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COVER PHOTO

Beechcraft King Air 350

By Clint Goff

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The Second Act



Retired as a MC-12W Liberty aircraft, this King Air 350ER moved from the battlefield to the classroom at the Pittsburgh Institute of Aeronautics.

by Robert S. Grant | Photos courtesy Pittsburgh Institute of Aeronautics

During an early May afternoon, the distinctive form of a Beechcraft King Air 350ER turned inbound to northeastern Ohio's Youngstown-Warren Regional Airport (KYNG). Sided with sharp-edged U.S. Air Force markings 090641, the aircraft impinged smoothly onto Runway 32. To the surprise of waiting spectators, hand-painted lettering N6441Y marred the elegant fuselage curves.

As the Pratt & Whitney PT6A-60A powerplants screamed to silence, the fragrance of exhausted aviation kerosene wafted into a welcoming crowd awaiting the civilian ferry crew and the MC-12W Liberty version of the Beechcraft series. Armed forces service completed, N6441Y would never fly again. Now an integral component of the teaching world, the five-tire epitome of airborne efficiency would become an instructional tool at the Pittsburgh Institute of Aeronautics' campus in Youngstown.



PIA understood Beechcraft products well. The institute's first Wichita, Kansas-born example was a piston-powered E-50 Twin Bonanza that arrived on Oct. 28, 1982, to become a functioning floor-based reference library for maintenance and avionics students. Other types followed. Turbine engines had already appeared on commercial markets and thousands powered agricultural, executive carriers, commuters and geophysical airplanes. In fact, PIA's classroom turbine pedagogy began with a donated Vickers Viscount 745D's

Rolls-Royce Darts in 1969 before a Beechcraft King Air 65-A90 with 578 shp PT6A-20s joined the inventory.

Undergraduates still benefit from training on the grounded A90, but modern technology requires a different skill set to maintain advanced aircraft platforms. Recognizing this need, PIA spent eight months navigating discussions with federal authorities to acquire the state-of-the-art MC-12W Liberty on April 7, 2026.

In the outside world, maintenance mechanics had to be wrenched away from "piston-pounder" regimes and deep-dive into the intricacies of the ubiquitous 1,040 shp PT6A-60As. Not complicated devices, the lightweight turbines demanded special breeds of knowledge. Fortunately, as an institution of higher learning, PIA has never been a stranger to dispensing meaningful education. The school entered aeronautics training in 1929 with headquarters in Pittsburgh, Pennsylvania, and three outlying campuses.

King Air N6441Y represented more than a pair of people-moving engines thrust into the instructional scene. New to the institute, the aircraft did not barge onto the premises as an impromptu drop-in but came to stay. Pupils looked forward to more than removing a few inspection plates and fairings to become workforce-ready talent. As avionics and maintenance candidates, they could now diagnose and maintain the Collins Aerospace Pro Line Fusion suite as well as multi-scan radar and integrated GPS with synthetic vision. Supported by a robust 400-amp generator, the aircraft's systems power

critical safety enhancements like terrain alerting and traffic collision avoidance systems.

The pristine aircraft arrived at Youngstown carrying a rich legacy, representing what private owners and commercial operators consider near-aeronautical perfection. The first of the parent line to carry U.S. Army colors had emerged from Wichita in 1974 for liaison and general personnel transport. The C-12A, or Super King Air 200, became common wherever American embassies were established. Some went to civilian humanitarian organizations such as Warren, Virginia-based Air Serv International which devoted resources to the needs of native peoples from the Democratic Republic of Congo's capital city of Kinshasa.

The birth of the MC-12W Liberty

On April 1, 2008, U.S. Secretary of Defense Robert M. Gates established a task force to encourage onsite provision of intelligence, surveillance and reconnaissance to support Coalition and American forces. A place became apparent for a compact airframe containing small teams in sub-zero or desert theaters of operations. High- and low-ceiling capacities, with field-proven reliability, needed to be part of the promise. King Airs presented with positive civil track records.

Through Project Liberty, named for World War II's cargo ship, Beechcraft provided airframes with basic engines and interiors. Technicians at contractor L3 Mission Integration pounced on the aircraft's bare bones in Greenville, Texas. After



In addition to the newly acquired King Air 350ER, students at PIA have access to this King Air 90 for practical training toward their A&P certificates.

eight months of complex effort with 340 subcontractors, the initial MC-12W arrived at Key Field in Meridian, Mississippi, 67 miles east of Vicksburg, for flying and maintenance familiarization. At least 37 ISR-equipped examples completed the journey by Aug. 31, 2010. With modifications and specialized electronics, price per unit skyrocketed to \$17 million.

"The MC-12W is not just an aircraft but a complete collection, processing, analysis and disseminating system," read a press release at the time.

The MC-12W's structural integrity suited austere and hostile conditions during the war on terrorism authorized by President George W. Bush. A mission commander and a copilot crewed the aircraft and coordinated with a sensor operator and laser target designator stationed behind them. A surface-based member complemented the team. Before being considered combat-ready, the cluster of high-tech experts worked and trained together on 12 qualification missions prior to deployment.

The MC-12W's gross takeoff weight reached 16,500 pounds versus the standard 12,500-pound King Air 200.

The 350ER's six auxiliary, main and nacelle fuel tanks contained 5,192 pounds. The additional weight necessitated stronger main landing gear, wheels, tires and brakes adapted from the Beech 1900D. Introductory sorties took place in Iraq during June 2009 and six months later, some teams reassigned to Afghanistan. Unarmed, but not defenseless, the aircraft carried radar warning receivers, chaff countermeasures and infrared lasers to blind incoming missiles.

By 2013, Liberty Program MC-12Ws logged 400,000 combat hours and destroyed 8,000 terrorists and insurgents as well as locating 650 weapons caches. Road-side bombs were detected and enemy reinforcements discouraged by called-down airstrikes in what strategists termed "irregular warfare." The Beechcraft 350ER could reach out as far as 2,580 nautical miles.

Other onboard systems included line-of-sight, satellite data links and voice communication as well as a ground exploitation cell allowing data from sensors to share with ground commanders. An infrared pointer provided means to single out personnel or radio mark surface



Pittsburgh Institute of Aeronautics graduated approximately 100 technicians this past year at its Youngstown, Ohio, campus.

objects. Acquired with slick, mission-ready flat floors lacking cabinetry or seats, the aircraft stationed on flight lines with Kevlar paneled bottoms and erosion-resistant antenna tape. The interior could be converted from wartime context to passenger configuration with 13 seats.

"The MC-12W's eight hours of flight endurance allows them to stay on station long enough to gather a complete and thorough picture of the battlefield," claimed a U.S. Air Force bulletin. "With powerful but efficient turboprop engines, Liberty aircraft can fly for hours at near-stall speed and ultra-low altitude or kick up the pace to 300 knots while cruising at 35,000 feet. Few other propeller-driven aircraft in the entire world, military or civilian, can provide

such flexible flight performance."

