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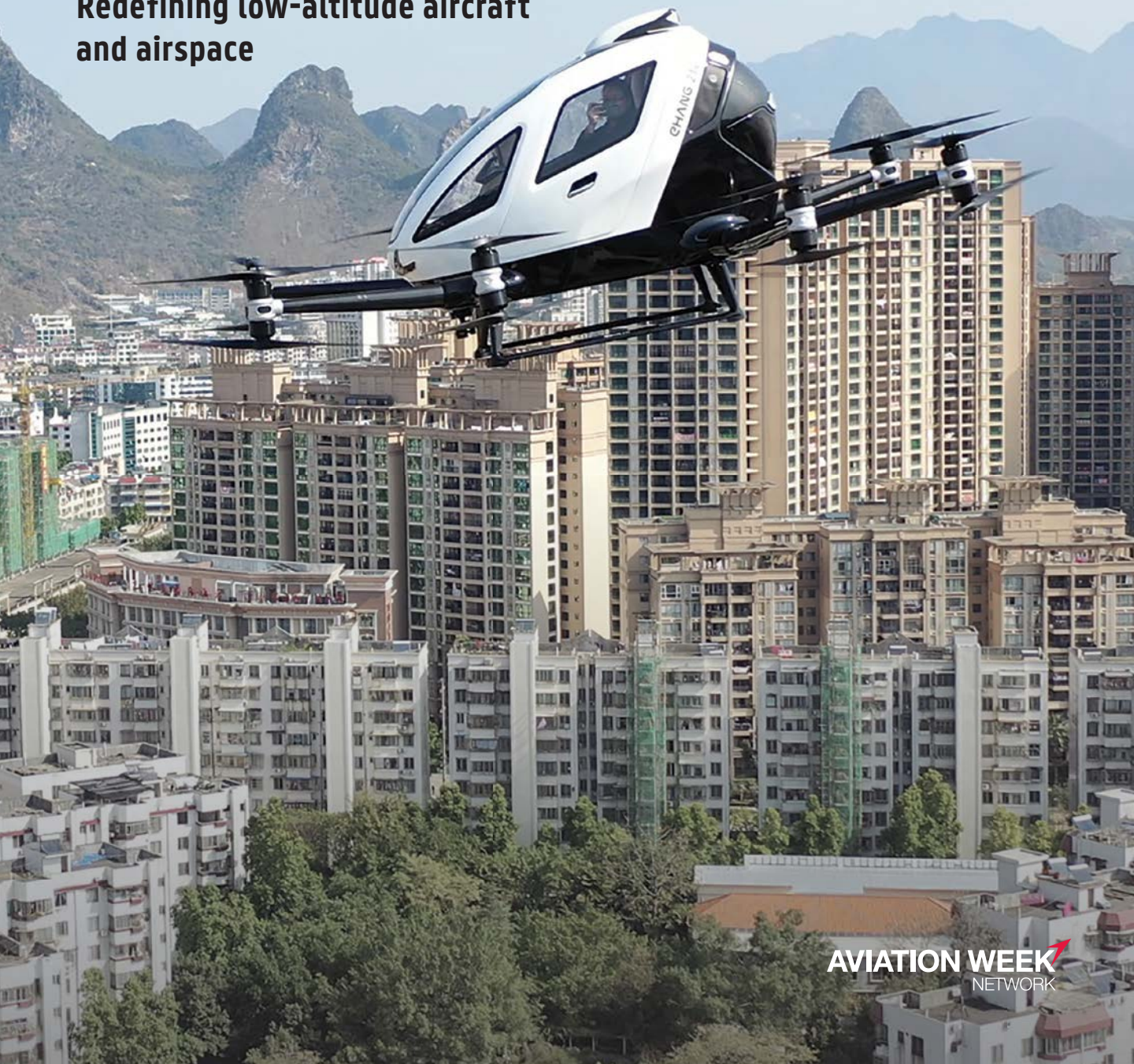
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SPECIAL REPORT

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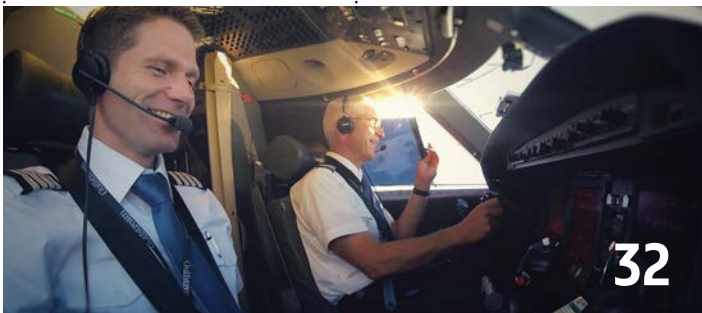
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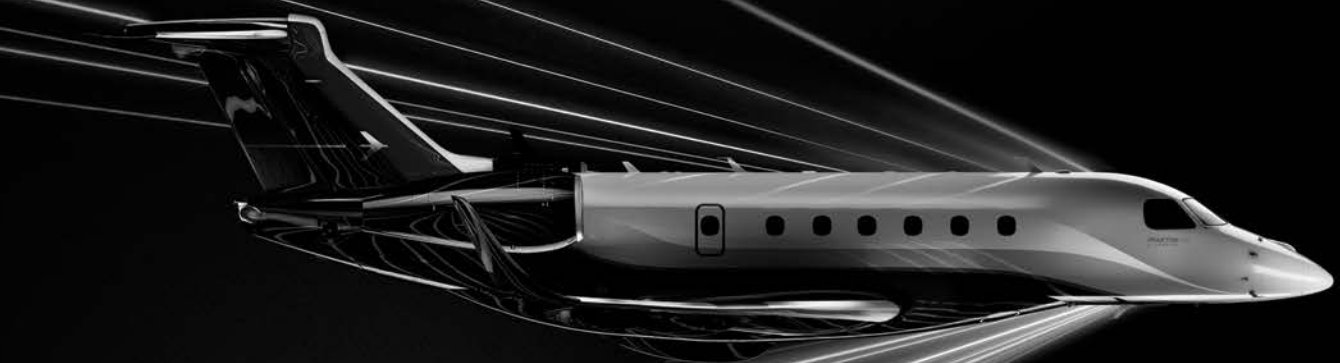
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“HEY SCOTT, IS THAT YOU? WHAT TIME IS IT THERE?”

That hardly equates to Alexander Graham Bell’s historic utterance, “Mr. Watson, come here.” Or Walter Cronkite’s, “Good evening, Europe. This is the North American continent live.” But unlike that first telephone message in 1876 or the first real-time transoceanic television transmission in 1962, my exclamation was unplanned, unscripted and full of wonder.

By way of background, our family sponsors a modest annual scholarship for a deserving Army ROTC cadet. We typically present the award in person, but COVID-19 nixed that this spring. So, we arranged a Zoom session and invited past winners, friends and officials to join in. One of the first faces to appear was fuzzy, in a dark place and speaking softly. That’s what prompted my query.

It was indeed Scott, whispering, lest he awaken his roommate at his combat quarters. Meanwhile, as other faces started to appear in their little on-screen boxes, my bride and I were particularly pleased to see Jimmy, our very first scholarship recipient, standing in the warm sunlight at Joint Base Lewis-McChord.

That’s when the technology really struck home for me. We were watching and conversing with a dozen young soldiers and others at places stretching from Afghanistan to Tacoma, Washington — 7,000 mi. across two continents and the Atlantic Ocean. And we were doing so using a battery-powered laptop computer resting on our dining table, and all of it for free. Wow.

Since then, videoconferencing has become a familiar tool for work and leisure for many users globally. As a consequence, I’ve been able to see siblings, nieces, nephews, their spouses and children in a matter of months rather than the years it might require to see each of them in person. And that goes for colleagues and collaborators as well, which is great.

But here’s the thing, I’ve worked in a home office for a dozen years and half joke that one of the rewards of such removal is my absence from meetings that too often prove to be time-wasters. However, once everyone was sent home, video meetings began to surge, and it seemed I was expected to attend most. Alas. So much for splendid, productive isolation. The truth is I’m becoming Zoom-weary, and I don’t think mine is a unique condition.

And that, I believe, will prove to benefit business aviation. Yes, these electronic engagements are a technological marvel and can help improve reach, familiarity, understandings and relationships, all of which I applaud. But even so, there’s

something undeniably missing in them. And here I quote John Emmerling, an old friend, aviation advertising guru (clients included FlightSafety International, Dassault Falcon Jet and NetJets) and long-time pilot. To him, at-home video conferencing is absent “The Schmooze Factor.”

He lays out his case in “How Will You Be Flying in 2025?” on medium.com. But some of his key points, with which I agree, include the fact that “humans will always crave actual human contact,” that industry conventions like those hosted by aviation associations comprise the “ultimate business-networking

tool,” and that the relationships and experiences (including misadventures) that result from actual attendance can help burnish company culture and, by the way, make for some really good stories.

The importance of in-person involvement was made plain to me in an album of tributes and memories presented to me at a significant birthday. Son Michael’s entry was one of thanks — for me being on hand to witness his graduations, his OCS trials, his commissioning, his berthed cutter, his training squadron mates and winging at Pensacola, his helo duty stations in Miami and Alaska, his wedding to Julie, to meet fellow staffers at the embassy in Tbilisi, Georgia, and, subsequently, to celebrate the births of Noah and Collin upon their homecoming. I was so pleased with and hold close to every experience.

Clearly, presence matters. It’s a kind of salute and a cheer that involves determination, effort and time. And the recipient understands and appreciates that even though it may go unexpressed. And that interaction, that bonding simply does not convey through a laptop app.

Thanks to my career access as a reporter, I’ve been face-to-face with a variety of notables including several U.S. presidents, congress folk, governors and a couple of kings; aero luminaries including Jimmy Doolittle, Chuck Yeager, Neil Armstrong, Jim Lovell and Sully Sullenberger; glitterati such as Jack Lemmon, Harrison Ford and John Travolta; financial titans Warren Buffett, Malcolm Forbes and Al Ueltschi; and a pretty good stickman on the greens and in the air named Arnold Palmer, among others. And I can attest that reading and hearing of their accomplishments is one thing, but being in their close presence and actually exchanging words while looking eye-to-eye is quite something else.

So, while video provides value in very many ways, the importance of actually being there is beyond measure. And that’s the gift business aviation facilitates so magnificently. **BCA**

And I can attest that reading and hearing of their accomplishments is one thing, but being in their close presence ... is quite something else.

Readers' Feedback

Good Answers

Your Q&A with Amy Spowart of the National Aviation Hall of Fame (*Fast Five*, September 2020, page 19; Aviation Week's Check 6 podcast) was spot on. Great questions and she had some really good answers. I love the Hall of Fame's Public Broadcasting Service partnership as well as young Noa and the Bessie Coleman project. Amy is a super lady.

Dave Hurley
Denver, Colorado

Great Interview

I really enjoyed your interview with the National Aviation Hall of Fame's Amy Spowart. She's quite an impressive person. Our two organizations work together often and I appreciate her intelligence, enthusiasm and focus.

Greg Principato
President & CEO
National Aeronautic Association
Washington, D.C.

Why Can't You Fly an Airplane?

I've been a reader of *BCA* for a long time. I even submitted comments occasionally. Really appreciate what you guys communicate.

After reading "The Human-Engine Interface" (August 2020, page 56), I just wonder why pilots get so mucked up. I'm a corporate pilot with a good bit of time in multiple types. Maybe I'm just old school, but why can't some of these new guys fly an airplane? I just shook my head that regarding Asiana Flight 214 there were "no real challenges to speak of" except "the ILS glideslope was out of service." On a perfect VFR day! Seriously? Good grief. And the other accidents noted: head scratchers.

I had another captain I flew with laugh and say to me "You can take the steam gauges out of the airplane but not out of the pilot." I was flying Pro Line 21 and pulling up VOR needles as reference. When I would click the autopilot off at 5,000 ft. on approach, he

would say, "Oh, lord, let the accident sequence begin." When I flew turbojet Learns, I wouldn't use the autopilot for anything much other than cruise!

I've trained a lot of copilots, done plenty of IOE's and there are some talented folks out there. And some . . . make you wonder.

Just thought I'd throw in my 2 cents. Cheers to all you folks. Great job. I enjoy it all!

Jim D.
Nashville, Tennessee

Expect a Premium Increase

"Middle-Age Muddle" (*Viewpoint*, September 2020, page 7) regarding old airplanes and old pilots is right on. And it looks like the insurance companies may, as usual, be the ones to say too old is too old.

When the policy on the new King Air 350i I fly renewed this past June, the agent said to expect a significant premium increase. No surprise there.

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But when the quote came back — the only quote for the \$100 million liability we carry — the guy who had been chief pilot was relegated to the right seat only because he is 75. No extra premium would get him back to pilot in command (PIC). They are OK with me at 71 as PIC, but don't know if that will last four more years. If it does, it won't last longer.

Even more extreme is that the open pilot warranty requires anyone we use as second in command (SIC) be type rated in the King Air 350 and have attended an approved training school in the past 12 months. They also must have 1,500 hr. total, 500 turboprop hr. and 50 hr. in the King Air 350. I would guess the only person who meets those qualifications is flying for Wheels Up. So, the idea of hiring a pilot working their way up, probably from a university training program, is out because of the turboprop hours and time in type requirement.

And all of this is in an airplane certified for one pilot. We always had a company SOP for two crew but would ferry the airplane to the shop, for example, sometimes with a single pilot. Now that's out. Even flying with an empty cabin still requires two pilots.

We all have known that underwriters have an unpublished age limit, but now we know for sure that for some — or all — it's 75. Or maybe lower. We'll see. So, you're right. A new generation of pilots and airplanes will be here sooner than some thought.

Our company — a first-tier automotive components supplier — is back working and flying pretty much at pre-virus levels. In fact, demand is greater than available staff. Most manufacturers here in West Michigan were having difficulty finding enough workers before the pandemic. Now the problem is compounded by the leave that is necessary when anybody is around someone who has been ill, or suspected

of having the virus. Not sure how long it will last, but the auto industry just can't build the SUVs and pickups fast enough to resupply the inventory.

Hang in there.

J. Mac McClellan
Grand Haven, Michigan

Editor's note: To those wondering: Yes, that's the same Mac McClellan, a former colleague, who was a staff editor at BCA before moving to Flying magazine and ultimately becoming its long-time editor in chief. Although ready for a well-earned retirement, he accepted an offer he couldn't refuse and became a professional business pilot. He now heads for the links when off duty.

If you would like to submit a comment on an article in BCA, or voice your opinion on an aviation related topic, send an email to jessica.salerno@informa.com or william.garvey@informa.com

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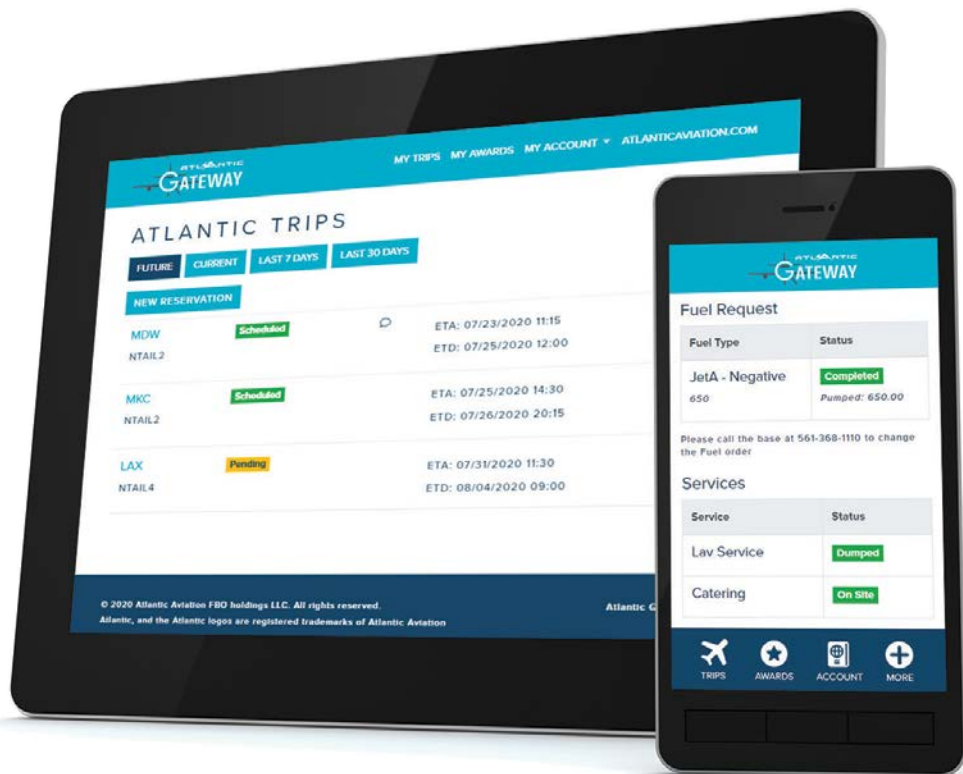
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NEWS / ANALYSIS / TRENDS / ISSUES

► **TEXTRON AVIATION HAS UPGRADED ITS LARGEST** Beechcraft King Air with new autothrottles, improved avionics, reworked cabin and other enhancements and redesignated it the Model 360 and 360ER. Deliveries to customers are to begin this quarter; the new model replaces the King Air 350i. The Innovative Solutions & Support (IS&S) autothrottle system com-



putes and manages engine power from takeoff roll to landing. **It reduces pilot workload and provides over-speed and under-speed conditions as well as over-temp and over-torque conditions.** Other upgrades include a digital pressurization system, which automatically schedules cabin pressurization during climb and descent. The system replaces the manual pres-

surization controller on the cockpit pedestal. The aircraft will feature a cabin altitude of 5,960 ft. when cruising at an altitude of 27,000 ft., a 10% improvement compared to the King Air 350i. Lower cabin altitude provides more comfort for passengers during flight, especially during longer trips. Meanwhile, flight deck upgrades also include the relocation of indicators, including flap position, cabin rate of climb and cabin altitude. Sirius XM is also an option. The redesigned cabin features additional legroom, custom-built cabinetry and pullout worktables. In addition, there's optional Wi-Fi, USB charging stations, standard power outlets, LED cabin lighting with lighted cup holders, and a private aft lavatory. The aircraft, which seats up to 11 people, has a base retail price of \$7.9 million, while the King Air 360ER's base is \$8.795 million. More than 7,600 King Airs, including 1,300 Model 350s, have been delivered since the iconic twin's first flight in 1964.

► **CHICAGO EXECUTIVE AIRPORT (KPWK) RECORDED 9,041** takeoffs and landings in July, marking the busiest month for flight operations at the general aviation hub since July 2015 and capping a remarkable turnaround from the falloff in activity since the arrival of the COVID-19 pandemic. The movements involved all manner of aircraft ranging from lightplanes and training aircraft to business turboprops and jets. "We're encouraged by this strong return of flight operations during the summer months," said Jamie Abbott, the executive director of the Wheeling, Illinois, facility. "Our staff and partners at the airport continue to work diligently to maintain open and safe facilities, and it's a testament to their efforts that general aviation in the Chicagoland area is thriving." **The reliever airport typically handles 80,000 aircraft movements annually and generates some \$400 million in annual output.** Formerly known as Palwaukee Airport, it is jointly owned by the Village of Wheeling and the City of Prospect Heights.

► **ON AUG. 29, E-COMMERCE GIANT AMAZON RECEIVED** FAR Part 135 approval from the FAA for its Prime Air drone delivery service, making it the third U.S. company so granted. However, the Seattle-based company did not say where or when it would begin commercial deliveries by drones. In April 2019, Alphabet Wing became the first operation OK'd for drone del-



ivery of packages in Christiansburg, Virginia, while UPS Flight Forward earned a broader Part 135 certification the following September. UPS conducted the first drone delivery flight with the certificate on Sept. 27 at the WakeMed Health campus in Raleigh, North Carolina. Alphabet Wing's original Part 135 authorization was expanded to a Standard

certification last October. In its latest announcement, Amazon described its delivery drone as fully electric and shrouded, with an "industry-leading" detect-and-avoid system. The company's goal is to deliver packages to customers in 30 min. or less from the time they order.

Gulfstream Opens Global Parts Distribution Hub in Atlanta



Gulfstream Aerospace has opened an Atlanta hub dedicated to global aircraft parts distribution. The facility is 2 mi. from Hartsfield-Jackson Atlanta International Airport (KATL) and thus should facilitate parts delivery. The warehouse will maintain about \$23 million in inventory. Gulfstream is partnering with Crane Worldwide Logistics, which provides the warehouse space and handles the logistics services.

Bell Opens First Facility in Wichita



Bell has opened a facility in Wichita to support multiple programs and business areas, including engineering, supply chain, professional manufacturing and corporate services. The new facility will initially employ 20 former workers of Textron Aviation, Bell's sister company. It is Bell's first presence in Wichita. Whether Bell will assemble aircraft in Wichita has yet to be determined.



For the latest news and information, go to AviationWeek.com/BCA

Jetfly Takes Delivery of First PC-12 NGX



European fractional ownership company Jetfly Aviation has taken delivery of the first Pilatus PC-12 NGX along with its fifth PC-24 aircraft. The Jetfly Group, which includes Fly 7 Aviation, currently operates 47 Pilatus aircraft. Delivery of the fifth PC-24 comes within two years of Jetfly's first. The company's fractional program has attracted 50 owners to the Swiss twinjet. Jetfly plans to take delivery of its sixth PC-24 by year-end.

Bye Aerospace Adds Parachute to eFlyer2



Bye Aerospace is equipping its electric aircraft with a parachute. The Englewood, Colorado, manufacturer has selected Aviation Safety Resources (ASR) to supply its Soteria line of whole aircraft recovery parachutes systems for its eFlyer 2 basic trainer. Under the agreement, ASR will design, test, prototype and deliver a recovery system specifically for the two-seat, battery-powered aircraft. The patented technology and updated design are said to offer space and weight savings when compared to other systems.

► **CIRRUS AIRCRAFT AND GARMIN HAVE ANNOUNCED** that Garmin's autoland system for the Cirrus Vision Jet has received FAA certification. The Safe Return system allows passengers to land the Vision Jet by touching a button located on the cabin's ceiling should the pilot become incapacitated. Once activated, the system assumes control of the aircraft, turning it into an autonomous vehicle that navigates to the nearest suitable airport for landing. It communicates with air traffic control, lands and brings the aircraft to a stop. The system is powered by a Garmin flight deck, called Cirrus Perspective+, to calculate the flight plan, avoid



terrain and weather, initiate an approach and land the aircraft without intervention. "With Safe Return, we are making personal aviation more accessible, elevating the passenger experience and taking the next step toward autonomous flight," said Zean Nielsen, Cirrus Aircraft CEO. **"The Vision Jet sets a new standard in personal travel with the combination of Safe Return and CAPS [Cirrus Airframe**

Parachute System], offering the ultimate level of safety, control and comfort for the pilot and passengers." The system also provides visual and aural updates to passengers, informing them of their current location, remaining fuel, destination airport and time of arrival. The system can also be disengaged if inadvertently activated. Cirrus delivered its 200th Vision personal jet in July. In May, Garmin's autoland system received FAA certification for the Piper M600 single-engine turboprop. And in August, it received European Union Aviation Safety Agency (EASA) and FAA certification for the Daher TBM 940 turboprop.

► **THE FAA HAS AWARDED \$3.29 MILLION IN GRANTS** to its unmanned aircraft systems (UAS) center of excellence, a coalition led by Mississippi State University (MSU). The University of Alabama-Huntsville will receive \$1.1 million, the largest portion of \$2 million in grants to six universities to study how drones can assist in disaster preparedness and response. The research will focus on coordinating procedures with the U.S. Departments of the Interior and Homeland Security, the Federal Emergency Management Agency and other local, state and federal organizations. As the lead university of the Alliance for System Safety of UAS through Research Excellence, MSU will receive \$1.29 million to provide overall program management, including financial tracking of core university project activities, review of project documentation before submission to the FAA and facilitation of meetings and outreach.

► **SIGNATURE FLIGHT SUPPORT IS EXPANDING ITS EUROPEAN** presence with the acquisition of TAG Aviation's FBOs at the Geneva and Sion airports in Switzerland. Terms of the deal for the two units were not disclosed. Signature expects to attain full operational



control of the FBOs in this quarter. Roger McMullin, TAG Aviation FBO SA president of the board, said, "I am extremely proud of the achievements of TAG's employees and pleased that they will be continuing their professional careers with an established organization like Signature Flight Support." The deal ends TAG's 54-year presence at

Geneva International Airport. The facility includes three private passenger lounges, two crew rest areas and an eight-seat conference room. It provides Swiss and French customers clearance to visitors on site. TAG Aviation's location in Sion complements the Geneva location and features a private terminal, hangar complex and on-site Swiss customs.

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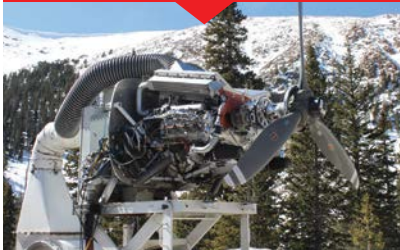
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Robinson Delivers 1,000th R66 Helicopter



Robinson Helicopter Co. recently delivered R66 Turbine Serial Number 1000. The helicopter's owner is Donovan Valentine of Monarch Helicopters, based in Nashville, Tennessee. Powered by a single Rolls-Royce RR300 turbine engine, the R66 was certified in October 2010, with first delivery occurring the following month. Since then, the aircraft has surpassed 1.2 million flight hours, a milestone, Robinson says, that was achieved without any reported inflight engine failures.

Engineered Propulsion Systems Files for Chapter 11



Engineered Propulsion Systems Inc., which was developing a diesel engine for the general aviation market, has filed for Chapter 11 bankruptcy protection. Launched in 2006, the New Richmond, Wisconsin, company was formed to develop, manufacture and market a lightweight, "flat vee" diesel engine for light single and twin aircraft and run on Jet-A. An attorney for EPS stated that a recently formed entity with "Chinese and other foreign interests" would likely make a move to acquire all EPS assets.

