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The ADS-B Mandate Are you and your King Air ready?

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A MAGAZINE FOR THE OWNER/PILOT OF KING AIR AIRCRAFT





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ON ADS-B

by Bill Thompson

extGen, the FAA's initiative to transform Air Traffic Control (ATC) from a ground-based radar tracking system to an aircraft-based, satellite positioned tracking system, has driven the FAA mandate that aircraft operating in airspace that now requires a Mode C transponder must be equipped with at least ADS-B Out by January 1, 2020.

ADS-B (Automatic Dependent Surveillance – Broadcast) is a satellite-based position and an aircraft-based transmission system that reports real time flight data automatically to ATC ground stations and local aircraft traffic equipped with ADS-B In receivers (see Figure 1 for a pictorial explanation on the next page).

What does this mean to you, the King Air owner/ operator?



It doesn't matter whether the cockpit of your King Air holds any variation of legacy (steam gauge) equipment or the latest in glass cockpit technology, everyone will need to be ADS-B mandate compliant.

Why the change?

What's wrong with the current airspace control system? The current system relies on ground-based radar technology originally designed in the early days of World War II. Yes, there have been advances in technology and upgrades along the way but, even so, this solution doesn't have the capability to handle the projected increase in air traffic capacity or the required safety requirements associated with the demand.

This has been talked about enough over the past few years, that we all know the mandate is coming, and as stated by Bruce DeCleene of the FAA, "If you want reliable access to controlled airspace, you must equip for ADS-B."

You may be wondering – when to equip, how to get there, what to get, how much it will cost, and how long it will take. I hope to answer some of the unknowns you have in this article.

When should I schedule my upgrade?

Yesterday! The latest statistics from the FAA show that of the 160,000 estimated aircraft requiring ADS-B modifications, only approximately 28,000 have been accomplished. After doing the math, that means each month between now and the mandate deadline 4,000plus aircraft need to be retrofitted for ADS-B Out.

The longer you wait, the more expensive it will be and the longer the downtime will become. If you're an infrequent flyer and extended downtimes aren't an issue, maybe this will work for you. If you rely on your King Air for revenue generation, you better consider this sooner rather than later. The current lack of response from the aviation community, in general, to equip for ADS-B is getting ready to hit critical mass as manufacture supply and shop capacity are not going to be able to handle the workload as we fast approach December 31, 2019.

How to get there

In the general sense, an STC "paired" WAAS GPS receiver and transponder system is required. (LPV is a



function of the GPS and FMS and is not required, but budget dependent is a nice upgrade). As a legacy flight deck King Air owner of any model, options from the least expensive transponder swap-out to the high-end cockpit upgrade are all available options.

With almost 9,000 King Airs flying in any number of different avionics configurations and your specific piloting requirements, your shop is the best support mechanism in figuring out what options fit best. Whether sticking with your beloved OEM equipment for upgrades or opting for more advanced features, third-party solutions as replacements, the choices are abundant.

Typical OEM solutions provide ADS-B Out compliantonly upgrades. The costs associated are based on the dash number and mod status of your existing equipment. This can be as simple as a minimal cost service bulletin upgrade or as costly as full equipment replacements. From a Rockwell Collins standpoint, the simple rule of thumb is if you have any variation of TDR below a TDR -94 -007, these units will be required to be replaced with new TDR -94 -501s. It doesn't matter if you have straight TDR -94s or TDR -94Ds (TCAS-II) applications, both apply.

The same holds true for the GPS. A WAAS GPS receiver is the backbone of the ADS-B as the position source information. While there are various options, I will talk about two here that are incorporated in OEM applications. Upgrading to the GPS-4000S from Rockwell Collins is an easy solution as a "slide in" replacement to

Figure 1: WAAS GPS satellite position information is processed by all aircraft. The onboard avionics compile a host of information, including the GPS position, and transmit it airplane-to-airplane and airplane-to-ground.

The second segment of this process (inset) occurs once the ground station receives the information, processes the data and rebroadcasts throughout the local coverage area. TIS-B (Traffic Information Service-Broadcast) and ADS-R (Automatic Dependent Surveillance-Rebroadcast) work together to transmit a comprehensive traffic awareness for aircraft in the terminal area.

the existing GPS-4000(). With minimal wiring between the transponders and GPS receivers this is one of the simplest options available. This upgrade doesn't require additional pressure vessel penetrations for new antennae, and therefore no additional engineering costs.

Installing a stand-alone WAAS GPS receiver such as Free Flight's 1203C to provide the position source is another way to meet the mandate with little to no effect on the OEM flight deck. If you find yourself in a place that upgrading the transponder is nothing more than a service bulletin but a GPS source is the issue, moving to a stand-alone GPS may be the way to go. Remember, these options are ADS-B Out only.

Other third party ADS-B options include Garmin's WAAS GPS systems (legacy GNSs or the new GTNs) and ADS-B transponders. These options offer feature rich ADS-B In applications that are available to both panel mounted displays and personal electronic devices (PEDs), such as the iPad[™] and Android tablets.

Most solutions are straight forward and easily understood. When the cost of upgrading your existing equipment to be compliant climbs into the mid-to-high five figures, or even into the low six figures, it's time to evaluate options. Maybe a flight deck upgrade to Garmin glass or a full radio suite upgrade is a better solution for you. Talk to your shop and look into your options, because the added features provide free FIS-B weather and TIS-B traffic to compliment your existing avionics and may be a better, more economical solution.

What you get

Meeting the mandate will get you ADS-B Out only. You will not see any changes in the flight deck or pilot operations. If you want features that are not available on your OEM avionics suite even after this modification, this is the point where considering alternate solutions outside the typical OEM equipment can provide you with increased capabilities in the way of adding free ADS-B weather, traffic and a host of other features such as wireless flight plan uploading and WAAS/LPV operations. This may be just what you're looking for.

I can't emphasize enough how important a role your avionics shop should play in determining the best value-added solution appropriate for you. Having a knowledgeable shop that understands the options available based on your given budgetary requirements will be the biggest factor in determining the best options for you to choose from.

How much will it cost?

Cheaper is NOT always better and when getting quotes to upgrade your aircraft, whether for mandate compliance or anything else, always compare apples-toapples. If there's a large discrepancy in pricing between quotes that usually indicates something other than a great deal. Ask questions to get more information. Quotes should not vary by more than around five percent of total cost. It does no service to ask for competing quotes between shops if we're not all on the same page.

Once you have a few quotes that meet your requirements, the options are very similar and the pricing between them are in alignment, it's time to determine which shop you believe is the best fit for you. Factors such as who has the experience, the support capability and the reputation for providing a solid customer experience throughout the process and beyond, are the items that should be a top priority in your consideration.

Something to consider is Flight ID. Applicable to the TDR-94 applications, an important consideration is the capability to change the flight (FLT) ID by the flight crew. As a cost savings on the more complex avionics suites, CMD Flight Solution's ADS-B STC amendment eliminates the need for controller and interface computer upgrades by removing the ability for the flight crew to change FLT ID. If this is not an important requirement for you, consider using CMD's AFID (aircraft FLT ID) adapter for



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Comfort. Function. (660) 885-8317 / www.AvFab.com cost savings instead of modifying the complete avionics suite for dynamic FLT ID changes.

For specific examples, see the sidebar for several options that have been vetted to provide a good rough order of magnitude (ROM) estimate to budget your upgrade.

How long will it take?

Based on the solution you select, parts availability and the associated ADS-B option, upgrades can be done in as little as one-to-two days or a few weeks. The disclaimer here is the same that I stated before – the longer you wait, the longer your downtime and higher the costs will be, because the demand will be higher and the supply lower.

