King Air

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October 2021 Volume 15 / Number 10

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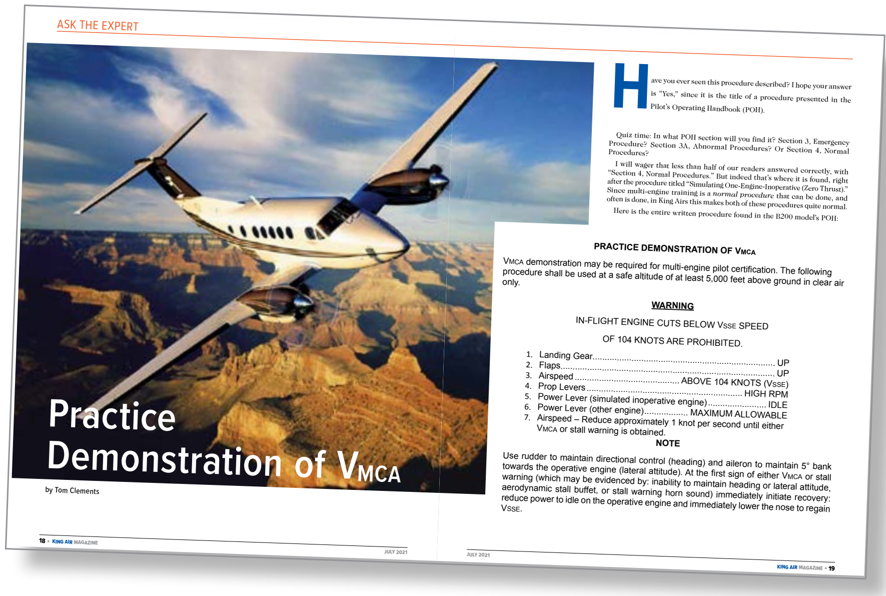
A Missed Opportunity



ASK THE EXPERT

Practice Demonstration of VMCA

by Tom Clements

Have you ever seen this procedure described? I hope your answer is "Yes," since it is the title of a procedure presented in the Pilot's Operating Handbook (POH).

Quiz time: In what POH section will you find it? Section 3, Emergency Procedure? Section 3A, Abnormal Procedures? Or Section 4, Normal Procedures?

I will wager that less than half of our readers answered correctly, with "Section 4, Normal Procedures." But indeed that's where it is found, right after the procedure titled "Simulating One-Engine-Inoperative (Zero Thrust)." Since multi-engine training is a *normal procedure* that can be done, and often is done, in King Airs this makes both of these procedures quite normal.

Here is the entire written procedure found in the B200 model's POH:

PRACTICE DEMONSTRATION OF VMCA

VMCA demonstration may be required for multi-engine pilot certification. The following procedure shall be used at a safe altitude of at least 5,000 feet above ground in clear air only.

WARNING

IN-FLIGHT ENGINE CUTS BELOW VSSE SPEED OF 104 KNOTS ARE PROHIBITED.

1. Landing Gear .... UP
2. Flaps .... UP
3. Airspeed .... ABOVE 104 KNOTS (VSSE)
4. Prop Levers .... HIGH RPM
5. Power Lever (simulated inoperative engine) .... IDLE
6. Power Lever (other engine) .... MAXIMUM ALLOWABLE
7. Airspeed – Reduce approximately 1 knot per second until either VMCA or stall warning is obtained.

NOTE

Use rudder to maintain directional control (heading) and aileron to maintain 5° bank towards the operative engine (lateral attitude). At the first sign of either VMCA or stall warning (which may be evidenced by: inability to maintain heading or lateral attitude, aerodynamic stall buffet, or stall warning horn sound) immediately initiate recovery: reduce power to idle on the operative engine and immediately lower the nose to regain VSSE.

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Tom Clements' article in the July issue titled, "Practice Demonstration of VMCA" was a missed opportunity to clarify that just because a manufacturer has an Aircraft Flight Manual (AFM) "approved procedure" doesn't mean it is always a good idea to follow same.

The procedure as presented in the article and AFM is in conflict with both the AFM's information on the purpose of VSSE and various communiqués issued over the years about the hazards of single engine operations and training related to single engine stall-spin accidents in multi-engine airplanes. As stated by the AFM regarding VSSE: "Intentional failing of one engine below this speed is not recommended." Note that this statement does not excuse purposefully rendered (or simulated) inoperative for training. Whether due to loss of rudder effectiveness OR wing stall, SE operations below VSSE has the potential for drastic rolling/wing drop components from which recovery could be impossible.

There is NEVER a pilot training nor real-life requirement (beyond certification flight testing) to duplicate nor "check" what any multi-engine aircraft's actual AFM indicated VMCA (Red Radial Line) might be.

Instead, the sole purpose of VMC pilot training and demonstration should be to reinforce the pilot's need to maintain directional control (HDG) in split power conditions, at all costs, primarily with use of rudder AND if/when adequate control cannot be maintained or is in doubt (for any reason known or unknown), reduction of power on all engines (toward idle) must be the first response to loss of HDG control (i.e., decrease or eliminate asymmetric thrust causing directional control problem) while then increasing airspeed (for added rudder effectiveness) with maximum application of all available rudder and flight control inputs required.

Pilot training of VMC is ONLY about control, not about performance to be obtained (max climb or min descent) during SE operations. VMC inflight training is NEVER about the Red Radial Line, it is only about maintaining directional control and the potential for loss of control in asymmetric power situations, especially with loss of airspeed. The loss of any airspeed results in reduced rudder effectiveness AND nearing loss of control potential when near and below VSSE, due to loss of margins for adequate rudder control and/or stall-spin prevention.

VMC training is about avoiding any SE operations with asymmetric thrust below VSSE and/or if control cannot be maintained at ANY SPEED, in order to avoid SE loss of control and SE stall-spin situations all together, reduce asymmetric thrust and AOA to increase control effectiveness until above VSSE. In reality, NO intentional or unintentional single engine operations should be conducted below VSSE.

If more pilots were taught the emphasis of reducing power when below VYSE and accelerating toward VSSE when directional control is in doubt (well before published VMC), there could be far fewer SE rollover accidents (i.e., right side up even off airport is better than an upside-down crash anywhere). Review King Air loss of directional control accidents (ADS & ICT, etc.) and know that an early reduction in asymmetric thrust (no matter the reasons encountered) could have completely changed the outcomes.