▶ **EMBATTLED AIRCRAFT CONNECTIVITY PROVIDER GOGO** will sell its commercial aviation unit to bankrupt satellite services provider Intelsat for \$400 million in a deal that might help the latter return to a viable business while the former tries to avoid liquidation. In a late Aug. 31 announcement, Intelsat said the cash deal will combine its high-throughput satellites with Gogo's 2Ku antenna to better position Intelsat in an inflight connectivity (IFC) market that is expected to grow double-digits long-term, despite COVID-19. "The addition of



Gogo's commercial aviation business provides compelling strategic value for our stakeholders and makes strong commercial sense," Intelsat CEO Stephen Spengler said. "Gogo's business is a perfect fit with Intelsat's expansive satellite network and infrastructure due to the breadth of Gogo's technological solutions, global reach and operational excellence." The U.S. Bankruptcy Court

for the Eastern District of Virginia in Richmond approved the deal earlier Aug. 31. Intelsat will fund the purchase through debtor-in-possession financing, which was arranged in bankruptcy court. The company, one of the leading brands for satellite-based communications, filed for bankruptcy May 14 after being unable to keep servicing a long-building debt load and in the face of a need to make new investment to transition spectrum under a federal plan to boost 5G. The transaction is expected to close before the end of the first quarter of 2021, but remains subject to "customary conditions" and regulator approval. When it announced the potential sale on Aug. 10, Gogo CEO and president Oakleigh Thorne said his company was looking to ride the business aviation market as it struggled with commercial aviation's near implosion due to COVID-19. While airliner traffic remains off by at least half or more from 2019 levels, it comes on the heels of a years-long restructuring Gogo had endured as the IFC market already was flagging.

▶ **TEXTRON AVIATION'S SECOND CESSNA 408 SKYCOURIER** twin turboprop made its first flight in Wichita on Aug. 10, thus joining the prototype that launched for the first time three months earlier. At the time, the first aircraft had completed 38 flights and logged more than 76 flight hours. Through the flights, the company said it had been able to expand speed



and center-of-gravity envelopes, and complete preliminary engine and propeller tests and initial stability and maneuverability testing. A third, and final, flight test aircraft is to join the development program in the coming months. The program also includes three ground test articles. Entry-into-service of the \$5.5 million aircraft is expected in the second half of 2021.

Textron Aviation is offering the SkyCourier in a variety of configurations, including a freighter with a 6,000-lb. payload able to carry three standard LD3 shipping containers, and a 19-seat passenger version. The aircraft is equipped with two Pratt & Whitney Canada PT6As and includes a Garmin G1000 NXi avionics suite. It has a max cruise speed of 200 kt. and a max range of 900 nm. FedEx is its launch customer with an order for 50 aircraft and an option for an additional 50.

▶ **WHEELS UP HAS FORMED A NEW BUSINESS DIVISION** called Wheels Up Aircraft Sales, offering aircraft brokerage, acquisition, trade and advisory services. With the expansion, the company offers private jet membership, aircraft management and whole aircraft sales. The move follows its acquisition of Gama Aviation, software developer Avianis Systems, and of Delta Private Jets from Delta Air Lines this year. The new business unit is led by Chris Brenner, former senior vice president of sales for the Americas at Jetcraft Corp., John Odegard and Seth Zlotkin. Odegard and Zlotkin cofounded QS Partners, NetJets' aircraft sales and acquisition company.



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Universal Avionics Introduces Kapture CVR/FDR



Universal Avionics has introduced its Kapture line of cockpit voice and flight data recorders (CVR/FDR). The company's sixth generation of recorders has received FAA Technical Standard Order (TSO) authorization and meets all of the latest certifications and requirements, including ED-112A compliance, allowing operators to fly around the world. The Kapture product line includes five model options, offering a customized recording solution.

Special Missions King Air Delivered to Victoria Police



Textron Aviation has delivered a Beechcraft King Air 350ER to Australian aviation service company Skytraders, which will operate and maintain the aircraft on behalf of Victoria Police. The aircraft has entered service. The King Air will primarily support Victoria Police Air Wing (VPAW) and its team of Tactical Flight Officers, who lead airborne law enforcement, training, search and rescue, and extended offshore marine safety missions throughout the state of Victoria, Australia.

► **EMBRAER HAS LAUNCHED A MEDEVAC VERSION** of its Phenom 300 light jet that is available as a new build or retrofit. The Phenom 300MED is the product of a partnership with European aerospace company Umlaut and Aerolite, a medical interior developer and supplier. The Brazilian airframer and Umlaut are jointly seeking an STC for the specialized interior, which involves Aerolite equipment. The two companies are developing a comprehensive set of configuration choices for the aircraft. The Phenom 300MED will hold either one or two stretchers with the ability to carry an incubator and additional medical equipment. It will also feature hospital-grade trim and finishing. Embraer will install the equipment through



its service and support organization. The Phenom 300 platform is uniquely positioned for medevac operations, said Michael Amalfitano, Embraer Executive Jets president and CEO. "Given the current health crisis, we are proud to be working with two world-class medevac solutions partners and we are primed to

immediately start taking orders for this unprecedented air-ambulance solution." Umlaut brings its background in aircraft engineering, refurbishment and certification know-how to the product, officials say, while Aerolite's focus is on the design, engineering, production and installation of air medical interiors. It has delivered more than 500 medevac interiors. Embraer has delivered more than 550 Phenom 300-series business jets since the first one entered the market in December 2009.

► **DUNCAN AVIATION HAS UNVEILED A NEW DESIGN CENTER** at its Battle Creek, Michigan, MRO (Maintenance, Repair and Overhaul) facility. Duncan says the updated Design Center now has 30% more space, a more efficient work area and an inviting environment for customers as they spec out designs for their aircraft paint and interior modifications. The Center features a new conference room and a sample library full of cabinets and countertop space to show customers material samples. The space then extends to include separate workstations for individual designers. "This new space is organized and efficient, and it better captures the professionalism of the Design Team," says Andy Richards, executive vice president and COO of Duncan's Battle Creek facility.

► **GULFSTREAM AEROSPACE HAS OPENED A NEW, COMPANY-OWNED** service center at Palm Beach International Airport (KPBI) in Florida, while Jet Aviation, a sister company, opened a new hangar and FBO there as well. The two General Dynamics subsidiaries



share 161,000 sq. ft. of space, with more than 104,000 sq. ft. dedicated to Gulfstream. Each company has its own hangar and shared office space. Gulfstream's hangar will accommodate up to seven G650ER or G650 aircraft. Jet Aviation's facility includes a 42,000-sq.-ft. hangar designed to handle large-body aircraft. The two

share more than 9,000 sq. ft. of a first-floor passenger terminal. Jet Aviation is currently constructing a new FBO and hangar terminal in Scottsdale, Arizona, with completion scheduled for early 2021. It is also working to replace a storm-damaged hangar in Houston. In 2019, Gulfstream opened a facility in Van Nuys, California, and expanded facilities in Appleton, Wisconsin, and Savannah, Georgia. It also recently began operations at a new service center in Farnborough, England.

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Bell Delivers JetRanger X to Alameda County Sheriff's Office



Bell Textron has delivered its first public-safety-configured Bell 505 JetRanger X to the Alameda County Sheriff's Office Air Support Unit. Sheriff Gregory J. Ahern said, "The Bell 505 is an outstanding machine that will provide a vital service to the citizens of Alameda County for years to come. This force-multiplier will enable us to quickly respond to any emergency within the region, thus elevating our service to the community."

High-Speed, Dual Connectivity for G650 and G650ER



Gulfstream Aerospace has received FAA approval for the installation of a high-speed, dual internet system on its G650 and G650ER aircraft. Provided by Viasat, the system gives customers access to internet speeds that are some of the fastest in the industry. A streaming video service is also available, so customers can view high-definition content without compromising connectivity. "We are pleased to offer this as a retrofit to our current G650 and G650ER customers," said Derek Zimmerman, president, Gulfstream Customer Support.

▶ **GE AVIATION IS PROGRESSING WITH ENGINEERING** and certification testing on its Catalyst turboprop designed for Textron Aviation's new single-engine Cessna Denali. The engine maker says first delivery of the Catalyst should occur by year-end. But Textron officials declined to speculate on when the first flight of the \$5.25 million Denali will take place. It had earlier expected first flight in 2019. Rob Scholl, Textron Aviation senior vice president for sales & flight operations, said, "Everything going on in the world right now just gives us a lot of uncertainty on the timing." By mid-August, the 10 Catalyst test engines assembled had amassed more than 1,800 hr. of combined operation. And by then GE had completed development testing for icing certification, along with testing for altitude, endurance, vibration, durability, ingestion and integrated prop controls. The Catalyst met with delays last year mainly from more-stringent testing requirements implemented by the FAA. GE said the program is going through "the most extensive certification testing ever for a turboprop engine" in the business and general aviation segment. The COVID-19 pandemic also added to the delays. In the meantime, GE has 98 patented technologies on the Catalyst, the first turboprop in its class to introduce two stages of variable stator vanes, cooled high-pressure turbine blades and 3-D printed parts. The engine operates at a 16:1 overall pressure ratio, which GE says allows it to achieve 10% higher cruise power than its Pratt & Whitney Canada competitor.



▶ **FXAIR, A PROVIDER OF "PREMIUM ON-DEMAND CHARTER,"** was formally launched in late July as its owner, Directional Aviation, restructures its global businesses to better respond to post-COVID-19 opportunities. Headquartered in New York, the new entity is led by Gregg Slow, a former XOJET and NetJets executive. It is equipped with 12 Bombardier Challenger 300 and five Global Express jets, all removed from fractional ownership and operated exclusively for FXAIR through Flexjet, another Directional company. FXAIR will also tap into a network of "individually curated premium aircraft from some of the industry's most respected and safe flight providers." Bookings can be made via a smartphone app, by phone call or online. "We're defining premium charter as second-generation former fractional aircraft," says Slow, who most recently had been with PrivateFly, yet another Directional business. "These are airplanes that have been flown in fractional for 10-12 years. We're monetizing them for the next 10 years of their life cycle." **Plans for the brand have been in the works for some time.** But according to Andrew Collins — the new firm's CEO and director of Directional's jet-card and on-demand product portfolio, including Sentient Jet — the launch was brought forward because of increasing demand that the company is seeing across its brands. Those needing to travel and able to afford private aviation are turning to the sector as the lowest-risk option amid the coronavirus pandemic. "Sentient sold the most jet cards it's ever sold in its 20-year history in June, and then matched that in July," he says. "A lot of folks are thinking about [private aviation] in terms of their choice for flying going forward." The company believes it can build and retain a significant share of the growing market with a premium service. Collins and Slow maintain there is a potential market formed by around 360,000 households in the U.S. with "addressable assets" of \$10 million or more who do not yet fly privately. The challenge, they said, is to turn those attracted to the sector during the pandemic from one-off clients to long-term customers. "What we've seen over the last couple of months is an enormous influx of that group," Slow says. "In a typical month we might see 8-10% of our business coming from clients new to private aviation. But in June and July, we've seen 60-65% of our business coming from new entrants to private aviation."

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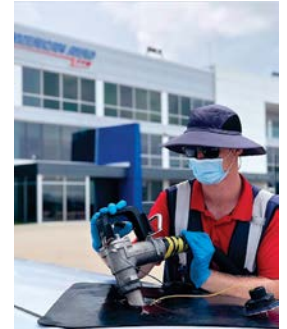
At American Aero, no detail is too small. From an 11-acre ramp to a 90-second dishwasher for quick-turn flights, the premier FBO at KFTW has created the optimal environment for passengers and flight crew.

“Everything we do is with the customer in mind,” said General Manager Angela Thurmond.

“The design of our facility, the amenities we offer, our unparalleled focus on safety, and most important, the commitment and training of our people.”

American Aero leads the industry in ground handling safety, as the first FBO in the world to earn Stage 3 certification by the International Standard for Business Aircraft Handling (IS-BAH). Team members are also Ritz-Carlton and NATA Safety 1st trained.

“We are committed to creating extraordinary experiences,” Thurmond said. “We will never let down in our pursuit to be the best for our customers.”



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Questions for Robert Rockmaker

1 Why FSANA? Aren't there enough aviation advocacies?

Rockmaker: There was no association dedicated to flight schools, which arguably are among aviation's most important institutions if the industry intends to continue. At the turn of the century there were some 2,400 pilot training operations in the U.S., but after the 9/11 attacks and the Great Recession, the count was down to 1,600, a 33% decline. And we estimate the COVID-19 pandemic will claim another 50-75. Despite that, new schools are being created.

2 Can you point to any successes?

Rockmaker: Three years ago, there were 1,400 FAA-Designated Pilot Examiners; now there are 850. Obviously, they play a critical role in advancing pilots. In the past, they were pretty much restricted geographically by their FSDO. But FSANA led a working group with representatives from the FAA and other aviation associations that convinced the FAA to let examiners travel and conduct check rides anywhere. That was a big help. Also, examiners were limited to two flight checks a day. But if the candidate made some small error doing one element such as turns around a point, chandelles, power-on stalls, that sort of thing, the test candidate and the examiner could review it on the ground and go up and do it again, correctly. Yet that counted as one of the day's two check flights even though the examiner could easily do another. We got that policy changed. And now we're participating in an 18- to 24-month-long aviation rulemaking committee to make recommendations regarding the examining community. Unfortunately, many examiners are of an age that makes them vulnerable to the coronavirus, and so a good number are reluctant to venture out and that is impacting flight testing all over. I so look forward to this virus being contained.

3 Considering the awful state of the airlines, is there still interest in flying professionally?

Rockmaker: Absolutely. If you're starting from scratch and your goal is to be a professional pilot in the airlines, business aviation, EMS or whatever — we call it going from zero to hero — it's going to take years before you have enough experience to get into the right seat of a turbine aircraft. By then the air carriers will be growing again and there will have been a lot of retirements and so lots of opportunity across the industry. So quite a number of schools are extremely busy training. A good thing, too. There were 800,000 licensed pilots in the late 1970s; and at this year's start, that number was down to 665,000, of which nearly a third were students. The industry needs them all.

4 What's it cost to earn a private today?

Rockmaker: It varies quite a bit, depending upon lots of factors. But figure between \$7,000 and \$11,000. Learning to fly has never been inexpensive, but the certificate is for life.

5 Any movement to rein in those costs?

Rockmaker: The Cessna 172 is used by a lot of schools for basic training and for good reason: It's a great all-around airplane — safe, reliable and forgiving. But a new one costs \$350,000 to \$400,000 and that makes it very difficult to keep prices down. In many respects, it's hard to justify placing an ab initio student in such a machine only to knock it around hard at times. And keeping older airplanes flying in a training environment is very expensive in terms of maintenance and parts. As for Piper's equivalent, it's up around \$250,000 to \$270,000 new. And so, the training industry is in dire need of a simpler, less-expensive aircraft to keep rates from getting further out of hand. **BCA**



Robert Rockmaker

*Founder, President & CEO,
Flight School Association of North
America, Allentown, Pennsylvania
(www.fsana.com)*

A lifelong Pennsylvanian, Rockmaker's aviation adventure began early and classically — learning to fly out of a small grass strip, now a shopping center, near Allentown. He soloed at 16, got his private at 17 and went on to earn a commercial license along with instrument and multiengine ratings and even glider and seaplane tickets. He spent a decade as assistant manager at today's Lehigh Valley International Airport, and then some years managing an FBO in Philadelphia. Earning a bachelor's degree in air commerce from the Florida Institute of Technology, he spent a quarter century heading the Aviation Council of Pennsylvania. During his tenure, the council helped eliminate the state sales tax on fixed-wing aircraft and the use tax on parts and repairs. Then, seeing a void, in 2009 he founded FSANA.



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Wither Analog Navaids?

What's next in the NextGen age



BY **DAVID ESLER** david.esler@comcast.net

When the FAA conceived NextGen as the long-awaited modernization of the U.S. air traffic control system, it hooked its progeny to the Global Positioning System.

Proven in nearly two decades of service, phenomenally accurate, and rapidly becoming the preferred medium for air and surface navigation, GPS was the logical choice as the centerpiece for a 21st century ATC system. Furthermore, its positioning accuracy to within a few feet (or, with dual-frequency receivers and augmentation, a couple of centimeters) enabled Automatic Dependent Surveillance, whereby aircraft could report their own locations irrespective of radar. And like GPS, ADS had already been proven in oceanic operations as FANS 1/A, delivering positions to control centers in near real time via data links to communications satellites that then downlinked to the centers.

To form the armature of the NextGen architecture, FAA chose a new variation on Automatic Dependent Surveillance, ADS-B (for “broadcast” as opposed to the FANS ADS-C, where the suffix refers to a virtual “contract” forged between aircraft operator and controller). With ADS-B, the aircraft’s position could be data-linked either to ground stations and thence relayed via landline to ATC centers (or after March

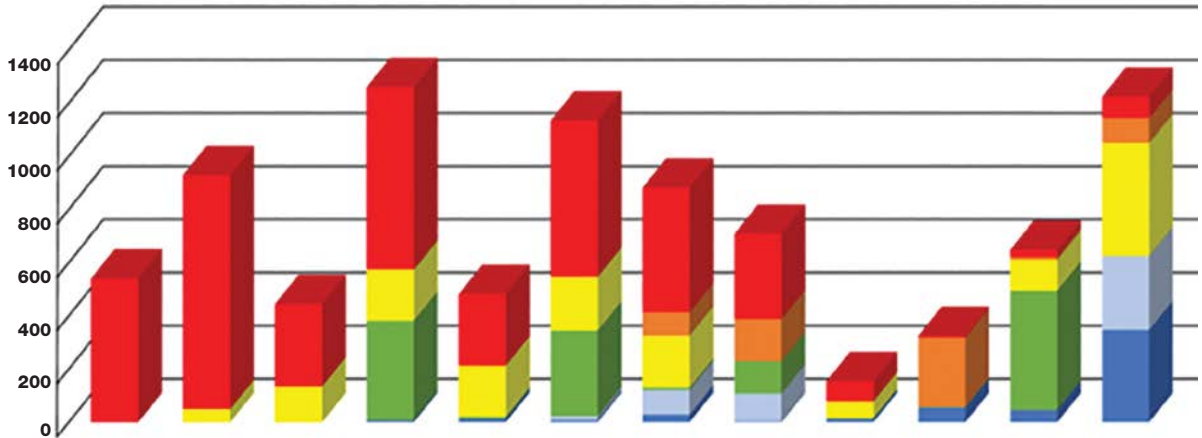
2019, to Iridium communications satellites through the Air-eon space-based service) that, like the ADS-C FANS system, downlink to the control centers.

Thanks to the broadcast function, aircraft could maintain their own separation while controllers monitored aircraft movements on digital displays.

ADS-B’s effectiveness and potential were proven in the FAA’s Capstone project, a trial conducted in Alaska between 1999 and 2006. It significantly reduced accidents among charter and bush operators and regional airlines operating in some of the most hazardous weather and terrain in North America. Based on that success, early in NextGen planning, ADS-B was put forward as key to a comprehensive, cost-effective technology that would initially supplement radar and ultimately reduce it to second-tier or backup surveillance.

One of the strongest arguments in favor of ADS-B as a replacement for radar and the legacy nav aids network was economics. First, it is vastly less expensive than radar. The small ground stations that accept ADS-B transponder signals — roughly the size of cellphone repeaters and consisting of antenna, receiver, target processor and telecom links to ATC facilities — can be installed almost anywhere. And unlike

NavAids System Age Data As of October 2018



	VASI	VOR	TACAN	LOC	HP DME	GS	MALSR	REIL	ALS	RVR	LP DME	PAPI
30+	541	879	309	682	268	582	467	318	74	4	25	78
25-30				7		7	89	160		263	12	96
20-25		50	135	189	193	200	195		65		115	423
15-20				376	7	322	10	122		3	449	
10-15						15	91	105				279
<=10				7	14	8	30	3	15	55	47	348
Total	541	929	444	1261	482	1134	882	708	154	325	648	1224

radar, the units feature no moving parts, and thus require considerably less maintenance and electric power to operate them. Secondly, ADS-B saves money for operators since the tighter procedures and point-to-point routing it supports reduce flight times and thus, fuel burn, CO₂ emissions and wear on airframes and engines.

“When you look at a ground-based system, it looks like a road map,” Ric Peri, vice president, government and industry affairs at the Aircraft Electronics Association (AEA), observed. “Typically, you would fly point to point on ground-based transmitters [e.g., VORs]. With GPS, though, you can fly the most efficient route, and in fact, the FAA will allow you 360 of them.” Either ATC chooses the most efficient route or, in some cases, permits self-routing and is only required to maintain separation of aircraft. “Given that the shortest distance between two points is a straight line, not having to go through intermediate waypoints saves time, fuel and money.”

The natural evolution from FANS to a domestic surveillance system substituted the inexpensive ground stations for the communications satellite reporting function, and in its planning for NextGen, the FAA envisioned an array of these VHF-band transceivers covering the U.S. and its territories. The agency outsourced the design, construction, deployment and operation of the ground-based ADS-B network to the private sector.

In competitive bidding, Exelis Corp. (formerly ITT) won the 18-year, \$1.8 billion contract in 2007. It was subsequently purchased by Harris Corp., which in turn selected subcontractors Thales, Selex and AT&T to manufacture radios for the ground stations and provide connectivity between the stations and ATC facilities. Under the contract, the FAA does

While older nav aids, especially VORs, may be eliminated by attrition, in some cases, DMEs actually may be added to the MON in major terminal areas.

not own the ADS-B network. It leases it as a turnkey operation that Harris runs from a small control center in Herndon, Virginia.

Legacy Nav aids

When the ADS-B deployment was completed in 2013, 650 ground stations had been installed across the U.S. and in Guam, the Virgin Islands, and even aboard 13 oil drilling rigs in the northern Gulf of Mexico to provide ADS-B coverage to the helicopter fleet servicing the oil industry.

Fully tested that year, the network went on line, capable of providing ADS-B Out positioning data streams to the control center and ADS-B In information to equipped aircraft. It is estimated that as a surveillance tool, ADS-B is as much as 20% more cost-effective than radar. In the initial planning, there was an assumption that once the ADS-B network was up and running and aircraft equipment mandated, the FAA could begin to decommission its expensive legacy radar and nav aid network. But there were considerations that had to be taken into account.

First, as the AEA’s Peri points out, by making its new Air Traffic Management (ATM) system entirely dependent on GPS, the FAA had essentially “hitched its future” to a navigation system it doesn’t control. After all, GPS was conceived, developed, paid for, and its satellites launched by the U.S. Air Force under the auspices of the Department of Defense (DoD)

and approval of Congress. Federal legislators appropriated the funding on the condition that the system also be available to civilian users — the FAA among the many. FAA is one of those users, however; the satellite constellation remains firmly under the control of DoD.

And as noted in “GPS Vulnerabilities” (BCA, March 2019), the 21-satellite constellation rotating 12,500 sm above Earth is unprotected, as are its signals to the ground, and thus vulnerable to tampering. Certain national entities have routinely “spoofed” GPS signals in the vicinity of U.S. or its treaty members’ military maneuvers. And while there is a federal law prohibiting interference with GPS signals, small jammers are sold on the so-called “dark web” to people interested in blocking GPS tracking services. Often these jamming efforts take place on or near airports, with the result of disrupting operations.

Understandably, the DoD reserves the right to compromise portions of GPS coverage for military training or for hacking tests to learn how the system could be attacked.

Speaking on GPS vulnerability, John McGraw, vice president, regulatory affairs at the National Air Transportation Association (NATA), pointed out, “There have been occasions of local outages, relatively small scale, that were quickly resolved. But what would happen if you had a widespread outage? Say, half the U.S. How would it be managed and what would it take to backstop that? From an aviation perspective, you would go ‘procedural.’”

A GPS Backup

Given NextGen’s GPS dependency, in order to protect aviation operations, a backup nav system seems imperative. During the

early years of GPS development and implementation, there was talk of preserving the Loran-C network, a low-frequency nav system, to serve in standby. But it was expensive to maintain and its usage was declining, so in the end it was decommissioned and dismantled.

The FAA “knew it needed a backup for the [GPS] system,” Peri said. But with no state-of-the-art option available, the agency had no choice but to rely on the existing analog ground navaid system — or a portion of it — for backup. In December 2011, the FAA announced in the *Federal Register* a “notice of proposed policy” on its dual strategy of reducing the legacy VOR system to a “Minimum Operational Network” (MON) that would supplement Performance Based Navigation (PBN, *i.e.*, ADS-B) and come to the fore should GPS go down.

Given no technological alternative or the funds to invest, the FAA’s choice of the MON was the most logical option available to ensure safety in the National Airspace System. “If you had a complete failure of ADS, ATC would revert to the ground-based system,” Peri explained. “Losing GPS completely would create a challenge, hence the hybrid system. This means they will retain ground-based systems for the high-density infrastructure — radar, VOR — but will transition to a primary RNP, the preferred method, and still have the analog approaches on the books as a backup. The FAA philosophy is that we will keep the last generation to supplement the next generation, should it fail.”

According to an FAA document, the following criteria were employed to tailor the existing 1,300-unit VOR network into the MON:

► Retain VORs to perform ILS, localizer or VOR approaches

Advocating Navaid Preservation

Aviation groups have been actively engaged with the FAA in the development of the Minimum Operational Network (MON) of legacy nav aids.

According to Steve Brown, vice president of operations at the NBAA, his organization has not been “static” in terms of its relationship with the FAA.

In particular, he said, “We have a staff that is embedded at the ATC Command Center near Manassas, Virginia, and along with us, there is a military staff, a cell from the airlines and one from IATA [the International Air Transport Association]. We are invited tenants with full-time staff working alongside the FAA staff, not just on tactical management of the system but longer term strategic elements, one of which is GPS transition. The way we do the last is [through] the National Customer Forum, essentially composed of representatives from users of the system.”