In Conclusion

Because ADS-B is a mandate affecting all aircraft operators, an interesting side effect is it's made you all smarter avionics shoppers. Use that knowledge to help your avionics shop provide the best solution for you. If you still don't feel you know enough about this subject, don't be afraid to ask questions. It's vital you and your shop are on the same page or you very well may end up dissatisfied with the outcome. If your shop has supported your aircraft for some time, you should be able to call them and get rough baseline numbers. Knowing your equipment list and the current part numbers is not only helpful in the quoting process, but can make the difference when your aircraft gets to the shop and having additional charges added.

Finally, it's time to mention the added security. As it stands, installations being completed are coming out with about a 20 percent failure rate. Although all shops

Common ADS-B Options for King Airs

Garmin GTN/GTX King Air Package:

Meet the mandate with the power and price point of Garmin.

Upgrade the following:

- Upgrade GNS-430W to GTN-625
- Install GTX-345 ADS-B In/Out Transponder
- Install GTX-335 ADS-B Out Transponder
- Install Flight Stream 510

What do you get?

Upgrade from the existing GNS to a GTN touchscreen to meet all the existing requirements of the removed GNS and on-screen control of the transponders.

Installing the GTX-345 provides ADS-B In/Out with the backup GTX-335 for ADS-B Out.

The Flight Stream 510 opens the ability for wireless cockpit connectivity for flight planning, weather, traffic and a backup attitude indicator.

doing ADS-B installations are required to have the proper equipment and tooling to complete ADS-B compliance ground checks, some don't. Installations aren't always done correctly or the configuration data isn't loaded accurately during post-install configuration. I highly recommend for your own piece of mind to either ask your shop for a copy of the FAA's ADS-B Performance Report for your airplane after it's been returned to service or you can get it yourself. By receiving the ADS-B Performance Report, you'll have a report from the organization that matters, the FAA. This information will grade your installation and if there are any problems, they will be identified. If you choose not to go this route, you can always assume that your shop did the job correctly and hope to not get that letter from the FAA informing you otherwise.

Better to be safe, in my opinion. Here is the link to FAA's ADS-B Performance Report: *https://adsbperformance.faa.gov/PAPRRequest.aspx*

Bill Thompson has been in the avionics industry for 20 years and has considerable experience in general and corporate aviation working in both the OEM and MRO environments. As an A&P of 22 years, and holding inspection authorization for more than 13, Bill specializes in avionics system integration utilizing the latest technology with a focus on maintaining the vitality of older aircraft. Starting out in the piston world, Bill worked for Sarasota Avionics before moving on to Hawker Beechcraft to work with corporate aircraft. Now with TECHNICAir, and numerous Garmin G1000 and Rockwell Collins Pro Line Fusion installations under his belt, Bill has considerable knowledge regarding the avionics legacy of almost all the King Air platforms.



How long will it take?

The install upgrade from existing equipment to a solid baseline Garmin solution takes five working days based on work scope and Garmin's part lead time.



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How much will it cost?

The actual cost for your aircraft will depend on the exact part numbers and mod status of existing equipment installed in your aircraft. Typical installations range between \$10,418 to \$28,145.

Garmin G1000 to G1000nxi Upgrade:

Garmin has listened to what King Air G1000 operators have asked for and have delivered.

Upgrade the following:

- Replace existing pilot and co-pilot PFDs with new GDU-1050s
- Replace existing MFD with a new GDU-1550
- Replace existing display Controller with a new GDU-477
- New software load



What do you get?

Upgrading the G1000 gets you performance-plus! Garmin will provide you with features such as ADS-B In/Out with FIS-B weather and TIS-B traffic, wireless cockpit connectivity, enhanced situational awareness with SurfaceWatch, visual approaches, active radar map overlay on all screens and a host of other advancements.

How long will it take?

The upgrade from G1000 to G1000nxi can be done in as little as two days. Drop it off day one, pick it up by lunch on day two.

How much will it cost?

The typical cost for this upgraded install is between \$46,845 - \$50,410.

If your G1000 has been done in the past two years, take advantage of Garmin's rebate program. Ask your shop for more details.

Garmin G1000nxi Installation:

Upgrade to the new G1000nxi, an avionics revolution for your cockpit.

Upgrade the following:

- From nose-to-tail and wingtip-to-wingtip this is a full avionics suite transformation.
- Whole new glass cockpit. LPV capable WAAS/GPSs, digital AHRS/ADC, digital radar, digital autopilot and more.



The new Garmin G1000Nxi

What do you get?

Where the G1000 left off with its very capable avionics suite the G1000nxi has picked up. With the ADS-B In/ Out, take advantage of FIS-B weather and TIS-B traffic, wireless cockpit connectivity, enhanced situational awareness with SurfaceWatch, visual approaches, active radar map overlay on all screens and a host of other advancements.

How long will it take?

The upgrade to G1000nxi can be done in 15 days. It will be worth the wait!

How much will it cost?

The actual cost for your aircraft will depend on the options selected and trade-in value of existing equipment installed in your aircraft. Typical installations range between \$341,750 - \$389,995.

Rockwell Collins Pro Line 21 Airspace Modernization

With Pro Line 21, the foundation has been set. Rockwell Collins' block point upgrade with Airspace Modernization provides mandate compliance and more.



Upgrade the following:

- Upgrade all three AFDs to -3010E
- Install new Synthetic Vision Computer
- Upgrade DBU to -5010E

- Upgrade TDR-94Ds to -501
- Upgrade GPS-4000() to -010
- Upgrade IFIS to latest status (required)

What do you get?

This fully integrated install will be certified using Rockwell Collins STC SA11133SC.

The modifications include ADS-B mandate compliance, add WAAS/LPV flight performance, and synthetic vision technology.

How long will it take?

The upgrade from Pro Line 21 to Pro Line 21 Airspace Modernization takes 15-18 working days based on work scope and Rockwell Collins' parts exchange and upgrade lead time.

How much will it cost?

The actual cost for your aircraft will depend on the exact part numbers and mod status of existing equipment installed in your aircraft. Typical installations range between \$102,717 - \$236,145.

NOTE: The above explanations are general options, if your panel has had separate avionics enhancements added, it will be different.



A lineup of the King Airs, that were flown to the first King Air Gathering (KAG), on the ramp at KNHD. PHOTO CREDIT: MIKE SCHROEDER

so that the group would be small enough to benefit from all that was being offered. It wasn't long after the word got out, that those 50 openings were filled!

The King Air Academy, who spearheaded the event, also got support from many King Air product and service providers as sponsors, exhibitors and speakers. The event was jam-packed with informative presentations and panel discussions where attendees were able to ask questions and even follow-up with speakers during breaks and lunch, as well as visiting the many exhibits. Presentation topics included avionics and ADS-B, inspection strategies, the PT6 engine, maintenance, modifications, troubleshooting and much more.

During the afternoon of the second day, *King Air* magazine maintenance contributor Dean Benedict even put a King Air on jacks and provided pointers on maintenance issues to look for, as well as showing the motion of the landing gear and how the emergency extension of the gear works.

King Air Gathering Deemed a Success!

Initial

by Kim Blonigen

ing Air magazine contributor Tom Clements announced the first King Air Gathering (KAG) in the January 2017 issue of this magazine, as well as the King Air Academy sending out informational flyers to King Air owners and operators. The attendee list had been limited to 50 King Air owners/operators,

 Image: Contract of the panel discussions at the gathering.



Attendees of the King Air Gathering, taking in useful information from one of the speakers.

King Air owners/operators of various models came to this first gathering and gave very positive reviews. So much so, that a second KAG is being planned for the fall of this year, September 29-30 at Dayton, Ohio. Many of the suggestions from those who attended the first gathering are being implemented to make the second one even better.