Please rethink "Loss of Directional Control" inflight single engine training and all SE operations …

Sincerely,
Kevin P. Hynes

Honoring Aviation Innovator
James Raisbeck

Sept. 29, 1936 – Aug. 31, 2021

by Kim Blonigen

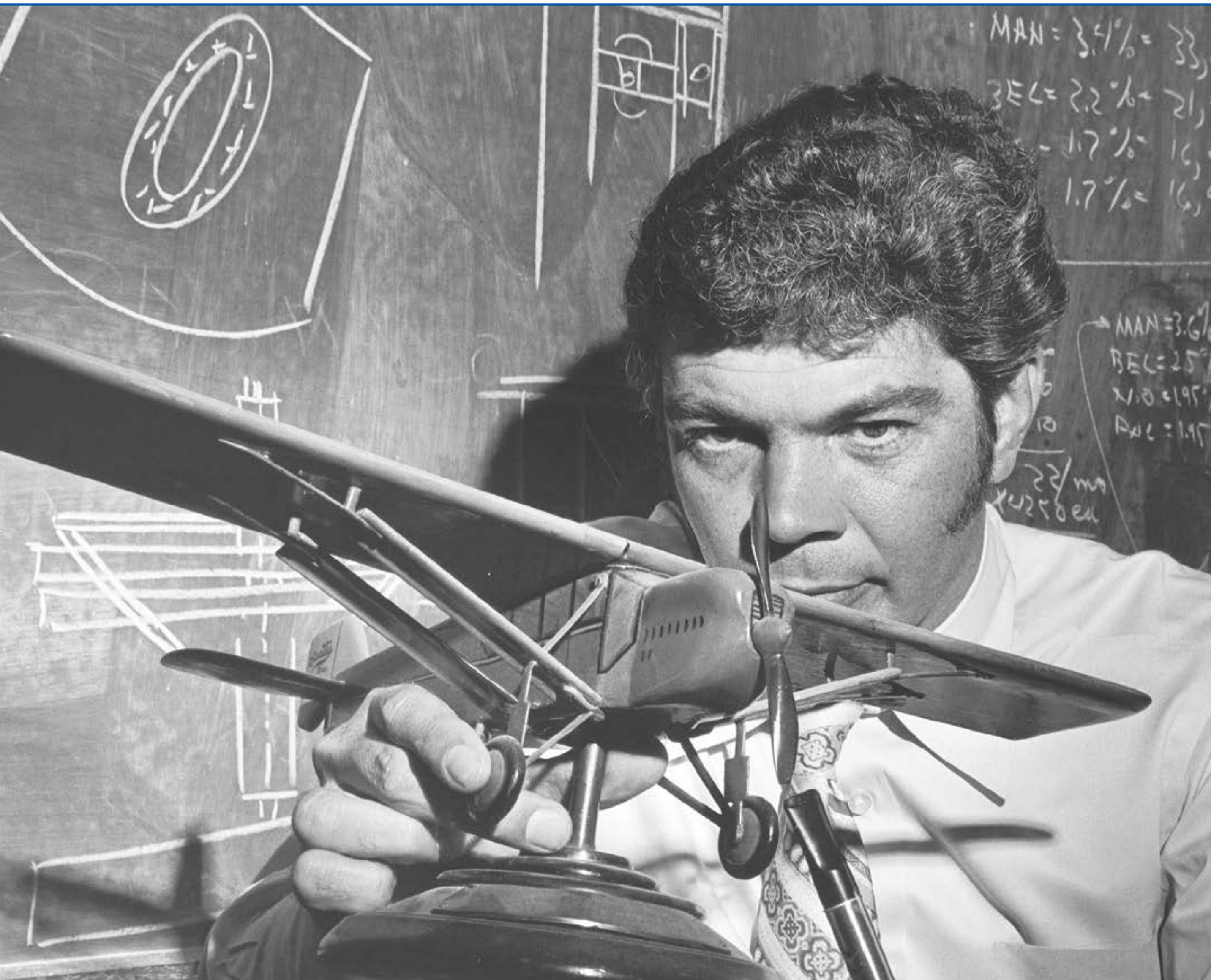
After working several years at Beech Aircraft, I had heard the Raisbeck name in relation to the King Air, but I didn't realize the impact that James Raisbeck had on the ever-popular turboprop until I became editor of the *King Air* magazine. I interviewed James shortly after the magazine was launched in 2007. That conversation has stayed with me over the years because of the amazing mind and entrepreneurial passion he possessed.

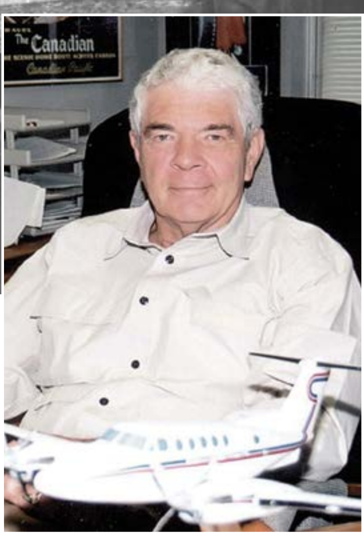
He told me, "With my life, I decided to influence the face of aviation – primarily beginning in safety and then performance and productivity – through breathing currently available technology into airplanes in current or recent production."

I heard from James earlier this year and responded that I hoped he was "enjoying his much-deserved retirement." I had assumed that since he sold the company in 2016, he would gradually retire. His response was an insight into his entrepreneurial spirit and dedication to improving aviation. He said he was still working at the company and was exploring a particular improvement for commercial airplanes. "Maybe there will be a time I can share our progress … plenty of time yet, as I won't be 85 until September!"

Since the King Air Gathering was taking place at the Beechcraft Heritage Museum, I thought it would be nice to have our historical columnist, Ed Phillips, interview James and highlight his impact on the King Air. The article starting on page 6 came from some of the discussions between James and Ed in May 2021.

I'm glad we were able to capture his spirit and share it with readers. I think you'll agree that James did what he set out to do – influence the face of aviation in safety, performance and productivity – and was still working on that goal up until his last moments.