Other places where the NBAA is active include the NextGen Advisory Committee (NAC) and several technical subcommittees. “Here we formulate the plans and recommendations that go to the NAC. Also, the RTCA [Radio Technical Commission for Aeronautics] is another forum we work with, adapting the avionics that must interface

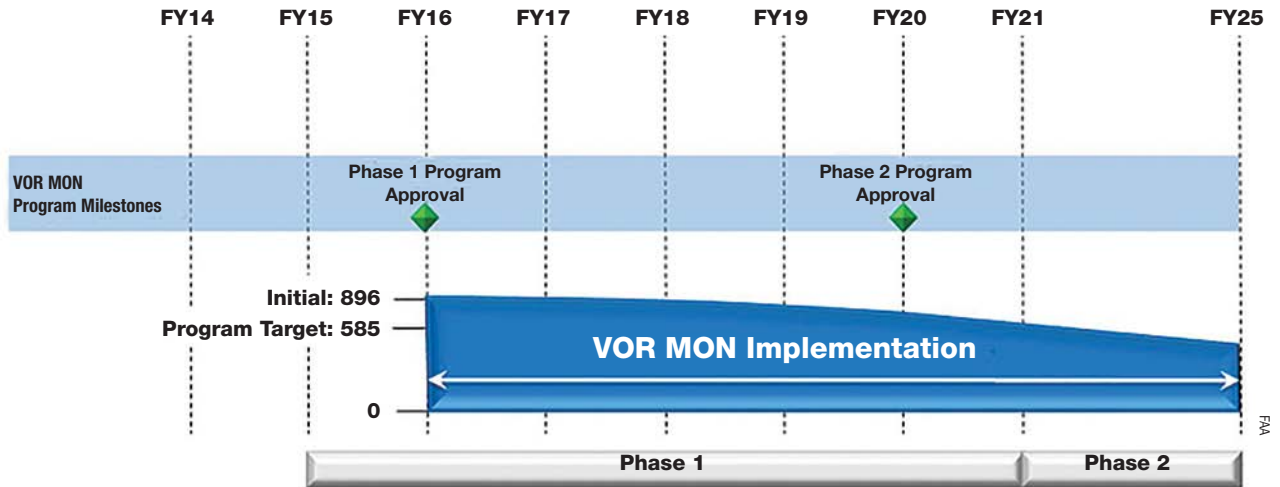
with the FAA infrastructure and employing it in a synchronized way. This is a significant load of work for the users.

“The GPS backup question, that solution is not fully fleshed out by the FAA at this time,” Brown continued. “The core elements are VOR MON as well as a DME-DME residual network that would be complementary. The FAA knows there is a need to fortify GPS.”

What concern does the NBAA have in the GPS backup process? “We have to protect GPS,” Brown affirmed. “No interference with it can be allowed, as it [GPS] is the future we are going toward. So, we have to worry about interference. The FAA and DOD are focused on it, monitoring jamming attempts, countering interference attempts, anti-jamming, a full spectrum of activity to protect and enhance GPS as a strategic asset. Today, everyone intersects with GPS a lot — everyone is a stakeholder.”

At the Aircraft Owners and Pilots Association (AOPA), Jim Coon, senior vice president, government affairs, cited the FAA’s “right-sizing program” for the National Airspace System (NAS) that resulted in the MON of legacy nav aids. “The AOPA has worked collaboratively with the FAA . . . to identify the correct criteria and timeline to ensure safe and efficient operations,” Coon told BCA, “while also

VOR MON Program Timeline



supporting MON-designated airports “at suitable destinations” within 100 nm of any location within the continental U.S. (CONUS). Selected approaches would not require ADF, DME, radar or GPS.

- ▶ Retain VORs to support international oceanic arrival routes.
- ▶ Retain VORs to provide coverage at and above 5,000 ft. AGL.
- ▶ Retain most VORs in the Western U.S. mountainous areas, specifically those anchoring Victor airways through high-elevation terrain.

As of this year, 74 VORs have been targeted for decommissioning, with a total of 300 scheduled to be taken down by 2025.

- ▶ Retain VORs required for military use.
- ▶ Retain co-located DME/TACAN systems.
- ▶ Phase 1 of the VOR reduction program began in 2016 with 311 units targeted out of 896 total across the U.S., including Alaska, Hawaii and possessions. Thus the completed MON would consist of 585 legacy VORs plus a handful of new

allowing time to equip with NextGen systems like WAAS GPS, which is outlined in the PBN NAS Navigation Strategy, which we helped write with the FAA.”

The AOPA agrees with the FAA’s modernization approach, “as there simply is not enough funding and manpower available to have a 21st century NAS on top of one from the 1950s,” Coon continued. “We have to reduce our legacy infrastructure in order to increase the number of GPS approaches that pilots want — and which are cheaper and safer. The AOPA has advocated with the FAA to establish a sustainment effort to ensure the critical nav aids we need on a long-term basis are maintained into the future.”

But he noted that most existing nav aids are well beyond their service life. Consequently, the FAA has launched the DME/VOR/TACAN sustainment initiative to begin replacing the critical ones “and the AOPA has been meeting with prospective vendors.”

In terms of NAS resiliency, Coon recognized the threat of GPS interference — “which is common and of high concern,” as the NAS has become dependent on the satellite navigation technology. The VOR MON will be in place through at least 2045, Coon predicted, offering

general aviation a “safety support system” in the event of a GPS outage. In addition, a DME-DME system “offers larger aircraft another resiliency solution.” These two networks are being established now, and should be fully operational in the next few years, “occurring concurrently with the nav aid reduction that does not support the resiliency network.”

But the AOPA continues to be concerned about routine and large-scale GPS “denials” orchestrated by the DOD, which controls GPS. (See “GPS Vulnerabilities,” *BCA*, March 2019.) “We continue to feel the hazards caused by this activity are not being adequately acted on by the FAA and mitigated,” Coon emphasized.

Concerning a state-of-the-art backup for GPS, Coon identified eLoran as “one solution of a few that are being considered.” However, a major caveat for such a system would be the fleet retrofit cost. Furthermore, integrating a new position source into existing nav equipment could take decades and be expensive to the point that few general aviation aircraft operators will choose to adopt it. “The AOPA is active in these conversations to ensure alternate position, navigation and timing solutions are realistic for the general aviation fleet,” Coon said. **BCA**

ones added in some high-density traffic locations.

According to the FAA's Malcolm Andrews, enterprise services director, Program Management Organization, by midsummer of this year, 69 removals out 74 targeted had been completed and the FAA was looking at around 300 total decommissions. "That will still leave about 600 in the NAS for predominantly general aviation operators," Andrews told *BCA*, adding, "allowing them places to land within 100 mi. of where they are." In addition, Andrews claimed the FAA was "improving and adding about 125 new ones to the DME network. We continue to maintain and keep ILSes — no changes there right now." Phase 1 of the MON is scheduled to be completed by the end of this year; Phase 2 will extend to 2025, completing the takedown.

Thirty Down a Year

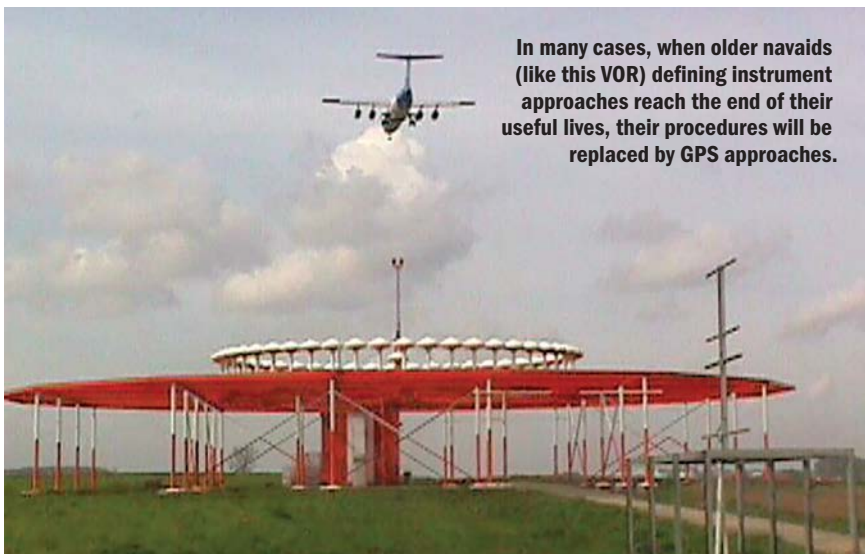
Steve Brown, vice president for operations at the NBAA, said that for each of the approximately 30 VORs targeted each year for decommissioning, there is a public notice for commentary. Brown should know: In his previous career, he was FAA associate administrator for air traffic.

"There is a lot attached to these facilities," he explained, "en route airways, instrument approach procedures, and

so forth, and this is what we comment on. [The FAA] won't shut one down until there is a procedure in place for the function the VOR performs, for example, a VOR approach. These are nav aids in specific locations that affect specific airports. In almost every case, the replacement will be GPS — which may already exist as an overlay of the VOR procedure. New GPS procedures are being produced every week, a continuous process. The new services — largely satellite-based — will go in and be commissioned prior to the VOR being decommissioned."

Another former FAA executive is

In many cases, when older nav aids (like this VOR) defining instrument approaches reach the end of their useful lives, their procedures will be replaced by GPS approaches.



ISTOCKPHOTO

the NATA's McGraw, who managed the Flight Technology and Procedures Division for seven years. During that stint, he led the planning effort for PBN, which is GPS dependent. "When we started pushing out GPS procedures," he reminisced, "the performance was good, and it didn't require the cost and overhead required to maintain the old ground system that defined the existing procedures, so it was very attractive. There were even things you could do with satellite navigation that you couldn't do with the ground network."

With accurate and cost-effective GPS procedures in place, the FAA began

Radar will be retained at major terminals with high-density traffic, although 32 sites have been red-tagged for decommissioning.



ISTOCKPHOTO

decommissioning NDBs at some airports where the 1940s-era facilities anchored approach and landing procedures. “Congress said they had to sell the components by auction for \$5.00,” McGraw continued, “and several airports bought them and lobbied Congress to maintain them. So, the FAA said, ‘If you need it, justify it.’”

This gambit resulted in the FAA providing GPS approaches at every runway where there had been an NDB procedure. Doing so not only improved the technology, but the new equipment didn’t need nearly the maintenance required by the old NDBs.

“With RNAV and RNP, you no longer need airways and en route VORs to establish them,” McGraw continued. “So, what do we need to remain in place? Maybe DME and the terminal VORs, perhaps even adding them while decommissioning the en route ones. So, we’d wind up with a hybrid solution. ILSes will be available for many years because the vertical component is still more accurate than with GPS, even with WAAS.”

In the event of a GPS outage, an FAA statement provided by the Southwest Region communications office declares, “Air carrier aircraft will revert from GPS to DME area navigation [RNAV] and continue to the destination to fly an ILS approach.” But “air carrier aircraft” only? What about business aircraft, many of which are better equipped than the average airliner, we posited to the FAA’s Andrews. Indeed, he answered, business jets would be included in this category.

Moreover, the NextGen DME program will add approximately 125 new units to support continued RNAV operations during GPS outages.

On the other hand, general aviation aircraft not equipped with DME RNAV avionics will revert to “conventional navigation” using the VOR MON and proceed to one of the airports within 100 nm of their positions to execute either ILS or VOR published approaches.

“When you get into the general aviation airspace,” the AEA’s Peri said, “you will see the loss of the infrastructure that will not be replaced when it ends its useful life. The FAA is not rebuilding the towers; they are letting them go by attrition. We are already seeing ground-based approaches being replaced with GPS approaches. It was slow at first and is now being ramped up as the analog facilities are reaching the end of their useful life and not being replaced.”

Safety, Resiliency and Radar

And what about radar, given that ADS-B’s strong suit is that it’s a surveillance tool that can establish aircraft position even in places where ground-based

radar may be obstructed or beyond reach?

“We have an extensive radar net and will retain the crux of that,” David Gray, the FAA’s deputy director for surveillance services, said. “We always

Third-Gen GPS Constellation

The third Block IIIA satellite supporting the third generation of the Global Positioning System was launched June 30 aboard a Space X Falcon 9 rocket. The Block IIIs operate at higher power than Block II Navstar system predecessors and transmit revised GPS signals.

The three in orbit 12,427 sm above Earth will be joined by 22 Block IIIF satellites scheduled to be lofted between 2025 and 2034. The third-gen satellites are said to be more resistant to jamming and other forms of interference including solar activity.

Since 1978, a total of 75 GPS satellites have been launched, 31 of which are operational, nine in reserve, and three in test mode (the Block IIIAs). Over the years, 30 satellites have been retired and two destroyed in launch accidents. The constellation requires a minimum of 24 operational satellites for global positioning/navigation/timing coverage, and the third generation system is predicated on 33 operational units. **BCA**

GPS Tech Backup Study

In November 2019, the Department of Transportation (DoT) selected nine high-tech companies in the U.S. and two in Europe to demonstrate technologies that could potentially support air traffic movement and management should GPS become unusable.

A relatively paltry \$2.5 million was allocated to the program and the department did not indicate what each company was to demonstrate. However, it did hint that it was no accident that the selectees represented a diverse mix of capabilities and expertise in certain technologies.

“We are seeking the best solutions to ensure that America has a combination of PNT [positioning, navigation and timing] systems that, when used together, will be difficult to disrupt,” explained Diana Furchtgott-Roth, the department’s deputy assistant secretary for research and technology.

The parameters for a backup system, Furchtgott-Roth said, were that it would have to be terrestrial, wireless,

have wide-area coverage, be difficult to disrupt and be capable of expansion to include positioning and navigation services. That’s an ambitious collection of capabilities akin to those of GPS itself, except for the ground-based requirement. Each technology was required to have been successfully tested in a simulated environment and be capable of operating without benefit of GPS signals while providing positioning and timing information.

Among the firms chosen for demonstrations, two — Hellen Systems LLC, Middleburg, Virginia, and Serco Inc., New London/Norwich, Connecticut — are focused on developing eLoran systems. Another, Satelles Inc., based in Reston, Virginia, uses the Iridium communications satellite constellation (not to be confused with the Air-eon ADS-B endeavor, which also uses Iridium satellites) to provide timing and location services independent of GPS and claimed to be 1,000 times stronger. **BCA**

expected that we would have to maintain safety and resiliency. We are removing 32 radars, a mix of the non-cooperative and cooperative ones, or full sites. Overall, maybe another 60 or 70 [will be decommissioned] over the next five years. This leaves us with a resilient network to ensure safety.”

Added McGraw, “The plan is not to eliminate radar but to take advantage of ADS-B improvements such as a better latency and higher accuracy. So, radar will be retained in the terminal areas. ADS-B was required to have coverage in all areas where we have coverage now with radar

— and in fact, better coverage in terrain, expanded coverage where we didn’t have it before.”

On its timeline, the FAA is looking at 2030 to reevaluate the legacy system, Peri claimed. “They want to get about 10 years of good RNAV data to figure out what to do with the analog backup system — what works and what doesn’t. It’s all about RNAV, but they need time to measure it and decide what to do in terms of a GPS backup. There is talk of a hybrid navigator that could switch between GPS or Loran. But in the meantime,

we’ll have the legacy aids for at least 10 more years. Until the FAA has a reliable backup to the satellite system, we will continue to have the ground-based system as a backstop. And since the DoD controls the satellites, the FAA has to control the backup, and right now there is nothing else out there on the short-list.”

But the FAA’s Gray affirms that the agency will not get rid of any infrastructure if doing so compromises safety. “And that safety has to continue even in the case of a GPS outage,” he said. “Aviation is only a small piece of GPS, which is a multi-billion-dollar industry. So, this is why we have a robust backup. We use it because of the benefits it offers, primarily accuracy. We have techniques from a surveillance standpoint to ensure that the data that gets to controllers is accurate, and we check it in real time to ensure it is of the highest quality. We check every report once a second for every aircraft that is using ADS-B.”

And, Gray claimed, while the DoD reserves the right to periodically conduct tests on the GPS network, the FAA is informed “well in advance” to prepare for them. Same for radiation blasts from the ionosphere. “Safety will not be compromised; we may be a little less efficient operating on the MON, but safety will be contained. Operations continue during the COVID-19 pandemic. Deployment of equipment at some of our facilities has been slowed due to the pandemic but not greatly. We’ve adapted quickly.”

So, what does the future hold for a GPS backup that would incorporate 21st century technology? “eLoran has been discussed for years,” McGraw speculated. “There’s been a lot of talk but no funding. Other technologies are being looked at, as well, to provide a reliable position source and act as a backup or even a future replacement. There’s a continual study of what we will do next and protect what we have currently. [See “GPS Tech Backup Study” sidebar.]

“Enhanced vision systems? Enough nav to get you into the vicinity of an airport and the enhanced viz to get you on the ground? There was a proposal to use cell tower signals, hybrid systems that pull together any and all signals you might have. If you have a local vulnerability, it can be easily managed and resolved — we can do that — but the large-scale disruptions would take something pretty big to create it, something really horrific. ‘Other government agencies’ are looking at that, as well!” **BCA**

ADS-B vs. ADS-C

What is the difference between ADS-C, or FANS 1/A, the oceanic surveillance system used especially in the North Atlantic, and ADS-B?

First, ADS-C is the progeny of the Future Air Navigation System (FANS), a child of the 1980s and an ICAO planning group. FANS was based on the premise that in areas devoid of radar coverage, the high navigational accuracy of then-contemporary flight-management systems (FMSes), synthesizing aircraft position from multiple sensors, could be leveraged to provide a kind of virtual radar for oceanic controllers to use as a conformance tool. With the aircraft’s avionics automatically reporting position at a preset interval to a communications satellite in geostationary orbit — the International Marine Satellite network, or Inmarsat, was the obvious choice — the data could be downlinked to the appropriate oceanic control center and presented on a computer display. Voila!, virtual radar and a “contractual” arrangement with the air traffic controller, hence the nomenclature ADS-C.

When combined with Controller Pilot Data Link Communications (CPDLC) — essentially, “texting for aviation” — ADS-C constitutes FANS 1/A (the “1” for Boeing, the “A” for Airbus, the original users of the technology) and has become the primary surveillance medium in oceanic airspace. That is especially true in organized track systems like the NATS in the North Atlantic and the PACOTS in the Pacific.

ADS-B came along at the end of the 20th century. It differed in that it initially broadcast aircraft position to ground stations that then relayed the location data to air traffic control centers via landline. In the second decade of this century, however, the Aireon project came together to exploit excess payload capacity on the second-generation Iridium telecommunications satellites to spawn a space-based ADS-B system. It thereby offered the possibility for air navigation service providers throughout the world the benefits of ADS-B without the expense of ground networks.

Because ADS-B is designed to report an aircraft’s position once a second, it is considered more accurate than ADS-C, whose pilot/controller “contract” averages 10 min. This is essentially the same thing as “latency” in radar, the time between “paints” of a target on the controller’s display as the radar antenna rotates. So, ADS-C may provide only near-real-time surveillance, and if you can’t see a target in close to real time, you can’t conduct tactical ATC. Thus, under ADS-C, controllers must set longer distances in trail, say, on a highly choreographed track system, to ensure safe separation.

So, a clear distinguisher between the two variants is that ADS-B is a surveillance system and ADS-C is a conformance-monitoring or tracking system. **BCA**



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Stable by Design

The dangers lurking in **an ill-conceived checklist**

STEVEN FOLTZ



BY **JAMES ALBRIGHT** james@code7700.com

When I think back to my last several unstable approaches — I’ve had a few over the years — there are usually a few reasons behind each. Chances are they resulted from actions by other aircraft, instructions by ATC, sudden weather changes, or conduct internal to my aircraft — in other words, me. While there are things we can do to shape the outcomes of the first three inciting events, they are for the most part outside our control. The last item, however, is within our grasp of control. Or is it?

It has almost become an unwritten rule: If you aren’t stable by 1,000 ft. when in instrument meteorological conditions (IMC), go around. There is much discussion about how to wire in the correct vertical and horizontal parameters, establishing stable approach criteria, combatting pilot continuation bias and normalizing the go-around decision. In fact, I’ve done just that in these pages (“New Approach to Stabilized Approaches,” May 2014).

But there is another facet of this problem that hardly gets any discussion at all: checklist design. If you extend the landing gear at glideslope intercept, you will typically have about 2 min. remaining until touchdown. More importantly, you will have less than a minute prior to your stable approach height

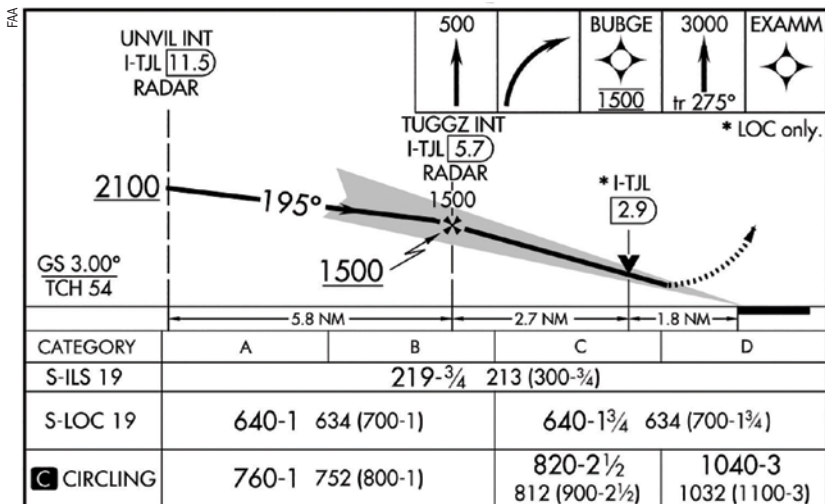
Gulfstream G150 pilots Dan Hoyberg-Nielsen and Steven Foltz and their checklist

when in IMC. Is that enough time for the crew to accomplish all checklists, fly or monitor the approach, and look outside for the landing environment?

I heard of a Hawker’s before-landing checklist with 16 items on it, 15 of which came after the gear is extended. Bad design. If the pilots are busy ticking off 15 things to do just a minute or so prior to landing, how much effort can be focused on keeping things, um, stable? Of course, aircraft design plays a role in checklist design, but there are things we can do as operators to reduce the destabilizing effect of having to accomplish too many tasks just prior to landing.

How Much Time Once the Gear Is Down?

A good time to conduct the before-landing checklist is after the landing gear has been extended, which, in turn, is best accomplished just before or upon intercepting the glideslope. Delaying gear extension until glideslope intercept can be said to improve approach stability, since adding drag when



The profile view of the Teterboro Airport ILS Runway 19

starting down reduces (or can even eliminate) the need to reduce thrust settings.

So, how much time does that give you to accomplish any checklists? The ILS Runway 19 at New Jersey's Teterboro Airport (KTEB) can provide a useful working model. Since the runway is a mere 6 ft. MSL, it also makes the math easy. Glideslope intercept happens at 1,500 ft MSL and 4.5 nm from runway end. At a hypothetical approach speed of 120 kt. ground speed (to make the math easy), we are traveling at 2 nm per minute, or 1 nm every 30 sec. In the example approach, we will have 2 min., 15 sec. until crossing the runway threshold to accomplish the before-landing checklist.

But if we are in IMC, we will want to have that done no later than 1,000 ft., our stabilized approach height, giving us only one-third the altitude and one-third the time, so just 45 sec.

The pilot flying (PF) and pilot monitoring (PM) are working as a team getting the airplane fully configured, on speed, on course, on glidepath and in a position to land no later than stabilized approach height. And once it is there, they need to keep it there for the landing. Keep in mind the PM should be simultaneously monitoring the approach progress as well as the radios. The PM will also have to look outside with increasing frequency as the descent progresses. Is 45 sec. enough time to do all of that and accomplish a properly designed checklist?

How Should a Checklist be Designed?

It may seem odd to us today, but early aviators survived nearly 30 years of aviation without formalized checklists. Doing everything that needed to be done was just a part of the pilot mystique. But with the arrival of the airplane that became the Boeing B-17, people realized there was too much for pilots to do to leave those tasks to memory.

An early model of that airplane crashed in 1935 when the very competent test pilots forgot to unlock the controls. The design was almost abandoned, thinking it was just too complicated an airplane for any pilots to fly. However, the U.S. Army Air Corps proved otherwise by developing checklists for its

crews for takeoff, flight, landing and after landing. We modern aviators just accept that checklists are a part of the job. Or, at least most of us accept that.

Are checklists required? FAR Part 91.503 says that we need to have checklists accessible at our "pilot station" for each flight, but not that we necessarily have to use them. You can argue that Part 91.13 ("Careless or Reckless Operation") compels us to do so. I would agree with that, but not everyone does.

Regardless of whether you regard checklists as mandatory or optional, there is a right way and a wrong way of designing them. While the following from FAA Order 8900.1, Volume 3, Chapter 32 is specifically aimed for Parts 91K, 121, 125 and 135, I think Part 91 operators would be well advised to adopt the guidance as well:

► Most normal procedures do not require incorporation into a checklist. You don't, for example, need to spell out the individual tasks of landing the airplane.

► Checklists should be kept as short as practical to minimize "heads down" time.

► Technologically advanced aircraft can reduce the number of checklist items, relieving flight crew workload.



Boeing Model 299 crash, Oct. 30, 1935

► In two-pilot aircraft, both pilots should challenge and respond to critical flight guidance items on approach.

► Checklists should not be relied upon to initiate changes in aircraft configuration. These changes should be keyed to operational events, such as glideslope intercept.

Manufacturers have wide latitude in checklist design and for the most part look for consistency among aircraft models. The "checklist philosophy" varies not only among planemakers but also with regulatory agencies and operators. Pilots flying multiple types may have added challenges when these designs vary even slightly.

Two Examples

Some of the best and worst before-landing checklists I've seen come from Gulfstream. Here is one from the latter category, for the G150.