Watch for more information to be released, as it becomes available, in this magazine and by going to kingairsociety.com. KA

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Pre-Flight Procedures from a Maintenance Perspective

by Dean Benedict

or many years, I maintained a B200 owned by a family business that had used the same pilot for ages. He was ex-airline and a decent stick, but every time he picked up the King Air after maintenance, he pulled the door shut, started the engines, and took off – he didn't even check the oil!

This boggled my mind. I've seen a lot of pre-flight routines, but this was no pre-flight at all. Some of my guys thought I should take it as a compliment that the pilot had so much faith in the work we were putting out, but I'd rather have my work questioned and verified by a thorough pre-flight. Needless to say, when this King Air went out the hangar, everyone in the shop gave it an extra walk-around before "Speedy Gonzalez" came to pick it up.

Make a Mid-Maintenance Visit

Most shops don't allow customers in the hangar because of insurance reasons, but if you have never seen your King Air in the middle of a phase inspection, you need to. Have the shop foreman give you a tour, just don't be surprised by what you see, even if it looks like total mayhem. Panels are open everywhere, the engine cowls are off, and wing lockers, if you have them, are removed. Much of the interior is sitting on the hangar floor and the floorboards are pulled up to expose the guts (electrical, plumbing and ducting). There might be a control surface off – most likely a flap, so the Teflon washers can be accessed for replacement.

Airplanes are 15 pounds of stuff crammed into an oddly-shaped five-pound bag, and getting to that stuff is time-consuming and non-ergonomic. The skinniest mechanic gets stuffed into the hellhole where they might have to remove ducting and avionics boxes just to do the 12-month check on your ELT. He or she then moves on to a dozen other tasks to be performed in there.

So, when you perform your post-maintenance preflight, you obviously aren't going to re-inspect the airplane, but think about what you observed. You're not doubting your shop; rather, you're confirming their execution of an extremely complex job. And if you find something amiss, good shops will rush to remedy the



Many things get taken off and inspected during a King Air phase inspection, so it's always wise to perform a postmaintenance pre-flight.

situation. That missed item will become a learning session for all involved, not to be repeated.

Cockpit Out of Order

After maintenance, it is vital that you allow ample time to restore your "switchology" to your liking. Check everything, and assume nothing. You have no idea how many mechanics and avionics guys have been in and out of your cockpit. Switches were flipped, breakers were pulled, levers were moved. The friction locks were loosened to check engine cables for binding. Every pilot has their preferred "switchology." When I had my shop, I made every effort to return the cockpit to the configuration present at drop off. With repeat customers, I learned their habits and preferences. However, in my post-maintenance debrief, I always asked every pilot, every time, to check and restore all cockpit preferences.

The oxygen mike switch is a great example – when is the last time you touched that? Most likely it was in a simulator during loss of pressurization. But what if, during maintenance, an inexperienced mechanic puts all the switches in the "off" (down) position because it seemed like the right thing to do? He has no clue he just turned the O^2 mike on, cutting out the regular mike in the process. Now the pilot arrives to take delivery of the aircraft. He's in a rush to leave and has already taxied out before he realizes his mike is in-op. So, he taxis back in, shuts the engines down and barks at the shop because now he is delayed and frustrated. This can happen in reverse too. Some pilots choose to leave systems in the "on" position all the time so they don't have to remember to turn them on each time they fly. I've seen this with windshield heat, pitot heat, and the vent blower, among others. When the aircraft goes in the shop and external power is applied, these systems come on. An unsuspecting mechanic touches the pitot tube and gets his fingerprints burned off.

The pre-flight procedure on a King Air, as specified in your POH, is a long and involved routine. Many are compelled to develop shortcuts. But if they are the only one that flies that airplane, and if they assume the cockpit is the way they left it last, then they are bound to encounter unwelcome surprises when they get their aircraft out of maintenance – unless they check everything carefully.

Distractions

Back in my days at BeechWest in Van Nuys, California, there was a very sharp owner-operator with a King Air 200. This guy was totally by the book. One day he was preflighting out on the ramp. He had an aft cowl open when line service paged him for a phone call. He left what he was doing, went inside to take the call, then came back out and continued his pre-flight. On takeoff, that rear cowl ripped off as soon as he rotated. That's when he realized he had forgotten to latch the cowl properly before taking that call, and after that call he failed to backtrack over what he had been doing when he was paged.

A few years ago, an owneroperator was pre-flighting his E90 when the fuel truck operator came by to clarify his fuel request. He was on a step ladder checking his oil at the time, so he got down to talk to the fuel truck operator then finished his pre-flight. He loaded his



passengers and took off for a weekend retreat only to lose oil pressure on one side a short while later. After some very tense moments, he got on the ground safely and found the oil dipstick on that side exactly where he laid it when the fuel truck came by. That shocked him. He was absolutely certain he had replaced that dipstick.

My late father-in-law was the epitome of a thorough and deliberate pre-flighter. My wife remembers many hours of cooling her heels in an FBO while her dad did his pre-flight routine. He kept laminated checklists handy and read each item out loud as he performed the task. When she was old enough, he had her read the item out loud and he repeated it back to her as he checked it. But despite his best efforts, after 50 years of flying, he left an oil cap latch open and lost oil pressure right after takeoff. Fortunately, he circled back around and landed safely, but he was embarrassed beyond imagination. Chances are, he was distracted when he was checking the oil on that side – I'll bet his cell went off.

Cell Phones – A Distraction on Steroids

Although cell phones have revolutionized our lives in many ways, these devilish devices have their downside. Distracted driving is just the tip of the iceberg. In the workplace – aircraft maintenance hangars in particular – cell phones are a menace to safety. One item on a phase checklist can require many small tasks in succession.



When a cell phone goes off, it grabs attention away from the job at hand. Cell phones destroy focus. The problem worsened when text messaging became common. A short conversation becomes five or six "dings" and each one is an interruption.

In my shop, I had a zero-tolerance policy on cell phone usage that required mechanics to keep their phones turned off and stowed in their toolbox, not in their pocket on "vibrate." I fired two perfectly good A&Ps for violation of this policy. In one case, we were changing the engine mounts on a B200 before installing new engines. The metal portion of the mount assembly attaches to the engine case with four bolts. Two rubber blocks (isolators) sandwich around the mount. A large bolt runs through the center of this "isolator sandwich" to the engine truss.

There is a sequence of tasks to installing these. The four bolts going to the engine case must be safetied before the isolators go on. Otherwise it is next to impossible to safety them later. On a 200, with four engine mounts per side, there are 16 bolts to safety per engine. The mechanic assigned to the left engine was a great wrench when she followed my directions. But on this day, she was going back and forth to her toolbox way more than necessary. When I checked her progress, I found all the rubber blocks in place but the bolts weren't safetied. I asked, "Aren't you going to safety-wire these?" She replied, "Well, I got distracted." I then heard the soft "ding" of her phone, in her pocket. She went back to her toolbox where she surreptitiously texted while appearing to search for her safety-wire pliers.

Aircraft maintenance is complicated enough without cell phone distractions. Many times I woke up in the middle of the night, unable to remember if I safetied everything properly. I got out of bed, got dressed and drove to the airport at 2:00 in the morning to doublecheck myself and put my mind at rest.

I know of larger shops where the managers use text messaging to communicate with mechanics in the hangar. I vehemently disagree with this practice. First, the mechanics don't need more distractions and second, the use of cell phones on the job should be discouraged, not encouraged. Thirdly, the desk drivers might benefit from some firsthand hangar observation to keep their finger on the pulse of things.