As eyes-in-the-sky, the MC-12W's niche included surveillance of friendly ground troops transiting through mountain passes when visibility beyond curves and hills became nil. They detected enemy forces slinking into attack lines and warned American-led Allied ground pounders. The high-altitude team with cockpit night vision compatibility provided sharper interface than drone coverage.

When not detecting or surveilling, MC-12W crews worked alongside ground troops. Besides side-by-side mission planning with men and women, they protected members of the closely knit clan. They calculated weapons and logistics requirements and understood the language-slang of their non-aviation associates.

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Retrieved from storage in Waco, Texas, earlier this year, the King Air 350ER joined PIA's family of similar platforms from civil and military-oriented industries.

In high stress situations, air staff and contacts below expected little time to respond to airstrike requests. Enhanced situational awareness improved safety and if necessary, the MC-12W converted to air ambulance configuration or tailored to maritime operations.

The rugged construction permitted a 98-knot V1 with takeoff rolls rarely exceeding 3,800 feet despite desert temperatures. High strength flaps allowed selection at 202 knots and maximum 182-knot gear speed for aerodynamic braking. On final, Vref with 30-degree flap slowed approach to 104 knots. Pilots appreciated instant power response during emergency overshoots before

the whiz of rocket-propelled grenades and subsequent explosions spoiled their day.

In 2014, the USAF Air Combat Command divested itself of the MC-12W Program to free resources for fielding other aircraft. The proven Beechcraft went to Oklahoma Air National Guard's 137th Special Operations Wing at Will Rogers International Airport. Ongoing international dramas indicate they may be shifted elsewhere for counterinsurgency operations. At the time of writing, press releases suggested MC-12Ws could be assigned to more Air National Guard stations within the United States. Wherever these specialized



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Branded 090641 as a MC-12W and reregistered N6441Y, the 2009 King Air 350ER was delivered to PIA's Youngstown campus in 2026 where it is now a classroom and mentor.

weapons travel, they project American presence.

A new mission for N6441Y

While MC-12Ws worked unseen, non-profit PIA graduated nearly 100 technicians this past year at the Youngstown campus. Classroom and laboratory methodologies stressed hands-on practical experience – no assembly line tutelage to earn their A&P certificate. Persistence brought N6441Y from storage in Waco, Texas, into the institute's family of similar platforms in civil and military-oriented industries.

Staff at PIA recognize that more than 7,800 King Airs in numerous versions had been manufactured and every one of them needed care from newcomers to the aviation realms. Avionics and maintenance students knew they would encounter airframes like what they handled on classroom floors. After graduation, they welcome opportunities to enhance experience.

"Hands-on training is the cornerstone of our program," said campus director Joe DeRamo. "The addition of the aircraft and its PT6 engines enhances our students' learning environment. We're proud to continually invest in resources and grow the programs we offer at the Youngstown Airport."

Ignoring bumped foreheads, bodily odors in confined fuselages and fingers pierced by safety wire under hot summer suns, PIA's acolytes probed the entire aircraft's vapor-cycle air conditioning condensers, evaporators and fire protection systems to reinforce classroom concepts. Operable de-icing plumbing enables hands-on repairs to wing boots or horizontal and vertical stabilizers. Even supposedly simple jacking is not ignored; a 10,657-pound mass slamming to the floor would produce serious, perhaps deadly, consequences. Beechcraft N6441Y became a treasure of learning

the instant the four-blade Hartzell propellers ceased rotation. Leadership throughout the U.S. Air Force and U.S. Army partners expressed only praise for the aircraft and the Liberty Program.

As N6441Y settled into a new home, its mission took an innovative meaning. No longer protecting our borders from the sky, the King Air would now carry the dreams and ambitions of future aviation technicians. Every switch flipped, inspection performed and lesson learned about the aircraft helps prepare students. The aircraft has become more than an airframe – it has become a mentor and classroom. Though its flying days have ended, the greatest journey has just begun: Shaping technicians of tomorrow. **KA**

Robert S. Grant has published more than 2,500 articles in six countries as well as a bimonthly column for a Canadian west coast magazine. He has accumulated 20,200 accident-free hours in his flying career, including 5,300 on seaplanes, beginning in a fabric-covered hand-started Aeronca Champion. He operated Beechcraft King Air A100s in central and eastern Canada as well as during a five-month contract for Yellowknife's Buffalo Airways. Grant also spent 15 years in African nations and flew his first King Air 200 in Chad for U.S.-based humanitarian organization Air Serv. He lives in Ottawa and hopes to fly again in a Beechcraft.



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King Air External Power Evolution and Annunciation Explained

by Paul Sneden

An external power cart is a great tool to have for everything from engine starting to preflight checks. It can keep your battery charged, ensure a full 28 volts for cranking (batteries are typically around 24 volts) and run air conditioning on King Air aircraft with electrically driven compressors without starting the engines.

King Air flight manuals provide some information on external power systems, but they leave a bit to the imagination. I hope this article clears up any subtle misunderstandings.

Power carts and the aircraft receptacle

One universal concept in the flight manuals for various models is that the ground power should be capable of high current for engine starting but should still be limited to 1,000 amps for a very short duration. A direct current motor is a virtual short circuit until it starts to rotate. That creates a huge starting surge of current. Without power-cart limiting, the starter-generator's starting torque could shear the drive or spines before the mass of the engine's

rotating components has time to accelerate. Small carts for ground operations other than starting are fine but start carts should have some limiting features.

For those folks purchasing smaller power carts for your hangars, keep the DC motor surge theory in mind. Even if it seems your air conditioning and blower don't pull all that much current during operation, the motor starting surge is on the order of hundreds of amps. Newer carts that self-protect by shutting off are not going to make you happy. If your goal is only to run avionics, then press on.

Another common concept or rule: Do not connect external power when the aircraft battery is below approximately 20 volts. No current-limiting circuitry exists between the external cart and the battery, and a battery discharged to that low a voltage is hungry. The charging current could easily be high enough to bake aircraft wiring. High starter current is short-lived and the wiring will be fine. Battery charge current draw can last longer, and your wiring can cook. The only safe resolution is to

remove the battery and perform a bench charge using a charger with limited output.

All models recommend (or in some cases require) the battery switch to ON. The common concept is that the battery can help suppress transients, but under real conditions the aircraft systems will still feel a voltage spike regardless of the battery's presence. The battery will, however, become a replacement source if the externally supplied power drops or fluctuates.

One major advantage of turning the battery on before supplying external power comes from how avionics relays are wired. By default, avionics relays are closed and supply power when de-energized. That's a fail-safe circuit for bad relays. So, to isolate your avionics, the relays must pull energized when the avionics power switch is placed in the OFF position. No battery power? No avionics off. Then a spike or surge on external power initiation becomes a race between relays. That's not a great gamble.

External power evolution

In the earliest of the 90 series, the act of plugging in the power cord to the external receptacle was all it took to power the aircraft buses from the cart. No relay, no protection. Assuming the power cart was properly wired with a negative ground, power would be immediately applied to the aircraft buses. If the cart was wired backward, or provided an overvoltage, then smoke emission was assured.

