DECEMBER 2019 $10.00 www.bcadigital.com

BCA

Business & Commercial Aviation

STATUS REPORT

Epic E1000

Certificate awarded, production proceeding

ALSO IN THIS ISSUE

Flying Garmin's Astonishing Autoland

Special Report: Cabin Connectivity

The Connected Cockpit

Squawk This!

Alone, Dependent and Confused

Stall by Surprise

AVIATION WEEK NETWORK


BUILDING ON OUR HISTORY.
INVESTING IN YOUR FUTURE.
10 NEW PRODUCTS IN THE LAST SIX YEARS
12K+ EMPLOYEES WORLDWIDE
18 COMPANY-OWNED SERVICE CENTERS
75+ MOBILE SERVICE UNITS
CITATION
We invest in our products, and in you.
Cessna.com/Unrivaled
Cessna
TEXTRON AVIATION
© 2019 Textron Aviation Inc. All rights reserved.

BCA
Business & Commercial Aviation

CONTENTS DECEMBER 2019

Keep up with all the news and blogs from BCA editors "like" us on facebook
facebook.com/avweekbca
and follow us on twitter
twitter.com/avweekbca

Digital Extras

Tap this icon in articles in the digital edition of BCA for exclusive features. If you have not signed up to receive your digital subscription, go to **aviationweek.com/bcacustomers**

For the latest developments, go to **www.bcadigital.com**
Selected articles from BCA and The Weekly of Business Aviation, as well as breaking news stories and daily news updates

COVER
Courtesy of Epic Aircraft

Features

Departments

BCA
Business & Commercial Aviation

Editor-in-Chief **William Garvey** — william.garvey@informa.com
Executive Editor **Jessica A. Salerno** — jessica.salerno@informa.com
Senior Editor/Chief Pilot **Fred George** — fred.george@informa.com
Safety Editor **Richard N. Aarons** — bcasafety@gmail.com
International Operations/Features Editor **David Esler** — david.esler@comcast.net
News Editor **Molly McMillin** — molly.mcmillin@informa.com
Art Direction **Lisa Caputo** — lcaputo@aviationweek.com
Art Department **Colin Throm** — colin.throm@aviationweek.com
Associate Producer **Theresa Petruso** — theresa.c.petruso@informa.com
Copy Editor **Scot Greenan** — sgman124@gmail.com
Contributors **James Albright**— james@code7700.com
Mal Gormley — malgormley@gmail.com
Kent S. Jackson — kjackson@jetlaw.com
Ross Detwiler — rossdetwiler.com
Patrick Veillette, Ph.D. — jumprsaway@aol.com
Ringston Media — info@ringstonmedia.com
Editorial Offices 520 Folly Rd., Ste. 238, Charleston, S.C.
(520) 638-8721 • (843) 718-2458

Publisher **Frank Craven** — frank.craven@informa.com
Phone: (913) 967-1729
Managing Director, Business Aviation Intelligence/Data Services **Anne McMahon** — anne.mcmahon@aviationweek.com
Phone: (646) 291-6353
Director of Sales, Business Aviation **Elizabeth Zlitni** — elizabeth.zlitni@informa.com
Phone: (913) 967-1348
Advertising Production Coordinator **Kara Walby** — kara.walby@informa.com
Informa, 9800 Metcalf Ave., Overland Park, KS 66212
Phone: (913) 967-7476 • Fax: (913) 514-7303
SeniorAudience Development Manager **Tyler Motsinger** — tyler.motsinger@informa.com
Phone: (913) 967-1623
Head of Business Aviation Fleet Data **Nigel Prevett** — nigel.prevett@aviationweek.com
Phone: 407-314 7403
Head of Valuations, Business Aviation **Chris Reynolds** — chris.reynolds@informa.com
Phone: (913) 967-1956
Subscription Information **BCA Customer Service:**
(800) 525-5003; +1 (847) 9147
Email: bca@omeda.com
Manage Your Subscription:
aviationweek.com/bcasubscribers
Reprints **Wright's Media**
informa@wrightsmedia.com
Phone: (877) 652-5295 • Fax: (281) 419-5712

President, Aviation Week Network **Gregory Hamilton**—hamilton@aviationweek.com
Managing Director—Civil Aviation **Iain Blackhall** — iain.blackhall@aviationweek.com
Administrative Offices 605 3rd Ave., New York, N.Y. 10158