In my opinion, you don't need your own phone going off during your pre-flight routine, any more than you need cell phones distracting mechanics while they work on your aircraft. You could just as easily be sidetracked like the pilots mentioned above. It could be the line guy, the fuel guy, or an impatient passenger. Why add to the chaos? Your phone can be turned off.

On a side note: I was honored to participate in the first King Air Gathering (KAG) this past April. One of the highlights was having a King Air on jacks in an adjacent hangar so I could give a live demonstration. We did a gear swing and covered some of the points to check when you get your aircraft out of maintenance. This proved to be quite popular. There is nothing quite like a King Air mechanical gear in action! The whole event was very well received and I am looking forward with great enthusiasm to the next KAG. I hope arrangements can be made for a similar demonstration. I get a kick out of meeting King Air owners and pilots and helping them get the most out of their aircraft.

Dean Benedict is a certified A&P, Al with over 40 years of maintaining King Airs. He's the founder and former owner of Honest Air Inc., a maintenance shop that specialized in Beech aircraft with an emphasis on King Airs. In his new venture, BeechMedic LLC, Dean consults with King Air owners and operators on maintenance management and supervision, troubleshooting, prebuys, etc. He can be reached at *dr.dean@beechmedic.com* or (702) 773-1800.

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Ask the Expert



by Tom Clements

alk down a ramp where numerous King Airs are parked and look closely at their propeller blades. I wager that you will see quite a variety of conditions. Some will look almost new, whereas others will be badly sandblasted. It may be that the reason for the difference is reasonable and unavoidable. Namely, one airplane operates only on long, paved, well-maintained runways, and the other aircraft spends much of its life operating from a short, dirt strip on the owner's ranch. But it also may be that the one with the sad-looking props, even though it spends much of its time on good runways, is also suffering from one of two things, or a combination of both: Poor pilot technique and/or power levers that are poorly adjusted in the Beta and Reverse ranges. The goal of this article is to review proper operating techniques with you, as well as, providing a procedure for knowing if your Beta/Reverse rigging is as it should be.

Let's start with the rigging discussion and first review the three-blade model 200 graph below.



This particular graph presents numbers applicable to a three-blade model 200, and except for the numbers, it applies to all PT6-powered King Airs. The later models have the Ground Fine stop between Beta and Reverse and do not have the red stripes. The (+) and (-) symbols represent the areas where positive or negative thrust occurs, statically on the ramp.

As the graph shows, the position of the power lever controls two different things: Compressor Speed (N1 or Ng) and the position of the propeller's Low Pitch Stop (LPS). (This stops also goes by the name of "Flight Idle Stop" in some references, including portions of the Maintenance Manuals. I have always believed that "Low Pitch Stop" is a more obvious term that better describes exactly what is being repositioned.)

Notice the flat portion of the upper line, the Beta area. This flat portion, in which N1 should not change, is appropriately known as the "Dead Band" since movement of the power lever within this range causes no response – dead reaction – from the Fuel Control Unit (FCU). By definition, the Beta Range is where the propeller's LPS is being repositioned to flatter blade angles while N1 is not changing.

Behind Beta is the Reverse Range. By definition, not only is the LPS continuing to be repositioned to lesser blade angles – it is, in fact, going to negative angles, meaning that the propeller is pushing air forward instead of aft – but also N1 is proportionally increasing, getting greater the more aft the power lever is moved. Typically, Maximum Reverse, all the way aft, should yield an N1 speed of about 85 percent. Remember that the relative speed of the compressor is not the same as the engine's relative power output. In other words, 85 percent N1 does not yield 85 percent power. On the contrary, 85 percent N1 is probably a bit less than 50 percent power! That King Air on the ramp with the badly sandblasted props? I'll bet its dead band is too small, too narrow. The engines are increasing N1 speed before the propeller blades reach flat pitch.



This not uncommon problem means that the airplane is difficult to slow down while taxiing. Before the blades can reach flat pitch, when the propeller is then acting as a large disk giving neither positive nor negative thrust, power is already being added. In other words, an N1 increase is being encountered before we have reached the bottom of the Beta range. When power is added while the blades are still providing a positive bite of air, we start to go faster, not slower!

What many misguided pilots do in this situation is to pull the power levers back more until finally the taxi speed slows down. What has taken place is that at last the residual thrust has been eliminated by forcing the LPS to flat or even negative pitch but at the expense of a higher-than-needed and higher-than-desired propeller speed (Np), since the increased N1 is creating more exhaust gases that are driving the propeller with more power. This higher prop speed, usually associated with a slightly negative blade angle, causes lots of blade erosion.

I have received this question many times during my King Air training events: "Why don't we get similar blade erosion when the blade angle is at, say $+10^{\circ}$, then when it is at -10° ? Even with High Idle selected, we can

taxi all day with the power levers at Idle and not erode the props, yet we chew up the blades at -10° and 70 percent N1. This doesn't seem to make sense."

The reason why a blade angle of -10° leads to more erosion than an angle of $+10^{\circ}$: Realize that there is a pronounced twist in each propeller blade, such that the inboard areas are taking a significantly larger bite than the outboard areas. So, when $+10^{\circ}$ is happening at the 30-inch station – the normal location out from the hub where angles are

measured – the blade tip near the ground may be almost flat. That flat tip creates very little airflow disturbance so the sand and grit and gravel and dirt on the surface are disturbed little. But when the angle is -10° at the 30-inch station, the tip may be at -20° creating a great little sucking vortex that vacuums the debris off the ground with unfortunate efficiency!

Vice versa, suppose the dead band is too large, like the graph below.



Now it is easy to kill residual thrust without an increase in N1 speed (and I surely like that!), but it is now common to find that propeller speed decreases so much before N1 increases, that Reverse is sluggish and often asymmetric. Also, especially on the Honeywell (née Bendix) FCUs, Maximum Reverse is usually not near the proper 85 percent value. Starting to rotate the FCU's speed setting shaft too late may not allow it to rotate far enough for the proper amount of Reverse power.

My preference would definitely be to have a bit too much dead band than not enough. So long as Maximum Reverse delivers reasonable stopping power, the wider dead band ensures being able to kill residual thrust for taxi.

By the way, how many readers are pulling the propeller levers all the way back into Feather while taxiing? With some situational awareness, this is a great technique! Not only can we achieve a propeller feathering check, but also with the blades slapping the



air "sideways" as they rotate we have zero taxi thrust. Plus, it is quiet!

So, what is this "situational awareness" I mentioned? First, although the propellers feather quite rapidly – just a few seconds – they take as much as 30 seconds to unfeather. So, if you will need positive taxi thrust to make it up that hill ahead or to maneuver with some tight turns on the ramp, it is not the time to feather. Second, we must remember that it is only safe to feather when the power levers are at Idle, not back in Beta or Reverse. Third, if we roll to a stop and leave the props in feather, there is a chance that our hot exhaust gases will not be blown safely away, but may negatively impact the nacelle and nose paint, oil temperature, as well as cause overheating of the nosemounted avionics boxes. Remember to push those prop levers forward when stopped.

This in-and-out of feathering while taxiing is especially useful is we have found that our dead band is too small – N1 is picking up too early – yet the mechanic has not yet had time to adjust it properly. It is easy to taxi without residual thrust, no matter how messed up our rigging is, by using the feathering technique.

Also, remember this useful "trick." When starting to taxi, if the airplane does not begin to roll when the brakes are released, try a quick in-and-out feathering instead of an application of power. Isn't that cool?!



The momentary bigger bite of air is just what was needed to make the plane begin to roll, yet with zero chance of blade erosion.

Another time that it is easy to erode the prop blades is during high-power run-ups. For example, the Overspeed Governor test requires a lot of power. Please make every effort to find and use a rather clean, paved area of the tarmac when conducting your checks.