Until LJ-154, LJ-155, LJ-185 and after, there was no protection whatsoever, even from reverse



A common concept is: Do not connect external power when the aircraft battery is below approximately 20 volts.

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polarity. Then, the third short pin of the power cord came into use for an external power relay, and we at least gained polarity protection for the aircraft and electronics. As King Airs and electrical systems evolved, the protection became more sophisticated, and in some models, we gained a dedicated switch, annunciation and meter to monitor the external input.

Another advantage of the short pin in the connector is that the two primary current-carrying pins are at least 50% engaged before the short pin closes the external power relay and allows power to the aircraft. That makes it impossible to draw an arc and burn out the primary pins and sockets. That's added protection if a hot power plug is inserted into the connector.

Starting with LJ-773 in 1978 for the C90s and LW-278 for the E90s, we gained overvoltage protection circuits that would monitor the third (short) pin of the power plug before allowing the external power relay to close. A kit (S.I.-1070) was available to add overvoltage protection

to the earlier aircraft back to LJ-502/LW-1. These overvoltage circuits also required setting the battery switch to ON to get external power to the buses. The 200 series had the external power relay from the start and adopted overvoltage protection by BB-364/BT-4.

External power annunciation

Gaining annunciation was a bonus; before it was available, there were numerous instances when the power cart used to start the aircraft became a pull toy when it taxied away. Expensive sheet metal repairs are assured. Annunciation has reduced the number of occurrences, but it hasn't completely solved the problem.

The evolution of the annunciation for external power is another confusing path to follow. Most of the 90 series until the C90A and F90 simply had no annunciation. The 200 and 300 series had an EXT POWER annunciator since the models were born, but the operation can be quite different.



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EXT POWER

The messages from an EXT POWER annunciation can vary significantly between models.

One glaring difference that haunts operators and technicians, until Collins' Pro Line Fusion avionics with the 200 series, is that the annunciator lamp is powered by the hot battery bus. That means that with no other switches on in the aircraft, if the external power plug is in the hole, then the external power annunciator is on. That's unfortunately led to many dead-battery discoveries after a night in the hangar when the plug was left in the external power jack.

That's a detail worth noting: The annunciation signifies a plug is in the jack, regardless of whether there is power to that plug. We'll cover that distinction later when we discuss the triple-fed bus aircraft. The earliest version of a plug detection was a microswitch in the plug housing on the wing. That was used in the 200s until BB-88, when what I call the "continuity detection" idea came about. From then on, all models used some form of circuit board to detect continuity between the long and short power pins on the power plug. In the power cord there are only two wires for power and ground and the long and short power pins are wired together. In the aircraft, these two are separate circuits. Since they become connected by the plug, that connection could be used for the annunciation – no more physical switch required.

The detection circuits migrated to printed circuit boards mounted farther away, and circuit breakers were installed near the external power receptacle to protect those longer small wire runs. In the triple-fed bus aircraft (C90A, F90, 300, B300), the circuits also became more sophisticated. The annunciator is illuminated only if the battery is selected ON, preventing battery discharge if the plug is left in. These annunciators also provide better signaling to the crew. If the plug is in, the annunciator will flash. If the now-included external power switch is turned ON, and power is successfully applied to the aircraft, then the annunciator will be on

steady-state. This also helps prevent taxiing away, since when the master caution light flashes, the circuit is also continuously tripped and that flasher can't be canceled either.

External power protection

Only with the advent of the triple-fed bus King Airs did we gain additional sophisticated protection circuitry. Before these, overvoltage protection and reverse-current protection were available based on serial number and maybe kit installation. In these aircraft, the printed circuit board that provides the annunciation distinction and flashing also is responsible for sending power to energize the external power relay. Of course, the circuit still rejects reverse polarity.

For overvoltage, even if you select the external power switch to ON, it won't happen if the voltage from the power cart is over 32 volts. That ensures your battery will charge, but at 32 volts the battery or aircraft circuits won't get cooked. If there is a transient



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excursion above 32 volts, the circuit will interrupt the external power, but even if the power drops back to something reasonable, the EXT PWR switch will need to be cycled off then back on.

If the voltage is under 25 volts, the circuit will close the relay and apply power, but the annunciator will continue to flash. That should prompt the crew to check the voltmeter and realize the battery may not be getting much charge. One condition for automatic bus tie closure in these systems is the presence of external power, and the bus closure signal is the same as the signal that closes the external power relay.



All models recommend (or in some cases require) the battery switch to ON.



There are many power carts that will meet the starting voltage and current requirements for a King Air.

External power voltage

In these triple-fed bus aircraft, the electrical systems also include an overhead voltmeter that, in addition to the bus selections, allows you to view the external power voltage before committing to the ON selection. That's always a good idea, since power cart voltmeters will get little or no attention throughout their lifespan, so accuracy is a bit questionable. This is also the first place to check if your annunciation continues to flash after selecting external power ON.

B300 Fusion

I believe we gave you some information with the Fusion crew alerting system messaging. Although the same circuit card is in use, the output that once gave us the flashing annunciator has been abandoned, so there's no indication for an undervoltage condition without consulting the meter on suspicion. The CAS messages are simply EXT PWR-CART or EXT PWR-ACTIVE. Although standard cockpit practice should be to ensure all CAS messages are removed from the multi-function display before taxi, I think the MASTER CAUTION flasher protected a few wings and power carts.

As always, reach out with your questions or comments! [KA](#)

Paul Sneden is the owner/president of KingAirDOM, a consulting firm, and King Air Maintenance Academy in Jupiter, Florida. He has been in the general aviation business for more than 50 years, holding numerous positions in aircraft maintenance, avionics and quality assurance. Beginning in 2006, Paul became immersed in the King Air world, creating and instructing maintenance courses for 90-, 200- and 300-series King Airs. He is also a regular speaker at the annual King Air Gathering. Reach him at paul.s.kamag@gmail.com or at 561-596-8626 (U.S. Eastern time zone).



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A photograph of a King Air aircraft on a runway. In the foreground, several large, light-colored rocks are scattered on the dark asphalt. The aircraft is in the middle ground, and the sky is filled with clouds.

DIRECT FROM THE DPE

Pebbles in the Flow

Understanding how foreign object damage events are created can help pilots prevent costly FOD occurrences.

by Joe Casey | Photos by Clint Goff

Among the King Air aircraft my company manages is a King Air 350 for which our pilots fly missions and our maintenance shop turns the wrenches. It's a wonderful situation as we have complete control of the overall management of that airplane. If a negative situation develops, it's either our fault or our opportunity to correct. It is fantastic if everything goes well (we get to take credit for good management) and can be terrible if something goes wrong (we own that problem).