Before Landing

- (1) Landing Reference Speed (VREF) ... CONFIRM & SET
- (2) WINDSHIELD HEAT ... AS REQUIRED
- (3) ANTI-ICE & DEICE ... AS REQUIRED
- (4) IGNITION ... AS REQUIRED
- (5) APR ARM ... ARM
- (6) Landing Gear ... DOWN/3 GREEN
- (7) ANTI-SKID ... CHECK ON (LIGHTS OUT)
- (8) Hydraulic Pressure ... CHECK MAIN & AUX
- (9) THRUST REVERSE ARM ... ARM
- (10) Brake Lever ... OFF
- (11) ENGINE SYNC ... OFF
- (12) GROUND A/B ... LAND
- (13) SLATS/FLAPS ... FLAPS 40°
- (14) Autopilot ... DISENGAGE

I think most of us mentally connect the before-landing checklist with the act of extending the landing gear. When we get rushed, we think “got to put down the gear,” followed by “what else?” Hopefully, the “else” is the checklist, but that can become rushed if it’s long and doesn’t lead with the most important item.

If at all possible, the before-landing checklist should begin with the landing gear so as to turn the whole thing into a callout: “Gear down, before-landing checklist.” That makes it less likely you will forget to call for the checklist.

The five items on the G150’s list prior to the landing gear are apt to be forgotten in the heat of battle. Some Gulfstreams, but not this one, have an “in range” checklist for these kinds of things that can be taken care of early. At least three of the items after the landing gear can be accomplished before this checklist: i.e., (5) APR (Automatic Performance Reserve), (10) brake lever and (11) engine sync.

I believe the autopilot item, on an airplane with or without autoland, should be considered a normal pilot duty that doesn’t require inclusion on a checklist. All of the “traditional” Gulfstreams, those originally designed by Gulfstream, cannot be landed with the autopilot engaged, and yet this checklist item isn’t used on those aircraft.

This G150 checklist takes an average of 45 sec. to accomplish, or just enough time from glideslope intercept to our stable approach height, provided there are no other distractions or other demands on the PM’s time. No doubt those distractions will occur, and the PM will be left with less time for monitoring.

Contrast the long and complicated G150 checklist with one from Dassault. The Falcon 900EXy has an exceptionally well-designed before-landing checklist, but to appreciate why, you need to look at the checklist that precedes it.

- (5) NO SMOKING ... ON
- (6) Cabin ... Ready
- (7) STATUS Page ... Checked

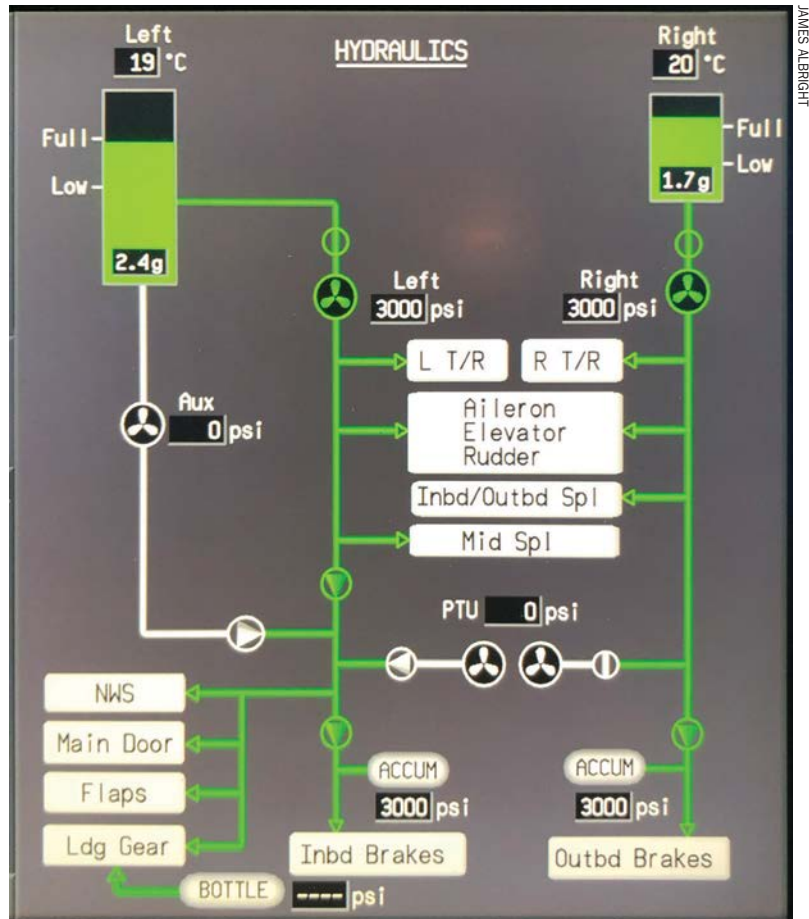
Before Landing

- (1) Landing Gear ... 3 Greens
- (2) SLATS/FLAPS ... 40°

It appears Dassault has made a conscious effort to ensure neither pilot is distracted by checklist duties once the gear, slats and flaps are set for landing. Most aircraft manufacturers fall short of this ideal because quite often aircraft design drives the checklist.

The Impact of Aircraft Design on Checklist Design

The G150 before-landing checklist provides an object example of how aircraft design drives checklist construction. Even



The hydraulics synoptic from a Gulfstream GVII-G500.

Approach

- (1) Altimeters (all 3) ... QNH
- (2) Approach Settings ... Checked
- (3) LANDING Lights ... ON or PULSE
- (4) FASTEN BELTS ... ON

after moving the five items that appear before the landing gear and three later items to an earlier checklist, we are still left with five items once the gear is down: (7) anti-skid, (8) hydraulic pressure, (9) thrust reversers, (12) ground air brakes (ground A/B) and (13) slats/flaps. These items cannot really



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be checked until the gear is down because of the many interdependent systems that rely on aircraft hydraulics or other complicating factors.

Three-thousand psi is almost a universal pressure for aircraft hydraulic systems, providing a lot of muscle from one part of the airplane to others using relatively compact and light-weight tubing. This has been the method of choice for many years when it comes to landing gear, flaps, slats, ground spoilers and flight controls. A limitation with such a setup is that the

It certainly beat my grease pencil technique.

The problem, however, was lurking in those analog switches. To illustrate, consider the Gulfstream III's master warning light panel. Before we do that, however, remember there is a saying in the Gulfstream world: "If you've flown one Gee Three, you've flown one Gee Three." That's because there are a lot of variations within that model.

In the GIII's that I flew, the warning light on the seventh row, first column was labeled "COMB HYD" and would illuminate

STEVEN FOLTZ



A Gulfstream GIII's master caution panel "lit up"

fluid under high pressure can deplete itself very quickly when the system develops a leak.

One of the most-feared scenarios is for a leak in the landing gear, flaps, slats or spoilers to deprive the airplane of wheel brakes at the last moment of flight. That is why many manufacturers include a last-minute check of those components and the hydraulic systems once the aircraft is fully configured. You can't do this check beforehand.

On many aircraft, however, the hydraulic system check can be completed automatically. Most of the critical systems that slow the aircraft prior to landing and then stop it can be electronically monitored to provide a warning should they fail. Shouldn't this relieve the pilot of the responsibility?

My first aircraft in the large category was the KC-135A tanker. At nearly 300,000 lb., it was large indeed. Designed and built in the 1950s, the aircraft's crew alerting system consisted of the two pilots, and as a copilot, the blame for missing anything fell to me. I learned early on to mark all the gauges with a grease pencil so I could, at a glance, detect when something wasn't the way it was hours earlier. It was an admittedly imprecise method, but it helped.

My first airplane with a master caution panel was a Boeing 747-200. It had an array of lights, each connected to an analog switch of some sort along with another light that told me if any of the other lights was triggered.

in amber if the pressure in what was called the "Combined Hydraulic System" fell below 800 psi. The airplane had a part-time 1,500-/3,000-psi system that would use the higher pressure with the gear or flaps extended. A drop to 800 psi may have been enough to detect a large hydraulic system leak in the landing gear but not enough for a small leak in the flaps. So, the ninth item after the landing gear in our before-landing checklist was to check the hydraulic system pressure on a gauge just forward of the copilot's inboard knee. It was a checklist item we couldn't give up and it had to appear after the landing gear and flaps.

The Gulfstream G500 (GVII) also has a 3,000-psi system that drives the landing gear, flaps and wheel brakes, though it is at 3,000 psi full-time. The pressure sensor feeds directly into a digital network that is monitored continuously for faults. A pressure drop below 2,350 psi immediately generates an "L Hyd Pump Fail" and if that were accompanied by a quantity loss below 0.3 gal. and further pressure loss below 1,600 psi, it would generate an "L Hyd System Fail" message.

These modern warning systems are ever-vigilant so we don't have to be. The requirement to check the hydraulic system after landing gear and flaps extension has been eliminated on many aircraft. Newer aircraft tend to have fewer checklist items because computers do much of the checking and the list has gone to single digits for many modern aircraft.



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The GVII's electronic before-landing checklist, with the first five items automatically completed

When I saw the Falcon 900EXy before-landing checklist (landing gear, slats/flaps), I was green with envy. Just two items! The before-landing checklist for my Gulfstream G500 is three times longer:

Before Landing

- (1) Autobrake — As Required
- (2) Seat Belt/No Smoke Passenger Warning — On
- (3) Exterior Lights — As Required
- (4) Landing Gear/Lights — Down/3 Green
- (5) Flaps — Down
- (6) Approach/Landing Airspeeds — Verify

But we G500 pilots have an ace up our sleeves: All but one of those six items are completed automatically by our electronic checklist. Setting the autobrakes, for example, also checks the appropriate item. The same holds true for the next four items. All that is left for us to do is to verify our approach and landing speeds.

How to Fix a Broken Checklist

Do you have a flawed before-landing checklist? If so, it could be that the manufacturer designed it in a way to be consistent with other aircraft in its fleet. Perhaps the developers gave the design duties to a non-pilot. Or it could be an old checklist design that didn't keep up with aircraft modernization. Whatever the reason, your options to improve what you have could be limited.

If you are flying commercially, your checklist will ultimately

have to be approved by your operator and approved or “accepted” by the principal operations inspector. If you are flying under Part 91 you have more latitude but should review FAA Order 8900.1, Volume 3, Chapter 32 to ensure you adhere to what the FAA will view as best practices.

Back to the G150. If I were king, this is what I would do with that model's before-landing checklist. My first step would be to add an in-range checklist for those things that do not have to wait for landing gear extension. Thus:

In Range

- (1) Landing Reference Speed (VREF) . . . CONFIRM & SET
- (2) WINDSHIELD HEAT . . . AS REQUIRED
- (3) ANTI-ICE & DEICE . . . AS REQUIRED
- (4) IGNITION . . . AS REQUIRED
- (5) ENGINE SYNC . . . OFF
- (6) APR ARM . . . ARM

Some manufacturers include an “in-range” checklist prior to landing; some call it an “approach” checklist and ignore the need for something prior to the high workload period just before landing. Using the in-range checklist and eliminating unnecessary items halves the G150's before-landing checklist to this:

Before Landing

- (1) Landing Gear . . . DOWN/3 GREEN
- (2) THRUST REVERSE ARM . . . ARM
- (3) GROUND A/B . . . LAND
- (4) ANTI-SKID . . . CHECK ON (LIGHTS OUT)
- (5) Hydraulic Pressure . . . CHECK MAIN & AUX
- (6) SLATS/FLAPS . . . FLAPS 40°

In my view, many before-landing checklists can be improved in the spirit of FAA Order 8900 guidelines by:

- (1) Placing all lesser items that do not have to wait for extending the landing gear and flaps in an earlier “in-range” or “approach” checklist.
- (2) Starting the before-landing checklist with an “event initiating” item, preferably the landing gear.
- (3) Eliminating items that are simply normal procedures, such as disengaging the autopilot or autothrottles, if that is normal procedure for your aircraft.

In the airline world, we could once divide aircraft by their automation philosophies, as in Boeing versus Airbus. However, today it seems those two are moving closer to a middle ground. In the business jet world, I have been a fan of all things Gulfstream for decades, and that meant I had to look upon all things Dassault with a certain skepticism. But as with the Boeing/Airbus dichotomy, it seems even a long-time Gulfstream driver can salute the maker of Falcon Jets and the checklists attendant to them.

You may not be able to reduce your before-landing checklist to just two items, but you might be able to get some improvement by reordering items not dependent on landing gear position and eliminating things that don't belong. The PM should devote as many of the 45 sec. between gear extension and stable approach height to monitoring the PF. Doing so will improve the crew's chances of flying a truly stable approach. **BCA**

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The Anti-Anti-Ice Protection

“Light” snowfall can be deceptively dangerous

BY PATRICK VEILLETTE jumpraway@aol.com

Modern deicing and anti-icing methods have proven effective when properly applied and the limitations of the fluids are observed. However, the duration of that protection can be degraded by meteorological conditions including freezing rain, ice pellets and hail, heavy snow, high wind velocity, fast-dropping air temperatures or any time when freezing precipitation with high water content is present. Some other factors that can reduce the effectiveness of deicing and anti-icing procedures range from the inclination angle and contours to surface roughness and temperature of aircraft surfaces.

A team of researchers from the National Center for Atmospheric Research (NCAR) and United Airlines discovered several under-recognized conditions in

which an aircraft might attempt to take off unknowingly with contaminated wings. The project was sponsored by the National Science Foundation through an interagency agreement with the FAA. Its results were reported as “Common Snowfall Conditions Associated With Aircraft Takeoff Accidents,” in the January-February 2000 issue of *Journal of Aircraft*.

In the study, the team examined five icing-related FAR Part 121 mishaps. The accidents occurred at New York LaGuardia (KLGA) on March 23, 1992 (USAir Flight 405, Fokker F-28); the former Stapleton International Airport (KDEN) on Nov. 15, 1987 (Continental Flight 1713, DC-9-14); Washington National (KDCA) on Jan. 13, 1982 (Air Florida Flight 90, Boeing 737-222); Logan International (KBOS) on Feb. 16, 1980

(RedCoat Air Cargo, Flight RY103, Bristol 175 Britannia) and Newark International (KEWR) on Nov. 27, 1978 (TWA Flight 505, DC-9-15).

While these accidents all occurred more than two decades ago, the detailed meteorological data attendant to them allowed the researchers to note key similarities among all five. For example, the temperatures were between 25F and 31F, the winds were 8-13 kt. and the accidents occurred during the peak snowfall period of a storm associated with snow bands.

There was, however, a large disparity between the reported visibilities that raised questions among investigators and others within the industry. The reported visibility varied from 0.25 mi. in the KDCA accident to 2 sm in the KBOS accident. That might lead one



CHALABALA

to conclude that the snow was falling heavily in the Washington accident versus rather lightly in the Boston crash. However, in the former, the first officer described the snowfall as “not heavy, no large flakes,” giving a false sense of security that the conditions were not too bad. Such a visual illusion can trick any flight crew into making the same wrong assessment.

This study, together with other work at the NCAR, determined that fluffy snowflakes can obscure visibility up to 10 times more than small, dense flakes, even though both contain the same amount of water. When researchers dived deeply into the meteorological data in these accidents, the snow was falling at a liquid-equivalent rate between 0.08 and 0.10 in./hr. in all five accidents.

This illusionary phenomenon can mislead pilots and air traffic controllers into interpreting relatively good visibility as “light” snowfall when in fact the snowfall consists of dense, compact flakes that are actually depositing substantial amounts of frozen water onto critical aircraft surfaces.

The types of snowfall that can result in deceptively high visibility during high rates of precipitation include wet snow, snow with rimed crystals (cloud droplets accreted onto ice particles, similar to rime ice on aircraft), snow consisting of compact crystals, and snow pellets. These can lead to high visibility because of their relatively small cross-sectional area and higher terminal velocity as compared to dry, fluffy snow. One of the important conclusions of this team’s project is that visibility is not a good indicator of liquid-equivalent snowfall rate.

As a result of this research, the FAA provides amended guidelines for the estimation of the prevailing visibility based upon snowfall intensity. Table 43 of the FAA’s Holdover Time (HOT) Guidelines, Winter 2019-2020, issued Aug. 6, 2019, provides guidance on the estimation of snowfall intensity. A pilot uses the reported visibility and the temperature to determine if the snowfall intensity falls within very light, light, moderate or heavy categories. A flight crew is then able to determine the HOT using this estimate of the snowfall intensity along with the air temperature and fluid concentration level.

The chart provides guidance for both day and night conditions since nighttime conditions increase the pilot’s perception of visibility by a factor of two. This is due to the different types of light scattering occurring during the day versus those at night.

Winds on Taxi

The NCAR/United team uncovered a secondary problem that can occur while waiting for takeoff. Wind can affect the snowfall accumulation rate on critical aircraft surfaces, especially those inclined into the direction of the wind. Let’s consider your aircraft is creeping along a taxiway parallel to the runway. The reported winds are 8-10 kt. straight down the runway. So, while slowly advancing, your aircraft is experiencing an 8- to 10-kt. tailwind. This matters because a tailwind will blow falling snow particles more directly onto the upper surface of the wing, which is

typically angled at about 10 deg. from the true horizontal, and significantly increase accumulation. According to a lead NCAR researcher, “For the wind speeds observed during the aircraft accidents studied, the enhancement factor ranges from 1.75 to 2.0.” In other words, the accumulation rate of snow on a wing nearly doubled while waiting in line for takeoff.

The holdover times are tested to provide protection against accumulation of contamination under specific temperature and precipitation limits. That time calculation is negated when conditions fall outside of those limits. A two-fold increase in the accumulation of wet snow on a wing’s surface will most certainly degrade the protection provided by anti-icing fluids.

Another potential effect occurs during a crosswind since it can cause differential accumulation of frozen precipitation on the wing facing into the wind, leading to asymmetrical lift and drag during rotation for takeoff. During the KLGA accident, a crosswind was hitting the trailing edge of the right wing preferentially, with the left wing shielded from the wind by the fuselage. Upon rotation, the aircraft rolled while still in ground effect. The researchers opined that the roll may have been caused by one wing receiving more snow accumulation than the other.

Peak Snowfall = Higher Risk

As noted, the five accidents occurred during the peak snowfall period of storms associated with snow bands of heavier snowfall rates. Those rates at temperatures near freezing are also larger than at colder temperatures since cold air can’t contain as much moisture. Snowfall conditions near 32F are particularly hazardous due to the more-frequent occurrence of high snowfall rates and partial melting of the crystals, leading to the misleading condition of high visibility and high snowfall rates.

The research team provided a special warning to both flight crews and deicing operators: “The passage of potentially hazardous snow bands [which can be detected by Doppler radars by the NWS] should be of particular interest to deicing operators due to their potential hazard, and the resulting increased deicing operations likely to be required due to the higher snowfall rates associated with these bands.”

The study’s authors suggested that this particular combination of

temperatures, wind and liquid-equivalent snowfall may be conducive to the buildup of hazardous ice accumulations on aircraft.

This research has contributed to essential information that is contained in special notes below the Holdover Time tables. For example, “The time of protection will be shortened in heavy weather conditions. Heavy precipitation rates or high moisture content, high wind velocity or jet blast may reduce holdover time below the lowest time stated in the range.”

Use the Right Charts

Deicing and anti-icing fluids are tested and qualified for operation within a specific temperature envelope and set of conditions. It is vital to use the right chart and to apply any corrections listed in the notes.

If critical aircraft surfaces are composed of composites, use the charts for composite surfaces. The difference is significant. For instance, the Holdover Time for Type I fluid used on an aluminum aircraft surface with temperatures at 27F or warmer is 6-11 min. In contrast, the Holdover Time with the same fluid on a composite aircraft surface is only 3-6 min. (Note: These numbers are quoted from the FAA’s Holdover Time Guidelines, Winter 2019-2020, issued Aug. 6, 2019. At the time of this article’s preparation, the 2020-2021 guidelines weren’t yet available.)

Holdover time may be reduced when aircraft skin temperature is lower than outside air temperature. The wings of an aircraft become “cold soaked” when they contain cold fuel as a result of flight at high altitude or from having been refueled with cold fuel.

Whenever precipitation falls on a cold-soaked aircraft when on the ground, clear icing may occur. Frost or ice on the lower surface of the wing in the area of the fuel tank is an indication of cold soaking. Even in ambient temperatures between -2C and +15C, ice or frost can form in the presence of visible moisture or high humidity if the aircraft structure remains at 0C or below. Clear ice is difficult to detect visually and may break loose during or after takeoff.

The following factors contribute to cold soaking: temperature and quantity of fuel in fuel cells; type and location of fuel cells; length of time at high altitude; temperature of refueled cell; and time since refueling.

The Association of European Airlines

recommends using a strong mix (more glycol) to ensure a sufficient freeze point buffer. Its “Recommendations for Deicing/Anti-Icing of Aircraft on the Ground” from September 2008 states, “As fluid freezing may occur, 50/50 type II, III or IV fluid shall not be used for the anti-icing step of a cold-soaked wing.”

It is also necessary to adjust the holdover time when flaps or slats are extended to takeoff configuration before anti-icing fluid is applied and remain in those positions while taxiing. By the way, the fluid concentration may change if the fluid is subjected to sustained heating.

Applying Recent Findings

By combining the NCAR/United team’s findings with the results of other engineering studies on the performance of wings in wintry conditions, some clear guidelines emerge for winter operations.

Let’s presume you’ve dropped off your clients for their ski vacation at one of the uncontrolled airports in the Rocky Mountain region. While the passengers are delighted to deplane into a snowy scene, you have to reposition the aircraft for the next leg. As you perform your turn-around duties, a “light” snow begins to fall. AWOS reports a temperature of -3C and a visibility of 0.75 sm.

You note the conditions, consult Table 43 in the FAA’s Holdover Guidelines and apply the proper correction for the visibility. Doing so, you determine the proper estimation of the snowfall intensity as moderate,” and ask the FBO to apply Type I and Type IV fluids.

Since the FBO uses a “generic” Type IV fluid with a 75/25 fluid concentration ratio, the HOT obtained from Table ADJ-20: “Adjusted Generic Holdover Times for SAE Type IV Fluids” is 30 to 57 min. The deicing and anti-icing is done on the ramp. You then use the remote communications outlet frequency to get your IFR clearance and the controller asks you to call when you are sitting at the end of the runway ready for takeoff.

Unfortunately, there is a long line of inbound aircraft waiting to shoot the instrument approach, and since there is no radar coverage below the mountain top level, ATC can’t clear anyone for takeoff on the instrument departure procedure until the arriving aircraft have announced to ATC that they have safely landed. For the sake of our scenario let’s put an 8-kt. wind striking the right side of your aircraft as you patiently sit on the parallel taxiway near

the end of the runway while awaiting release from ATC.

Your jet features a supercritical wing that produces remarkable cruise performance, but the downside is that high-performance airfoils exhibit markedly worse stall characteristics when contaminated by ice, snow, etc.

Clinton E. Tanner, Bombardier’s senior technical advisor in flight sciences, notes that high-performance jet wings tend to exhibit leading-edge stalling. In this phenomenon, the short bubble that naturally occurs along the airfoil’s leading edge “bursts” and the airflow detaches suddenly and completely from the leading to the trailing edge. A serious consequence is the lack of aerodynamic stall warning and an abrupt loss of lift.

NASA Glenn Research Center and the National Research Council of Canada have studied the aerodynamic characteristics of high-performance airfoils that have a coating of anti-icing fluid. The stall angle was reduced to 15.3 deg. compared to the clean value of 20 deg. The study concluded that secondary wave effects could have a significant impact on the maximum lift coefficient and stall angle for anti-icing fluid tests on the thin, high-performance wing.

Crosswinds can likewise create a stall at a lower angle of attack (AOA). During crosswind takeoffs and landings in a swept-wing jet, the “upwind” wing experiences airflow that is more direct (i.e., perpendicular) to the wing’s leading edge, and this generally improves the wing’s performance. Conversely, the “downwind” wing experiences the airflow at a greater angle (essentially increasing the “sweep” of the wing), which decreases its lift, increases drag, promotes the span-wise flow of air, and thereby reduces its stall AOA. Bombardier’s Tanner cites flight test results showing that sideslip reduces the stall AOA of the right wing by up to 3.5 deg. when it experiences a sideslip of 20 deg.

John O’Callaghan, a national resource specialist in aircraft performance at the NTSB, has warned that the stall of all types of aircraft occurs approximately 2-4 deg. AOA lower with the wheels of the aircraft on the ground. Flight test reports noted “post-stall roll-off is abrupt and will saturate lateral control power.” The catastrophic roll-off of the wing in the Roswell accident was due in part to no warning before stall in ground effect.

To sum up the threats to your repositioning flight:

- (1) Your wings were cold soaked

from the previous flight.

(2) The wind may have caused extra accumulation of wet snow on the right wing as you sat on the taxiway.

(3) You are flying a high-performance jet whose wing is especially prone to adverse stall characteristics when contaminated.

(4) A layer of anti-icing fluid was applied to give you protection within the Holdover Time, but anti-icing fluid itself extracts a stall margin penalty as the aircraft is rotated for takeoff.

(5) There is the negative influence of ground effect as well as crosswinds on the reduction in stall AOA, particularly on the right wing.

All of these reduce the margins from an actual aerodynamic stall during a takeoff that can occur without aerodynamic warning.

And lastly, (6) If there's a notable delay between fluid application and takeoff, all Part 135 pilots must comply with procedures in their company's "Ground Deicing and Anti-Icing Program" including actions required if an HOT is exceeded. This can include conducting a tactile check of the aircraft's surfaces. And if operating under Part 91, and an excessive hold time is experienced, one of the pilots should conduct such a check even though a shutdown and then restart of the left engine will likely be necessary.

This hypothetical but not uncommon situation amply demonstrates the benefits when deicing and anti-icing operations are conducted close to the end of the runway and coordinated with air traffic control so that aircraft are promptly cleared for takeoff soon after being serviced. If your aircraft has been on the ground in conditions conducive to wing contamination and there is any doubt in your mind as to whether the lifting surfaces are free of ice or snow, get out and conduct a preflight tactile check to be sure.