By Informa Markets

BCA – Business & Commercial Aviation (ISSN 0191-4642) is published monthly by Informa Markets, a trading division of Informa PLC, 9800 Metcalf Ave., Overland Park, KS 66212-2216. Also the publisher of *Aviation Daily, Aviation Week & Space Technology, The Weekly of Business Aviation* and *World Aerospace Database*. Single copy: Current and back issues, $10.00 Domestic/Canada/Mexico. $15.00 International. Subscriptions (1 year, 12 issues): United States and Canada, $59.00; all other countries, $79.00. For single copies/back copies call Customer Service at (800) 525-5003 in the United States and (847) 763-9147 for all other countries. Periodicals postage paid at Kansas City, MO and additional mailing offices. Registered for GST as GST #R126431964. Canada Post Publication Mail Agreement Number 40026880. Editorial contributions should be addressed to BCA, 520 Folly Rd., Ste. 238, Charleston, S.C. 29412, editorial address and must be accompanied by return postage. Publisher assumes no responsibility for safety of artwork, photographs or manuscripts. USPS 503-450.

Printed in the U.S.A.

Postmaster: Send address corrections to BCA - Business & Commercial Aviation, P.O. Box 1174 Skokie, IL 60076-8174. (Present subscribers include label)

BCA

ADVERTISING SALES

Publisher

Frank Craven – frank.craven@informa.com
(202) 517-1061

Director of Sales

Elizabeth Zlitni – elizabeth.zlitni@informa.com
(913) 967-1348

NORTH AMERICA ADVERTISING SALES

Pacific Region

Miguel Ornelas – miguel.ornelas@aviationweek.com
(661) 480-7000

Midwest Region

Rob Howlett – rob.howlett@aviationweek.com
(949) 481-4519

Jodi Espinoza – jespinoza@acukwik.com
(913) 967-1651

Eastern Region

Cheryl Mahon – cheryl.mahon@aviationweek.com
(949) 481-4519

Florida, Georgia, South Carolina

Beth Eddy – betheddy@aviationexhibits.com
(561) 279-4646

Canada

David Seaberg – david.seaberg@vicbrownmedia.com
(416) 787-0914

Strategic Account Managers

Tom Davis – tom.davis@aviationweek.com
(469) 854-6717

Matt Holdreith – matt.holdreith@informa.com
(646) 719-0767

FBO ADVERTISING SALES

Jodi Espinoza – jespinoza@acukwik.com
(913) 967-1651

Sara Hellon – sara.hellon@informa.com
(913) 967-1833

Jennifer Shafer-Doyle – jennifer.shafer@informa.com
(913) 967-1833

WORLDWIDE ADVERTISING SALES

Francine Brasseur – francine.brasseur@informa.com
+(617) 649-0411

Michele Markarian – michele.markarian@informa.com
(617) 649-0420

Europe

Robert Springthorpe – robert.springthorpe@aviationweek.co.uk
+44 (0) 207 017 7627

Andrea Prudente – andrea.prudente@aviationweek.com
+44 207 152 4524

Israel

Tamir Eshel – invision@netvision.net.il
+972 (9) 891-1792

William Garvey
Editor-in-Chief
william.garvey@informa.com.

Leading by Example

The goals are **seismic, critical and achievable**

WHILE THERE WAS PLENTY OF SUBSTANTIAL NEWS EMANATING from the NBAA's annual gathering in Las Vegas this past October, what struck me as a notable change of focus was the emphasis on themes with global significance to business aviation going forward.

Past conventions typically highlighted specific threats such as user fees, denied access, airport closures, bullying airlines or some tax or regulatory proposal. By contrast, this year attendees heard time and again about the industry's need to attract talent, especially young women; to emphasize its utility and good works; to support science, tech and math education; and to get sustainable alternative Jet-A flowing through the entire aviation fuel distribution system.

All of those aspirations are equally laudable and seismic, requiring a huge collective effort and time, the latter being in short supply for realizing some of them. Yet, however daunting in scale, such movements invariably begin with individuals taking action. With that in mind, I was struck by the National Aeronautic Association's annual awards program, held a couple of weeks after the NBAA gathering. While the NAA honorees rightly included military and air carrier personnel, business and general aviation were wonderfully represented by achievers who had helped get the industry moving toward those distant but important goals.