Something did go wrong recently with that King Air. As part of the phase inspection, the fuel nozzles on both engines were due for a flow check and inspection (every 400 hours). With the fuel nozzles removed, it is a perfect time to accomplish a borescope inspection to make sure everything is OK in the inner bowels of the engine. And, while you have the borescope out, it's a good idea to look at the first-stage compressor blades with that

same borescope. This is a normal maintenance rhythm at any quality King Air maintenance shop when nozzles are due.

Well, wouldn't you know it. The right engine had FOD (foreign object damage) on two of the first-stage compressor blades. Sometimes FOD is small enough to be blended – a technician literally has a small piece of sandpaper on the tip of the finger and monotonously rubs the blade until smooth. But oftentimes the limitations for the damage require that the blade be repaired or replaced off-airplane at an engine shop. If so, the engine is removed, crated and sent to the engine shop for disassembly.

When blades only need to be blended, a sigh of relief can be heard in the next county. Blade blending is super-cheap and easy in the realm of engine troubles. Alternatively, you'll hear a gasp of fear from two counties over when an engine must be removed from the airplane and sent to the engine shop for FOD repair. No one wants the cost to split open an engine before the next major engine event.

When a PT6 engine must be split open, it is not just the offending first-stage compressor blade that must be repaired or replaced, but anything else that is discovered out of limits in the engine must also be brought within limits. Sadly, to get to the first-stage compressor, the engine is completely exposed. It's like going to a doctor when you have the sniffles: you'll have the sniffles addressed, but a good doctor is going to look at the whole body on any exam. Many an early cancer diagnosis was discovered by a good doctor during a sniffles exam. Kudos to that kind of doctor. And kudos to the engine shop that looks at the whole engine when the first-stage compressor blade FOD is repaired or replaced.

The FOD event on our King Air cost \$83,000. Let that sink in. An unexpected \$83,000 invoice is a stomach punch for just about anyone regardless of financial position. The repair also cost the owner two months of downtime. For an airplane that operates 200+ hours each year, two months down is a lot of logistical inconvenience.

Those dang jumping pebbles

This raises the question, "What caused the FOD?" What was that foreign object and where'd it come from?

In my experience, 90% of the time you'll never know the source of a FOD event or when said event occurred.

Sometimes FOD can be determined by the shape of the damage. I've seen a blade that had a perfect indentation from the head of a small bolt, and it was easy to trace that damage back to poor maintenance practices. More often you'll see strikes that look like an itty-bitty shark bit a piece of the blade; there'll be a rounded area missing on the leading edge. Sometimes, multiple blades have multiple damage events.

Did a single pebble strike multiple blades or multiple pebbles get ingested? It's hard to tell. The induced flow of air will ensure that the object(s) get sucked farther into the engine, causing more downstream FOD. If the first stage is damaged, there's usually more damage to other parts of the engine until the offending pebble is crushed into small pieces by the fast-moving turbine and spat out the exhaust.



The engine anti-ice switch moves the ice deflector in the front of the engine and opens the door behind the engine where debris can be ported overboard.

Death by a thousand cuts

Another type of FOD can be from ice in flight. Ice can collect on the leading edge of the inlet or on the prop. With ice present and then the prop heat switched to ON, the ice flies off the prop and/or inlet lip in chunks and goes into the inlet. That ice will cause the first-stage compressor to look like rough grit

sandpaper. It won't be one or two shark bites on the compressor blades, but there'll be thousands of small indentations. It'll be death by a thousand cuts. The compressor blades will feel rough to the touch, which degrades the aerodynamic effectiveness of the blade. Whether a pebble, blade of grass, ice or tiny bolt left by an inattentive

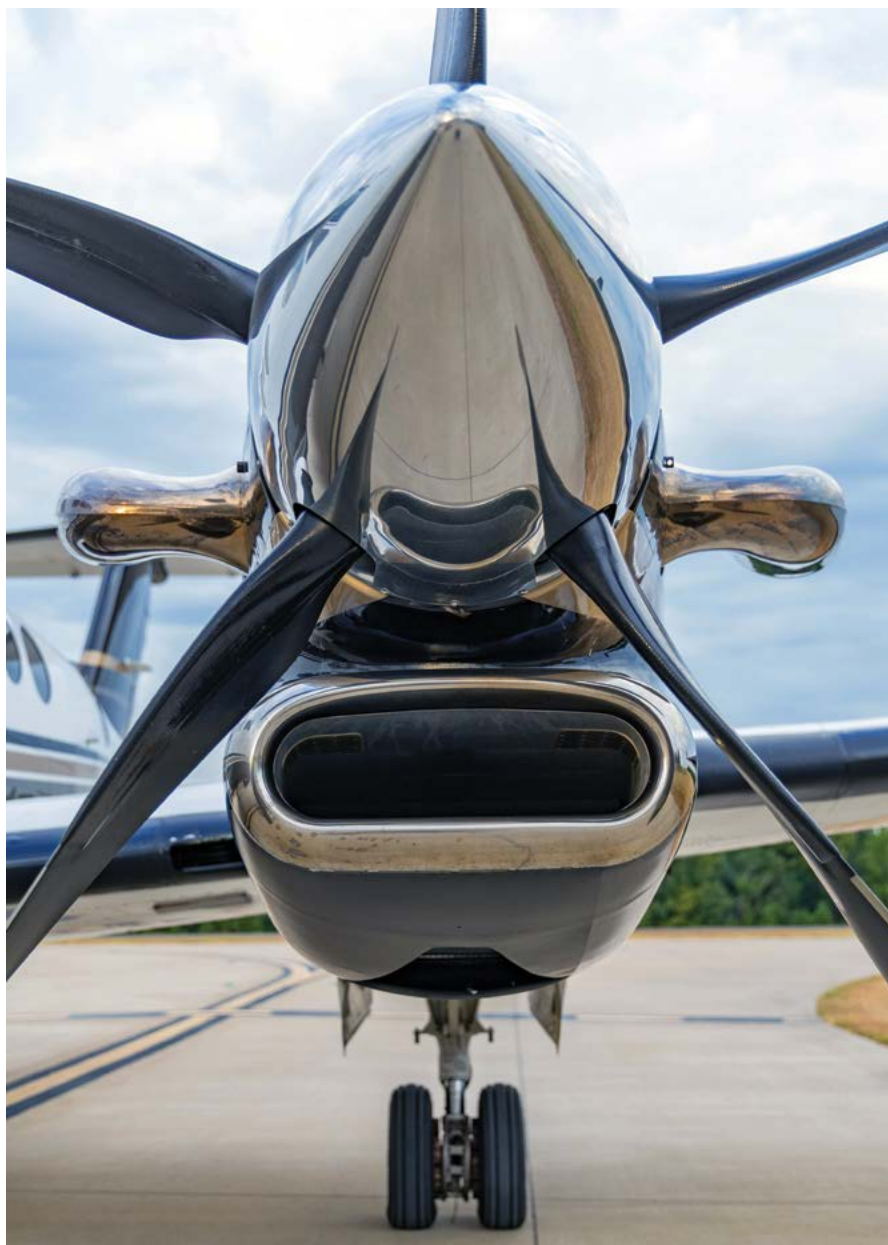
maintenance technician, the damage will have to be repaired.