Finally, the FAA's Safety Alert for Operators 06002 (March 29, 2006) "Ground Deicing Practices for Turbine Aircraft in Nonscheduled 14 CFR 135 Operations and in Part 91" contains some solid safety information. Prepared by the General Aviation Joint Steering Committee, it recommends that directors of safety, operations and fractional ownership programs, along with flight crews of turbine aircraft, perform "a comprehensive review of current deicing policies and procedures" along with current winter weather operations training. Sound advice with winter's chill in the air. **BCA**



RHYMAN007

Sticky Film's Unwanted Effects

You've probably noticed that a layer of sticky residue remains on an aircraft's wing after a flight in which it was treated with anti-icing fluids. Unfortunately, it has consequences beyond repelling ice and snow.

European Union Aviation Safety Agency (EASA) Safety Information Notice No: 2008-29 (Issued April 4, 2008) "Ground De-/Anti-Icing of Aeroplanes; Intake/Fan-Blade Icing and Effects of Fluid Residues on Flight Controls" advises that repeated application of thickened deicing and anti-icing fluids may leave a dried residue in aerodynamically quiet areas, such as cavities and gaps. This residue can rehydrate when exposed to high humidity conditions, precipitation, washing, etc., thereby increasing its volume considerably. And the goo is also susceptible to refreezing when exposed to conditions at or below OC. These changes may cause moving parts such as elevators, ailerons and flap actuators to stiffen or jam in flight. Residues may also collect in hidden areas around flight control hinges, pulleys, grommets, on cables and in gaps. Rehydrated residues may also collect inside flight control surface structures and cause clogging of drain holes or imbalances to flight controls.

Maintenance technicians should follow the proper procedures in the aircraft's maintenance manual for the inspection of critical surfaces, the tolerances allowed, using authorized tools and complying with appropriate methods to remove and clean the surfaces. **BCA**

Other Do's and Don'ts

► Operate the APU only when necessary during deicing and anti-icing treatment.

► Do not operate the wing anti-ice system on the ground when thickened fluids (e.g., SAE Type II, III or IV) have been applied. Do not use the wing anti-ice system as an alternative method of ground deicing and anti-icing.

► During taxi-out, avoid using reverse thrust on snow- or slush-covered runways, taxiways or ramps unless absolutely necessary. Using reverse thrust on snow- or slush-covered ground can cause slush, water and runway deicers to become airborne and adhere to wing surfaces.

► If the taxi route is through ice, snow, slush or standing water, or if precipitation is falling with temperatures below freezing, taxi out with the flaps up. Taxiing with the flaps extended subjects them and flap devices to contamination.

► If there are any questions as to whether the airplane has frozen contamination, request deicing or proceed to a deicing facility. Never assume that snow will blow off. There could be a layer of ice under it. In rainy conditions with OAT near freezing, do not assume that raindrops on surfaces have remained liquid and will flow off. Raindrops could freeze onto the surface. A similar issue can occur due to cold-soaked fuel in the wing tanks.

► Make certain to extend the flaps to the takeoff setting before taking the runway. Verify that airplane surfaces are free of ice, snow and frost before moving into position for takeoff. Check the flight controls and flaps to ensure freedom of movement.

► Rotate smoothly and normally at VR. Do not rotate aggressively when operating with deicing or anti-icing fluid. Retract flaps at the normal flap retraction altitude and on the normal speed schedule. **BCA**

Committed to Stop

A go-around doesn't — Citation runway overrun in Michigan

BY **ROGER COX** rogerdodger62@gmail.com

The lack of accurate, timely information about the amount and nature of runway contamination has been a factor in too many accidents. Knowing if the pavement is wet, slushy or icy makes a big difference in a pilot's decision to land. And if upon touching down, the runway proves slicker than expected, the decision time on what to do next narrows, one's attention begins to tunnel and the peril has increased exponentially. Go around or ride it out?

The pilot of a Cessna Citation 525C made the wrong choice on Jan. 16, 2017, lost control of the airplane, went off the runway's end and finally came to stop, wingless, inverted and on fire. Miraculously and thanks to a stranger's heroism, the pilot was pulled from the wreckage, seriously injured, but alive.

The Flight

The CJ4, N525PZ, departed single pilot from Genesee County Airport (KGVQ), Batavia, New York, at 1057 local, destined for Livingston County Airport (KOZW) in Howell, Michigan. The FAR Part 91 business jet was on an IFR flight plan.

Prior to departure, the pilot used the Aviation Digital Data Services (ADDS METAR) website to check the weather and NOTAMs. At the time, KOZW was reporting winds 160 at 3 kt.; 5-sm visibility with mist; sky conditions, 5,000 ft. broken, 6,500 ft. overcast; temperature, -1-C; and dew point -3C. A few minutes after the airplane launched, KOZW began reporting light snow, with visibility decreasing to 3 sm.

As the airplane descended toward the airport, the pilot listened to the KOZW AWOS-3 recording whose information was essentially the same

as a METAR. Unlike the Automatic Terminal Information System (ATIS) at towered airports, AWOS does not provide information like landing runway, approach in use or field conditions. KOZW was still reporting 3 mi. visibility in light snow and temperature/dew point of -1C/-3C. The airplane was equipped with Next-Generation Radar (NEXRAD) and onboard radar. The NEXRAD showed precipitation, but when the flight broke out of the broken cloud layer, the pilot saw none.

Upon being vectored to the ILS Runway 13 approach, the pilot canceled his

180 on the right side of the runway and assumed that pilot would not be preparing to take off if conditions were icy.

In a later telephone interview with an FAA inspector, the CJ4 pilot said he knew an icy runway was a possibility because of the weather conditions. As a result, he had planned to touch down, test the brakes, and then, if necessary, go around. He stated he flew at VREF and landed "on the chevrons." The pilot told the NTSB investigator in charge (IIC) that the spoilers deployed at touchdown and he then "tapped the brakes" only to discover he had no stop-



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According to the Textron Technical Report, the wings of the Citation separated from the fuselage and had post-impact fire damage.

IFR clearance. He then made calls on the Common Traffic Advisory Frequency (CTAF) during the approach and again on short final. However, he didn't query anyone on the frequency as to the condition of the runway. He noticed what he thought was a Cessna

ping action. Thereupon, as planned, he retracted the spoilers, raised the flaps and advanced the power to go around.

Unfortunately, one engine spooled up faster than the other and the airplane began to yaw to the left. The pilot recalled reducing power to idle

and applying right rudder to correct the airplane's heading, but the jet continued off the 5,002-ft.-long runway. Upon leaving the pavement, the aircraft struck a fence, plowed through a ditch, screeched across a road, burst into flames as it rolled inverted and finally came to a stop. A witness told an FAA inspector that he saw a fireball and the airplane roll upside down. At that point, he stopped his car, hustled to the aircraft, opened the cabin door and helped the pilot get out of the burning wreckage.

The Investigation

The NTSB conducted a "Limited" investigation of the accident and, as such, the IIC did not travel to KOZW. She was assisted by FAA inspectors and air safety investigators from Textron Aviation. The State of Michigan also conducted an investigation and forwarded its report to the IIC.

According to the Textron Technical Report, the wings separated from the fuselage and had post-impact fire damage. The right flap and inboard section aileron remained attached to the right wing. The left flap and inboard section of the aileron remained attached to the left wing. Both wing outboard sections were separated from their respective wings. The fuselage was inverted with the empennage attached. The outboard approximately one-third of the left elevator was separated from the empennage. Inside the cockpit, the speed brake handle was observed in the 0% position, throttles were in takeoff, and the flaps were retracted.

The airplane was equipped with a Cessna Aircraft Recording System (ARes) and investigators were able to determine ground speed, throttle lever angle, true airspeed, speed brakes, weight on wheels and altitude. The data showed that after touching down, the throttles were advanced for a period of about 15 sec., reduced, then advanced momentarily once again.

The pilot reported the two-year-old airplane had logged 320 hr. since new. Its last inspection was two days before the accident. He also reported the airplane's landing weight was 14,500 lb. At that weight, the performance landing section of the airplane flight manual (AFM) showed the VREF should be 108 kt. and the dry runway landing distance for the conditions at the time of the accident was 2,700 ft. The manual provided adverse runway correction data that

showed if the runway had 0.5 in. of water on it, the landing distance would be 2,950 ft., and if it had 2.0 in. of dry snow, the landing distance would be 3,750 ft. The landing distance shown for wet ice was 13,625 ft.

The private, instrument-rated pilot reported he had type ratings in the Citation Mustang, CitationJet and the British Aircraft 167 Strikemaster, and was SIC qualified in the B-17 Stratofortress. He also had a helicopter rating. He reported he had 5,800 hr. at the time of the accident, including 320 hr. in the CJ4. He had flown this model airplane 17.4 hr. in the last 30 days, 64.9 hr. in the last 90 days, and his last flight review was on April 10, 2016, at FlightSafety International in the CE525C simulator.

The skills required to obtain a single-pilot type rating in a multiengine turbine-powered airplane normally correspond to those needed for a commercial or ATP pilot certificate.

A witness said he saw the airplane touch down prior to the Taxiway A-2 turnoff, and another witness said he saw the airplane in the flare "a couple hundred feet past the Crosswinds building." A third witness said when he heard the jet noise increase he thought "it was a bit late for thrust reversers." The pilot told the Michigan investigator he thought he had applied full power when he was about halfway down the runway.

A Google Maps measurement showed that the distance from the approach end of Runway 13 to Taxiway A-2 is 1,650 ft. The Crosswinds building is on the west side of the airport with a direct view of Runway 13's landing area. If the airplane touched down 1,500 ft. beyond the approach end, the pilot took 6 sec. to brake, then applied takeoff power at the halfway point of the runway and left it there for 15 sec., it would have been 4,900 ft. down the runway before he retarded the thrust levers.

In addition to the reported METAR information, witnesses reported nearby roads were slick and icy, and sleet and freezing rain had begun about an hour before the accident. The mechanic who was taxiing the Cessna 185 the pilot saw before landing said conditions were mist or light rain with ice on the pavement. He was waiting to cross the runway to go back to the shop after doing maintenance.

The airport staff had not issued any NOTAMs regarding the icy runway conditions. Neither the airport manager nor the employee on duty had learned how to enter data into the digital NOTAM

manager system. That system had been introduced by the FAA in October 2016.

The FAA's NOTAM search feature is a major improvement to the older system. When field condition NOTAMs are issued, you can find them easily and they are easy to understand. Go to <https://notams.aim.faa.gov/notamSearch/nsapp.html#/> and enter your airport ID, and look for the field condition (FICON) line items.

Probable Cause

In its analysis, the Safety Board considered the pilot's attempt to land, his mistaken assumption about the Cessna 185 he saw, the wet ice landing distance and the lack of NOTAM reporting by airport officials.

The probable cause issued was: "The pilot's attempted landing on the ice-covered runway, which resulted in a runway excursion and impact with terrain. Contributing to the accident was airport personnel's lack of training regarding issuance of NOTAMs."

Further Considerations

One of the main reasons for owning and operating high-performance turbine-powered business airplanes is the convenience they provide in using smaller airports located near customers and distant corporate offices. With that convenience comes some additional considerations, and I think this case illustrates two of those.

► **The advisability of an attempted stop and go** — This CJ4 accident bears some resemblance to another accident in 2008. In that one, the pilot tried to stop a Hawker 125-800, applying wheel brakes and lift dump, and then decided to go around. His airplane struck the localizer antenna, crashed in a cornfield, and all aboard were killed.

During the investigation of that accident, I interviewed three highly experienced business pilots who were teaching at the Part 142 school where the accident pilots trained. They had between 15,000 and 29,000 hr., all had type ratings in Hawkers and Cessna jets, and two were typed in Learjets. One was typed in the Lockheed JetStar, and one had been an FAA inspector for 16 years and supervised 100 Part 135 certificates. Two had long experience as pilot examiners.

When asked if an attempted stop-and-go maneuver (I'll call it ASG) like the Hawker accident pilot did was a good idea, two of the three instructors said

Cause & Circumstance

no. One said he had never conducted a go-around after deploying lift dump and he did not teach or recommend doing so. He said attempting a go-around after deploying lift dump was “a good way to crumple the airplane” and “the odds are way against it.” However, the third instructor said if you brief beforehand, you can do the go-around quickly. He was referring to a two-crew airplane whose pilots had good coordination.

He related a personal experience of flying into a small airport on the north shore of Lake Superior with a 5,600-ft.-long runway that in winter usually had ice on it but no braking reports available. He said it was a tricky maneuver and should be practiced beforehand on a longer runway.

The divergence of opinion among these experts tells me that some pilots still consider the ASG maneuver an acceptable practice. So, I think it’s reasonable to explore the options more closely.

In favor of the ASG is the value of getting into the particular airport. Often there’s an office nearby and few alternatives. The company airplane has to prove its value. The Lake Superior airport noted earlier was located by a primary business destination for the pilot’s company and there wasn’t another suitable airport. It was land or go home.

The downside of the ASG is the very high risk of an accident. On a relatively

short runway, there is no room for error. The Hawker crew took 7 sec. to deploy lift dump and remained on the 5,500-ft. runway for 17 sec. before the pilots set takeoff thrust. The NTSB found that if they had continued to brake, the airplane would probably have stopped in the runway overrun.

Another example took place on July 15, 2005. A Citation 525A collided with a localizer antenna in Newnan, Georgia, after the pilot conducted a go-around late in the landing roll on a wet, un-grooved runway. The pilot stated that he applied brakes upon landing and that the airplane then hydroplaned. He then chose to abort the landing with 2,300 ft. of runway remaining (the runway was 5,500 ft. long).

In the CJ4 accident in Howell, Michigan, the pilot made several errors that I think were predictable. He used the airplane flight management system to calculate landing distance, but the values produced by that system were only as good as the runway contamination data he entered. In addition, he failed to make a CTAF call asking anyone about the runway condition, and he made a wrong assumption about the intent of the Cessna 185 he saw on the ground. Furthermore, he failed to realistically anticipate the time and distance required to flare and brake.

As noted, when he applied takeoff

thrust, the engines spooled up unevenly. This is most likely to happen when you move the thrust levers rapidly, which can happen in a time-critical event like a go-around. He raised the flaps to zero, which increased the ground distance required to get airborne. And the kinetic energy he added during his 15-sec. go-around attempt added greatly to the destructive force of the crash.

To me, one of the biggest negative factors about ASG is the lack of procedure, training or guidance on how and when to do the maneuver, and the impossibility of calculating aircraft takeoff distance and climb performance. You are, in effect, a test pilot attempting to do something no competent authority has demonstrated to be safe. When you plan to apply brakes on an icy runway and then go around, you are betting the airplane that you will perform flawlessly doing a complex maneuver you’ve never practiced.

In 2011, the NTSB wrote a “commit-to-stop” recommendation (A-11-18) intended to have manufacturers set some limitation on the latest point on landing where a go-around should be attempted. The FAA declined to act on this recommendation, but wrote an Information for Operators bulletin (InFO 17009) on the subject. The InFO leaves it up to the operator to determine the commit-to-stop point. The

Accidents in Brief

Compiled by Jessica A. Salerno

*Selected accidents and incidents in August 2020.
The following NTSB information is preliminary.*

► **August 9 About 1430 CDT, a Piper**

PA-22-150 (N6849B) was heavily damaged when it was involved in an accident near Burlington, Wisconsin. The pilot and passenger were seriously injured. The airplane was operated Part 91 personal flight. According to law enforcement personnel who spoke to the pilot after the accident, the pilot reported that the engine was not developing the RPMs he expected during the takeoff, which resulted in a reduced rate of climb.

During the attempted initial climb, the pilot performed various pitch maneuvers to gain airspeed and lift. About 1 mi. from the departure airport and unable to gain altitude, he pitched up the airplane to avoid two rows of trees and impacted a third row of trees. The airplane nosed down and impacted the terrain.

► **August 8 — At an unknown time, a**

Bell 206B (N284S) was destroyed when it was involved in an accident near Marathon, Texas. The pilot was seriously injured, and the three passengers were killed. The flight was operated as a Part 91 aerial survey flight. The flight’s mission was to conduct aerial survey of desert bighorn sheep in the Texas Black Gap Wildlife Management Area. When the helicopter did not return for refueling at the expected time, a search was initiated. The wreckage was located about 1200, by the Texas Parks & Wildlife

Department personnel who notified authorities. The pilot reported to the first responders that about 5 min. before refueling; the helicopter was about 800 ft. AGL when he felt a slight vibration. He informed the passengers he would be conducting an emergency landing. The vibration intensified and he was losing maneuverability, the vibration got worse. The helicopter lost lift and crashed short of the intended landing area. The pilot stated that the engine never stopped producing power. The helicopter pilot was not in contact with air traffic control.

► **August 7 — About 1400 PDT, a**

Sportine Aviacija Lak-17B, motorized glider (N290MH) was substantially damaged when it was involved in an accident near Lake Port, California. The private pilot was fatally injured. The motorized glider was operated as a Part 91 personal flight. The flight departed from Runway 28 at

problem with this idea is that small operators and private pilots have no flight standards department, aircraft performance department or safety department to help set policy and probably don't read InFOs or even know what they are. Our CJ4 accident pilot may have had only informal sources of information to help him formulate a plan for landing at KOSW.

► **Assessing landing distance** — Following the runway excursion of Southwest Airlines Flight 1248 at Chicago's Midway Airport (KMDW) on Dec. 5, 2005, the NTSB issued recommendation A-07-57. It called for Part 121, 135 and 91K operators to do an arrival landing distance assessment (LDA) based on actual conditions and add a 15% safety margin. The FAA did not write a new regulation, but issued SAFO 06012 and Advisory Circular AC 91-79A, which recommends the LDA to both turbojet and non-turbojet operators. In other words, use the latest and best available weather and runway information and recalculate landing distance before you land.

FAA FICON NOTAMs now use the Runway Condition Assessment Matrix (RCAM) 1 to 6 numbering system, which you can find in Section 4-3-9 of the Aeronautical Information Manual (AIM). If KOZW personnel had entered a FICON NOTAM at the time the CJ4 departed, it probably would have been

5/5/5, which corresponds to wet, frost or up to one-eighth inch of slush, dry or wet snow on the touchdown, mid-field and roll-out zones of the runway. (See "Slip Sliding on Snow," *BCA*, September 2020, page 46.) That was well within the landing performance capability of the airplane.

The light snow that began 5 min. after the airplane departed and the freezing temperatures were apparently enough to form an icy glaze on all the pavement in the vicinity of KOZW by the time the airplane arrived. The actual field conditions at the time of arrival were of critical importance. Just a verbal description of icy pavement should have been enough to send this pilot to another airport. An important conclusion is that the most recent information is best.

Two accidents illustrate the value of paying attention to last-minute runway condition information. On April 12, 2007, a Pinnacle Airlines Bombardier CL-200 Regional Jet overran the end of Runway 28 at Cherry Capital Airport (KTVC) in Traverse City, Michigan. ASOS data reported visibility, 0.5 sm in snow; temperature, 0C; dew point, -1C. Snow removal was in progress, and while the airplane was on final approach, the airport operations supervisor told the captain on the CTAF frequency that the estimated braking action was "probably nil."

However, the RJ captain was

skeptical of this report and continued his approach. He didn't do a landing distance assessment; if he had, he would have realized the airplane could not stop on the runway available. The latest information from the supervisor, though irregular, was the best information.

And on March 5, 2015, Delta Flight 1086 departed the left side of Runway 13 at New York's LaGuardia Airport (LGA) in a snowstorm. The crew had carefully assessed landing performance, but runway conditions worsened while they were on approach. When the captain called the runway in sight at 233 ft. AGL, he expected to see the runway surface, but it was covered with snow. He had 23 sec. to decide to land or go-around. The latest information was in front of him, and it suggested a go-around would be the best choice. He decided to land.

If you fly a business jet or turbo-prop, you will undoubtedly face a similar situation at some point. I think the first takeaway from this accident is to carefully consider this commit-to-stop policy: In doubtful conditions, go around, and if you land, stay on the ground at the first application of braking or deployment of stopping devices. The second takeaway is to do an arrival landing distance assessment using the best and most-recent field condition information. **BCA**

Lampson Field Airport (102), Lakeport, California about 1200 on a local flight. According to family members, the pilot was based out of 102 and had recently purchased the glider. They continued by stating he was still in the certification process and could only fly the glider within 20 mi. of Lampson Field. After the pilot had not returned home from the flight, family members were able to check a SPOT device which indicated his last position. The wreckage was located on steep and wooded terrain about 1 mi. west from the departure end of Runway 28. According to photos supplied by first responders, the glider was found in multiple sections.

► **August 8 — About 1845 CDT, a** Robinson R-44II (N89LA) sustained heavy damage when it was involved in an accident near Logan, Iowa. The commercial pilot was seriously injured.

The helicopter was operated as a Part 137 aerial application flight. The pilot was assigned to spray a 380-acre cornfield. The pilot had just completed several spray runs and was turning to line up for another run, when he heard the engine emit a "pop" noise and the engine then accelerated. The pilot pulled pitch to slow the engine with no avail. The pilot reported he had control of the helicopter, but he did not have control of the engine speed. The pilot attempted to flare and land the helicopter; however, the helicopter impacted an area of rising terrain and came to rest on its right side.

► **August 7 — About 1036 EDT, a** Cessna P210N (N6300W) was destroyed when it was involved in an accident near Allendale, South Carolina. The pilot and passenger were seriously injured. The airplane was operated as a Part 91 personal flight. According to the

pilot, he departed Gainesville Regional Airport (GNV), Gainesville, Florida, with an intended destination of Allendale County Airport (AQX), Allendale, South Carolina. Prior to departure, he fueled the airplane with 58 gal. of fuel. The flight was unremarkable, but when the airplane was on short final approach to Runway 35 at AQX, the engine experienced a total loss of power. The propeller continued to rotate and the pilot attempted to restart the engine by switching the selected fuel tank but was unsuccessful. The pilot realized that the airplane was not able to reach the runway and he attempted to perform a forced landing to a field. During the forced landing, the airplane struck trees and impacted the ground. After impact, the pilot and passenger egressed, and then a postimpact fire ensued.

► **August 5 — About 1245 EDT, a** Piper PA28-180 (N7213W) was

Accidents in Brief

substantially damaged when it was involved in an accident near St. Agatha, Maine. The flight instructor and student pilot received minor injuries. The flight instructor reported that he and the student pilot planned to complete a “refresher flight” to continue the student’s advancement to his checkride. After completing a variety of maneuvers and basic navigation procedures, the flight instructor had the student pilot demonstrate flight at less than cruise airspeed. The flight instructor believed the airplane had slowed down to about 90 to 100 mph, the engine power was reduced to about 2300 rpm, and the carburetor heat was on. The flight instructor subsequently told the student pilot to increase the power and return to normal airspeed; however, as the student did so, the engine “did not respond.” The flight instructor characterized the engine power as not sufficient to maintain altitude; however, it was still “running perfectly” near idle and all engine instruments were in the normal range.

The flight instructor took over the flight controls and “checked everything.” He reported that switching fuel tanks, adjusting mixture and power settings, checking the primer, and adjusting carburetor heat did not increase engine power. He subsequently identified an open field and completed a forced landing. During the landing roll through rough terrain, the airplane’s landing gear collapsed which resulted in substantial damage to the fuselage.

► **August 3 — At 1941 EDT, a** Eurocopter EC130-B4 (N55GJ) was heavily damaged when it was involved in an accident in Knoxville, Tennessee. One passenger was killed, and the pilot and two additional passengers were not injured. The helicopter was operated as a Part 91 personal flight. After refueling the helicopter, the pilot and his passengers departed McGhee Tyson Airport (TYS), Knoxville, Tennessee, about 1826 for a

flight in the local area. About 1940 the pilot made a right circling approach over the Tennessee River toward a landing site near the river’s edge on his property. He reported that he, “was descending with low power and a 25 deg. angle of descent; ever slowing to come to a hover at low speed over the water.” He stated that he added power to stop the descent and was planning to hover to the landing site at a height about 75 ft. above the water. When he added power, the helicopter “started to settle” and he “pulled max power to stop the settling” however, the helicopter continued to descend into the water. A passenger stated that when the helicopter descended toward the water in a level attitude, the left “skid hit and then rotor hit” and the helicopter was “torqued into the water on the left side.” The pilot and two of the passengers were able to egress the helicopter before it sank.

Examination of the accident site by the FAA inspector revealed that the helicopter came to rest on the bottom of the Tennessee River about 435 ft. and 149 deg. from the landing site on the pilot’s property. The helicopter’s fenestron was recovered floating nearby. The helicopter was recovered from the river mostly intact.

► **August 2 — About 1904 CDT an** experimental, amateur-built Quad City Challenger II Special airplane (N990SS) was heavily damaged when it was involved in an accident near Jonesboro, Louisiana. The pilot and passenger received serious injuries. The airplane was operated as a Part 91 personal flight. Witnesses reported that the airplane flew over their house. They heard the engine “backfire” and then it seemed to lose power. The airplane entered a gliding right turn, apparently attempting to return to the airport; however, they lost sight of it when it descended below the tree line. The accident site was located in a wooded area about 3/4-mi. north-northeast of the airport. An engine examination is planned once the airplane is recovered from the accident site.

► **August 1 — At an unknown time, a** Grumman American AA-5 (N7192L) sustained heavy damage when it impacted terrain less than a mile west of the Marion County Airport (X35), Dunellon,

Florida. The private pilot was fatally injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 personal flight.

The pilot/co-owner held a private pilot certificate with a rating for airplane single-engine land. According to the airport manager, the pilot texted his girlfriend at 1527 eastern daylight time and said he was going to “fly a couple laps” around the X35 traffic pattern. The pilot did not file a flight plan and was not in communication with air traffic control. When the girlfriend did not hear back from the pilot later that afternoon, she contacted the airport manager, who in turn notified law enforcement. A search was initiated, and the airplane was located the following morning less than a mile west of the airport in heavily wooded terrain.