Similarly, consider the condition of the runway as you initiate the takeoff roll. If it is unpaved or the pavement is in poor shape, now is the time to make a rolling takeoff with power application coming in proportionally as the airspeed increases. Of course, when the runway is of minimum length, we won't have the luxury of slow power application. But when there is excess runway, it is a technique that has merit.

How about landing? How do we avoid blade erosion now when we need and want to use Reverse? Easy answer: Go in quickly and deeply, then get out.

For a landing where aggressive Reverse will be used, it is common to run the propeller levers full forward well before touchdown so that we waste no time moving them after touchdown. All we have to do is lift and pull the power levers aft. Here is a time that aggressive, fast action is indeed called for and won't harm a thing. Remember when I stated that Maximum Reverse is less than 50 percent power? Hence, there is no way that torque, ITT, not N1, is of any concern to you, the pilot, when those power levers are buried all the way back. "Slam" is a word used rarely when talking about flight and engine controls but, truly, here is the time to slam those power levers into Maximum Reverse without delay. Also realize that the power levers move in an arc, not in a straight line. To position them at Max Reverse requires more of a downward push during the last bit of travel, than an aft pull.

There are three important reasons for obtaining Max Reverse immediately. First, the sooner we can establish full reverse thrust, the shorter our landing distance will be. Second, the drag that Reverse provides is dependent upon airspeed squared. That is, at 80 knots, the drag is four times as effective as at 40 knots. Third, we only want to utilize Reverse when we are moving forward fast enough to leave the sucked-up dirt and debris behind us.

It is maddeningly common for me to observe a pilot who uses very little Beta or Reverse after touchdown but then, when he sees the turnoff coming into view, he at last starts pulling Reverse thrust. No, no, no! Now, not only is Reverse not very effective due to the slow airspeed, but also blade erosion is almost guaranteed if the surface is less than perfect!

Sure, if you are quite familiar with the airport layout and know that the turnoff is far ahead, the use of Beta only after touchdown – and maybe not even much of that – is just fine. But when the turnoff is a bit "unknown," it is much better to be aggressive first, then play with the Beta range only when at 40 KIAS or below. Remember that the POH states that Reverse should not be used below 40 KIAS. I suggest that you begin slowly moving the power levers forward from the all-the-way back position when you see 60 KIAS, and make sure that they are at Ground Fine or at the bottom of Beta by the time you see 40. Don't make the common mistake of thinking you need to be over the Idle Gate by 40 KIAS. No, staying in Beta is the proper procedure, but just make sure you are out of Reverse, back into the dead band, Beta area.

To conclude, let's see how we can evaluate our Beta and Reverse rigging, from a pilot's standpoint. The first thing to do is to make sure that your Low Pitch Stop (LPS) begins its travel back into Beta at the proper blade angle. Since it is almost impossible to find a mechanic who will use a protractor on a blade while it is spinning, angle is verified not by an actual angle measurement, but rather by a "Flight Idle Torque" setting. A graph exists in Chapter 76 of the Maintenance Manual that shows what this torque should be, and at what RPM, for any given altitude and OAT. Realize that the value is not the same for most retrofit props, as it is for the standard propeller options. I'll make it easy for you. The chart below provides most of the values for different King Air models and different propellers, at Sea Level on a Standard (15°C) day:

MODEL	TEST SPEED	TORQUE VALUE
MODEL	(RPM)	(Percent)
All 3-Blade 90- & 100-Series	2,000	600 ± 40
C90B (4-Blade)	2,000	605 ± 40
C90GT	1,800	545 ± 40
4-Blade McCauley, 90-Series	2,000	580 ± 40
4-Blade Raisbeck 90- & 100-Series	1,800	505 ± 40
4-Blade Raisbeck (Magicam)	1,800	805 ± 40
F90 and F90-1, Standard Prop (GLPS)	1,800	360 ± 40
A100	2,000	440 ± 40
3-Blade Hartzell, 200-Series	1,800	800 ± 40
3-Blade McCauley, 200-Series	1,800	750 ± 40
4-Blade McCauley, 200-Series	1,800	660 ± 40
4-Blade Hartzell-Raytheon, B200	1,800	520 ± 40
4-Blade Hartzell-Raisbeck, 200-Series	1,800	635 ± 40
MODEL	TEST SPEED	TORQUE VALUE
	(RPM)	(Percent)
300 (FLPS)	1,500	42 ± 2%
350 (FLPS)	1,500	36 ± 2%

In a clean run-up area, aim into the wind, make sure the propeller levers are fully forward, then add power until you reach the specified propeller speed. Record both left and right torque values, as well as OAT and Pressure Altitude (29.92 in Hg), and pass them on to your maintenance folks. (If the wind is really howling that day, take both an upwind and downwind reading so that they may be averaged out.)

While still in the run-up area, select High Idle on the condition levers and bring the power levers to Idle. Next, move either power lever back over the Idle gate – even over the Ground Fine gate, if need be – while watching the propeller speed. As the blade flattens, giving less rotational resistance, the RPM should rise. As the blade angle goes negative, the extra rotational resistance will cause the RPM to fall. Experiment until you find exactly the flattest pitch position and make a mark on the power quadrant where the aft edge of the power lever shaft is now located. (Putting some masking tape next to the slot makes this task easier and less messy.)

Now do the same with the other power lever: Find where the RPM is the highest and mark it appropriately. Are both sides close together? I hope so, but the marks will tell the story to your mechanic. Next, while the power levers are still at the flat pitch position, retard the condition levers back to Low Idle. If both left and right N1 speeds do indeed fall



back to Low Idle, that's great! It confirms that your dead band is large enough to kill your residual taxi thrust without adding power.

However, if one or both N1 speeds hang up at something between Low and High Idle, then your dead band is too narrow and your props are candidates for sandblasting ... not good. I have even discovered rigging so out-ofspec that the N1 started to exceed High Idle before we found that flat pitch, peak RPM position. Yuck! This dead band is much too small!

We are not quite done yet. Presuming your N1 speeds did indeed drop to Low Idle when the condition levers were pulled back to the hooks – as they should – now take each power lever individually and pull it back further from your Flat Pitch mark until you see an N1 increase. We hope it happens almost immediately, before we move even 1/8 of an inch. If we need to move significantly more than that, then the dead band is so large that a big decrease in propeller speed will be seen, leading to sluggish reaction when Maximum Reverse is reached.

There is one last check to make and record: What is the stabilized N1, Np, and Torque in Max Reverse? Make sure the run-up surface is very, very clean before selecting full Reverse while stopped. Do this with one engine at a time, since there is a possibility of rocking back onto the ventral fin if both propellers are in Maximum

Reverse at the same time. If no such ultra clean runup pad exists, then record the values after you have selected Max Reverse while rolling down the runway soon after touchdown, before beginning to ease out of Max Reverse when 60 KIAS shows up. We hope the N1s come out near 85 percent and that Np is within 100 to 200 RPM of takeoff redline.

It takes an experienced and dedicated PT6 mechanic to make the proper rigging adjustments in a timely and accurate manner. If you have access to such an individual, I am happy for you. If you don't, then it will be a time-consuming and frustrating endeavor. The description of the work in the Maintenance Manual leaves much to be desired. Having access to an old-timer with lots of experience is invaluable!

Poor Beta and Reverse range rigging is common to find and, in truth, has little impact on safety. But when the rigging is correct, the pilot's job is easier and more enjoyable, and the propeller blades will fare much better!

King Air expert Tom Clements has been flying and instructing in King Airs for over 44 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*.