In-flight ice damage is quite easy to avoid – turn on your ice defenders early. The “hot five” (pitot heat left/right, stall warning heat and fuel vent heat left/right) should always be on in flight. I can't think of a single reason to ever not turn on these critical defenders for the entirety of every flight.

Prop heat is another defender I recommend be turned on anytime you think you might enter an area of cold wetness. Effectively, there's no penalty for turning on prop heat. You'll not burn up the heating pads on the individual blades, and it'll cost nothing more than electrons. Your generators will burn a few more amps, but the generators on any King Air have huge capacity. With prop heat selected ON, you eliminate the potential for ice to develop on the protected part of the blades. In my rookie years of King Air flying, I rarely turned on the prop heat except when I knew I was about to need it. Now, in my much more mature King Air flying, I have entire flights using prop heat.

Deflectors on defense

Pilots dislike turning on the ice deflectors. They believe it'll slow them down, lessen their rate of climb and burn more fuel. They are right to a small degree. Turning on the ice doors will impact all performance parameters negatively, but in their haste those pilots have forgotten the huge cost of FODing out two engines. The bottom line is that in-flight ice must be avoided and is easy to avoid by simply turning on your ice defenders before entering



The wise PT6 pilot will do anything to avoid even something so small as a pebble in the engine inlet.

icing conditions and leaving your defenders on until well past the time that ice is present on the airplane.

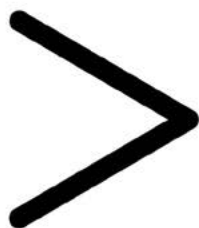
Then there's the elephant in the ice room: proper use of the ice deflector (or inertia separator) on the ground. The King Air pilot community has diverse opinions on management of the ice deflectors, but most FOD potential exists on the ground.

This was the crux of the matter when considering the FOD event on our King Air. We have three pilots who operate the King Air 350, and no one knows which pilot had the FOD or where it happened. Human nature wants to place blame when something bad happens, but blame won't fix the damage. The only way to serve the pilot community is for us to learn from others' mistakes, for that is far cheaper than learning from our own mistakes.

Only one engine had FOD damage, and only two blades in that engine were damaged. So, it was not an

in-flight ice FOD event. It was probably a singular pebble that caused the FOD. It likely struck one blade, bounced around the inlet a bit, struck the other blade, then was sucked deeper into the engine. A single pebble seems so innocuous, but that single pebble was the probable cause of a lot of damage. Whether in your engine or your shoe, pebbles matter.

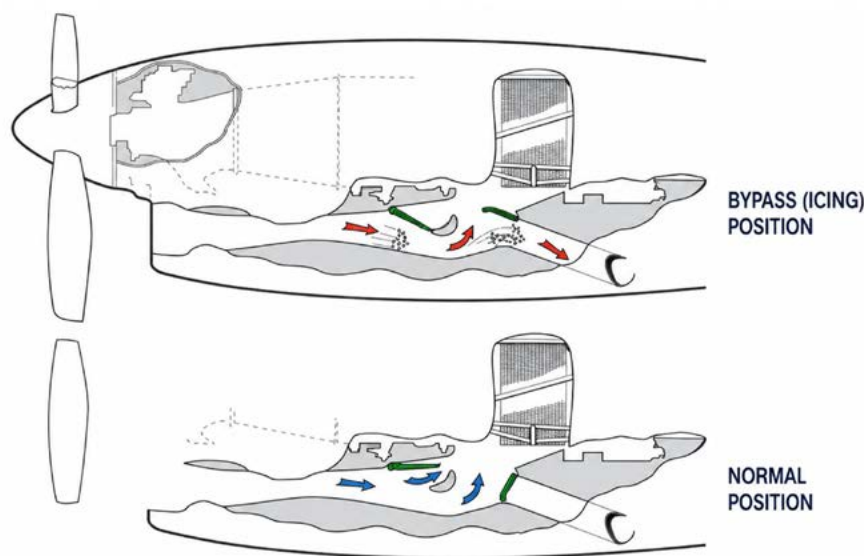
The compressor turbine of a PT6 engine turns about 36,000 rpm when at 100%, but those speeds are only seen in the upper reaches of flight at high power. On the ground, we usually idle the Ng of our engines (depending on variant) somewhere between 52% Ng and 65% Ng range, so this means that compressor turbine is turning somewhere between 18,720 rpm to 23,400 rpm at idle. That's an incredibly fast speed! A thin turbine blade doesn't stand a chance spinning at such speeds when a pebble of any size hits it. The wise PT6 pilot will do anything to avoid even something so small as a pebble in the engine inlet.



POLARIZERS

A SOLUTION THAT DOESN'T BURN OUT





This Pratt & Whitney PT6 engine inertial separator diagram shows the physical path that incoming air must take before it reaches the engine compressor. In the normal position (bottom graphic), anything that goes into the inlet has nowhere to go but into the engine. In the bypass position (top graphic), anything having mass would not be able to make the abrupt turn to enter the engine and instead gets ported overboard.

Door #1 or #2: Which does the pebble choose?

So, how did that pebble enter the inlet? There are only two ways a foreign object can enter an engine: through the inlet on the front or through the back door underneath the engine. The front of the engine is protected with an ice deflector. That one ice deflector switch moves the deflector in the front as well as opening the door in the back where debris can escape.

When the ice deflector is off, the front door is up (not diverting air) and the door in the back is closed (meaning anything that goes into the inlet has nowhere to go but into the engine). If the ice deflector is on, then the front door is down (diverting air downward) and the back door is open (allowing debris to be ported overboard). With the ice door on, that pebble has a chance of jumping into the inlet and then going out the

open back door quietly without any resultant damage to the engine.

The ice deflector works best when there is more airflow into the engine (induced flow), and most engineers will advise that the ice deflector really doesn't do much deflecting until 40 KIAS, which is when there's sufficient induced flow. Understanding induced flow is key to knowing how to defend your engines against the jumping pebbles. To get a foreign object into the engine inlet, we need two things to occur: 1) a force sufficient to lift the foreign object to the elevation of the engine inlet and 2) a flow of air (induced flow) into the engine to suck that foreign object into the engine. Where do we get the force that lifts the foreign object? From the propeller.

That problematic prop

The propeller has two main ground operations that have enough

force to lift a pebble: excessive use of beta/reverse and when the propeller is feathered. The classic case of the jumping pebbles happens on landing. The pilot lands the King Air and slams the power lever into reverse, but the ice deflector is off. The prop wash on the ground is immense and blows the pebble into the air as it bounces and skips from the air being blown before the prop. With the ice deflector off, if that pebble enters the inlet, it has nowhere to go except into the engine. If that pebble gets past the squirrel cage – the affectionate name for the inlet screen – there'll be a FOD event.