The awards and those honored:

Katharine Wright Trophy

▶ Barbara Walters-Phillips. A pilot and enthusiastic middle school teacher, Walters-Phillips' acclaimed Aviation Invasion program provides boys and girls with practical math, science and tech knowledge and hands-on aviation experiences, including meeting air traffic controllers, pilots and technicians at Orlando Executive Airport.

Distinguished Statesmen of Aviation

▶ Jonathan Gaffney, Statesman of Aviation. A retired U.S. Navy commander, former congressional aide and airport executive, in 2007, he took charge of the NAA — a century-old nonprofit that oversees aviation awards and records and supports "air sports" in America — then in dire financial shape. Gaffney restored the organization's fiscal health before exiting in 2016.

▶ Michael Heuer, Statesman of Aviation. A competition aerobat, he is a founding member and long-time volunteer leader of the International Aerobatic Club. A retired airline captain, Heuer also served as a board member of the Experimental Aircraft Association for 17 years.

▶ Mary Miller, Stateswoman of Aviation. BBA/Signature Flight Support's vice president of industry and government affairs, she has been a welcoming but firm doyenne at Reagan-Washington National Airport since 1981 upon joining Butler Aviation, Signature's predecessor. Miller was a force behind the readmission of business aircraft to DCA after their post-9/11 banishment.

▶ John Rosanvallon, Statesman of Aviation. A well-regarded top executive with Dassault Falcon Jet, which as a member of ICAO's Committee on Aviation Environmental Protection, helped gain approval for a proposal to help largely substitute sustainable alternate jet fuel for petroleum-based Jet-A by 2050. The company is also supporting CAEP actions in favor of carbon offsetting for international aviation.

Public Benefit Flying

▶ Larry Forney, Distinguished Volunteer Pilot. Engineer and oil company chief executive, he is an active volunteer pilot for Angel Flight South Central, where he serves as board director and leader of the Southeast Texas Wing.

▶ Jim Hassenstab, Distinguished Volunteer Pilot. Software company chairman and Angel Flight Central member, he was among dozens of volunteer pilots who airlifted people to and from a Nebraska town isolated by flood waters, including a woman desperate to be with her dying mother, who passed away the day after they were reunited.

▶ Gene Pfautsch, Distinguished Volunteer. With 32 years of continuous service, Pfautsch is the longest serving volunteer at Wings of Hope, the St. Louis-based nonprofit that provides air transport for those in need in the U.S. and around the world.

▶ Veterans Airlift Command, Outstanding Achievement. Since its founding in 2006, the VAC volunteer pilots have flown in excess of 10,000 veterans and family members (pets, too) to medical treatment, reunions and military services, among other missions, and continue to do so on a near-daily basis throughout the U.S.

Brewer Trophy

▶ You Can Fly. Created by the Aircraft Owners and Pilots Association, the umbrella program makes flying more accessible and affordable by supporting flying clubs, encouraging best flight training practices, getting lapsed pilots back in the air, and helping high school students learn more about aviation careers.

And finally,

Bruce Whitman Trophy

Instituted this year in honor of the late FlightSafety International CEO, the award goes to "outstanding individuals who have made significant contributions to aviation or aerospace in the United States, and who by working with museums and other institutions have promoted an appreciation by students and the broader public of the sacrifices and legacy of members of the military service." The inaugural recipient, quite appropriately, is Bruce Whitman.

I salute all the recipients and their achievements. And if business aviation as a whole follows their example, the important goals highlighted at the NBAA gathering should be attainable and the community secure well into the future. **BCA**

Readers' Feedback

NOTAM Problem Explained

I wanted to put on record my appreciation of David Esler's "Ending NOTAM Nonsense" (*BCA,* November 2019, page 18).

This is the best summary and analysis of the problems with the current system that I have read. It's clear he took great care to tell the story in full; it's incredibly well researched, and a great achievement to get the perspective from so many people at the forefront of the changes from the International Civil Aviation Organization, the FAA, Eurocontrol and the NBAA (and of course, our NOTAM team here). Well done.

In today's media landscape it's refreshing to see such well-thought-out, in-depth writing. You've also done a great service to the NOTAM problem itself — telling the story of any problem is half the battle.

Thank you!