"With my life, I decided to influence the face of aviation … "

A Passion for PERFORMANCE

James D. Raisbeck's innovative modifications to the Beechcraft King Air product line provide owners and operators with a series of upgrades that improve the airplane's capability, utility and overall value

by Edward H. Phillips

James D. Raisbeck's distinguished career in aviation spans more than 60 years. In 1980 he established Raisbeck Engineering, Inc., followed in 1996 by a subsidiary, Raisbeck Commercial Air Group. (Raisbeck Engineering, Inc.)

Raisbeck Engineering, Inc. has provided performance improvements across the entire King Air product line, here, a King Air 200 with many of the company's modifications.

"Mr. Raisbeck has made our aircraft faster, given the owners of our airplanes the usage of more airports through lowered calculated landing speeds, and provided the aircraft with more operational flexibility. A staggering percentage of our King Air fleet flies with Raisbeck modifications," said a former Beechcraft sales executive. He added, "Mr. Raisbeck should be lauded for his work to improve the safety of the business aviation fleet," and his "work in the area of stability and control has led to an easier aircraft to fly and less reliance on complicated systems to maintain controlled flight."[1]

For more than 40 years Raisbeck Engineering, Inc. has provided performance improvements across the entire King Air product line, beginning in the early 1980s with the Model 200/B200 series King Air, and eventually filtering down to the Model 90 series and the C90GTX, as well as the Model 250 and 350. In terms of basic airframe design, the twin-engine turboprop Beechcrafts are similar to one another and have provided Raisbeck Engineering with opportunities to improve performance. These systems have made positive contributions to improving the King Air's range, speed, access to airports, reducing operating costs, as well as improving the aesthetics of the airplane itself.

Raisbeck currently offers a wide range of upgrades that includes both aluminum and composite swept-blade propellers, known as the "Raisbeck Swept Blade Turbofan

In 1984 Raisbeck Engineering teamed with Hartzell to design, certify and manufacture lightweight 4-blade aluminum propellers for the King Air 200/B200 series, expanding to the 90/100 series in 1985. In 2013 the team developed a swept-blade version for all King Air models, followed in 2016 by composite 5-blade propellers for the King Air 200, 250/260 and 350/360 series. (Raisbeck Engineering, Inc.)

King Air models equipped with high-flotation main landing gear can be retrofitted with composite doors that fully enclose the gear, increasing cruise by approximately 8-12 knots. (Raisbeck Engineering, Inc.)

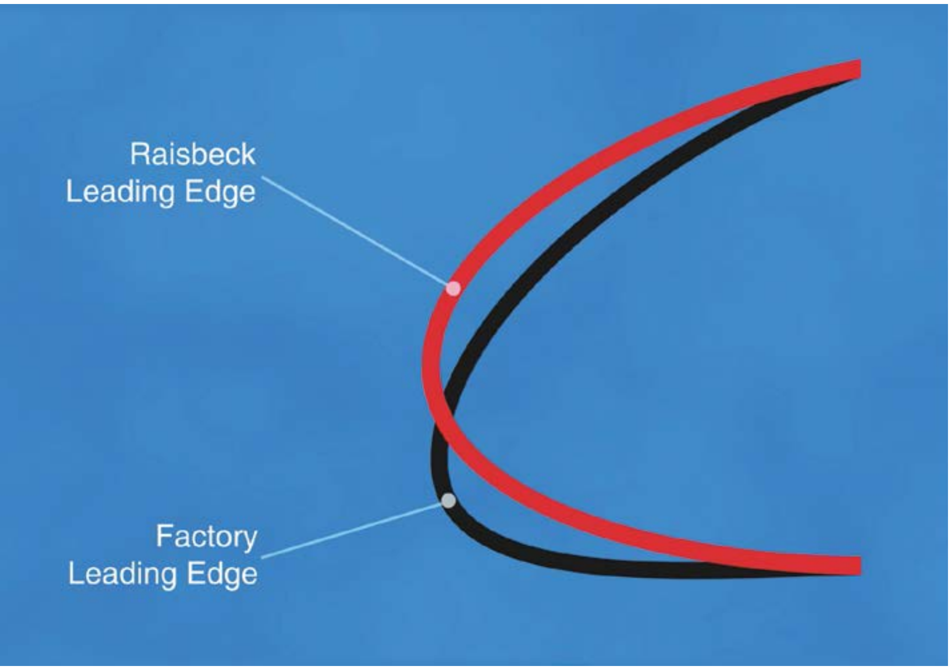
Wing lockers are optional on all EPIC packages designed for the King Air series. Each locker provides an additional 17 cubic feet of volume and can hold up to 300 pounds per nacelle. (Raisbeck Engineering, Inc.)

Installation of aft body strakes on King Air models increase directional stability and eliminate altitude limitations of the yaw damper system. (Raisbeck Engineering, Inc.)

" … cabin noise is reduced by up to one-third and single-engine climb (flaps retracted) is increased by 25.8% … "

Propeller System." In 2014 the composite blades were developed in concert with Hartzell Propellers. Constructed of carbon fiber, the propellers have a diameter of 96 inches and save an average of 48 pounds compared with a standard, four-blade propeller installation. Raisbeck claims cabin noise is reduced by up to one-third and single-engine climb (flaps retracted) is increased by 25.8% compared to the OEM four-blade propeller installation. Composite propellers for the Model 350 are 106 inches in diameter and save an average of 54 pounds compared to the standard propeller.

As of May 2021, Raisbeck Engineering had sold 1,686 shipsets of the swept-blade propellers, including 1,276 sets of aluminum and 410 sets of the composite version. Of these, 589 have been installed on 90-series Kings Airs, 83 on the Model 100, 1,043 on the 200-series King Air and 63 on the Model 300. The blades were standard equipment on Textron Aviation's Beechcraft King Air C90GTX.



Artist rendering of the inboard leading edge section as originally installed on the Beechcraft Super King Model 200, and the modified design created by Raisbeck Engineering, Inc. According to the company, the revised leading edge reduced both cruise drag and fuel consumption and allowed for increased payload. (Raisbeck Engineering, Inc.)