To prevent FOD events, use beta/reverse sparingly during landing. If needed on a short runway, use it. However, avoid excessive beta/reverse during normal landings. While better than rolling off the runway, beta/reverse introduces FOD risk. Ensure the ice deflector is on if using beta/reverse.

Use beta/reverse quickly after landing, as it's more effective at higher speeds. Below 40 knots, it produces little reverse thrust and induces little flow into the engine, reducing the ice deflector's effectiveness. One hallmark of a professional King Air pilot is that they rarely use beta/reverse regularly on normal landings.

The other area where pilots must consider the FOD potential is when feathering the propeller. The prop dumps the oil that is holding the prop blades in flat pitch, and they suddenly feather. This sudden movement sends a whoosh of air in all directions and can disturb debris under the propeller, potentially



Often you'll see strikes that look like an itty-bitty shark bit a piece of the compressor blade; there'll be a rounded area missing on the leading edge.

blowing pebbles from the ground and ingesting them through the open back door (if the ice deflector is on).

Insight from other markets

The King Air community has gained insight from other aircraft with PT6 installations much lower to the ground. In the Piper PA-46 market there is a PT6-converted airplane called a JetPROP. I fly these airplanes often, believing them to be super-cool airplanes. In the JetPROP market, the PT6 engine is nearly 2 feet lower than on any King Air, meaning that jumping pebble doesn't have to jump as high to cause some real damage.

The JetPROP POH advises that the prop be feathered first but feathering the prop first can disturb any foreign objects under the prop. We advise a pilot to shut off the engine with the condition lever while the prop is still in flat pitch, wait three to five seconds (so the induced flow is greatly reduced and the prop starts to slow down), and then feather the prop. There is less induced flow, less whoosh when feathering and far less potential of a FOD event.

I have started doing this procedure in the King Air with great success. Since the prop is attached to the power turbine (not directly linked to the Ng turbine), it doesn't care whether it is feathered or left in flat pitch on shutdown (it will eventually feather when the oil pressure drops). You will not hurt your engine or propeller by feathering (or not feathering) manually. And you won't create a FOD risk if you delay the feathering until shortly after the engine is shut down.

If you are the owner and the pilot of your King Air, you want to avoid a FOD event because you are writing the checks and you won't want downtime. If you are a pro pilot, you want to avoid a FOD event because non-pilot owners don't tend to understand FOD events and they don't appreciate unforeseen invoices. Avoiding the FOD event is altogether the best path and it is doable if the pilot understands how FOD can occur.

We'll never know which of our pilots caused the FOD event and we don't care. I'm certain none of them intentionally damaged the engine. While negative events can happen, they can be mitigated by aware pilots implementing good operational practices. We conducted a pilot's call with all our pilots to discuss the points outlined in this article. I hope this information serves as a reminder of good operational practices that can keep your King Air out of the engine shop. **KA**

Joe Casey is the owner of Casey Aviation, Inc., based at Angelina County Airport (KLFK) in eastern Texas. The company manages four King Air aircraft and provides flight training in many models of airplanes. He has 19,300 hours of total flight time, over 4,500 of which are in King Air airframes. He is a certified ATP-ME/SE commercial pilot with ASES, Rotorcraft-Helicopter/Instrument and Glider ratings. Casey is also a designated pilot examiner (DPE) with many authorizations from Sport Pilot through ATP, CFI-Initial and the BE-300 type rating issuing authority up to the ATP level and holds CFI, CFII, MEI, CFI-H, CFI-IH and CFI-G certificates. He has flown 83 North Atlantic crossings in King Air aircraft.



TRAVELOGUE

New Discoveries

Flying to and touring New River Gorge National Park

by Matthew McDaniel



PHOTO COURTESY: WEST VIRGINIA DEPARTMENT OF TOURISM

As we approached the first stretch of whitewater rapids, our youthful rafting guide was positively giddy with excitement. Since launching our nine-person raft, we had glided sedately down an entirely genteel portion of the New River in West Virginia. Introductions had been made all around and we had learned of our adrenaline junkie guide's nomadic lifestyle, traveling across the U.S. and abroad, chasing seasonal guide work. He routinely led unsuspecting tourists through skiing, surfing, rafting, trekking, kayaking, climbing and even ultra-marathon adventures.

On the surface, he was the quintessential surfer dude/ski bum whose demeanor was filled with swagger and slang-filled language. Nonetheless, he was hilarious and put everyone aboard at ease. As we dropped into the first rapids, the rubber raft bent and twisted. We all got soaked with warm spray as he screamed, "Five forward,



One of the best ways to enjoy views of New River Gorge National Park in the summer is to raft the river for which the park is named.

PHOTO COURTESY: WEST VIRGINIA DEPARTMENT OF TOURISM



Bill Chouinard, who also flies King Airs, gives aerial tours of the New River Gorge National Park & Preserve in this restored 1943 Boeing Stearman biplane through Wild Blue Adventure Co., the company he and his wife own.

PHOTO COURTESY: WILD BLUE ADVENTURE

then get left," commanding our paddle strokes and body positions. Using his terminology, we soon "got spit" from the churning waters and were again serenely drifting downstream within America's newest national park. Only seven sections of rapids to go.

The newest (national park) is one of the oldest (rivers)

The New River Gorge, in southern West Virginia, was established as a national river in 1978 under President Jimmy Carter. In 2020, a portion of it was redesignated

and named New River Gorge National Park & Preserve (NRGNP). It became the 63rd U.S. national park and remains the nation's newest designated national park.

The New River, however, is far from new. It is one of the world's oldest rivers and predates the Appalachian Mountains that grew to surround it over many millennia. Where NRGNP cuts through the Appalachia Plateau, its gorge exposes rock up to 330 million years old. This gorge was once so remote that it was essentially inaccessible and unknown. The river was missing from a 1755 map. When the area was remapped in 1764, the newly

discovered waterway was labeled simply, “new river.” Initially, it was referred to as “Wood’s River,” after explorer Col. Abraham Wood. However, that name didn’t stick, while New River did.

In the late 1800s, railroads started being built alongside the river and through the isolated valleys. With railroads, the region’s rich coal deposits could be transported to the world beyond. That brought coal companies, jobs and money to the area. Boomtowns popped up to support the coal industry and the new populace whose labor it depended on. In the latter half of the 20th century, non-residents became aware of the area’s natural attractions. In 50 miles of river, the elevation drops over 750 feet, creating some of the nation’s premier whitewater stretches.

In all, New River Gorge National Park & Preserve protects 72,000 acres of land and water among 53 miles of the New River. The national park portion comprises about 7,000 acres within the gorge, where hunting is not permitted; the remaining 65,000 acres make up the national preserve, where traditional activities like hunting and fishing are allowed.

NRGNP welcomes nearly 2 million visitors annually to enjoy the river via swimming, rafting, kayaking, canoeing and more. Vast expanses of the park also offer hiking, biking and horse trails; scenic drives and overlooks; historic districts; and all manner of plant and wildlife viewing. The park’s landmark is a colossal bridge that also happens to be irresistible to BASE jumpers.