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The "Baby Beechcraft" Part Two

Beech Aircraft Corporation's Model 76 "Duchess" and the Model 77 "Skipper" were welcome additions to the company's product line, but the economic recession of 1981 clipped their wings

by Edward H. Phillips

During the three-day Beechcraft International Sales Roundup held in November 1975, two proposed aircraft were revealed to more than 800 Masters of Aircraft Salesmanship attending the event. The first to be unveiled was the PD 289, a preliminary design aimed at the four-place, lightweight twin-engine segment of the market, and PD 285, a single-engine, two-place airplane aimed at training fledgling student pilots how to fly.¹

Both Beechcrafts were intended to fill gaps in the company's entry-level product line that had been occupied since 1963 by the successful Model 23 *Musketeer/Sundowner* and Model 24 *Sierra* series airplanes. As with their older brethren, the new airplanes would augment the lineup of Beechcraft products at the company's popular Beech Aero Centers, but would also compete with the new Piper PA-44 *Seminole*, Cessna Model 303 and the Grumman American GA-7 *Cougar* – all aimed at the same lightweight, multi-engine trainer market as the Model 76.

The PD 289 would be powered by two Avco Lycoming, four-cylinder piston engines, each rated at 180 horsepower and fitted with counter-rotating propellers. An early proof-of-concept prototype had begun flight testing in September 1974 that continued into 1975, providing Beech engineers with a wealth of flight-test data about the design's aerodynamics, performance with one-engine inoperative, airframe and engine systems and overall flight characteristics. A year later at the 1976 sales extravaganza, company officials introduced the former PD 289 as the Model 76 *Duchess*. The name had been chosen after a contest involving hundreds of Beechcraft franchise employees. Of these, 25 had submitted the name "Duchess" and each person was awarded \$250 for their suggestions.²

The Duchess would be built at the company's facilities in Liberal, Kansas, alongside the Model C23 and C24 single-engine Beechcrafts. The first production Duchess flew on May 24, 1977, with veteran Beech engineering test pilot Vaughn Gregg at the controls. FAA certification was achieved on January 24, 1978, with approval for day and night VFR/IFR flight operations in the Normal Category. Beechcrafters rolled out the first Duchess for delivery in May 1978, and many of the initial production airplanes were flown to Beech Aero Centers to train aspiring multi-engine pilots.

The Model 76's aluminum alloy, semi-monocoque fuselage and full-cantilever wing used the same bonded honeycomb sandwich technology as the Model 23/24



The Beechcraft Model 76 Duchess was introduced in 1978 as a multi-engine trainer for Beech Aero Centers and as a competitor to the similar Piper Seminole and Grumman American Cougar. The Duchess was built from 1978-1982 at the Liberal, Kansas, factory. Maximum speed was 191 mph. (WICHITA STATE UNIVERSITY LIBRARIES, SPECIAL COLLECTIONS AND UNIVERSITY ARCHIVES)

series. The wing featured the NACA-developed 63_2A415 airfoil section with dihedral set at slightly more than six degrees, while the angle of incidence varied from three degrees at the wing root to zero degrees at the wingtip. Frise-type ailerons were installed along with single-slot trailing edge flaps that were electrically operated. Wingspan was 38 feet with a total area of 181 square feet, including ailerons, and wing loading was 21.5 pounds per square foot. The empennage featured a tall vertical stabilizer topped by a horizontal stabilizer with conventional elevator/rudder, each surface equipped with a trim tab.³

The main landing gear was a rugged, but practical, trailing beam design that retracted inward into wheel wells, while the nose gear retracted upward and forward into the lower nose section. All three gear were extended/ retracted using an electro-hydraulic system similar to that of the Model C24 *Sierra 200*. The main gear featured a generous track of 10 feet six inches that, in concert with the steerable nose gear, made the Duchess easy to maneuver on the ground. A separate hydraulic system was installed to supply fluid for disc brakes on the main gear.

Typical empty weight (varied depending on equipment options) was 2,446 pounds, increasing to a maximum takeoff weight of 3,900 pounds. The Duchess could takeoff (sea level/standard day) in 1,017 feet. Maximum ramp weight was 3,916 pounds with a zero fuel weight of 3,500 pounds. Standard fuel capacity was provided by a single tank in each wing for a total of 100 useable gallons. Useful load for a standard-equipped airplane was 1,470 pounds. The two Avco Lycoming air-cooled, O-360-A1G6D four-cylinder, opposed piston engines were each rated at 180 horsepower and were fitted with carburetors, not fuel injection, to reduce costs. The Hartzell twoblade, constant-speed propeller on the left engine rotated clockwise, while the right engine's propeller rotated counter-clockwise. That arrangement essentially eliminated the long-standing "critical engine" scenario and eased pilot workload with one engine inoperative.

In terms of performance, the Model 76 compared favorably with its single-engine senior, the six-place Beechcraft Model A36 *Bonansa*, and was inserted into the Beechcraft product line between the A36 and the Model 58 *Baron*. A sampling of approved airspeeds associated with flying the Duchess include:

- Vne (never exceed airspeed): 194 KIAS
- Maximum speed: 171 KIAS
- Maximum cruising speed, 6,000 feet altitude: 166 KIAS
- Stall speed, power at idle RPM, flaps fully extended: 60 KIAS

The Duchess had an excellent, two-engine rate of climb at sea level of 1,248 feet per minute, but decreased to only 235 feet per minute at maximum gross weight with one-engine inoperative. Service ceiling 19,650 feet with both engine operating, falling to 6,170 feet with one engine inoperative.

Beech Aircraft marketing and management officials considered offering a turbocharged version of the Duchess (unofficially designated the Model 76TC). One airplane was modified by installation of two Avco Lycoming TO-360 turbocharged engines that required modification of the cowlings to accept the turbocharger installation. First flight occurred on January 31, 1979, piloted by Vaughn Gregg who was accompanied by flight test engineer Bryan Mee. The Model 76TC made 43 flights and accumulated 34.4 hours in the air before the project was cancelled. The final flight occurred on July 10, 1979.⁴

Initial orders for Duchess were strong, with 72 aircraft built in the first year of production followed in 1979 by 213. Production continued at a slower pace during the next few years until 1982 when production was terminated because of tough market conditions. A total

Flying the Beechcraft Skipper

B eginning in 1979, the Beech Flying Club operated the *Skipper* alongside the Model C23 *Sundowner* for training student pilots. The Skipper's cabin was spacious compared to that of a Cessna 150/152 (which I had flown for years) and about equal to that of the Piper *Tomahawk*. Visibility outside from the cockpit was excellent, and the large doors made entry and exit easy. The instrument panel was well laid out, and the centrally-located power quadrant housed the throttle, mixture and carburetor heat controls.

The wide main landing gear track, coupled with the steerable nose gear, facilitated learning how to maneuver the airplane on the ground, and the brakes were more than adequate for the flight training task. Although the Model 77 had a maximum gross weight of only 1,650 pounds, I often wished the Avco Lycoming O-235 engine had another 35 horsepower, particularly on hot summer days in Kansas.

I usually flew one-hour training sorties with fuel tanks half full to help performance, but the airplane's rate of climb was always marginal with two people on board, often managing no more than 100-150 feet per minute (fortunately, that part of Kansas was flat!). Once airborne, however, the Skipper flew well. The student usually mastered shallow and steep turns quickly, followed by slow flight and introduction to stalls. For these maneuvers the Skipper was a superb flight training platform, but once again, I wished it had more horsepower. Climbs to higher altitudes were a slow process. That unfortunate characteristic became more evident when it came time to give the student optional spin recovery training. The usual scenario went like this: After a thorough ground school session discussing spin entry in the Skipper and the salient points of spin recovery, we donned backpack parachutes and took off, climbing to a minimum of 6,000 feet (8,000 was preferred, for safety's sake). After advising local ATC of our intention to conduct multiple spins in the practice area, I demonstrated how to make the Skipper spin:

- Power to idle.
- Maintain altitude.
- At the stall break, hold the control wheel full aft, wings level, being careful not to release back pressure.
- Apply full left rudder.
- When the airplane reluctantly rolled left, apply full right aileron to induce a cross-control stall.
- The Skipper would roll sharply into the incipient spin, but only if the flight controls were held in position.

