, better known as "WACO," based in Ohio.

Travel Air relocated to a larger, but still inadequate, building on West Douglas Avenue in 1926 and remained there until the summer of 1927, when manufacturing was moved five miles away to a spacious new building on East Central Avenue. That summer Beech flew a specially-equipped Type BW to victory in the second annual Ford Reliability Tour, assisted greatly by skilled navigator Brice Goldsborough of the Pioneer Instrument Company. Next, Travel Air won a contract from National Air Transport (NAT) for eight Type 5000 cabin monoplanes for service on NAT's short-haul routes in the Midwestern United States. Impetus for the Type 5000 came from none other than Clyde Cessna. In June 1926, Cessna built a high-wing cabin monoplane at his own expense and on his own time. Walter Beech later flew the ship and believed it had potential as a small transport. Cessna, along with chief engineer Stearman and his assistant Herbert Rawdon, reworked Clyde's design into a larger aircraft.

Travel Air lost its chief engineer late that summer when Lloyd Stearman resigned and moved his family to Santa Monica, California, where he began building airplanes under the name "Stearman Aircraft Company." Lloyd's departure was matched by Cessna when, in January 1927, he resigned to start the Cessna Aircraft Company in a small, rented building on the west side of Wichita. He was intent on realizing his dream of building monoplanes with fully cantilevered wings, and by spring of that year he had completed his first design – the "*Cessna Phantom*" – and the future of his little company looked bright. The resignations of his two friends left Walter Beech temporarily in charge of Travel Air. Later that year he would be elected president of one of the nation's fastest- growing commercial airframe manufacturers. For Beech, Cessna and Stearman, however, the best was yet to come. The success of their individual companies in 1928 and 1929 further reinforced Wichita's claim as the "Air Capital of the World." KA

NOTES:

1. McCoy, Sondra Van Meter; "*The Primary Contribution of E.M. Laird to the Aviation Industry of Wichita*;" University of Wichita, 1962, Page 9.
2. "*Biennial Census of Manufacturers*", Department of Commerce, 1921.
3. It should be noted that although the concept of a passenger-carrying air service early in the 1920s was actually legitimate, the idea was far ahead of the technology, financing, facilities and public acceptance required to make it a reality.
4. E.M. Laird letter to the author. Contrary to myth, Beech was not a flight instructor during the war. He did, however, earn the highest respect from his commanding officer for his diligent work overhauling and maintaining Curtiss OX-5 engines for Curtiss JN-4 primary trainers.
5. The only assemblies and equipment salvaged from the Limousine were the Liberty engine and its mount, wing center section panels, outer wing panels and the empennage.
6. After Beech and Stearman resigned, Moellendick placed Lloyd's brother, Waverly, in charge of engineering. The company soldiered on under a new name until the summer of 1927, when Jake stopped production to build a monoplane, "The Dallas Spirit," for the Oakland-to-Hawaii Dole race. The airplane and both occupants went down somewhere in the vast Pacific Ocean, never to be seen again. Moellendick and Laird's old company soon went bankrupt and entered receivership.

Ed Phillips, now retired and living in the South, has researched and written eight books on the unique and rich aviation history that belongs to Wichita, Kansas His writings have focused on the evolution of the airplanes, companies and people that have made Wichita the "Air Capital of the World" for more than 80 years.

By 1928, the new Travel Air factory on East Central Avenue was manufacturing the Type 2000 that replaced the original Model "A." Resplendent in the colors of Harvard University, this Type 2000 was sold to the school's flying club.
(EDWARD H. PHILLIPS COLLECTION)

Raisbeck Announces Special Pricing & Expanded Combo Options

Raisbeck Engineering released 2016 pricing for its product offerings for the entire line of King Air models. New and more deeply discounted combination packages are also being offered.

The company announced three important elements:

1) 2015 prices for individual systems have generally been extended through 2016.

2) Combination and EPIC Completion packages have been expanded and priced with greater discounts. They now include Raisbeck/Hartzell Swept Blade Propellers. A full EPIC Performance Package for the C90 series, including Swept-Blade Propellers, Dual Aft Body Strakes, and full FAA-approved AFMs is $107,809, a $13,750 savings. Similarly, the Crown Wing Lockers and Dual Aft Body Strakes for the King Air 250/200 family are offered in combination. Individually, the price would be $85,408; together they are $76,408, a $9,000 savings.