Bridge experiences

The New River Gorge Bridge is an engineering marvel. As one of the world’s highest vehicular bridges, it spans over 3,000 feet and features a 1,700-foot arch. For the first 26 years it was open, it was the world’s longest single-span arch bridge. It retains that claim for any bridge outside of China and it is the third-highest bridge in the U.S.

There are several thrilling ways to experience New River Gorge National Park & Preserve’s biggest attraction.

On the underside of the bridge is a 2-foot-wide maintenance inspection catwalk, running the full length of the roadway above. Bridge-walk tours click visitors into



See stunning autumn foliage in New River Gorge National Park.

PHOTO COURTESY: WEST VIRGINIA DEPARTMENT OF TOURISM

safety rigging, allowing them to walk about a quarter of a mile of the open-air catwalk.

Some travelers arrive from around the world to jump off the bridge and into the New River. This is only allowed on Bridge Day, scheduled on the third Saturday of each October. The bridge closes to vehicular traffic, allowing pedestrians to walk across and qualified BASE jumpers to leap into the 876-foot canyon below legally.

The first known BASE jump from the bridge occurred in 1979 when an Army vet jumped in view of 200 spectators. To deter illegal jumps, Bridge Day began in 1980 as an annual sanctioned and supervised event for BASE jumpers and rappellers. About 400 BASE jumpers participate and there have been three deaths recorded. Bungee jumping ended in 1994, just two years after a New Zealander plunged 823 feet to set the world record for longest bungee jump.

Beckley beckons

Beckley is an unimposing town of only 17,000 residents, though closer to 115,000 people live in the greater metropolitan area, making it the major hub of West

Virginia's southern region. With a history heavily tied to the coal industry, the area's tourism has taken root more recently with the added awareness from the national park designation.

The most convenient airport for flying into the NRGNP region is Beckley's Raleigh County Memorial Airport (KBKW). The generally sleepy, pilot-controlled field is surprisingly well suited to host visitors flying turbine and piston aircraft alike.

Approaches into Beckley require terrain awareness regardless of the direction from which you've traveled. While the mountains may not be the proportions of the Rockies, they are equally unforgiving to carelessness or inattention. KBKW's main runway is the 6,750-foot-by-150-foot Runway 01-19. Both the ILS and LPV approaches into 19 offer minimums down to 220 feet AGL, while the LPV into 01 has a slightly higher, terrain-influenced minimum of 315 feet AGL. The shorter crosswind Runway 10-28 (5,001-foot x 100-foot) is relatively unobstructed when landing east, as it crosses the city of Beckley, allowing its LPV guidance to be used down to 200 feet and 3/4-SM visibility. Landing west, on the other hand, ➤



Sandstone Falls is in the southernmost section of New River Gorge National Park.

PHOTO COURTESY: WEST VIRGINIA DEPARTMENT OF TOURISM

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The author with his wife and daughter at one of many New River Gorge Bridge viewing points along Fayette Station Road. When completed in 1977 (and for 26 years thereafter), it was longest span, single arch bridge in the world.

PHOTO CREDIT: MATTHEW MCDANIEL

is heavily terrain-limited, offering only LP minimums of barely below basic VFR ceilings. Once on the ground, the relatively new, large terminal is easy to spot at the northeast intersection of the runways.

At first, the terminal feels like it's strictly for airline traffic (of which there is minimal Essential Air Service only). Nonetheless, transient and overnight parking is permitted on the terminal apron. The county offers full-service fuel and rental cars can be claimed within the terminal. Caution: Confirm attended hours and availability in advance and be prepared to provide your own tie-down ropes and chocks.

A realistic alternative to KBKW is Greenbrier Valley Airport (KLWB), near Lewisburg. The airport offers a larger variety of airline services and rental cars than

Beckley, but it requires about double the driving time to reach the most popular areas of NRGNP or either of the park's two visitor centers. While KLWB offers a slightly longer runway (the 7,003-foot-by-150-foot Runway 04-22), there is no crosswind option available. A single ILS serves Runway 04, while LPV approaches serve both runway ends. As with KBKW, terrain awareness is necessary and none of the approaches get quite down to the minimums of a flat-land airport.

We approached KBKW from the northwest on a VFR day, with a blustery west wind making the descent across the Appalachian foothills slightly bumpy. We were cleared for a visual approach to 28 and flew a standard traffic pattern. Both a helicopter and a training aircraft were departing at the time and coordination was easy

and cordial via the common traffic advisory frequency. A charter flight was loading passengers at the terminal when we arrived. Within 30 minutes, we were unloaded, tied down, refueled and driving away in our rental car. It was fast, easy and affordable.

Day 1: First looks

It was a 30-minute drive to our vacation rental house in Fayetteville, which put us minutes from the park's prominent New River Gorge Bridge and the Canyon Rim Visitor Center. Along the route, we enjoyed a fantastic lunch at The Cathedral Café, a converted church that feels like the beating heart of the quaint downtown. Owned by a former New River raft guide, the café has been hosting locals and tourists alike for 25 years. After a leisurely walk, enjoying the July Fourth festivities and decorations, we headed into the park proper.

Our first glimpse of the gorge was crossing the bridge, an impressive 876 feet above the river. Only moments later, we were enjoying panoramic views of the park via the visitor center's viewing areas. Armed with maps and info from the rangers, we were soon driving the steep and winding Fayette Station Road to the gorge floor. This scenic one-way drive is just 8 miles long – about half on each side of the river – and combined with the single-lane Tunney Hunsaker Bridge (built in 1889) at the bottom, this was the only way to drive down to and across the river until 50 years ago. Today, the drive offers multiple waysides for viewing the gorge and the massive New River Gorge Bridge (completed in 1977) from various perspectives.

At the bottom, riverside beach areas offer recreation, relaxation and commanding views of the old and new bridges. Ascending the other side of the gorge, the Wolf Creek trailhead parking lot intersects a network of trails that include easy 1-mile treks as well as moderate-to-strenuous routes like the 4-mile Fayetteville Trail. After some easy hiking, we continued the drive out of the gorge, bringing us back into Fayetteville.

Unlike many national parks, NRGNP is easy to visit, even without in-depth advanced planning. No season is off limits, though winter is likely the least inviting and often brings seasonal facility closures. Spring offers the exhilaration of fresh growth, crisp air and abundant wildlife viewing. In summer, the New River itself is the

perfect escape from the heat. Autumn is optimum for seeing stunning fall colors. We'd chosen a summer holiday weekend and still had no trouble booking lodging or activities with little notice. We ended Day 1 at our rental's pool and grill, recuperating from a busy day flying in and touring the park's northern areas.

Day 2: History and recreation

Learning about local history and riding the rapids were our goals for Day 2, so we set off to the park's central area and the Thurmond Historic District.