Other upgrades include new inboard leading edges, high flotation gear doors (for airplanes equipped with larger wheels and tires), ram air recovery system, dual aft body strakes and crown wing lockers. Collectively, these items are known as EPIC Performance Packages and are available for installation on the Model C90, E90, Model 200/B200/B200GT; Model 250 and Model 350. Among Raisbeck Engineering's earliest projects to improve performance was a redesign of the inboard leading edge of the Model 200 King Air. Originally fabricated from a combination of aluminum and honeycomb sandwiched materials, the leading edges would slowly deteriorate and separate over time due to the effects of temperature and moisture. "We aerodynamically reshaped (changed the contour) the inboard section using a composite material," Raisbeck said. These changes resulted in reduced drag and fuel consumption while increasing payload.

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The EPIC Platinum Performance package for the Model 200/B200 King Air includes either five-blade aluminum or five-blade composite swept propellers that reduce noise while providing more thrust; new inboard leading edges, high-flotation gear doors to restore climb and cruise performance of 8-12 knots compared with the standard main gear installation. According to the company, the Ram Air Recovery System (RARS) improves airflow to the Pratt & Whitney Canada PT6-42 engines and can reduce ITT by as much as 18°C.

According to Raisbeck Engineering, the package also includes dual aft body strakes that provide enhanced directional stability and reduces drag to allow for better climb and cruise performance. In addition, the strakes can eliminate altitude limitations regarding an inoperative yaw damp system. In 2001 the strakes were adopted as standard equipment on the Model 350 King Air and became optional on the B200 and C90. The wing lockers are an optional item that add 17 cubic feet of volume (per nacelle) and can accommodate up to 600 pounds (300 pounds per nacelle).

The Life of a Legend

Born and raised in Whitefish Bay, Wisconsin, Raisbeck graduated from high school in 1954 and joined the United States Air Force, serving as a flight engineer. Four years later he attended Purdue University where he earned a degree in aeronautical engineering and mathematics. In 1961 he joined the Boeing Commercial Airplane Company as a research aerodynamicist. He was part of a team of engineers who designed and tested an internally blown trailing edge flap system installed on the prototype Boeing 707, better known as the "Dash 80."

These and other experiments led to development of low-speed, high-lift flap configurations for other Boeing commercial airplanes. Raisbeck recalls that Boeing "gave me plenty of rope. There were so many hard problems to figure out, but that's my passion." After leaving Boeing in 1969 he joined Robertson Aircraft Corporation where he served as president and CEO from 1969 until 1973, leading the certification effort for STOL designs installed on various Piper and Cessna airplanes. He worked briefly with Allen Paulson at American Jet Industries as vice president until striking out on his own to establish Raisbeck Group in 1974.

Among the new company's early accomplishments were development of a more efficient, supercritical wing for Rockwell International's Sabreliner 65 series. Eventually, production airplanes featured the wing and a large number of Sabreliner 60- and 80-series jets were retrofitted with the improved design. Later, Raisbeck's Mark II wing systems were certified for the Learjet 23-24 series, followed by the Mark IV wing for the Learjet 30 series business jets.

In 1996 Raisbeck established a subsidiary of the parent company known as the Raisbeck Commercial Air Group, Inc.

Raisbeck at Robertson Aircraft where at age 33 he was president and CEO. (James D. Raisbeck)

One of James Raisbeck's first engineering assignments was working on a blown-flap, high-lift system that was installed on the prototype Boeing 707 (Model 367-80), commonly known as the "Dash-80." The system proved to be highly effective and allowed the jet transport to maintain controlled flight at speeds approaching 60 knots.
(James D. Raisbeck)

That year the company introduced its Stage 3 Noise Reduction System for the Boeing 727. American Airlines ordered 52 of the systems, along with other major and smaller airlines. After the terrorist attacks on America September 11, 2001, Raisbeck Engineering focused its efforts on making flight deck security a priority for certain airline aircraft built by Boeing Commercial Airplanes. The company designed bullet-proof doors and bulkheads for the Boeing 737 and 757 along with armored cockpit security systems. Alaska Airlines and other scheduled air carriers ordered the doors. In March 2002 Raisbeck Engineering transferred the cockpit security program and its customers to Boeing Commercial Airplanes.[2]

During his long and successful career in aviation, James D. Raisbeck has been recognized worldwide as a talented aerodynamicist and technology innovator as

well as a savvy entrepreneur and marketing expert. A partial listing of his major acknowledgements include:

- 1979: Distinguished Engineering Alumnus, Perdue University
- 1999: Outstanding Aerospace Engineer, Purdue University
- 2002: Lifetime Meritorious Achievement, National Business Aviation Association
- 2004: Elected to Living Legends of Aviation
- 2007: Aviation Pathfinder, American Institute of Aeronautics and Astronautics (AIAA) and the Seattle Museum of Flight
- 2012: Fellow of the AIAA

In addition to those honors, Raisbeck was a member of the Society of Automotive Engineers, the National Business Aviation Association and listed in editions of "Who's Who in America," "Who's Who in Science and Engineering," "Who's Who in the West," and "Who's Who in the World."

An aviation official who knew Raisbeck well summed up his distinguished career this way: "Beyond his many accomplishments, Mr. Raisbeck's most enduring contribution will be the enthusiasm and passion for aviation he has passed on to so many of his employees, colleagues and customers." [3]

Raisbeck's summary, however, emphasizes it this way: "Every big point in my life was a lesson learned, and each of those lessons came from a mistake." The formula for success in the world of aeronautics is simple – "the difference between winners and losers is that winners do not make the same mistake twice." [4] KA

NOTES:

1 Quote from Donald A. Dwyer, vice president of global sales, Raytheon Aircraft Company, October 2004

2 Karen Di Piazza, Living Legends of Aviation, 2008

3 Quote from Donald A. Dwyer, vice president of global sales, Raytheon Aircraft Company, October 2004

4 Interview with the author, May 2021

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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GOOD VIBRATIONS — The Benefits of Dynamic Prop Balancing

by Dean Benedict

When I ran my maintenance shop and got a new company truck, I kept the old one at the airport as a crew car. After several months ofdriving the new one, I used the old one to run an errand and was shocked at the slop in the steering. I didn't remember it being that way. Nor did I recall the road noise and interior rattles I was hearing. This old truck was my daily driver for many years but these problems developed so gradually over time that I never noticed them.

The wear and tear from moving parts creates excess play (or slop) over a period of time. Small vibrations develop and increase slowly. This happens with anything mechanical. Aircraft propellers can go out of balance over many of hours of operation. The changes are undetectable on a flight-by-flight basis.