3) Operators who replace their original Raisbeck Turbofan Props with Raisbeck/Hartzell Swept Blade Propellers are treated to EPIC Completion discounts.

This pricing philosophy includes Raisbeck's newest offering, the King Air 350 four-bladed Aluminum Propeller with Swept Blade Technology, priced at $98,500 with no trade-in required. Deliveries of the propellers began in January.

Banyan to Hold NextGen Mandates & Aircraft Upgrade Event

Banyan Air Service based at Fort Lauderdale Executive Airport is hosting an event that will prepare, educate and save you money on your ADS-B, FANS-1A, EFIS and/or IFE upgrades.

The event will be held on Thursday, Feb. 18, 2016, at Banyan (FXE) in hangar 62. Attendees can attend anytime from 10 a.m. to 4 p.m. and visit with the manufacturers. Banyan will provide a catered lunch by BurgerFi from 11 a.m. to 1 p.m. RSVP online at *banyanair.com/2020* to receive special discounts on parts and service and a 10 percent discount at Banyan Pilot Shop the day of the event.

Aircraft including Rockwell Collins' King Air 250 with Proline 21 and Proline Fusion upgrades will be participating. Universal Avionics will be there with their NextGen solutions. CMD Flight Solutions will offer their ADS-B STC solutions for all models of Lear, Citations and King Airs. Garmin will have the G1000 King Air

solution and a King Air 350 onsite. Gogo Aviation will have their IFE and connectivity solutions available.

Also participating with aircraft upgrades for King Air owners and operators will be Raisbeck Engineering showcasing their Swept Blade Turbofan Propeller for the King Air 200/B200/B200GT, BLR Aerospace Winglet Systems for the King Air B200, B200C, and B200GT, and Blackhawk Modifications with engine upgrade packages for King Airs.

TRU Simulation + Training Hits Milestones in Relation to King Air

TRU Simulation + Training has succeeded in hitting some milestones that will benefit King Air owners and operators.

In its recently opened East Coast Part 142 satellite pilot training center, ProFlight®, a subsidiary of TRU Simulation + Training, has received FAA qualification for its King Air 350i Level D Full Flight Simulator and pilot training programs. The pilot training programs for the new production Beechcraft turboprop provide initial type-rating and an introduction course on the Rockwell Collins Pro Line Fusion avionics package, as well as recurrent and FAR part 135 training. ProFlight instruction combines use of the King Air 350i full motion flight simulator and proprietary Level 6 flight training device for enhanced avionics training capability in a modern classroom setting that incorporates interactive animated courseware for all aircraft systems. ProFlight is the first pilot training center to offer instruction on the new Pro Line Fusion equipped King Air 350i aircraft.

The new TRU Simulation + Training Aviation Maintenance Academy opened its modern Part 147 training center in December of last year. The 35,000 square-foot, state-of-the-art facility combines traditional classroom and hands-on aircraft maintenance instruction in a climate-controlled environment – both inside the classroom and in the adjacent hangar space. The schoolhouse design, curriculum, high technology courseware, and part task trainers reflect TRU's extensive experience providing aviation maintenance training for the military, as well as feedback gained from civil aviation technicians working in the field today.

Currently, mechanical and avionics maintenance theory and practical courses are being offered for Beechcraft new production King Air 350i turboprops with the Collins Pro Line Fusion avionics package. The TRU Simulation + Training Aviation Maintenance Academy is the first to offer training on this new production aircraft. In early 2016, the Academy plans to offer additional courses that include mechanical and avionics theory and practical training for the Beechcraft King Air 250 and C90GTx turboprops.

King Air Technically...

RECENT SERVICE BULLETINS, ADVISORY DIRECTIVES AND SAFETY COMMUNICATIONS

From King Air Communiqué 2015-8

Issued: December 2015

ATA 04 – King Air Special Purpose Aircraft – Wing Life Evaluation

All

The King Air was designed and certified as an executive transport airplane. This means that the King Air was designed to carry passengers from point A to point B by taking off, ascending to a comfortable cruising altitude (generally above 20,000 feet), and descending after an hour or more of flight and landing at the destination.

The standard inspection program was developed to provide the level of inspection needed to ensure that the airplane operates in a safe and reliable manner throughout the life of the airplane.