The spin stabilized nicely after the second turn. Rotation was rapid, and I normally allowed up to five or six turns before initiating recovery. The next steps happened in fast succession to terminate the spin:

- Full opposite rudder to stop rotation.
- Apply brisk forward pressure to the control wheel to break the stall.
- When rotation stopped and the wings were flying again, maintain wings level and slowly apply back pressure to resume straight and level flight, being careful not to exceed airspeed limitations.

A majority of my students elected to take the spin training and benefitted from it, but I always emphasized that flying the airplane properly was the best way to avoid a stall/spin incident. of 437 Model 76 were built, and as of 2016, many are still flying with private owners and flight schools both in the United States and internationally. Prices vary from about \$65,000 for a well-equipped airplane to as much as \$150,000 for an exceptional example that has been meticulously maintained and has accumulated only 5,000-8,000 hours total time on the airframe.

The company's other new airplane, the two-place Model 77 *Skipper*, began life in 1974 as the PD 285 and was intended primarily as an entry-level trainer to be operated by Beech Aero Centers. Originally, the PD 285 was to be powered by a Teledyne Continental four-cylinder, air-cooled, opposed piston engine rated at 100 horsepower, and the engineering proof-of-concept airplane first flew from Beech Field on February 6, 1975, with a conventional empennage design.

As flight testing progressed, however, the flight test airframe was rebuilt with a T-tail empennage, and the Continental powerplant was replaced by an Avco Lycoming, four-cylinder O-235-L2C engine rated at 115 horsepower. The chief reasons for the T-tail stemmed from engineering's desire that the airplane to possess good pitch control at low airspeeds, as well as excellent recovery from intentional spins. The latter was important because the Skipper was approved for intentional spins (up to six turns) and, in the author's opinion, was an excellent airplane with which to introduce pilots to intentional spins, and more importantly, how to recover safely (see page 25).

First flight of a pre-production airplane occurred on September 12, 1978, under the control of Vaughn Gregg. The FAA certified the Model 77 in April 1979 and plans called for initial deliveries to begin from the factory in Liberal, Kansas, in May. Beech Aircraft officials had this to say about the new Skipper: "A totally new aircraft combining the best fruits of NASA research and Beechcraft's long experience, the Model 77 incorporates the T-tail first used so successfully on the Beechcraft Super King Air, and a new GAW-1 wing section originated by NASA following their high-speed, supercritical airfoil studies [the wing was particularly designed for low-speed flight and was well suited to a primary trainer such as the Skipper]. The airplane's spacious, two-place cabin affords a full 360-degrees of visibility ... and left and right cabin doors [provide] convenient access."5 Soon after the announcement that the Model 77 would enter production, orders came in from Beech Aero Centers worldwide for a few hundred of the new Beechcraft. The Skipper began equipping Beech Aero Centers in 1979 when 47 airplanes were manufactured.

General specifications for the Model 77 include:

- Full-cantilever wing using the GAW-1 airfoil featuring a dihedral of six degrees at the root; wingspan 30 feet, total area 129.8 square feet.
- Wet-wing cells held a total of 29 gallons of useable fuel.
- Tubular spar fabricated from aluminum alloy sheet combined with fiberglass-based adhesive to ensure bonding along all stations of the wing.
- Ribs bonded to aluminum ally ribs.

- Ailerons stiffened by heavy beading across the span.
- Electrically-operated flaps, also heavily beaded for stiffness.
- All primary flight controls and flaps were actuated by torque tubes instead of cables under tension.
- Lower fuselage structure was bonded together, then built up using aluminum alloy, semi-monocoque construction.
- The cantilever T-tail empennage featured a horizontal stabilizer with trim tabs on each elevator panel and the rudder.



The two-place Model 77 Skipper became Beech Aircraft's basic trainer in 1979. Approved for up to six-turn spins, the Skipper was powered by a Lycoming engine rated at 115 horsepower. Only 312 airplanes had been built when production ended in 1981. (WICHITA STATE UNIVERSITY LIBRARIES, SPECIAL COLLECTIONS AND UNIVERSITY ARCHIVES)

The fixed main landing gear was set at a track of 8 feet 3.5 inches and used tubular springs for shock absorption, while the steerable, self-centering nose gear incorporated an air-oil shock absorber and shimmy damper. Toe-operated brakes were standard equipment. The Model 77 was a relatively small airplane – total length from propeller spinner to tail was 24 feet 1.5 inches, height 6 feet 11 inches, and the T-tail spanned 9 feet 10 inches. The Avco Lycoming O-235 engine was a good choice for the trainer and had already earned an excellent reputation for reliability and low operating costs, despite some problems with spark plug fouling caused by 100LL avgas that had come into use by the late 1970s. A Sensenich fixed-pitch, aluminum alloy propeller was standard equipment.

Performance was nominal for a primary trainer. Maximum speed (sea level) was 106 knots and cruising speed was only 105 knots at a power setting of 80 percent. With flaps fully extended, the Model 77 stalled at 47 CAS (calibrated airspeed). Maximum rate of climb was 720 feet per minute and service ceiling was 12,900 feet. Loaded with full fuel (29 gallons useable) and flying at an altitude of 4,500 feet at maximum cruising speed, the Skipper had a range of 327 nautical miles (nm), increasing to 413 nm at 51 percent power setting.⁶

By 1981, demand for the Model 77 began slipping away as the nation prepared to weather an economic recession that would eventually lead to a severe downturn for the general aviation industry. Production continued at the Liberal factory through 1980 at a rate of about 10 airplanes

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per month when 140 Skippers were manufactured. That number declined to 125 in 1981 when Beech Aircraft Management terminated production after 312 of the trainers had been built.⁷

As of early 2016, a large number of Skippers remain active with flight schools, but many have been purchased by private owners who fly them for fun and on short air tours in the United States, England and Western Europe. Prices average between \$15,000-\$25,000, depending on total time on the airframe, engine and equipment.

- 1. McDaniel, William H.; *"The History of Beech"*; McCormick-Armstrong Co., Incorporated, Wichita, Kansas; 1982.
- 2. Ibid
- Taylor, John W.R.; "Jane's All The World's Aircraft;" Jane's Publishing Company Limited, London, England; 1981.
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- McDaniel, William H.: "The History of Beech;" McCormick-Armstrong Co., Incorporated, Wichita, Kansas; 1982.
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- Phillips, Edward H.; "Beechcraft Pursuit of Perfection:" Flying Books, Publishers and Wholesalers, Eagan, Minnesota; 1992.

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, Kan. 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.



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Textron Aviation Introduces Online Customer Portal

Textron Aviation Inc. has rolled out a new web-based customer portal, which allows customers to seamlessly manage their aircraft maintenance and provides increased transparency and efficient communication when aircraft service is required.

The Customer Portal allows individual owners or directors of maintenance to track an aircraft through its entire maintenance cycle and is designed to reduce the aircraft's downtime. Accessible through any device at any time, owners, operators, directors of maintenance and technicians can manage numerous tasks within the portal, including initiating service requests, tracking maintenance events, ordering parts, reviewing and approving maintenance tasks, viewing invoice history and paying invoices online.