When this happens, dynamic prop balancing can make a big difference. The vibrations and raggedness in flight that had been slowly creeping in intensity are suddenly gone. It often elicits rave reviews such as, "I never realized it could be this smooth!" or "Wow, it's like night and day!" and my personal favorite, "Gee, now my feet don't fall asleep on the rudder pedals."

Additions and Subtractions

Propeller blades erode over time from friction with the air during flight. Just look at how much paint wears off the tips of your props between Phase inspections. Fortunately, your King Air props are inspected at every Phase. The prop system is checked operationally in ground running, and the individual blades are closely inspected. Your mechanic is looking for nicks and gouges from rock strikes, hail or other FOD. Cracks will form at a nick or gouge, if not remedied early.

Metal props are dressed (filed down) to smooth out the dents and chips, then re-painted as necessary. Metal prop blades are painted to protect against corrosion. Filing and

general erosion remove material. Painting and re-painting add material. Over time, these subtle additions and subtractions to each blade changes its original contour. This throws off the balance thus increasing vibration.

Extreme additions to a prop blade are too much paint or an uneven paint job. Extreme subtractions come from over-zealous filing by an inexperienced mechanic, or the necessary correction of a big divot. If yougo in and out of dirt strips, the risk of rock divots goes with the territory. If you get one, it will be filed out at the next Phase. These extreme situations can aggravate prop imbalance and increase vibration.

Bad Vibrations

There are some telltale cracks on a King Air that point to out-of-balance props. Just remember that turbulence and the expansion/contraction of pressurization are going to take their toll, so the development of some cracks is normal on any airplane. All noticeable cracks should be documented and monitored.

That said, if I see cracks in the exhaust stacks, engine cowlings or nacelle inspection panels it gets my attention and I will look more closely. If I see cowlings starting to crack at doublers or stringers, or nacelle panels cracking at screw holes, those are signs the props may be out of balance and I start thinking about dynamic prop balancing. The same holds true with exhaust stack cracks, especially when they keep cracking around previous repair areas.

Another important concern regarding prop vibration is wear and tear on the bearing inside the engine fuel control input shaft. Being much smaller than the rest of the bearings in the engine, this bearing is the most susceptible to prop vibration. Failure of the fuel control can cause the engine to run away and an over-torque situation could result; if this happens, the engine needs to come off for inspection and repair. The point in mentioning this is that the risk of premature failure of engine components can be reduced by dynamically balancing the props.

The Balancing Act – Static versus Dynamic

Static balancing is done by prop shops after repair or overhaul. Where one blade is a tad heavier or lighter than the others, weights are added or subtracted as necessary to bring the prop into balance with itself. Dynamic balancing is done after the props are reinstalled on the aircraft. It is performed, one side at a time, with the engine running normally at takeoff rpm. We may call it prop balancing, but it is the entire prop-and-engine combination that is being balanced.

Diagnostic equipment is required to measure the vibrations so that the strategic placement of stainless steel balancing weights can be determined. The equipment measures vibrations in inches per second (ips). Although the maintenance manual lists 0.3 ips as the goal, the

“Dynamic balancing … is the entire prop-and-engine combination that is being balanced.”

industry standard has been 0.2 ips for as long as I can remember. The trick is to distribute the weights to reduce the vibrations. Whenever possible, I strived for 0.1 ips. Done properly, it can be very effective.

Sometimes I would get a prop that was just overhauled and statically balanced at the prop shop that was horribly out of balance when installed. Experience taught me to strip off all the weights used in static balancing and start from scratch. This proved more efficient in the long run.

Dynamic prop balancing is not part of any recurring inspection. It is not needed on a regular basis. But whenever a prop came off for *any* reason, it was my practice to perform dynamic balancing when it went back on.

There is no downside to dynamic prop balancing. It is well worth the money. As they say, an ounce of prevention is worth a pound of cure. KA

*Based on an article of the same name from the May/Jun 2010 issue.

Dean Benedict is a certified A&P, AI with over 45 years of maintaining King Airs. He’s the founder and former owner of HonestAir Inc., a maintenance shop that specialized in Beech aircraft with an emphasis on King Airs. Currently, with BeechMedic LLC, Dean consults with King Air owners, operators and maintenance shops on all things pertaining to King Air maintenance. This includes troubleshooting, pre-buys and maintenance management. He can be reached at *dr.dean@beechmedic.com* or (702) 524-4378.

After Start Electrical Checks for the Five-Bus System

by Tom Clements

The expanded, first-flight-of-the-day checklist procedures in the Pilot's Operating Handbook (POH) include a somewhat lengthy and hard-to-understand series of steps for confirming that the electrical system is fit for duty with all its safety devices operating properly. My guess is that this procedure is executed quite rarely and, when it is done, the pilot is going through the steps without truly understanding what is being accomplished. The aim of this month's article is to provide some insight and clarity into what is being tested in this series of steps.

The pilot's left subpanel where the after start electrical check procedure begins.

The five-bus system is the name I use to refer to the newer King Air electrical system that first appeared in 1978 on the F90 model. Since that time it has become the system on the C90A and after series, as well as the 300-series – both the "straight" 300 and the B300, which is known as the 350 (and now, 360). The latest members of the 200-series, including the 260, retain the electrical system of their predecessors. Hall-effect devices, automatic load-shedding and bus tie relays are unknown on BE-200s, as well as on all the 100-series and the earlier members of the 90-series. Skip this article if your King Air does not contain a "triple-fed bus." (Many folks refer to this newer system as the triple-fed bus system. In fact, the 350 and 360 even have a sixth bus, but overall the system functions exactly like it's five-bus brothers.)

The full test procedure spelled out in the POH takes place after both engines are started and both generators are operating. Of course, we should never turn on a generator while using an External Power Unit (EPU) so if we started with such a unit, it needs to be turned off and disconnected before proceeding.

In fact, since observing the battery charging or not charging is a part of the tests to come, I recommend that we *not* use an EPU for this start. Make it a normal battery start of the first engine and a generator-assisted start of the second engine. That leads to the battery charging at a rather high level.

During the test procedure we want the inverter to be on if we have one. (Both inverters in 350s that have two.) The latest models have gone entirely DC (Direct Current) with no need for an inverter providing AC (Alternating Current). However, we do not want the avionics on yet. Not to say that they will be damaged during the tests to come, but since there will be momentary bus power interruptions it is preferable to not have the avionics subjected to any power disturbances.