According to the airplane’s co-owner, she and the pilot had recently purchased the airplane. She said it had not flown in 14 yr. and the airplane was “in pieces” when it was purchased. The unassembled airplane was transported to the pilot’s home, where it was partially assembled by the pilot, and then moved to X35. The pilot did not hold an FAA-issued mechanic certificate but was known to restore, build and repair vehicles and boats. The co-owner, who is not a pilot, said the pilot performed a test-flight of the newly assembled airplane on July 14, 2020, and reported that some of the gauges were not working. She thought one of the gauges was a fuel gauge.

The airport manager said the pilot was a “staple” at the airport and liked to “tinker” with things. His goal was to get the airplane to a point where he could have a certificated airframe & powerplant mechanic perform an annual inspection. The airport manager said the pilot had flown the airplane a few times before the accident flight. On one flight the engine sputtered and lost power, but the pilot was able to land safely back at the airport. The pilot told the airport manager he had a problem with vapor lock and some of the gauges were “acting up.” The airport manager said that on the July 14 flight, the pilot was taking off and landing numerous times on the 5,000-ft.-long runway. During this flight, the airplane struck a runway light and had a tail strike. **BCA**

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BY **MAL GORMLEY** mal.gormley@gmail.com

First there were drones, or unmanned aerial vehicles (UAVs). And then, more grandly, there came unmanned aerial systems (UASes), which encompass the entire package needed to operate a UAV, including the aircraft itself, the ground control station, cameras, navigation sensors, software, training and skills needed, and tools required for maintenance.

UAVs are already a key element serving niches poorly or ill-suited for traditional aircraft. These applications include medical logistics; property and railway infrastructure management; airport, power line, structure and power plant inspections; newsgathering and outdoor videography; forest fire management; and many more. On the near horizon, widespread package delivery and air-taxi businesses will

likely expand beyond their current trials in various locations around the world.

Until recently, most civilian UAVs were small (under 55 lb.) devices operated by an individual using a handheld device or cellphone equipped with software to control the drone and capture and transmit images and data to the operator. You can buy recreational drones that meet this definition almost anywhere. Drone clubs are springing up worldwide and evolving into a fascinating, unique competitive genre of its own.

Meanwhile, businesses and business aviation flight departments are employing more sophisticated hardware for a variety of uses. *BCA* regularly reports on UAV developments and there are a lot. Indeed, there's so much activity in this fast-moving topic

EHang's two-seat autonomous air taxi conducted a recent unmanned test flight in Raleigh.

it can be hard to keep track. With that in mind, this report is intended to help inform those who haven't had the time to closely follow the latest advanced air mobility developments on *AviationWeek.com*. Think of this as a FL 300 overview of the subject.

A New Ecosystem

Enter advanced air mobility (AAM), including the subset of urban air mobility (UAM). While the latter is focused on air-taxi routes and air traffic management within and around cities, AAM will absorb those applications and capabilities and expand beyond the urban complex.

In the last few years, design teams, partnerships and multinational investment deals have radically advanced the AAM concept to encompass piloted and remotely piloted vehicles that are larger, faster and designed with greater range and payloads. AAM supporters are intensely searching for new ways to efficiently move people within and beyond cities in a safe, economical and environmentally friendly manner. Soon, many expect passengers and goods will routinely fly aboard a new breed of smart air vehicles.

By employing novel propulsive systems, airframes, air traffic strategies and governance, these new ventures are likely to compel a redefinition of aviation — including business aviation.

In the accompanying “AAM Developments” sidebar, we take a look at AAM safety, regulatory initiatives, technology and promising applications. But first we’ll look at some of the visions, goals and sober appraisals of AAM.

Great Expectations

There exists a portion of the public that believes on-demand and automated passenger and cargo air transportation services, typically without a pilot, are imminent. And, in fact, some medical and other supplies are now being delivered by UAVs in various parts of the world. But before these activities become commonplace some major issues must be resolved.

Nine out of 10 people live within 30 min. of a small community airport. That fact supports the practicality of using AAM to augment user services among community airports in addition to hub airports, thereby facilitating improved air access to commerce, airline travel and urban centers.

Key industry organizations have stepped up to analyze, coordinate and promote AAM development. And while there’s no complete agreement on all the details, there is growing consensus among those involved that the time for AAM is near, perhaps as early as 2023.

Government Promotion

NASA launched the Advanced Air Mobility National Campaign in March. It is intended to take an ecosystemic approach across five to 10 years, looking at all aspects of AAM and how it will

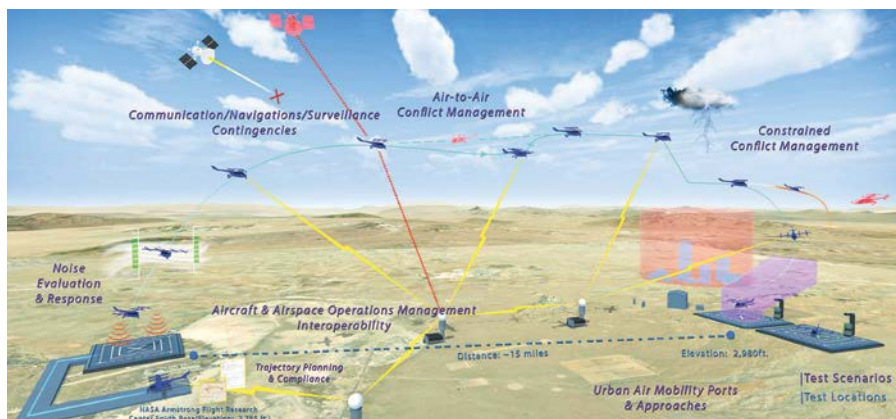


Illustration shows some of the elements involved in NASA's Grand Challenge

be integrated into the nation’s airspace system.

The agency is using the campaign to collect data and allow for testing opportunities for manufacturers and airspace service providers at all levels of maturity and provide the FAA with a clearer picture of how to make AAM a reality. More recently, NASA announced that it would be partnering with more than a dozen companies on the initial National Campaign Developmental Test (NC-DT) event in 2021. Joby Aviation is the only company providing an aircraft for flight testing thus far, but NASA has also partnered with vehicle developers Bell and Boeing, as well as airspace service providers such as AirMap and GE/Airxos.

Ultimately, the goal of the AAM National Campaign (formerly called the UAM Grand Challenge) is to gain public confidence and accelerate the realization of emerging aviation markets for passenger and cargo transportation in urban, suburban, rural and regional environments.

NASA’s vision for AAM is that it:

- ▶ Will provide safe, sustainable, accessible and affordable aviation for transformational local and intraregional missions.
- ▶ Will provide transportation of passengers and cargo as well as aerial work missions, such as infrastructure inspection or search and rescue operations.
- ▶ Will provide services of about a 50-mi. radius in rural or urban areas, as well as missions of up to a few hundred miles to connect urban areas, rural areas, and rural with urban areas.

To help make that vision a reality, the agency will host a series of formal AAM campaigns beginning in 2022. These are designed to:

- ▶ Gain public confidence in AAM safety.
- ▶ Give vehicle manufacturers, operators and airspace service providers insights into the evolving regulatory and operational environment.
- ▶ Facilitate community-wide learning while capturing the public’s imagination.

The AAM National Campaign is intended to bring together aircraft manufacturers and airspace service providers to help identify maturity levels for vehicle performance, safety assurance and airspace interoperability and to develop and demonstrate integrated solutions for civil use.

Working with industry partners, NASA plans to develop testing scenarios that:

- ▶ Address key safety and integration barriers across AAM vehicle and airspace systems.
- ▶ Emphasize critical operational challenges toward commercial viability and public confidence in AAM operations.
- ▶ Identify requirements for AAM system development.

The first formal campaign, NC-1, is to enable participants to demonstrate integrated operations in relevant scenarios that include:

- ▶ Two-way network flight-plan communications.
- ▶ Beyond visual line of sight (BVLOS) operations.
- ▶ Simulated vehicle and operations contingencies.
- ▶ Dynamic traffic avoidance and trajectory management.
- ▶ Approach and landing in the presence of real structures (e.g., buildings in an urban environment) and associated mechanical turbulence.

NC-1 will be based on initial commercial operations proposed by

AAM Developments

Some recent Advanced Air Mobility-related proposals, events and developments indicate that interest remains strong in new modes of vertical flight.



Overair's Butterfly PAV is one of many concepts that may appear overhead in urban airspace

Cora Headed for New Zealand Trials

The New Zealand government and Mountain View, California-based Wisk have announced a memorandum of understanding establishing a passenger transport trial in Canterbury on New Zealand's South Island using the all-electric, self-flying Cora air taxi. Wisk (<http://www.wisk.aero>) was established in December 2019 as a joint venture between The Boeing Company and Kitty Hawk Corp. The two-passenger Cora first flew in 2017 and since then has logged more than 1,300 test flights.

China Approves EHang's eVTOL for Logistics

This June, Guangzhou, China-based EHang Electric Aircraft received approval from the Civil Aviation Administration of China (CAAC) to begin commercial operation of its EHang 216 autonomous air vehicle for unmanned air logistics. A short time later, an EHang 216 conducted four passenger-carrying public flights in the coastal city of Yantai, China. The trial flights, which were part of a demonstration tour, flew a total of four passengers on aerial sightseeing trips around the city's Fisherman's Wharf. (For more on EHang, see "Automated Aerial Tourism, Fire-fighting and More" sidebar.)

Eight Companies to Develop Remote ID for Drones

The FAA announced May 5 that Airbus, AirMap, Alphabet Wing, Amazon, Intel Corp., OneSky, T-Mobile and Verizon Skyward will assist in developing requirements for Remote ID UAS Service Suppliers (USS).

As described in the original Notice of Proposed Rulemaking, drones will be required to send out unique ID codes and location data while flying in U.S. airspace. The service would operate over cellular networks and operators would pay a monthly fee. In addition, the FAA planned to collect the GPS coordinates of the UAV operator.

Chinese drone giant DJI was not included on the FAA's list and has objected to the exclusion. DJI advocates for a version of Remote ID that doesn't require a fee or cellular connection or service subscription to function.

The proposal has raised privacy concerns of recreational drone operators who fear that the scheme would reveal the operator's personal location. The rules would apply to all drones weighing more than 8.8 oz. Manufacturers would have two years to implement the technology on their products, and older drones without the tech

industry for low-density, low-complexity environments. The test will also include key elements required to scale operations for more-complex environments.

Important to the AAM campaign's success will be NASA's continued close collaboration with and involvement of the FAA throughout all stages of the effort. NASA plans to address information requirements and provide lessons learned to inform FAA policy decisions on AAM safety, certification, operations and airspace integration.

While the first National Campaign is targeted for 2022, several developmental testing activities are planned to precede that. The first step involves activities — under the NC-DT event at NASA Armstrong Flight Research Center at Edwards AFB, California — that will lay the groundwork for the first challenge.

So far, 17 companies have signed Space Act Agreements with NASA to participate in the NC-DT and activities leading up to the first National Campaign. With these pacts, which do not involve the exchange of funds, both NASA and the signatories are to provide resources to accomplish the goals of the testing.

Roundtable Ruminations

This year, the Aerospace Industries Association (AIA) took part in the Consumer Electronics Show in Las Vegas for the first time. This major gathering of technology companies and experts provided a forum for the association to bring together key U.S. leaders and discuss the future of technology. In partnership with the Consumer Technology Association (CTA), the AIA co-hosted a UAM roundtable.

The AIA-CTA discussion featured a number of top U.S. leaders in this area, including Secretary of Transportation Elaine Chao, NASA Associate Administrator for Aeronautics Bob Pearce, Denver Mayor Michael Hancock and Los Angeles Department of Transportation General Manager Seleta Reynolds, as well as a number of representatives from companies including EmbraerX, Bell, Uber Elevate, Deloitte and Boeing.

Several key themes emerged at the roundtable that will likely be the focus of subsequent AAM working groups:

► The vehicle is important, but focus can't rest solely on it. For AAM to be successful in the long-term, the physical infrastructure, such as vertiports, and

digital infrastructure, including user apps, cybersecurity, ATM technology integration and a robust supply chain, must be developed.

► All actors in the discussion must be included to ensure ongoing dialogue with diverse participants from industry, all levels of government, infrastructure companies, urban planners and others. These conversations will be vital to achieving regulatory approvals, attracting investment, building a supply chain, attracting early users, addressing safety and environmental concerns, and garnering broad public acceptance.

Market Study

An October 2018 UAM market study by Booz Allen Hamilton, an American management and information technology firm, concluded that in 10 target U.S. urban areas, airport air-shuttle and air-taxi UAM operations would be viable, and under the best-case scenario have a market potential of \$500 billion. Further, it determined that so-called hybrid vertical takeoff and landing (VTOL) aircraft with one pilot on board and automation serving as a backup could serve the air-ambulance market successfully.

The study also found that constraints could be addressed with intragovernmental partnerships such as NASA/FAA, government/industry collaboration and existing legal and regulatory enablers. It employs the NASA definition of UAM “as a safe and efficient system for air passenger and cargo transportation within an urban area, inclusive of small package delivery and other urban UAS services, that supports a mix of onboard/ground-piloted and increasingly autonomous operations.”

The report details some of the technological constraints seen in the near-term immature market, including:

- The high cost of the service, partially driven by capital and battery costs.
- Adverse weather.
- ATM systemic stresses.
- The limitations of current battery technology, particularly in an electric vertical-takeoff-and-landing (eVTOL) air ambulance scenario.
- Other impacts, including community acceptance of eVTOL noise.

In a longer-term mature market, Booz Allen Hamilton analysts see the following tech challenges:

- Energy and environmental impacts of large-scale operations.

would essentially be phased out within three years.

Prior to the COVID-19 pandemic, FAA Administrator Steve Dickson had indicated a final rule could be released by the end of this year.

Elsewhere, drone traffic management system developer Altitude Angel will provide an unmanned aerial system (UAS) traffic management (UTM) platform for the Netherlands. Meanwhile, ANRA Technologies, a developer of commercial drone operations and unmanned traffic management platforms, has been selected for the U.K. UTM program. The program is part of a wider one that is government led and across the public and private sectors, aimed at enabling safe integration of drones into U.K. airspace.

The GoFly Prize Is Still a Go

The \$1 million Grand Prize is still to be awarded. The Boeing-sponsored GoFly competition team is discussing its next steps after high winds prevented the final flyoff in late February between personal flying machines competing for the prize money that has attracted individuals and teams from around the globe. The event at NASA Ames Research Center’s Moffett Field in Mountain View, California, attracted 20 teams. Five brought flyable vehicles that met GoFly standards,



The Boeing sponsored GoFly competition. Disruptor Award-winning TeTra3 was one of five personal eVTOLs approved for the flyoff.

passed FAA approvals and were OKed to fly. The GoFly network includes leading aerospace organizations as well as major leaders in flight like Boeing, Pratt & Whitney, the Vertical Flight Society and others.

The GoFly mission is to design and build a safe, quiet, ultra-compact, near-VTOL personal flying device capable of flying 20 mi. while carrying a single person. Offering a total of \$2 million in awards, the competition was launched to spur development of personal VTOL vehicles that can be used by anyone, anywhere.

While the flyoff had to be postponed, the five teams still competed for the \$100,000 Pratt & Whitney Disruptor Award, which went to the TeTra Aviation team from Tokyo.

Norway

Norway should be a driving force in the development, testing and early implementation of electrified aircraft, says a report by airport operator Avinor. Meanwhile, the Norwegian Civil Aviation Authority recommends that the government set specific objectives for electrifying domestic civil aviation, supported by incentives for technology development, investment support and operation of electric aircraft.

The report says that Norway’s dependence on aviation, abundant access to renewable electricity, unique short-haul network, plus active and interested

stakeholders, and political will to electrify the transport sector make Norway well-suited as a test area and first market for electrification of aviation.

Uber's Elevate Network

San Francisco-based ride-sharing innovator Uber plans to continue working closely with key stakeholders at local, state and national levels to create an urban air-taxi service. Partnering with Uber are innovative vehicle manufacturers including Bell, Joby, Pipistrel, Embraer, Boeing's Aurora Flight Services and aerial ecosystem partners Signature Flight Support, NASA, Georgia Tech, École Polytechnique and others. They are each developing concepts for electric vertical-



takeoff-and-landing (eVTOL) aircraft, built specifically for an aerial ride-sharing network in some of the world's largest city centers, with the aim to drastically reduce commuting time and expense. Dallas, Los Angeles and Melbourne, Australia, are to be Uber Air's first launch markets.

Meanwhile, with an investment of \$25 million, Korea's Hanwha Systems is co-developing an air-taxi service with Overair Inc., maker of the Butterfly UAV. Overair is a spin-off from the eVTOL technology company Karem Aircraft and is one of the named partners in the Uber Elevate air-taxi project.

And carmaker Hyundai has announced a UAM partnership with Uber and unveiled a full-scale mockup of its S-A1 eVTOL aircraft. **BCA**



Meanwhile, more mundane drone applications include drone inspections of aircraft.

► Cybersecurity of autonomous systems.

► Significant weather impact on large-scale operations.

► Large operations of new entrants, commercial space operations and private ownership of UAM vehicles could increase the complexity of airspace management and safety.

Non-technological issues seen in short- and/or long-term scenarios include:

► Competition from emerging technologies and concepts like shared electric and autonomous cars, and fast trains.

► Social mobility: new importance of travel time, increase in telecommuting, urbanization and de-congestion scenarios could reduce the viability of markets.

► Preference to fly with others they know in an autonomous UAM.

► Public perception: passengers' trust and apprehension with automation and pilotless UAM.

► Increase in some adverse weather conditions due to climate change may limit operations.

► Competition from existing modes of transportation.

► Public perception: passengers' concern about safety, security screening and preference for UAM only for longer trips.

► Laws and regulations for flying over people, BVLOS and carrying passengers (among others) are needed.

► Certification: gaps in the existing certification framework where UAM will experience challenges, particularly system redundancy and failure management.

Another Study

In a Stanford University publication, *Strategies for Posing a Well-Defined Problem for Urban Air Mobility Vehicles 2019*, researchers pointed out that American cities dominate the top-10 list of the most-congested cities around the world: Los Angeles (first), New York (third), San Francisco (fourth), Atlanta (eighth) and Miami (10th). This problem is expected to be exacerbated by growing populations and rising urbanization over the coming decades. In many states, there simply is no more physical space to build new transportation infrastructure.

"One offered solution is a data-driven approach to balance transportation network supply and demand," the authors state. "Another . . . is the utilization of the three-dimensional



EHang

EHang 216 is designed to fight high-rise building fires. With a maximum flight altitude of 600 meters (1,969 ft.), the “216F” can carry up to 150 liters (40 gal.) of firefighting foams in a single trip.

Automated Aerial Tourism, Firefighting and More

Chinese urban air-taxi developer EHang is to expand the production capacity for its autonomous aerial vehicles (AAVs) as it works to develop domestic and international markets for the passenger/medical support/firefighting-capable aircraft.

Expansion of an existing facility near its Guangdong province headquarters is expected to be ready for increased aircraft production early in 2021, with a planned initial capacity of 600 units a year. In 2019, the first year of production, the company delivered 61 units of its EHang 216, a 16-blade, two-seat, self-piloted electric vertical-takeoff-and-landing (eVTOL) aircraft. Speaking at a webinar on July 23 of this year, Edward Xu, the company’s chief strategy officer, said production this year had slowed to “about 20” unit deliveries as a result of disruption caused by COVID-19.

The local government will invest \$6 million in the expanded factory, which will include an air-mobility research and development facility and a training center.

EHang is working to develop logistics, aerial tourism and air-taxi markets for its eVTOLs in China, while initially focusing on unmanned logistics internationally. Xu said an owner of tourist sites in Guangzhou had bought more than 20 vehicles.

In June, the company received the first approval from the Civil Aviation Administration of China (CAAC) for commercial operations of the EHang 216 in air logistics missions. Then on July 14, EHang conducted four aerial sightseeing flights around the Fisherman’s Wharf in Yantai, a coastal city in Eastern China. Although the EHang 216 has two passenger seats, each flight carried only one person, lasted some 3 min. and traveled about 1 km (0.5 nm) at a 35-meter (115-ft.) altitude.

“The next step is we are going to get to more formal approval from the CAAC for the passenger service,” Xu

told the webinar organized by Farnborough International Airshow.

The company is also working on the world’s first E-port for AAV services in Hezhou, China. The facility is planned to be completed and operational by the end of this year and is expected to significantly accelerate the commercialization of EHang AAVs in the tourism industry.

EHang, meanwhile, has obtained a special flight operations certificate from Transport Canada that will allow unmanned logistics trial flights to be conducted routinely in Quebec province. This is the first permit of its kind for periodic operations in North America, the company said.

The Canadian approval comes after the March receipt of an operational flight permit from the civil aviation authorities of Norway and Spain for non-passenger flight trials, the first approval for long-term testing of the EHang 216 in Europe. This followed the first-ever U.S. trial flight of its unpowered air taxi at a North Carolina transportation eSummit, conducted with FAA approval.

More recently, the company unveiled a specially equipped version of the EHang 216 designed to fight high-rise building fires. With a maximum flight altitude of 600 meters (1,969 ft.), the “216F” can carry up to 150 liters (40 gal.) of firefighting foams in a single trip. It uses a zoom camera to identify the fire’s location, then uses a laser aiming device, a window breaker, fire extinguishing “bombs” and foam to smother the flames. The company notes a fleet of remotely dispatched 216Fs can respond to a fire before ground equipment can access the building.

EHang Founder, Chairman and CEO Huazhi Hu said, “The potential of our intelligent AAV technology platform is boundless. We will explore and develop more aerial solutions and use cases to empower smart cities.”

— Graham Warwick & Mal Gormley



Startup UAV developer Joby has a Defense Innovation Unit contract to study moving supplies around military areas using its eVTOL.

airspace to alleviate vehicle congestion on the ground. Capable of taking off, hovering and landing vertically, eVTOL aircraft have the potential to address some of the major shortcomings of present and future urban mobility.”

Agility Prime

The U.S. Air Force is expanding its interest in emerging eVTOL aircraft, in late February releasing its first “innovative capabilities opening” under the new Agility Prime program, for vehicles able to carry up to eight people. Two additional “areas of interest” (AOI) were announced on April 28, for vehicles up to two people or more than 500 lb. of cargo.

AOI 1 is looking at vehicles able to carry three to eight people over a range greater than 100 mi. at a speed greater than 100 mph. This covers most of the eVTOL air taxis now in commercial development, such as the Joby Aviation Generation 2 tilt-prop now in flight testing.

Due to the COVID-19 pandemic, the Agility Prime launch event, scheduled to be held in Austin, Texas, in late April, was transformed into a virtual online event during the week of April 27. Hayward, California-based startup Sabrewing Aircraft’s Rhaegal-A was

rolled out virtually on May 1, at the close of the kickoff event.

The Air Force is also interested in smaller eVTOLs carrying up to two people and being developed under FAR Part 103 rules for ultralight aircraft, says Col. Nate Diller, Agility Prime team lead and director of the Air Force’s AFWERX innovation unit. Examples include the LIFT Aircraft Hexa and Opener BlackFly.

Agility Prime is also interested in hybrid eVTOL unmanned cargo aircraft for longer-range logistics missions. Examples include the Elroy Air Chaparral now in flight testing and the Sabrewing Rhaegal.

AOI 1 requires bidders to fly their aircraft by Dec. 17 of this year. Joby and Beta Technologies are the first eVTOL developers to advance to the third stage of Agility Prime and receive contracts to provide flight simulators and test data.

The final product of AOI 1 will be prototype test reports that show which companies involved have a technical solution and have reduced technical risks through testing, Diller said. Then there could be follow-on contracts for operational testing and potentially procurement for an early operational capability.

The Air Force is aiming to field an initial handful of eVTOL vehicles for logistics missions by 2023, the current date for initial commercial UAM services targeted by the Uber Elevate aerial-sharing initiative. “We want to leverage those companies that are looking to be FAA-certified and in production by that time,” Diller said. To support the effort, the Air Force is offering its test ranges, considerable engineering talent and certification experience.

Agility Prime has also awarded Small Business Innovation Research (SBIR) contracts to Sabrewing Aircraft and Elroy Air worth a few million dollars each. But since the vast majority of funding for urban air mobility startups has come from the private sector, the coronavirus pandemic has disrupted fundraising activities worldwide.

Another Initiative

The NBAA is one of the founding members of a new organization — the Community Air Mobility Initiative (CAMI) — dedicated to providing communities and policy makers with the information and tools that will be vital to the successful integration of urban air mobility aircraft into daily transportation options.



JOBY

“The NBAA is a strong proponent of UAM and eVTOL, as there’s a clear connection to this technology for business aviation — whether it’s transporting employees within or between cities, or connecting transportation centers with local businesses,” said Mike Nichols, NBAA senior vice president of strategy and innovation. “We have a great infrastructure in place with our regional representatives and regional business aviation groups to advocate in support of UAM and we look forward to working with CAMI to achieve this.”

CAMI’s mission is to support the responsible integration of urban air mobility into communities through education, communication and advocacy. It connects communities and industry by providing resources to the public and decision makers at the state and local level.

“New technologies and new aircraft promise to make flight accessible and practical on a daily basis for more people than ever before,” said CAMI Co-Executive Director Anna Dietrich. “With that promise comes the responsibility to integrate those aircraft into our communities safely, responsibly and equitably. We created CAMI as the industry’s commitment

to our neighbors and the decision makers who support them to work to ensure that happens.”

The NBAA’s support for UAM was evident at its annual convention last fall, which featured, for the first time, an exhibit area for UAM aircraft, many education sessions about this emerging technology and the release of a report, co-authored by the NBAA and NEXA Advisors, detailing the financial and business case for UAM.