Rolling out to customers in phases throughout the remainder of the year, the customer portal is the latest addition to Textron Aviation's full suite of support solutions.

Raisbeck Adds Hampton Aviation as Dealer

Raisbeck Engineering is pleased to announce the addition of Hampton Aviation as an authorized dealer to its worldwide dealer network. Located in the hills of western Arkansas, Hampton Aviation specializes in heavy structural repair, inspections and modifications for all King Air models.

Since 1965, Hampton Aviation has maintained a singular focus: taking care of their customers. As experts in the industry of aviation service and repair, they have spent their existence

performing King Air inspections, airframe dismantles, repairs, paint and interior and modifications.

For more information regarding Hampton Aviation, please visit *http://www.hamptonaviation.com*.

Jeppesen and ForeFlight Form Alliance to Deliver Industry Leading Apps and Flight Info

Jeppesen and ForeFlight have announced that the they have entered into in a long-term strategic alliance to combine their industry-leading capabilities and worldwide content, which they say allows them to "bring advances in capability to customers globally that neither company could accomplish on its own."

The alliance focuses initially in two areas. First, beginning this summer, all ForeFlight subscribers will see Jeppesen global navigational, terrain and obstacle data in ForeFlight Mobile. ForeFlight subscribers on individual plans will be able to link their Jeppesen license in ForeFlight Mobile and purchase standard worldwide Jeppesen charts for use inside the app



through a simple e-commerce experience on *foreflight.com*. General aviation pilots will be able to choose between Jeppesen Mobile FliteDeck and ForeFlight Mobile as their

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preferred cockpit solution. Subscribers to ForeFlight Business Plans will purchase chart coverages through Jeppesen and then link them to their ForeFlight subscription for use inside the ForeFlight Mobile app.

The alliance's second area of focus serves users of Jeppesen FliteDeck Pro, the leading EFB solution for airlines and largescale operators. Jeppesen and ForeFlight will work together on a next-generation release of FliteDeck Pro for both iOS and Windows that will deliver a combination of the familiar capabilities in FliteDeck Pro and significant features and functionality from ForeFlight Mobile. The solution will respect the heritage of FliteDeck Pro, while also embracing capabilities from ForeFlight Mobile that many professional pilots already have experience using. Jeppesen and ForeFlight are working together closely with FliteDeck Pro customers in advance of bringing this to market to ensure the training impact is minimized. FliteDeck Pro customers will continue to receive application and content updates from Jeppesen.

To view more information on combined Jeppesen and ForeFlight products, please see www.foreflight.com/jeppesen and www.jeppesen.com/foreflight.

Max-Viz 2300 EVS Certified to D0-160G Standards

Astronics Max-Viz has certified its 2300 Enhanced Vision System (EVS) to the DO-160G standard. Blending infrared and visible light sensors, the Max-Viz 2300 EVS displays real-time heat sources along with LED airport lighting to make it safer for pilots to land in dark, challenging conditions.

The company says that many airports are converting over to low-heat LEDs, and many thermal imagers can no longer detect runway lights; however, the Max-Viz 2300 with its blended thermal and visible light image can.

The Max-Viz 2300 provides pilots with a level of situational awareness and safety by enabling them to see more precisely during day or night in adverse weather conditions, such as haze, smoke, smog and



light fog, even in the darkest night. At night, pilots can also see and avoid clouds for a smoother ride. Upon landing, pilots using the Max-Viz 2300 can view the runway and terrain clearly to avoid wildlife and unlit obstructions.

The Max-Viz 2300 system is now certified to Radio Technical Commission for Aeronautics (RTCA) DO-160G standards, which is the industry standard for the environmental testing of avionics hardware and is recognized by the International Organization for Standardization (ISO) as the de facto international standard ISO-7137.

Compatible with leading multi-functional displays (MFDs) and electronic flight bags (EFBs), the sensor image presents on any display that accepts composite video (RS-170) NTSC or PAL signals. The system meets or exceeds RTCA DO-160G standards, including resistance to temperature, altitude, humidity, shock, vibration, water, sand and dust, fungus, magnetic effect, power spikes, audio and radio frequencies, lightening, icing and flammability.

The Max-Viz EVS systems have 40 Supplemental and Type Certificates in fixed and rotor wing aircraft, and the Max-Viz 2300 is available now for installation, including with Garmin and Rockwell Collins Pro Line avionics systems.

For more information, visit astronics.com.



From Communiqué # ME-TP-003: Multi-Engine Turboprop Communiqué Issued: April 2017

ATA 28 – Pressure Build-Up in the Fuel Tanks All

Flight crews learn very quickly in their flying careers not to open the fuel caps on the King Air when the fuel tanks are full; doing so risks you spending the rest of the day with fuel soaked clothes and the accompanying smell. Here are the reasons why the fuel rushes out of the fuel tanks and why the main fuel tank is pressurized under normal operations.

Fuel is generally stored in underground fuel tanks; this fuel tends to be cold. This fuel is then pumped into the airplane's wing tanks and as the airplane sets out under the sun, the fuel will start to warm up causing thermal expansion. This fuel being trapped in the fuel tanks causes the internal pressure in the fuel tanks to rise. Opening the fuel caps under these conditions will relieve the pressure in the tanks an associated fuel stream comes with it. Even fuel stored above ground tanks can warm up while in the airplane's fuel tanks causing the same effect. The only safe way to open the fuel caps is to do so when the main fuel tanks are less than full. This condition is more common on the main and auxiliary fuel tanks (for those models with aux **b**



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Phone 949.266.7834 | Email jeruren@wcas.aero Phone 949.852.8340 | Email gstandel@wcas.aero www.wcas.aero tanks) and less common in the nacelle tanks (for those models with fuel caps on the nacelle tanks).

The condition described occurs on all King Air models; however, the King Air 300 and B300 are unique in that the pressure in the main fuel tanks can also increase any time the Transfer System is operating, which happens automatically anytime there is fuel in the aux tanks. The excess fuel being transferred to the nacelle tank from the aux tank is returned to the main fuel tank plumbing upstream from the flapper valve in the nacelle tank (see sketch). This excess fuel is what causes the pressure in the main and nacelle tanks to increase. This condition will exist until the fuel in the aux tank has been depleted and the transfer system is automatically shut off. Opening the fuel caps after a short flight (not long enough to deplete the fuel in the aux) will produce a stream of fuel and a sound of pressure being relief from the main tanks.

The fuel system is protected from over pressure by a pressure relief check valve located on top of the nacelle tank (see sketch on page 30). This Pressure Relief valve will open at approximately 1.66 psi. Essentially the fuel system can be pressurized up to 1.66 psi. Operators have blamed this pressure build-up to fuel leaks and spent a lot time finding the cause of the "over pressure that is causing the fuel leak." Operators later find that the system is operating normally and that the leak they

find is due to a leaky gasket, a loose clamp or faulty fuel bladder which cannot hold the normal pressure build-up.

NOTE: It is imperative that the orientation of the Pressure Relief Valve and the Suction Relief Valves are correct. A valve installed backwards can cause severe nacelle structural damage.

ATA 30 – Propeller De-Ice Wire Harness - Hartzell Service Bulletin

Serial Numbers LJ-1542 and after

Operators have reported that the propeller de-ice wire harness has been damaged during normal operation the airplanes listed above. Hartzell Propellers has issued Service Bulletin HC-SB-30-366 to address this issue. The Service Bulletin replaces the propeller deice wire harness and provides specific instructions on how to install and secure the wires to prevent the centrifugal forces of the propeller from damaging the wire harness. The Service Bulletin is available from Hartzell Propeller's web site at http://hartzellprop. com/ or by contacting their Technical Support at techsupport@hartzellprop.com.

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



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