Mark Zee
Founder
OpsGroup
New York, New York

Weight Was Always an Issue

I liked the opening photo used to illustrate James Albright's "Reclaiming Situational Awareness" (*BCA,* October 2019, page 30). Aircraft of that era are not something I know about, but as stated in the caption, the German aircraft is probably a Rumpler "Taube" (Dove), a design that originated in Austria in 1911.

At the outbreak of the Great War almost half the aircraft in use by the German army were of the "Taube" type — but as they were built by some 20 manufacturers there were a number of variations. The Rumpler version was the most successful.

The French aircraft in pursuit seems to be a Henri Farman Type F.20, which is said to have been the first aircraft to carry machine guns into the air. However, just as nowadays, weight was a problem as it seems the extra weight of the weapon meant that the F.20 could not exceed an operational height of 3,500 ft.

Sic transit gloria!

John Davis
Wichita, Kansas

"It isn't often that committee members get the recognition they so deserve doing thankless work and spending a great deal of personal and professional time improving our industry."

Jad Donaldson, *Harley-Davidson Motor Company*

Hard Work and Time

I loved "Seat Surrender" (*Viewpoint,* October 2019, page 7) and just wanted to reach out and say thank you for your service to the NBAA Safety Committee and to express my appreciation for bringing to light the great work that NBAA committees do for our industry and the association.

It isn't often that committee members get the recognition they so deserve doing thankless work and spending a great deal of personal and professional time improving our industry.

Again, thank you.

Jad Donaldson
NBAA Business Aviation Management Committee
Director of Aviation
Harley-Davidson Motor Company
Milwaukee, Wisconsin

Stepping Aside

I've been meaning to drop a line since my August copy of *BCA* arrived with a byline other than that of Richard N. Aarons atop *Cause & Circumstance.* My understanding is that my old colleague had expressed a desire to "step away from the computer . . ." or at least not be tied to it every month. If that's the case, good for him.

After 50-some years as a key cog, airplane and avionics evaluator, *Purchase Planning Handbook* numbers-cruncher, publisher persuader, regular target of the executive editor's deadline wrath and sometimes editor-in-chief, there is no question that Mr. Aarons deserves a break.

It also got me pondering about how many pilots his safety articles have helped to stay out of the trees, granite cumulus and NTSB accident reports. While there is no way to accurately calculate a precise number, my guess would be tens of thousands, and multiple generations over the years. Pilots who read and assimilated his *C&C* reports every month could not help but become smarter and safer.

For Mr. Aarons, it wasn't just a job, it was a mission he took seriously. Congratulations on all that good and valuable work.

Dave Collogan
Former BCA Washington columnist
Silver Spring, Maryland

Author's response: Absolutely great to hear from you. Thank you for the very kind words. I especially appreciate your thoughts that the *Cause & Circumstance* lessons might have done some good — I hope so.

Yes, it is time I step back a bit, if not only to allow folks with a fresh point of view to contribute, but also to allow my tired eyes to move back from the screen. Ross Detweiler will write some, and some folks from the International Society of Air Safety Investigators (tin kickers) have volunteered to write for *C&C* as well. I have reserved the right to step in from time-to-time to contribute when my interest is really piqued.

We are deep into the transition from cockpits staffed by aviators to cockpits staffed by system managers. Unfortunately, that has led to a transition period when it is sometimes questionable as to who's flying the airplane. Sometimes the right seat is occupied by an old, experienced aviator, but often it's occupied by a young pilot just out of the regionals who is great at pushing buttons but terrible at actually flying an airplane without "the magic." **— Richard Aarons**

Editor's note: I can attest to the value of having "an old, experienced aviator" in *BCA*'s cockpit. Yes, after decades of invaluable contributions, Mr. Aarons has earned the right to "step back a bit" . . . but not too far. We intend to keep him on permanent standby, so he can respond when the flying gets dicey. You see, he's our hands-on "magic."
— William Garvey

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

OPEN UP THE BOARDROOM

Work efficiently without limits.

Connect in real time with the secure, high-performance, low-latency network.