In addition to the NBAA, founding CAMI members include:

- ▶ Bell.
- ▶ Black & Veatch.
- ▶ Choctaw Nation of Oklahoma.
- ▶ General Aviation Manufacturers Association (GAMA).
- ▶ Joby Aviation.
- ▶ Jump Aero.
- ▶ Karem Aircraft.
- ▶ Massachusetts Department of Transportation.
- ▶ Raytheon.
- ▶ SAE International.
- ▶ Unmanned Safety Institute.
- ▶ Vertical Flight Society.

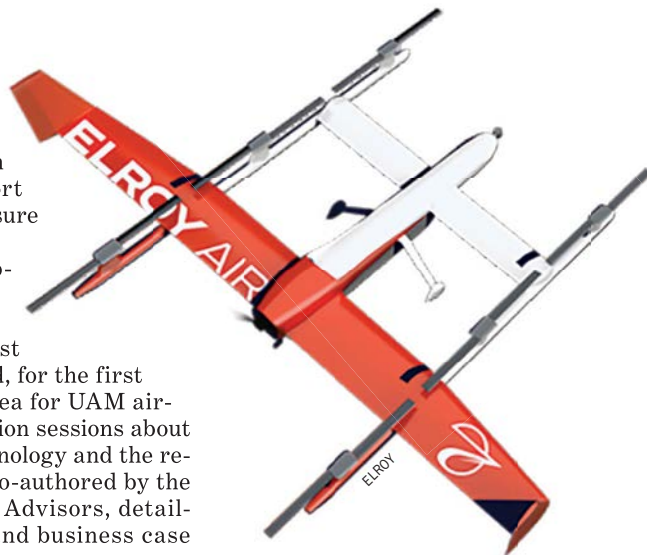
UAM to the North

With partners across government, academia, industry and the investing community, the Canadian Air Mobility Consortium plans to lay the foundation for advanced air mobility across the nation, including drone delivery and passenger/cargo air taxis, with an emphasis on sustainability offered by electric aircraft.

Matching closely with NASA’s roadmap for technological development and deployment, the group is raising \$1 million from partners — with a 50-50 match from Canadian federal, provincial and local governments — to conduct an economic analysis, develop operational and scenario applications, and then hold a demonstration event originally intended for 2020, although that may slip into 2021 due to the coronavirus pandemic.

Holding

Clearly, obstacles remain to be cleared. Launching some of the proposed ventures will likely cost millions, even billions of dollars before showing a profit. In the ongoing pandemic, funding is



Elroy Air’s Unmanned Cargo Aircraft proposal

likely to be uncertain. Certification, automation, airspace integration, human-machine interaction, cybersecurity, noise, hiring engineering talent and allaying public concerns about sharing dense urban airspace with flying robots will take time, likely more than the participants in the aforementioned AAM studies, organizations and developers foresee.

For AAM to succeed, it can’t focus on one-off operations, but rather on how these operations will reach scale. Safety is paramount and the activity must be unobtrusive. Once those are assured, the public may be able to see the benefits, including connecting people and goods between, to and within cities and beyond in ways that were never before possible. It’s noteworthy that mature organizations like NASA, the U.S. Air Force and the AIA are vetting and marshaling the players and gently guiding the emerging sector.

A successful AAM industry requires the integration of aviation into existing urban and regional transportation systems that are currently fraught with their own challenges, including traffic congestion, urban sprawl, environmental impacts and noise.

Although its challenges are formidable, AAM offers the potential to not only change the way in which people commute, but also open new markets for cities, industries and their workforces. By looking at the transportation ecosystem as a whole and including all actors from across industry and government in the discussion, a revolution and tremendous expansion in aviation could result. **BCA**

Equivalent Visual

Virtual VFR in IMC, chock to chock



BY **FRED GEORGE** fred.george@informa.com

In 2019, more than 4.5 million people traveled by air every day worldwide and many of them arrived late because of weather. Up to 70% of air traffic delays are caused by instrument meteorological conditions (IMC), according to the FAA. The agency says clogs in the National Airspace System (NAS) not only inconvenience travelers, they also cost operators up to \$4,500 per aircraft per hour. And such delays increase carbon emissions substantially.

As ceilings and visibilities go down, flight times go up. That's been the story of instrument flying for nine decades. In IMC, pilots must maintain considerably greater separation from terrain, traffic and runway thresholds than in visual meteorological conditions (VMC). The greater the spacing must be in poor weather, the longer will be the traffic jams in the skies. The same poor visibility conditions also impede flows between runways and ramps. Everything on the surface slows to a crawl because pilots, ground controllers, ramp agents

and line service people only can see what's going on at a very short distance.

Equivalent Visual Operations in Flight

MITRE Corp.'s Equivalent Visual Operations (EVO) project is a suite of technologies that aims to slash weather-related delays, both in the air and on the ground, by providing VFR-like operating flexibility in IFR conditions. The five main thrusts are ADS-B In and Out, tight-tolerance RNAV RNP curved and segmented procedures, wake vortex prediction, enhanced flight vision systems (EFVS) and synthetic vision systems (SVS).

Satellite-based augmentation systems (SBAS), such as the FAA's Wide Area Augmentation System (WAAS), have honed GPS position fixing accuracy to 2 meters. SBAS has been a key enabler for several EVO advances. ADS-B, for instance, uses SBAS to provide precision 3-D position and velocity data.

Seven years in development, Vu Cube goes into production development in late 2020 for mid-2022 entry into service.

ADS-B Out, broadcasting at 1-sec. intervals, has been required for most aircraft flying in most controlled airspace since Jan. 1, 2020. That's been a boon for ATC because the FAA's secondary surveillance radars (SSR) provide relative soft-target position fixing and only at 5- to 12-sec. intervals. Tighter precision and 1-sec. updates enable ATC to space aircraft closer to each other while maintaining much more robust safety margins than are possible with SSR. This increases traffic flow capacity, which is particularly useful in hub airport terminal areas that are prone to rush-hour traffic snarls.

Similarly, ADS-B In provides a considerably more accurate cockpit display of traffic information (CDTI) for aircraft that have the capability than TAS or TCAS traffic warning systems. While not mandated for the NAS, ADS-B In's

Ops



CDTI function improves situational awareness and it has demonstrated potential for time, fuel and emissions savings when used by pilots to maintain in-trail procedure spacing intervals.

RNAV RNP procedures, particularly approach procedures, offer some of the biggest benefits to increase traffic flow capacity. Many RNP procedures require SBAS or WAAS for tight tolerance navigation, putting aircraft on virtual monorails in the sky. This allows navigation procedure designers to route traffic around terrain, obstacles and noise-sensitive neighborhoods.

But most RNAV RNP procedures become unusable in low ceiling and visibility conditions as they lack the demonstrated 16-meter horizontal accuracy and 20-meter vertical accuracy, plus 6.2-sec. time-to-alert, needed to qualify for 200-ft. ceiling/0.5-mi./RVR 2400 LPV minimums. Indeed, as

many as 80% of all RNAV RNP procedures cannot be used when the weather drops below 800/1 approach minimums, according to Stedman Stevens, president of Vu Systems in Morrisville, North Carolina, and Nick Sabatini, former FAA associate administrator for aviation safety and now an aviation consultant.

When RNAV RNP procedures cannot be used, aircraft must be queued up in the conga line for Category I ILS or LPV approaches, causing substantial arrival delays. If the weather drops below 200/0.5, then only Category II or Category III precision approach procedures can enable aircraft to land. Special recurring CAT II/III approvals for airport ILS equipment and approach lighting, avionics equipment and crew proficiency make them costly to maintain for the FAA, airport authorities and aircraft operators.

EFVS that the FAA has qualified for operational credit can be used by operators to fly down to lower minimums than would be possible using unaided vision. Plenty of claims have been made for infrared (IR) EFVS sensors, but the FAA bases the amount of operational credit on demonstrated “quantified visual advantage.”

As of January 2020, only the Collins EVS-3600 (Bombardier Global 7500), Elbit/Universal EVS5000 (e.g. Dassault FalconEye), and Kollsman EVS-II (several Gulfstream jets, plus some Boeing twins and McDonnell Douglas trijets) and EVS-III (Gulfstream VII-500/-600) have been approved for 33% operational credit. For instance, if an approach has RVR 2400 published minimums, the above devices would enable an operator to fly down to RVR 1600 using EFVS. Operational credit bottoms out at RVR 1000, regardless of quantified visual advantage, in accordance with current rules.

Certificated FAR Part 121, 125 and 135 air carriers need OpSpec C048 EFVS authorization. Part 91 operators may apply for C048 letters of authorization (LOA) to pave the way for approvals by foreign civil aviation authorities. If a Part 91 operator want to use EFVS for landing and roll-out in lieu of

natural vision, a C048 LOA is required.

However, as shown in the accompanying graphic, fog, rain or cloud can blunt or blind conventional IR sensors that detect radiation in the 1 to 5 micron (60 to 300 THz) band, thus eliminating quantified visual advantage. Moreover, these sensors do not detect radiation from LED lights as they emit very low or no IR energy, also negating visual advantage.

Recent advances in EFVS, though, promise a weather breakthrough. Vu Systems, for instance, is developing the Vu Cube, a passive millimeter wave (PMMW) sensor that operates in the 3,200 micron (93.7 GHz) band. The system has been in development for seven years and Stedman only went public with it at last year’s NBAA Convention. It capitalizes on recent monolithic microwave integrated circuit development (MMIC or “mimic” for short) devices that are used in consumer electronics, such as mobile phones, home satellite receivers and fiber-optic communications.

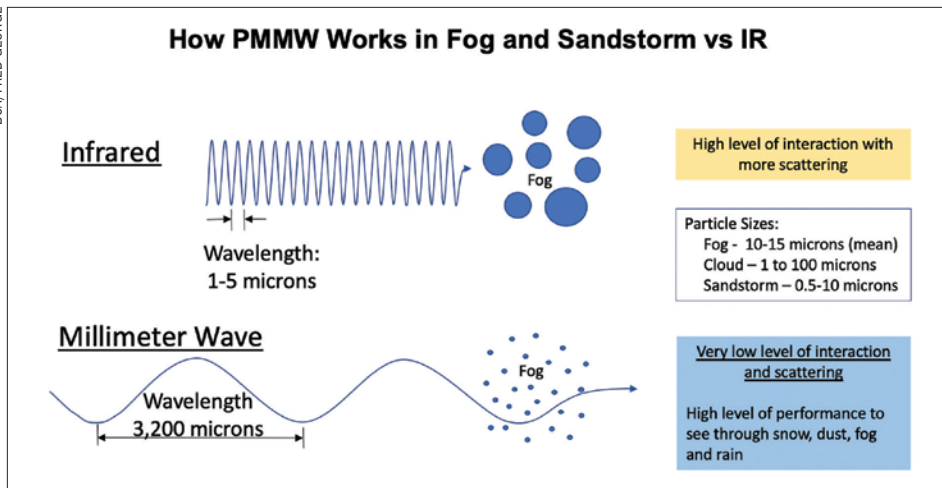
Similar to IR cameras, the PMMW Vu Cube detects small [+/-1C] temperature differentials between pavement, objects and their surroundings. The surface temperature of a paved runway, for instance, is quite different than the soil or grass that surrounds it.

But as PMMW uses much longer wavelengths than IR, the thermal radiation it detects is not attenuated significantly by clouds or precipitation. Thus, PMMW has the potential to provide a 2+ mi. visual advantage over the naked eye, thereby enabling pilots to see both the runway threshold and the entire runway length well outside published minimums almost all the time, Stedman asserts.

As illustrated, the image quality of PMMW is low resolution compared to the crisp video provided by IR. But when used as part of a head-up display (HUD) combined vision system (CVS) that blends synthetic vision, PMMW and IR EFVS, it can be an effective tool for meeting the EFVS requirements of Part 91.176(b) for identifying the runway threshold and touchdown zone from published DA/DH minimums down to 100 ft. above touchdown zone elevation. And then, in accordance with Part 91.176(a), it can be used to continue down to touchdown and rollout by making the threshold and touchdown landing surface “distinctly visible and identifiable to the pilot.” Sabatini and Stedman are confident a combined HUD CVS

BCA/FRED GEORGE

How PMMW Works in Fog and Sandstorm vs IR



Millimeter wave sensors detect radiation at much longer wave lengths than infra-red cameras, so they're not blinded by precipitation or sand particles. The downside is much cruder image resolution than high frequency IR sensors.

600 if the aircraft is capable of aided (guided) roll-out to taxi speed.

In contrast to CAT II and III operations, all the current and proposed EFVS regulations require no special authorization or training outside of Part 61.66 initial ground and flight simulator training, along with

After touchdown, egocentric view Primary Flight Display automatically becomes exocentric view Primary Taxi Display, providing green stopping point symbology.

using the Vu Cube will meet the requirements for EFVS in spite of its low-resolution imagery.

Stedman believes that advances in MMIC processing capabilities in radiology, among other high-tech industries, will enable Vu Systems' engineers to refine image quality with future operating system updates. For now, though, IR cameras can provide considerably higher resolution video in most weather conditions once the aircraft is on short final. That's why the firm currently is developing a combined SVS plus PMMW and IR EFVS equipment package for HUDs.

EFVS technology now is progressing so rapidly that the aviation industry recognizes the need to update the regulations. The RTCA's Special Committee 213 is formulating new minimum aviation system performance standards (MASPS) for EVS, EFVS and CVS. SC 213 proposes lowering the visibility floor on all straight-in approaches to RVR 600 from RVR 1000 if the runway has high-intensity runway lighting, touchdown zone lighting and centerline lighting. The committee also plans to reduce EFVS minimums to below RVR

logging six approaches using EFVS every six months. The EFVS rule essentially follows Part 61.57 instrument flight currency rules. Thus, in the future, operators won't need to undergo the rigors of CAT II/III qualification to fly down to the same RVR minimums — or even zero RVR.

Equivalent Visual Operations on the Ground

Successfully arriving on the runway in low visibility conditions is not the only challenge in inclement weather. Pilots also need to know whether they can then find their way to the ramp.

Honeywell is developing a group of technologies for ground operations in low visibility conditions that complement MITRE's EVO in the air. Its new Runway Overrun Advisory and Alerting System (ROAAS) offers impressive potential to help prevent runway excursion mishaps. The May 2020 runway overrun of Air India Express Flight 812 at Mangalore Airport and the August 2019 crash of a Cessna Citation Longitude at Elizabethton, Tennessee, accentuate the need for ROAAS and similar dynamic energy assessment tools on flight decks.

ROAAS uses aircraft ground speed, predicted touchdown point, RCR, runway available and runway remaining, among other factors, to estimate stopping distance. A window on the lower left of the PFD displays a diagram of the landing runway with a series of green dotted lines showing the computed stopping point. In this case, the aircraft is landing on 7,200-ft.-long Runway 25L at Phoenix Deer Valley Airport. The green dotted line shows that the aircraft will easily stop in about 4,800 ft. The second



Runway Overrun Advisory and Alerting System dynamically assesses available runway, projected touchdown point, runway condition reading and aircraft ground speed to warn pilots if they won't be able to stop on the pavement after landing.

illustration is Honeywell's exocentric primary taxi display (PTD) that automatically replaces the PFD after landing touchdown. The lower left ROAS inset window shows the aircraft already has slowed to 89-kt. ground speed and that it will stop well within the 4,000 ft. of pavement remaining. The green line and virtual signs across Runway 25L on the exocentric view also show the stopping point.

The exocentric PTD is part of a 3-D airport moving map (AMM) system with which we first flew on a Gulfstream G500 equipped with a Symmetry flight deck powered by Honeywell Epic. "Pilots get tired of taxiing in the dirt" as shown on most synthetic-vision PFDs, says Thea Feyereisen, Honeywell's senior engineering fellow, adding, "The most challenging part of many flights is taxiing." The 3-D AMM shows runways, taxiways, ramps, buildings, obstacles, hotspots and signage to promote situational awareness on the ground.

And now, ADS-B In will be added to 3-D AMM to show proximate traffic on the ground and in the air that potentially could pose a collision hazard. In this illustration, our aircraft has just turned eastbound from Honeywell's ramp onto Taxiway C at Phoenix Deer Valley. The peach-colored symbols near the departure end of Runway 7R show four ADS-B-equipped aircraft in the run-up area. The three cyan-colored diamonds, with tethers that depict their height above terrain, are aircraft broadcasting ADS-B Out on final approach to Runway 7R.

Eventually virtually all vehicles, maintenance equipment and movable obstacles will have an ADS-B Out capability, enabling pilots to spot fuel trucks, service carts and even lawnmowers on the PTD.

For retrofit applications, Honeywell also is developing 2-D and 3-D AMM and interactive taxi diagrams with ADS-B In traffic as an iPad app. Another long-term goal is to add D-Taxi CPDLC graphic depictions of taxi instructions from ground control so that pilots need only "roger" a complex assigned taxi route and then follow the magenta line as though it were an FMS flight plan route in the air. Even longer term will be graphic depiction of airport

NOTAMS on taxi diagrams, helping pilots spot taxiway closures, construction zones, inoperative lighting, and obstacles, such as cranes.

EVO Is Critical to Next Gen

Accommodating more aircraft, reducing delays and saving fuel are major goals of the FAA's next-generation air traffic management system. EVO is a critical component because aircraft can be spaced closer together, allowing them to operate from landing facilities with VFR flexibility in IFR conditions, providing safety margins that are better than today's ATC system.

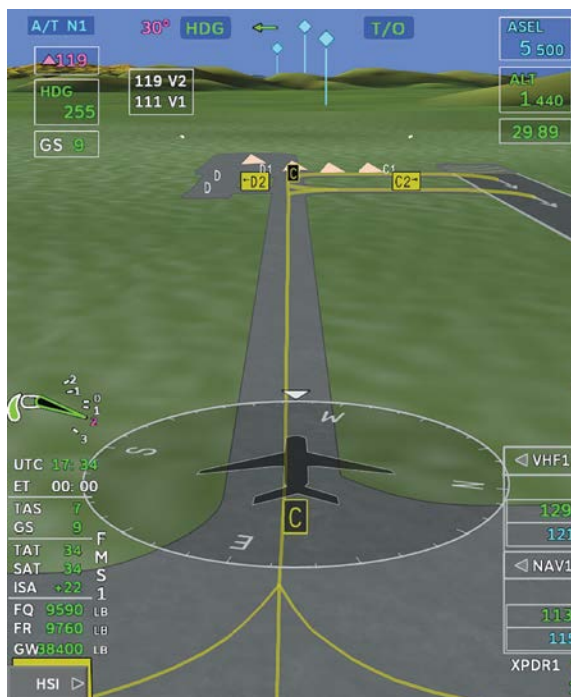
has long-term plans to crowdsource aircraft weather radar data, aggregating them from several aircraft by means of its Connected Radar data-link app tapping into the 3-D scanning "Intuvue" RDR-4000 and -7000 weather radars on participating aircraft. Imagine having access to the weather radar returns, plus lightning, hail and turbulence information, from a half dozen aircraft flying between the Northern and Southern Hemispheres, all sharing data to spot and skirt major thunderstorms and mesocyclones in the Intertropical Convergence Zone.

One of NASA Langley's ultimate goals is to attain a "better than visual" operational capability, providing all of the traffic flow capacity of VMC while improving on the safety of flying VFR. SVS and EFVS draw pictures on cockpit displays, providing virtual VFR windows to the outside world regardless of weather or darkness. HUDs are even more effective at keeping pilots in the loop when they have synthetic- and enhanced-vision background imagery. NASA Langley researchers Lance Prinzel, Linda Kramer and Christopher Wickens believe that virtual VFR approaches using HUDs with SVS and EFVS can be flown down to RVR 300 visibility.

Beyond EVO's clear operational benefits, the equipment should buy its way onto many aircraft because of the operational cost savings. Reducing or eliminating weather delays will provide a fortune in savings every year. Not having to equip, maintain and train for CAT II/III approvals will also shave costs.

Business aviation has been the first to embrace new avionics technologies for decades, well

ahead of equipage mandates by regulators for airlines. Ergo, it's reasonable to assume airframe manufacturers, such as Dassault and Gulfstream, will be EVO pioneers, based upon what they've installed on the flight decks of current production aircraft. The confluence of SVS/EFVS, ADS-B In, and 2-D and 3-D interactive airport moving maps, among other emerging technologies, promises to make flying safer, more efficient, greener and more comfortable. And as in the past, they will debut on business aircraft, letting other sectors play catch-up. **BCA**



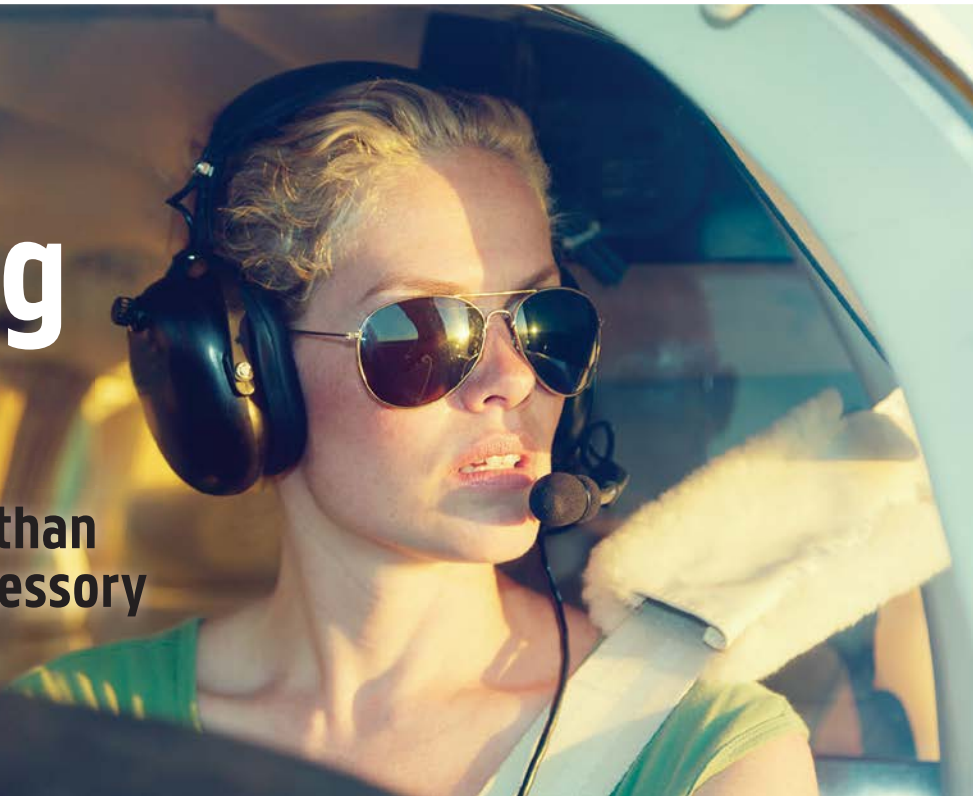
While taxiing between ramp and runway, ADS-B IN depicts positions of aircraft on ground in peach color and aircraft in flight in cyan color with kite string-like tethers showing their height above terrain.

Pilots often say, "OK, draw me a picture." EVO does just that. It promises considerably better situational awareness than provided by the naked eye, even in VMC, because it can detect and display hazards and conflicts well beyond visual range. ADS-B In provides that capability in all weather conditions. Advanced EFVS equipment, such as PMMW sensors, enables pilots to see runways miles well before they have to make go/no-go decisions on final approach.

Beyond-visual-range EVO, however, is in its infancy. For instance, Honeywell

Here's Looking at You

Shades, more than a fashion accessory



RICH LEGG

BY **PATRICK VEILLETTE** jumpraway@aol.com

Piloting demands good vision. But the aviation environment contains numerous hazards to our eyes that can affect our ability to accomplish our tasks, as well as threaten the long-term health of our eyesight.

The immediate threats include eye strain, glare and windshield failures. Long-term exposure to glare and ultraviolet (UV) radiation doubles a pilot's chances of developing cataracts and other age-related vision-robbing diseases.

Any factor that increases sunlight exposure to the eyes will increase the risk from solar radiation. That harm is cumulative and over an extended period increases the chances of developing an ocular disorder later in life. If you operate a high-performance aircraft that spends a considerable part of its flight profile near the stratosphere or during those times of the day when UV radiation is most intense, your dosage of UV radiation increases markedly.

On the ground, UV is partially filtered by the earth's atmosphere, but the higher you go, the less the protection. It is estimated that there is a 4% increase in UV radiation with each 1,000 ft. of elevation. According to an FAA study, "Optical Radiation Transmittance of

Aircraft Windscreens and Pilot Vision," flying over a thick cloud layer increases UV radiation by up to 80%. Fresh snow is a particularly good reflector and almost doubles a person's UV exposure. In such conditions, wearing a pair of sunglasses with a close-fitting wrap-around frame design is the best protection since UV-blocking lenses fail to block radiation from entering the eyes from the sides of the frame.

Aircraft windscreens provide only limited protection against some forms of UV radiation that penetrate the transparency, damage the retinal photoreceptors and, with long-term exposure, can cause permanent eye damage. Research conducted by Dr. Adrian Chorley, the original optometrist principal with Britain's Civil Aviation Authority, showed that between 2008 and 2015 long-wave ultraviolet A (UVA) proved to be the most harmful to pilots' eyes because a higher percentage of it penetrates the cockpit. And he noted that "there is good evidence that long-term exposure to solar radiation, especially the ultraviolet and blue light components, is a risk factor for cataracts and, to a lesser extent, age-related degeneration of the retina."

Blue light is a short wavelength that

progressively destroys light-detecting cells in the eyes, contributing to age-related macular degeneration, which is a leading cause of blindness. The hazard of bright sunlight and blue light increases with altitude.

Meanwhile, glare can come directly from the light source or can take the form of veiling glare, reflected from crazing or dirt on the windshield. Glare directly affects a pilot's ability to accurately detect objects, especially when the object is in the same direction as the glare. This negatively affects the ability to maintain visual awareness and therefore decreases flight safety. Studies have shown that reduced night vision can result from continued exposure to intensive glare (See "A Glaring Problem," *BCA*, November 2018).