Thurmond stands as an example of a classic boomtown, and with more than 20 park-owned structures, it is the best-preserved of the many historic places and structures within NRGNP. Rangers led a fascinating historical walking tour of this once thriving community, beginning at the depot-turned-visitor center.

Founded in 1873, the same year the railroad was completed, Thurmond soon became the epicenter of business in the gorge, thanks to coal exports and the trains that hauled them. The depot peaked in 1910 when 75,000 passengers passed through, along with so much freight and coal tonnage that the tiny village was the highest-revenue station for Chesapeake & Ohio Railway's mainline. The Great Depression and the automobile sealed the fate of Thurmond; the last steam locomotive left the depot in 1958. By 1984, the depot was closed, followed by the post office in 1995.

After a picnic lunch, we signed up for a half-day whitewater rafting excursion from one of the many vendors operating near the park boundaries. Experiencing the New River while afloat is worth the cost and cannot be duplicated from any land-side vantage point. Views of the massive boulders, stone blocks and outcroppings – imagine the size of a house – along the river's edge are breathtaking. The rapids range from Class II to V, but none are long in duration. Several are benign, while a few others are quite exhilarating.

While our guide enjoyed joking that he'd been at zero days since losing a rider into the river all summer, including one ejected during our voyage, the safety briefings and flotation equipment provided comfort levels most riders were happy with. If you did get dunked, the river was bath temperature in July and



Visit Thurmond, West Virginia, a historic boomtown within the national park, to see the preservation of buildings and infrastructure that supported the railroad and coal industries.

PHOTO CREDIT: MATTHEW MCDANIEL

following the guide's instructions put our single man overboard back onboard in a matter of seconds. The whole experience was far more fun than it was scary. The all-day voyages offer about the same amount of river and rapids; they just do so at a more leisurely pace, including stops for lunch, swims and brief shoreline hikes.

Day 3: Completing our tour de gorge

Day 3 began by heading south to the lower park, represented by the Sandstone Visitor Center. First, we stopped at Grandview Overlook on the southwestern edge of NRGNP. There we hiked the Castle Rock, Grandview Rim and Tunnel trails, covering about 2.7 miles of moderate-level hiking. Highlights included sweeping gorge views, sheer stone walls towering above and below the trails, and a commanding view of the bridge from

a high, downstream perch. We ran out of time for the popular Turkey Spur Overlook, a ridgeline hike ending with a 160-step climb to three overlook platforms.

We finished our tour at the southeastern finger of the park, where we stopped at many overlooks along the east side of the New River. Just past the Hinton Historic District, a preserved 24-block Victorian-era railroad town, we crossed the river again and proceeded north to Sandstone Falls. There, the largest waterfall anywhere along the New River – spanning 1,500 feet across the river with drops of 10 to 25 feet – is easily accessible via boardwalks and observation decks. A bit of easy rock scrambling can even put you into the river for prime viewing of the many tiers of the falls, all while keeping your feet dry. Before heading back to the car, we completed the Island Loop Trail for a tranquil stroll through farmlands transitioning back to forest.

From there, we were back at Beckley's airport within 30 minutes. Sunday was quiet at the terminal and since I'd refueled and paid upon arrival, we made an easy getaway. **KA**

Matthew McDaniel is a Master & Gold Seal CFII, ATP, MEI, AGI & IGI and Platinum CSIP. In 35 years of flying, he has logged over 24,000 hours total, over 6,200 hours of instruction-given and over 2,500 hours in various King Airs and the BE-1900D. As owner of Progressive Aviation Services, LLC (progaviation.com), he has specialized in Technically Advanced Aircraft and Glass Cockpit instruction since 2001. Currently, he is also a Boeing 737-Series Captain for an international airline, holds eight turbine aircraft type ratings and has flown 170 aircraft types. Matt is one of less than 10 instructors in the world to have earned the Master CFI designation for 12 consecutive two-year terms. He can be reached at matt@progaviation.com or 414-339-4990. A resident of Milwaukee, Wisconsin, Matt and his wife began visiting national parks when the oldest of their two children was an infant in 2005. The family is now 48 parks into a quest to visit them all.

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VALUE ADDED

Canada Approves 7-Blade Silent Prop for King Air 300 Series

MT-Propeller has received Transport Canada Civil Aviation STC SA26-78 for the installation of the 7-bladed Silent 7 propellers on Beechcraft King Air 300, 300LW, B300 and B300C aircraft powered by two Pratt & Whitney Canada PT6A-60As propeller turbines and for the same models powered by PT6A-67A engines, which are options on B300 and B300C models. This installation is also supplemental type certified by the FAA on STC SA119141B and by EASA under STC 10085161. *Source: mt-propeller.com*

aircraft maintenance organization. For years, Banyan has supported missionary and humanitarian efforts in Nigeria and contributed to hospital, nursing school and new runway projects.

Already an FAA Part 145 and EASA-approved repair station, Banyan continues to grow its global regulatory approvals, allowing international operators to receive qualified maintenance services while operating in the United States. Nigeria joins a growing list of international certifications for the service provider that includes Argentina, Aruba, the Bahamas, Brazil, Colombia, the European Union and Mexico. *Source: banyanair.com*

NBAA Names Interim COO

The National Business Aviation Association board of directors named Dan Hubbard as interim chief operating officer on Sept. 18 and designated Hubbard as the association's day-to-day lead while President and CEO Ed Bolen takes a leave of absence for cancer treatment. Hubbard has been with NBAA for 22 years and has served as its senior vice president for communications since 2008.

NBAA also announced that Heidi Williams will be elevated to senior vice president, operations, filling a role left by the retirement of Douglas Carr this past July. *Source: nbaa.org* **KA**

Textron Aviation Bolsters Customer Support in Australia

Textron Aviation received Civil Aviation Safety Authority (CASA) Part 145 approval for its Australian maintenance organization that includes three company-owned service centers in Melbourne, Perth and the Gold Coast, establishing one of the most comprehensive OEM-owned support footprints in Australia.

The company reports more than 1,400 Beechcraft, Cessna and Hawker aircraft operating in Australia and said the approval strengthens its ability to support customers with CASA-approved maintenance, modifications, overhaul services and aircraft-on-ground support closer to where they operate. *Source: txtav.com*

Statement of Ownership, Management, and Circulation for King Air

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Outside-County, 536; 2. In-County, 0; 3. Other Classes USPS Mail, 0; 4. Outside the Mail, 0. Total Free/Nonrequested Circulation (D 1-4), 536; F. Total Distribution, 2,091; G. Copies Not Distributed, 159; H. Total (F and G), 2,250; I. Percent Paid/Requested, 74.37%.

Jessica Haughn, CFO



MT-Propeller's Martin Albrecht in front of a King Air 350 featuring the 7-blade prop at a recent King Air Gathering.

Banyan Air Service Certified as Nigerian Aircraft Maintenance Organization

Banyan Air Service at Fort Lauderdale Executive Airport (KFXE) has expanded its international maintenance capabilities by earning certification by the Nigeria Civil Aviation Authority as a Nigerian

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