Also, do not activate the environmental system yet. Leave the Cabin Temp Mode selector in the OFF position. Otherwise, we may cycle the air conditioning compressor off and on during the process.

The procedure begins by moving the GEN TIES switch – located on the pilot's left subpanel – down to the OPEN, bottom position. This switch has three positions: OPEN at the bottom, NORMal in the center, and MANual CLOSE at the top. This is a lever-lock style of switch that must be pulled out before it will move. However, it springs from the top back to the center when momentarily selected to MAN CLOSE. In the case of the OPEN position, it must be pulled both to go there and to get out of that position.

When the switch is in OPEN, both the left and right generator bus tie relays should open. Both left and right Gen Tie Open Caution (yellow) annunciators should illuminate, and we check that they have appeared. I like to teach that we have now created two separate, single-engine airplanes. Yes, it's corny, but it helps get across the idea that the left and right sides of the electrical system are no longer connected. They aren't communicating with each other. Also, since the battery connects to the center bus – a bus that can no longer receive power from either generator due to the ties being open – it should no longer be charging. If your particular serial number King Air has a dedicated battery ammeter in the overhead panel then merely verify that the charging current is now zero.

For earlier models that do not have a battery ammeter, the way we must verify that the battery is indeed no longer charging is to note the loadmeter readings before we move the Gen Ties switch to OPEN and then note the reading afterward. There should be a major drop in generator load, generator output. Afterall, except for some lights perhaps, we haven't activated any aircraft system, so the battery's charging is the only significant electrical draw that we have.

One time in a zillion we may find that the battery is still charging. Not good! This is an important squawk for maintenance to repair. Either one of the bus tie relays is still closed – which is highly unlikely if the annunciator appeared – or else a diode is allowing current to flow in the direction it shouldn't.

To truly verify that our two single-engine airplanes are no longer connected, we turn on one side's windshield heat switch and verify that the loadmeter increases only on that side. Next, turn off that side's windshield heat switch and turn on the other side to see the other loadmeter increase. Keep in mind that if the windshield's temperature sensor is already feeling more than 100°F the heat will not activate. Wait for a cooler day!

Next, to verify that each of our single-engine airplanes has a functioning voltage regulator, we check the reading on the Left Gen and Right Gen positions of our six-position voltmeter in the overhead panel. Both should show correct, 28.25 ± 0.25 volts. (As if we can read it that accurately!) Voltage regulation is one of the many functions of the left and right Generator Control Unit (GCU). We are making sure that function works correctly even when the GCUs are not trying to parallel their generator's output loads.

The next step is to move the GEN TIES switch from OPEN back to NORM. Both Bus Tie Open annunciators should disappear and the loadmeters should nicely parallel. Momentarily turn on either side's windshield heat and verify that both loadmeters show a slight increase. Good! Our two single-engine airplanes have become one twin-engine again.

Now we reach for the switch just to the left of the GEN TIES switch, the one labeled BUS SENSE. It is spring-loaded to the center, normal position. Down is labeled TEST and up is labeled RESET. Tap the switch down to TEST.

What is being accomplished here is making the Hall-effect devices (HEDs) experience a magnetic field similar in strength to the field they would feel when 275 amperes or more passes through them. These HEDs – we have three of them – are the protective devices that will open an associated relay to stop the flow of excessive electrical current in the "wrong" direction. Unlike a fuse, current limiter or circuit breaker, these protective devices do not react to heat buildup. As you have experienced driving your old car under a high-power set of wires with the AM radio playing, electric current through a wire creates a magnetic field around the wire. The stronger the current the stronger the field. Mr. Hall, of Johns Hopkins University, was the fellow who first quantified this relationship. Not until the 20th century were devices invented that could measure current flow extremely accurately by measuring the magnetic field strength. When the price of these devices made them within reach of aircraft designers – Voila! – HEDs appeared on some airplanes' electrical systems, including King Airs. They provide an increased level of safety since they react so fast, before the temperature even begins to rise to the level needed to melt a fuse or to pop a circuit breaker.

In the previous paragraph I used the term "wrong" while referring to the direction of current flow. HEDs only respond to excessive current in the undesired, wrong direction. To explain further: Except for the power needed by the starter to turn the engine, it is undesirable for the battery to discharge quickly at a high rate of current flow. On the other hand, after the battery has been partially depleted during the start, it is desirable to have it receive current at a high rate for recharging itself. Similarly, since the charging current comes from the generators, it is normal to have a very high current flowing from the generators into the battery after starting. To get from the source – the generators – to the draw – the battery – current must flow from each generator through its respective generator bus to the center bus to which the battery connects. So at times it is normal and expected to have high current flow *from* a generator bus *into* the center bus.

The overhead panel where the loadmeters and voltmeters tell their stories.

But having high current flow *from* the center bus *into* a generator bus is rare and almost always would be due to a problem: That missing wrench finally bridged the metal of that bus to the airframe … a direct ground short. To conclude, all three HEDs – the two between the respective generator buses and the center bus and the one between the battery and the center bus – only react when more than 275 amps of current flows in the wrong or bad direction.

The time that it is normal to experience very high current flow out of the battery is, of course,

> “ … in the event of a dual generator failure, this newer electrical system will automatically shed … electrical load to prolong the time your battery can supply more critical items. ”

during engine starting. All three HEDs are “desensitized” – they take a coffee break and won’t work – whenever either starter switch is on.

Back to the test procedure: Since the HEDs react instantaneously, the BUS SENSE switch should only be momentarily depressed – I used the word “tap” above – and then released. The HED can be damaged if it senses the strong magnetic field too long.

After we “tap” the switch, all three HEDs should cause their respective relays to open, and we should now see three yellow annunciators: the same two we saw before – Left and Right GEN TIE OPEN – and also now BAT TIE OPEN. With these three relays open, the center bus should be totally isolated from the three sources of power, two generators and the battery. To verify that it is indeed “gone,” we again direct our attention to the voltmeter and confirm that there is zero voltage on the center bus. If voltage is still showing, then one of our annunciators is lying.

A more likely malfunction is that one of the three annunciators did not appear when we used the BUS SENSE switch’s TEST position: Probably a bad HED.