Exposure to glare and concentrating on a visually intense task can cause an unconscious clenching of the muscles around the eyelids, face, temples and jaws, leading to discomfort, pain from overuse, eye strain, increased fatigue and headache. Soreness of the eyes and neck, mild tearing, dryness, blurring or doubling of vision, light sensitivity, difficulty focusing on images, tightness of the temples or forehead, or a combination of these, are common descriptions

by persons experiencing eye strain. Headaches are the most common symptom. Eye strain can be unpleasant and disruptive to one's ability to concentrate and work. Other dangerous symptoms of eye strain include increased physical fatigue, decreased productivity and increased number of errors.

The correct sunglasses can reduce the adverse effects of bright sunlight, decrease eye fatigue, and protect the soft tissue in and around the eye from harmful solar radiation. In the evening, sunglasses can aid in adapting the eyes to darkness, which can be delayed by prolonged exposure to bright sunlight. Conversely, the wrong sunglasses can produce negative effects including difficulties viewing instruments and enhancing glare on the windshield.

When using sunglasses, there should be a proper balance between visibility of objects inside and outside the cockpit. While it's tempting to use dark sunglasses to cut out glare, pilots should be aware that certain lenses can reduce their visual performance in specific flight environments — and increase the potential for accidents. Reducing transmitted light reduces visual acuity, as anyone who has driven from a bright road into a dark tunnel while wearing sunglasses can verify. Even moderately dark sunglasses can, on a bright day, cut your vision down from 20/20 to 20/40. Color discrimination may also be reduced while wearing dark lenses. Target detection and resolution, especially for visual targets of medium to low contrast, can also be degraded if using sunglasses that are too dark.

UV light is not filtered equally by all types of sunglasses and can damage the eye, causing early cataracts. Cheap sunglasses should be avoided as they may only cut down glare. If one is unsure of the parameters of a particular tinted lens, ask an optical dispenser or eye doctor.

There's a long-standing misperception that polarization protects eyes from UV light. It does not. It simply blocks a specific angle of visible light. While this is great for use on the water or snow since it blocks light reflection off the surface, it offers no real value in the cockpit. In fact, with modern LCDs, such sunglasses are actually a serious hinderance. This is significant since LCDs have their own polarization filter built-in and placing two polarization filters over each other can completely block vision.

And while polarized lenses eliminate reflected glare from a flat surface,

looking through a laminated aircraft windscreen while wearing them can result in reduced and distorted images outside the aircraft. Due to manufacturing stresses, there may be small areas of polarization in an aircraft canopy or windscreen and, if the angles of polarization in the glasses and the windscreen differ, a blind spot can result. Polarization may also interfere with depth and distance perception, particularly during a bank.

Photochromic lenses that darken with increasing UV light are good for driving, but polycarbonate aircraft canopies may interfere with their proper darkening. Additionally, when going from bright sunlight into clouds, the glasses may take several minutes to lighten, thus aviators may experience visual performance loss then or mountain shadow effects.

Constant-gradient glasses come in various colors and are the most commonly used. All are about equally effective for glare, but green or gray lenses have the least adverse effect on your vision. Yellow lenses are good in haze, but less effective in bright sunshine. Sports orange lenses should not be worn because they interfere with blue-green discrimination and may make red warning lights more difficult to see. Pilots with color deficiencies should not use colored lenses and should stick to a quality gray lens. Blue-blocking lenses have been found to produce mild color discrimination losses in normal color vision subjects and severely reduce color discrimination for dichromatic (severe color-deficient) people.

So, what's the best eye protection for pilots? Dr. Van B. Nakagawara of the Aeromedical Research Division's Vision Research Team at the FAA's Civil Aeromedical Institute recommends lenses that are free from distortions and imperfections, have adequate light transmissivity (approximately 12-20% overall light transmission), cut down UV transmission by at least 90%, and do not alter color perception. Since color vision is important to pilots, dark tints (i.e., <8% transmittance) and tints that distort color vision (such as blue-blocking lenses) should be avoided. The use of larger lens sizes and, as noted, wraparound frame styles can prevent sunlight from entering peripherally and affecting vision.

Sunglass lenses are usually composed of glass, polycarbonate or plastic. Glass lenses are more scratch resistant than cheap plastic ones and retain their

tint best over time. Scratched lenses can greatly reduce their effectiveness to block UV light. Glass does have its issues, however. Such eyewear is generally heavier than other options and may have manufacturing defects leading to minute variations in thickness, which can distort color perception.

There are also plastic lens options. These lenses are much lighter and more impact resistant than glass ones but can easily be scratched. There are coatings that try to prevent scratches, but these are generally ineffective. Polycarbonate is the lightest and most scratch-resistant option but can absorb tints due to the coatings used.

Sunglass frames are another important design consideration for the aviator. A thick frame may break the seal of an oxygen mask, create an undesirable pressure-point along the temples (potentially leading to headaches), as well as admit unwanted noise under the muffs of headsets.

The windshields on turbine aircraft are designed to withstand the stresses of aerodynamic forces, pressurization, extreme thermal changes and bird strikes. There have been occasions in which the interior layers of an FAR Part 25 aircraft's windshield have delaminated from the rest of the structure and violently sprayed glass debris on the pilots. Events including windshield failures, bird strikes or loose items encountered during turbulence or aerobatic flight have caused dangerous debris that could cause ocular trauma.

For instance, the flight crew of an Airbus 319 on August 2016 experienced a sudden failure of the windscreen. "Preflight and takeoff were normal. I was flying the aircraft. We were on autopilot as we climbed through FL 200 when the FO's inner windshield shattered. It covered both pilots with small pieces of glass and continued to shatter and rain glass on the crew. We [advised] ATC and requested to return to ZZZ and [descend]. While descending, the FO got out the QRH and we went over the appropriate items. We were both wearing sunglasses at the time, which I think helped save our eyes." (NASA accession number 1377500)

All pilots have an important self-interest to protect their vision. And one of the most important protective items to ensure that is an effective set of sunglasses designed to mitigate the many threats to seeing clearly in the aviation environment. **BCA**

Pilot Report: SpecOps' SpecShades

The select soldiers, seamen and airmen who operate in the shadows in U.S. Special Operations forces need rugged eyewear to protect their eyes against the wide range of environmental threats.

It took an insightful pilot to come up with a better solution for eye protection that has now been widely adopted among the SpecOps community. Dean Siracusa, a professional photographer, entrepreneur and pilot, searched many years for materials and design engineering to create sunglasses that would protect an aviator's vision without compromise. Flying Eyes, the patented eyewear that resulted, is constructed of a unique material that allows the frame's temples to be 1 mm thin, nearly unbreakable and weigh approximately 0.5 oz. (14.5 grams). This unique, lightweight aerospace material is flexible and yielding without concern of the frames deforming or breaking.



The thinness means virtually no more noise leakage or interference with an active, noise-canceling headset. It also produces minimal pressure or irritation to the sides of the head when the glasses are worn for extended periods of time. And since polarization is incompatible with aviation cockpits, the default lenses available in all Flying Eyes eyewear are non-polarized.

The polycarbonate lenses provide 100% UV400 protection and clarity. They are also impact resistant and several frames offer Z87.1-2015 ANSI safety certification. These standards help ensure personal eye and face protection from impact, non-ionizing radiation and liquid splash exposures.

The Auditory/Hearing Department at the University of Texas has launched a study on the interaction of eyewear and hearing protection for not just pilots but anyone who has to wear both hearing and eye safeguards.

Flying Eyes are available with an option for lenses with gradient tints that are slightly darker at the top and slightly less so toward the bottom. This allows for easier viewing of the instrument panel while at the same time blocking harsh sunlight coming in through the windshield.

A dozen U.S. Air Force squadrons are now wearing Flying Eyes, and with the Z87 safety rating and new, clear lenses, this includes important crewmembers such as loadmasters and gunners. The service's Special Operations Command is now issuing them to new SpecOps pilots.

I have used military-issued sunglasses since learning to fly jets in the Air Force. The average duty day can be long for aviators, as were my days fighting wildfires and in the fractional cockpit when wearing eyeglasses for 12+ hr. The protection against glare was vital, but the sunglasses created a pressure point near my temples, which tended to give me headaches after hours aloft, along with some noise leakage under the ear muffs of my headset. Additionally, after a few hours, my older aviator-style sunglasses left pressure points on my nose. There was also the "leakage" of bright sunshine from the sides of the glasses.

After I wrote articles on eye glare and UV exposure at high altitude, Siracusa called with an offer to try Flying Eyes. I've worn these glasses on long days in a business jet, headed west-bound so we were in bright sunlight all day. I've also worn these in a helicopter



FLYING EYES (2)

while doing utility work. The eyeglass frames are so light that after 12 hr. I hardly noticed that I was still wearing them. I didn't feel the typical pressure points in the temples nor the bridge of my nose, and there was no noise leakage under the muffs of the headset.

Additionally, there was no leakage of sunlight from the sides. I definitely didn't feel the eye strain and fatigue that was typical on an average day with the aviator-style glasses that I've used for almost 40 years. I enjoy these sunglasses so much that I use them for fly-fishing and skiing as well.

These special glasses are available to the public and are being used in a wide range of activities. For those of us on the "mature" side of life (translation: needing prescription glasses), all Flying Eyes sunglasses are prescription compatible. Further information can be found on the company website at <http://flyingeyesoptics.com> **BCA**



Pilot Records Redux

If adopted, **this iteration will last a lifetime**

THE PILOT RECORDS IMPROVEMENT ACT (PRIA) REQUIRES AIR carriers, prior to hiring a pilot, to request and receive: from the FAA, records pertaining to the individual's certificates, ratings, medical certificates and summaries of legal enforcement actions; from other air carriers, FAR Part 91 and other operators who employed the pilot in the previous five years, records pertaining to the individual's training, competency, disciplinary actions, and/or terminations or other causes for separation; and from the National Driver Register, pertinent records concerning the individual's motor-vehicle driving history.

Congress inserted the PRIA into the 1996 Federal Aviation Reauthorization Act following airline accidents in which the NTSB found error by pilots with a history of poor performance, and the current employers had not checked and were unaware of the pilots' backgrounds. The death of a congressman in one of the accidents spurred Congress to write the new statute, rather than direct the FAA to formulate a regulation.

The next pilot records milestone followed the February 2009 crash of Colgan Air Inc. Flight 3407, which was operating for Continental Airlines Inc. According to many observers, the families of those who perished on that flight were instrumental in the passage of the "Airline Safety and Federal Aviation Administration Extension Act of 2010." This was not an FAA Reauthorization bill, but rather an extension of the agency's funding. The extension came with an extra 50 pages of "Airline Safety and Pilot Training Improvement."

At the time, most industry observers focused on the new requirements for all airline pilots to hold air transport pilot certificates, and few commented on its requisite for the creation of a new Pilot Records Database (PRD).

The next event in this decades-long pilot records saga resulted from the Feb. 23, 2019, crash of Atlas Air Flight 3591. As noted in this "Wrong Right-Seater" (*Cause & Circumstance*, page 52), the NTSB found that the first officer (FO) had fundamental weaknesses in his flying aptitude and a stress response that further degraded his ability to accurately assess the airplane's state and respond appropriately. The Safety Board also pointed to the FO's long history of training performance difficulties and his tendency to respond impulsively and wrongly when faced with an unexpected event during training scenarios at multiple employers.

The NTSB went on to state that had the FAA met the deadline and complied with the requirements for implementing the PRD ordered 10 years ago, that database would have provided hiring employers relevant information about the FO's employment history and training performance deficiencies. The Safety Board discovered that the FO had deliberately

concealed his history of performance deficiencies.

In addition, the NTSB criticized Atlas Air's pilot screening process, which relied on designated agents to review pilot background records and flag significant items of concern. In this instance, the screening process missed the fact that the FO had tried and failed to upgrade to captain at his last company.

The Safety Board proposed the establishment of a confidential voluntary data clearinghouse to share deidentified pilot selection data among airlines. The intent of the proposal was to help predict pilot success in training and on the job and in the doing would benefit the safety of the flying public.

However, not everyone agrees that a pilot database that never forgets a single failed check ride would automatically prevent accidents. The FAA issued a Notice of Proposed Rulemaking in March of this year, not quite a decade after the congressional mandate for the PRD. The NPRM requires Part 135 and 121 operators to report historical records dating back to Aug. 1, 2005. Operators will be required to upload employment, training, checking, testing, currency, proficiency and disciplinary records for every pilot under their employment over the last 15 years.

Notably, the proposal also defines a "corporate flight department" and imposes significant recordkeeping and reporting requirements on those Part 91 operators of two or more airplanes that require type ratings.

Comments to the NPRM by the business aviation industry pushed back on the FAA's proposal and reasoning. The NBAA and others argued that instructor and check pilot comments should be used to help direct additional opportunities for training, and not to prevent a pilot from being hired.

Doug Carr, NBAA vice president of regulatory and international affairs, called the proposed rule a "full frontal assault" on business aviation, highlighting three significant concerns. First, the NPRM's requirement that certain Part 91 operators report substantial training, employment, disciplinary and proficiency-related events would impose a considerable burden. For example, proficiency could mean recording day and night takeoffs and landings, instrument currency requirements and more. Second, the FAA proposes to include all check pilot comments associated with training and checking. Finally, he said, the FAA's attempt to define "corporate flight department" introduces untold unintended consequences for future regulations.

And by statute, a pilot's records could not be removed from the PRD without a death certificate. While nearly every state allows a felon's records to be expunged with a showing of good behavior, a pilot will have to live with a failed check ride for the rest of his or her life. **BCA**

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Bombardier Learjet 31A

Sporty performance, compact interior, short range

LEARJET CORP CREATED THE MODEL 31 IN THE MID-1980S BY MATING the Learjet 35A fuselage to the Learjet 55 “long horn” wing. The result was a light jet that few competitors could rival for climb performance, high-altitude cruise speed or overall fuel efficiency. Dozens of LR31 pilots proudly wore their “510” lapel pins after cruising at 51,000 ft.

Produced from 1988-1991, the aircraft had excellent runway performance and its signature anhedral “delta fins” on the tail-cone, plus wing aero mods gave it docile low-speed handling characteristics on a par with the far slower Citation 500/550. The mods eliminated the need for a stall barrier stick pusher and a requirement for an operative yaw damper for dispatch.

The winglet-equipped long horn wing, however, lacked tip tanks, thereby cutting fuel capacity by 2,076 lb. compared to LR35A. NBAA range thus shrank from 1,924 nm to 1,290 nm. Most operators say it’s a comfortable 1,000 nm airplane, leaving them 1,600 lb. of reserves at shutdown. An optional fuselage fuel tank increases capacity by 500 lb., boosting range by 200 nm. The 32-lb. Raisbeck ZR Lite transonic drag reduction kit can increase range another 100+ miles. Pilots also say the aircraft will routinely cruise at FL 430 to FL 470, letting them soar above most weather and turbulence.

The succeeding Learjet 31A, built from 1991 to 2003, is fitted with Bendix/King avionics, incorporating a rudder boost system that shaves 9 kt. off VMCG. It’s available with an optional weight increase to 17,700 lb. Production of the aircraft ceased when Learjet 45 superseded the last of the small fuselage Learjets.

Grandfathered onto the 1966 Lear 24 type certificate, Model 31A features similar system designs, including a parallel bus, DC electrical system with bus tie breakers, manually operated bleed air on/off switches, analog pressurization system, clamshell entry door with motorized closing system, and impressively powerful anti-skid brakes. The optional single-point pressure (SPPR) refueling can be used to fill both wing and fuselage tanks, eliminating the need to use the DC boost pumps to transfer fuel from the wings to the fuselage. Aircraft with SPPR have standard fuel heaters that eliminate the need for a fuel anti-icing additive. The 36-in. wide entry door is another popular option, as it makes it considerably easier to load and unload bulky items.

Weak points? The aircraft lacks a factory-standard external baggage bay. A Raisbeck aft baggage locker is a popular mod that helps to solve this problem. The forward lavatory is “emergency use only” for modest people as it has forward and aft privacy curtains, rather than a solid door and bulkheads common to aft lavs in other aircraft.

Scheduled maintenance inspections are A/B/C/D checks at 300/600/1,200 and 2,400 hr., respectively. or 12-/24-/48- and 96-month intervals, plus wing and horizontal demate at 12,000 hr. and invasive fuselage x-ray checks at 12 yr. Budget \$250 per hour for maintenance and \$50 per landing for brakes and tires, says Andy Olson, director of maintenance at Trine Aerospace in Colorado Springs, Colorado. Honeywell MSP Gold runs about \$666 per hour for both engines, but some operators with run-out turbofans just buy used TFE731-2 engines that run about \$120 per hour for time remaining to 1,400-hr. MPI or 4,200-hr. CZI (overhaul).

What breaks? Starter-generators usually need overhauling at 1,000 hr., or well before the 1,400-hr. scheduled maintenance intervals. Hydraulic flap, spoiler and landing gear actuators are prone to leak, the vapor cycle air-conditioner compressor and lines deteriorate, causing leaks and the electric de-ice boots on the horizontal stab may fail as they age. Plan to locate a large stash of spare parts long before anything goes awry, savvy operators say.

Competition in this class is tough, in spite of Model 31A’s clear performance advantages. It vies with the Citation II and S/II which have considerably larger cabins and factory-standard external baggage compartments, but cruise at much slower speeds. The S/II also has more range. Beechjet 400/400A have much roomier cabins, almost as much speed and about the same range. Learjet 35A has 450 mi. more range than the extended



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range version, but it can’t climb as high because of extra weight and poorer wing performance. Citation V is the toughest competitor in class, having great TOFL performance, a much longer cabin, good cruise speed and more range. But it’s also considerably more expensive.

Learjet 31A commands about \$650,000 to \$800,000 in the resale market, depending upon condition, maintenance status and remaining engine life. The 12-yr. fuselage and 12,000-hr. wing demate procedures each cost between \$150,000 and \$200,000, depending upon squawks, so be mindful when reviewing the maintenance log books. Aircraft enrolled in Honeywell MSP are worth considerably more than those not covered by engine programs.

Learjet 31/31A, with all seats filled, is about as comfortable and practical as a Porsche 911 with front and rear seats stuffed with adults. With few people aboard, though, it’s also about as much fun to fly as the Zuffenhausen blitz-wagen is to drive on the autobahn. So, if you’re a need-for-speed pilot, this is your kind of light jet. But if you’re searching for an aircraft with a comfy cabin and one-stop transcon U.S. range, this vintage hot rod might come up short. **BCA**

Edited by **Jessica A. Salerno** jessica.salerno@informa.com

News of promotions, appointments and honors involving professionals within the business aviation community

► **Aero Asset**, Toronto, Ontario, named **Joe Viveiros** and **Sebastien Delmaire** as Sales Directors. They will be based in Toronto and Dallas, respectively.

► **Air Charter Association**, (The ACA), appointed **Glenn Hogben** as joint deputy chair, sharing the role with existing deputy chair Julie Black, to help steer the association and members through the litany of challenges currently faced by the charter industry.

► **Asian Sky Group**, Hong Kong, appointed **Jeffrey C Lowe** as chief executive officer and **Nadav Kessler** as vice president of Sales & Business Development.

► **Bombardier Aviation**, Montreal, announced that **Marc Beaudette**, who previously lead the Tucson Service Center, has been appointed general manager of the Fort Lauderdale facility. **Michel (Mike) Menard** has been appointed general manager of the Tucson Service center.

► **Bye Aerospace**, Denver, Colorado, appointed **Col. Rod Zastrow** (USAF, Ret.) to the Board of Directors of the company which is development the FAA FAR 23-certified eFlyer family of all-electric aircraft.

► **CRS Jet Spares**, Fort Lauderdale, Florida, has added industry veteran **Vince Jimenez** to their team as Regional Sales Manager for the Western United States and two Canadian Provinces. Jimenez has held position with Honeywell Aerospace, Western Aircraft and Gulfstream.

► **Elliott Aviation**, Moline, Illinois, named **Lawrence Harting** as vice president of Operations for their headquarters in Moline. He will lead and oversee the facility's service, avionics, paint, interior and accessory operations.

► **flyExclusive**, Kinston, North Carolina, announced the addition of **Col. Donn Yates** to the role of Chief Operating Officer responsible for fleet operations and logistics as the company continues its growth in the private charter arena.

► **General Aviation Manufacturers Association** (GAMA), Washington, D.C., announced the addition of Hyundai Motor Group's Urban Air Mobility Division as an associate member.

► **Helicopter Association International**, Washington, D.C., announced that **Mike Hertzendorf** has joined the organization as vice president of operations. Hertzendorf is a retired U.S. Army special operations aviator who finished service as chief of staff of the 82nd Airborne Division.

► **National Air Transportation Association**, Washington, D.C., announced **Marc Ramthun** and **Emma Roberts** have been chosen for the newly formed Air Ambulance Subcommittee, a part of its Air Charter Committee. Ramthun, vice president of medical flight services for CSI Aviation, has been named chairman. Roberts, senior director of safety, training and compliance for REVA, has been named vice chair.



JOE VIVEIROS



SEBASTIEN DELMAIRE

► **Embraer Commercial Aviation**, Sao Paulo, Brazil, named **Martyn Holmes** chief commercial officer. Holmes, who joined Embraer in 2012, previously served as vice president for Europe, Russia and Central Asia. **Cesar Pereira** has been appointed vice president of Europe, the Middle East and Africa. He has held a number of senior roles in market intelligence, product development and sales engineering at Embraer. **Raul Villaron**, formerly vice president of the Middle East and Africa, has been named vice president of Asia Pacific. **Mark Neely** has been appointed vice president of The Americas. He previously served as regional vice president of sales in North America.

► **National Business Aviation Association** (NBAA), Washington, D.C., announced that Vice President of Educational Strategy and Workforce Development **Joanne "Jo" Damato**, CAM, has been appointed to the Department of Transportation's Youth Access to American Jobs in Aviation Task Force as an aviation educational stakeholder representative.

► **National Transportation Safety Board**, Washington, D.C., announced that vice chairman **Bruce Landsberg** was designated to continue to service in the position for a new term of three years.

► **Pilatus**, Stans, Switzerland, announced two new board members: **Hansueli Loosli** and **Lukas Gahwiler**. Pilatus plans to add further members to the Board in the company year.

► **Safran**, Paris, France, announced new management appointments: **Olivier Andries** has been named executive vice president, succeeding Phillippe Petitcolin; **Jean-Paul Alary** has been appointed chief executive officer of Sanfran Aircraft engines succeeding Olivier Andries; **Cedric Goubet** has been named chief executive officer of Safran Landing Systems; **Vincent Caro** has been named chief executive officer of Safran Nacelles.



CEDRIC GOUBET



JEAN-PAUL ALARY



KAI SEYMOUR

► **Sheltair**, Fort Lauderdale, Florida, announced that **Kai Seymour**, the grandson of CEO Jerry Holland and son of Lisa Holland, president and Frank Seymour, senior vice president, has joined the company, adding another generation to this family-owned business. He will begin as a management trainee and rotate through all departments.

► **West Star Aviation**, East Alton, Illinois, promoted **Lisa Hall** to Global Program Manager at their Grand Junction, Colorado facility. She brings over 30 years of aviation experience to the company with previous lead and management posts with Bombardier and West Star. **Luke Williams** joined the company as Corporate Controller responsible for the management and direction of all accounting, treasury and tax functions. **BCA**



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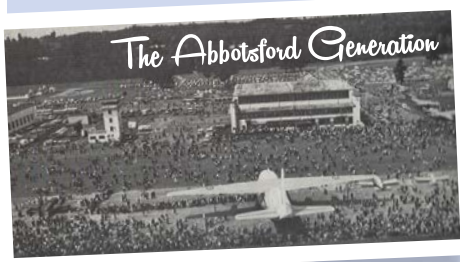
Anyone who has followed the **bizarre airline hijacking situation** and has given serious thought to possible solutions very likely has concluded that the **long-term answer** is international agreement. . .

Edited by **Jessica A. Salerno** jessica.salerno@informa.com

... Take away the asylum at the end of his trip and the potential hijacker soon turns to other ways of venting his diabolical spleen on humanity. . . The airlines on their own were reluctant to make any overt move against the hijacking threat.

A bust as an industry showcase, but the best airshow this side of Paris.

Here was a now-generation of some 129,000 folks — at least 60% of them under 18 — who converged during three days on a fertile meadow in the lush Fraser River Valley in British Columbia.



The colorful Markowsky clan, which enjoys pre-eminence among hospitable FBOs (Grand Island, Nebraska) installed a mechanical desperado to shoot it out (electronically) with some of the slowest draws in the world.



Mr. and Mrs. Juan Trippe (center, left) who need no introduction. And a young lady who caught the photographer's eye.



The sweat-shop crew for the *NBAA Daily* (bottom), which reported everything fit to print, and then some. (Later to become know as the *BCA ShowNews*.)



People Scene at NBAA: Bill Lear, telling about Learium, a new substance that will make his steam engine feasible, and about a palm-size autopilot that will fly anything from a Cessna 310 to a Boeing 747 . . . Capt. E.B. Jeppesen, noting in his ever-present notebook that Jepp DCA

airport diagram misspells hangar as "hanger" twice . . . Ex-astronaut Wally Schirra emceeding the First Niter Banquet with main speaker Apollo XII commander Pete Conrad . . . Mo Barret, ex-cp for Diamond International, looking for left-seat duties saying that the job situation is tighter than the Fed's grip on the money market. **BCA**




SN-600 Corvette bizjet, being built in France by Aerospatiale, has been flying since July Its manufacturer figures its main attraction will be the 18.8-ft.-long cabin, said to offer more passenger area than on any other small bizjet. Designed for cruise at Mach 0.72 with two P&W JT15D-1 turboprops, the Corvette is expected to sell for \$800,000 to \$900,000. Photo by Philippe LeBouc.



Miami Aviation Corporation or MAC as it is commonly know, says that their multi-million-dollar bonus check may not buy our wife a mink stole, but it just might put a few extra bills into your pay envelope.

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