Operators around the world have discovered that the King Air is an excellent platform for a number of missions outside the executive transport role. Operators have found that the King Air can be used in ambulance operations, maritime patrol, airway calibration, mosquito control, surveillance, mapping, search and rescue and lead airplanes for forest fire control, just to mention a few.

These missions, however, differ from the original intent for what the airplane was designed. The standard wing inspection program may not provide the adequate level of inspection to ensure a continued safe operation of the airplane. The King Air Structural Inspection and Repair Manual (SIRM) states the following. This is typical for the section covering the King Air 200 but it reads similar for the other models:

> *The inspection schedule (Chart 201) in Chapter 57-17-01 and 57-17-02 identifies the inspection areas, initial inspection periods, recurring inspection intervals and component replacement times. This schedule is based on airplane utilization, operation and maintenance in the category of service for which the airplane was originally designed; specifically, a pressurized executive or corporate transportation vehicle wherein the majority of cruise is above 10,000 feet altitude and flight duration is more than one hour. Should the aircraft be used for missions other than that intended by design, such as an air taxi, commuter air service, pipeline surveillance, livestock/predator animal control, search and rescue, navigation aids inspection, extraordinary service at low altitude or unusually short duration flights (less than 30 minutes), the inspections specified in the Standard Flight Profile Inspection Schedule (Chart 201) are not appropriate for continued airworthiness of the airplane structure. In such cases, promptly notify Beechcraft Technical Support and a special inspection program will*

be established to address the unique requirements of the airplane's mission.

The King Air SIRM is a FAA-approved manual, therefore this requirement is mandatory. Operators must contact Beechcraft via Technical Support to obtain an inspection program. The end result is a special inspection program specifically for the serial number of the airplane based on the mission profiles the airplane is flying. The inspection program is then listed in the Airworthiness Limitations Manual (ALM) for the airplane under the Special Purposes Section of the ALM. For operators who do not want their mission profiles to be known to the world, they can opt to having an Airworthiness Limitations Supplement or SIRM Supplement specifically for their serial number airplane.

Beechcraft Engineering requires the basic flight profile information to be able to perform the Wing Evaluation on your King Air. First, you need to collect as much information as available on the past, present and future flight profiles for each mission the airplane has or is going to fly and send it to Beechcraft Customer Service along with a list of the STCs or modifications the airplane has installed and the total times and cycles at time of installation. In the event the future usage is not established due to the aircraft just entering into the projected role, Beechcraft Engineering can recommend a time for which data collection can occur to establish a representative future usage.

The Flight Profile Definition Requirements (shown on the actual Communiqué) provide the details Engineering needs to perform the evaluation. You can also depict the flight profiles in a graph form (as also shown on actual Communiqué).

The process of developing a Wing Life Evaluation is extensive and requires several departments' involvement from structures, certification, publications, etc. The cost to develop the evaluation depends on the level of study needed which depends on the complexity of the flight profiles and can take up to nine months to complete due to interaction required with the regulatory authorities.

The final published results of the evaluation establishes reduced inspection intervals, but does not add any additional locations to those defined in the SIRM, and in some cases establishes new wing and component life limits, depending on the model King Air.

Once you have all the information required, you can contact King Air Technical Support. We will collect all the information and get you in contact with the Contracts Department. The contact information for King Air Technical Support is as follows:

Kingair_support@txtav.com
1-800-429-5372
316-676-3140

ATA 61 – King Air C90GTx Swept Blade Propellers

LJ-2121 and after

Beechcraft has made a model change to the King Air C90GTx starting at LJ-2121. These airplanes are equipped with Swept Blade Hartzell Propellers HC-D4N-3C/D9510SK. The propellers are installed on the assembly line under Raisbeck Engineering's Supplemental Type Certificate (STC) SA3593NM. The Instructions for Continued Airworthiness (ICA) for the STC are delivered with the airplane.

This is a reminder that these airplanes must be maintained in accordance with Raisbeck Engineering Maintenance Manual Document 85-120 and not the King Air 90 Maintenance Manual. This document is available for download from Raisbeck Engineering's website at *www.raisbeck.com*.

The above information is abbreviated for space purposes. For the entire communication, go to www.beechcraft.com.

King Air