A note to F90 operators: *In the electrical system installed on earlier F90s – the very first attempt Beech made to use this newer system – some problems exist. I won’t call them “mistakes,” but the temptation is strong to do so! The two test switches are not labeled the same as I have described although they operate identically. The voltmeter is missing two positions, including the center bus. The annunciators are really weird! Instead of the simplicity of separate Left and Right GEN TIE OPEN lights, you have a single GEN TIES OPEN light. Notice that its plural, not singular. When both ties are open – such as before start and after we activate the BUS SENSE OPEN switch – the annunciator is correct in being plural. But* *what about when an actual case of excessive current flow in the wrong direction activates only one HED? The answer is that we still get the Caution, yellow GEN TIES OPEN, plural, annunciator but now it is combined with an Advisory, green annunciator that says L BUS SENS OPN or R BUS SENS OPN. I am very glad that Beech corrected these little "problems" on the F90-1 and all later five-bus systems!*

Let's return to where we were in the test procedure. We have momentarily pushed the BUS SENSE switch down to TEST, released it promptly, checked for the three Caution annunciators and verified that the center bus shows no voltage. (You F90s that have no display of center bus voltage: Try to inflate the deice boots. They get their power from the center bus so their being inoperative tells you the center bus died, like it should at this time.) Nowhere does it state this next step in Beech's procedure, but I encourage you to do it. Did your inverter keep working? No warning, red Inverter annunciator illuminated? Good!

You see, in the event of a dual generator failure, this newer electrical system will automatically shed a lot of electrical load to prolong the time your battery can supply more critical items. It does this primarily by "killing" both left and right generator buses. You will be left with the same items you have when you first turn the battery switch on: only items powered by the hot battery bus, the triple-fed bus and the center bus. The switches with the white circles painted around them remind you what is still operative. With so much now gone, the designers believed (rightly so!) that losing the inverter at this time would *not* be a good idea. Consequently, each inverter has two sources of power. If and when a generator bus is powered, the inverter automatically gets its DC input from that side's generator bus: No.1 Inverter from Left Generator Bus and No. 2 Inverter from Right Generator Bus. But when the respective generator bus has no power upon it, then a relay automatically selects the inverter's power from the center bus.

Therefore, if your selected inverter did *not* fail when you tapped the BUS SENSE switch to TEST and made the center bus go dead, then you have just verified that the normal source of inverter power is available correctly. Although over the course of time as you run this test you will probably be using No.1 inverter some of the time and No. 2 inverter at other times – and thereby verify that both inverters have the normal power source from their generator buses available – why not now go ahead and move your inverter select switch to the other inverter to know that it is also wired correctly?

Another thought concerning this design of two sources of power for each inverter: Nowhere does Beech direct you to do what I am now going to suggest. But it is super easy and it verifies that the *other* source of inverter power, the alternate source, is working properly. Remember, if the inverter keeps working after the center bus goes dead, we have learned that the *normal* inverter power source is OK. To verify that the *alternate* source is also OK, simply turn on one inverter with only the battery switch on with no bus ties closed. Does the inverter light extinguish, and the inverter works fine? Great! Now check the other inverter and, I hope, find that it also can operate. Twice in my King Air instructing travels I found F90s in which the inverter would not operate without the generator buses being powered. They had lost their *alternate* inverter power source. I ask you, maybe a couple of times a year, to verify that both of your inverters operate after you have turned the battery switch on but nothing else. Do it occasionally as part of your cockpit checks in the hangar.

To complete the Beech After Start electrical checks procedure, all that remains is to momentarily tap the BUS SENSE switch up to RESET to allow all three bus tie relays to return to their closed status. Ah, now at last it's time for avionics and air conditioning! The electrical checks are finished.

I won't ask for a show of hands to indicate how many of you run this check on your day's first flight. There wouldn't be many raised hands, would there? Guess what? My hand wouldn't be up either.

My educated opinion concerning this check as well as run-up items like autofeather, rudder boost and overspeed governor checks is that even if they have been tested 20 times in the last hour, it is impossible to know if they will work the *next* time. Before going in for a Phase check, especially coming *out* of a Phase check or other invasive maintenance procedure, take the time and run ALL of the checks completely, slowly and with understanding of what is right and wrong. Normal operation, however? I am not an advocate of the time, fuel and noise it takes to do all checks routinely. On a deadhead leg once a month or so? Now you're making sense! KA

King Air expert Tom Clements has been flying and instructing in King Airs for over 46 years and is the author of "The King Air Book" and "The King Air Book II." 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 books, contact Tom direct at *twcaz@msn.com*. 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 *editor@blonigen.net*.

Statement of Ownership, Management, and Circulation for *King Air*

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Rebecca Mead, Chief Financial Officer

EASA Certifies Beechcraft King Air 360/360ER and 260 aircraft

Textron Aviation recently announced the Beechcraft King Air 360/360ER and King Air 260 have both achieved European Union Aviation Safety Agency (EASA) type certification and will begin deliveries to customers throughout the region.

"EASA certification begins a whole new era for the Beechcraft King Air in Europe," said Tom Perry, vice president of sales for Europe, Middle East and Africa. "The King Air has been the turboprop of choice throughout this region for more than five decades, and the new 260 and 360 will build on that legendary reputation. We have incorporated innovative and next generation technologies that enhance the flying experience for an already proven aircraft."

Renowned for its versatility and reliability, King Air turboprops have been a popular choice across Europe with more than 460 aircraft throughout the region. Nearly half of all King Airs in Europe are owned and operated in France, Germany and the United Kingdom.

ThrustSense Full Regime Autothrottle for King Air Gains STC Approval by EASA and TCCA

Innovative Solutions & Support, Inc. (IS&S) has been awarded European Union Aviation Safety Agency (EASA) and Transport Canada Civil Aviation (TCCA) Supplemental Type Certification (STC) for its ThrustSense® Full Regime Autothrottle for the King Air.

The company reports that the approvals mark over 40 countries outside of the U.S. to approve its revolutionary autothrottle technology, joining Australia, Argentina, Brazil, China, Mexico, Philippines, South Africa and Taiwan. Expanding along with the number of countries currently certifying ThrustSense, are the actual numbers of different King Air configurations now compatible with the IS&S autothrottle. Categories of newly customized ThrustSense King Airs include special mission, extended range, heavy-weight and Blackhawk Aerospace aircraft.

The IS&S ThrustSense Autothrottle with LifeGuard™ Protection is a full regime system from takeoff roll to

PHOTO CREDIT: TEXTRON AVIATION

landing phases of flight including go-around. ThrustSense's FADEC-like engine protection prevents both engine and airspeed exceedances that can and have become safety challenges during situations of high pilot workload. Most critical to safety, ThrustSense provides protection against VMCA, via the first ever system (LifeGuard™) that proportionally reduces engine power to maintain directional control, thus mitigating the most dangerous "low-and-slow" challenge associated with twin-engine operations. The ThrustSense Autothrottle system, currently in operation in the Beechcraft King Air, automatically controls engine output by computing and adjusting to the exact appropriate power levels, thus significantly reducing pilot workload at critical phases of flight.

ThrustSense is the first and only certified autothrottle for King Air 200 and 300 aircraft and is standard equipment on King Air 260 and 360 production models. It is available for retrofit at authorized King Air Service centers worldwide. KA

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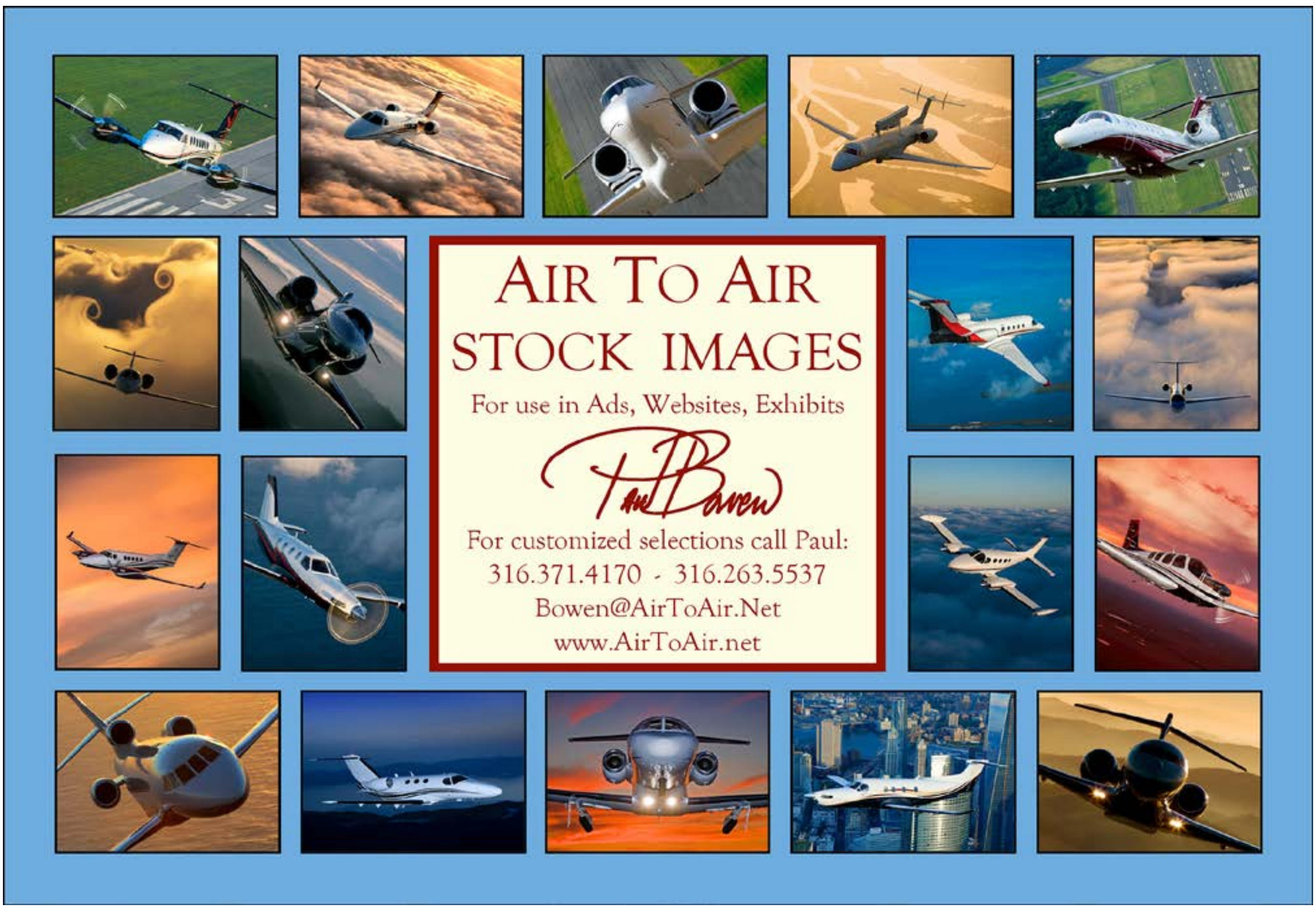

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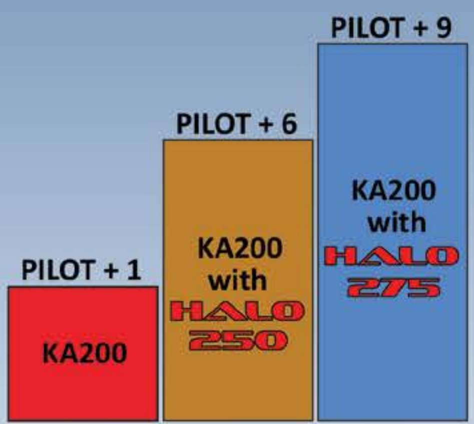

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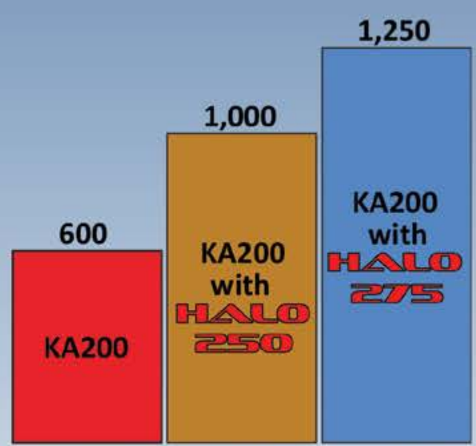

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