INTELLIGENCE

EDITED BY **WILLIAM GARVEY, JESSICA A. SALERNO AND MOLLY MCMILLIN**
william.garvey@informa.com
jessica.salerno@informa.com
molly.mcmillin@informa.com

NEWS / ANALYSIS / TRENDS / ISSUES

DASSAULT HAS COMPLETED the critical design review of its long-range, widebody Falcon 6X and is closing in on the preliminary design of the follow-on project, which is widely dubbed the 9X. "We finished the critical design review of the 6X this summer, which has triggered the start of industrialization and manufacture," Dassault Aviation Executive Vice President Carlos Brana says. "We have begun making parts, including the first wing, and we have assembled the first fuselage." Brana spoke at the NBAA Business Aviation Convention & Exhibition, held in Las Vegas Oct. 22-24. The fuselage assembly, which has been put together in Dassault's facility in Biarritz, France, will be moved early next year to the company's Bordeaux-Merignac site for completion and mating with the wings, the first of which is being assembled in another facility in Martignas. Flight tests of the aircraft's Pratt & Whitney PW812D engine are due to begin soon on the engine maker's Boeing 747SP flying testbed and follow initial trials with an earlier preproduction version in 2018. Six engines are involved in the test effort. Assembly of the first aircraft is to begin in early 2020, with first flight anticipated a year later, and certification and entry into service are expected in 2022. Although virtually no details of the concept have been revealed, the 9X is expected to be focused on a medium- to long-range design, with the wide cabin cross-section of the 6X and a configuration optimized to reduce noise and fuel burn.

CORPORATE ANGEL NETWORK RAISED MORE THAN $510,000 ON Oct. 23 at the National Business Aviation Association's annual convention. The Fund an Angel event at the Wynn Las Vegas hotel drew more than 600 people. The funds were raised through scholarships, donations and auction items, and support CAN's mission of providing free travel on business aircraft to cancer patients traveling to treatment centers in the country.

TECNAM TOOK FIRM ORDERS FOR 11 P2012 TRAVELLER 11-seat utility aircraft during the first two days at the National Business Aviation Association's annual convention in Las Vegas. South Africa-based Tamifield, a member of the AMRHO Group, placed an order for six of the new, high-wing twins with an option for 12 more. Charter Express, based in Colombia, placed an order for five of the Italian-made aircraft with an option for an additional five. "The impressive number of sales signed here at NBAA-BACE confirms the P2012's leadership in the general aviation market," said Walter Da Costa, Tecnam global sales and marketing director. The first few P2012 aircraft, which has a list price of $2.6 million for a standard-equipped aircraft, were delivered to Cape Air in Hyannis, Massachusetts, in September. The aircraft is powered by two 375-hp turbocharged Lycoming engines. It is European Aviation Safety Agency (EASA) and FAA certified.

Jet-A and Avgas Per Gallon Fuel Prices
November 2019

Jet-A

Region	*High*	*Low*	*Average*
Eastern	$8.85	$3.95	$5.85
New England	$7.85	$3.69	$5.12
Great Lakes	$8.22	$3.38	$5.34
Central	$7.61	$3.26	$4.69
Southern	$8.31	$4.14	$5.92
Southwest	$6.90	$3.10	$4.99
NW Mountain	$6.90	$3.11	$5.14
Western Pacific	$8.83	$3.64	$5.64
Nationwide	**$8.07**	**$3.53**	**$5.34**

Avgas

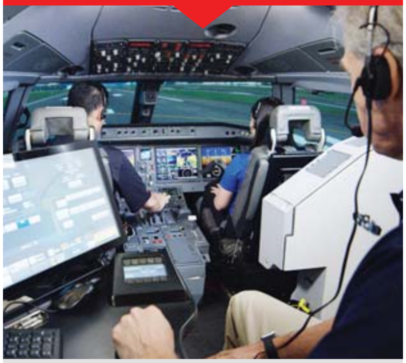
Region	*High*	*Low*	*Average*
Eastern	$8.71	$5.20	$6.82
New England	$7.45	$4.95	$5.95
Great Lakes	$8.59	$4.55	$6.37
Central	$7.59	$4.40	$5.69
Southern	$9.24	$4.20	$6.36
Southwest	$7.19	$4.00	$5.78
NW Mountain	$8.46	$4.97	$6.15
Western Pacific	$8.52	$4.80	$6.62
Nationwide	**$8.22**	**$4.63**	**$6.22**

The tables above show results of a fuel price survey of U.S. fuel suppliers performed in November 2019. This survey was conducted by Aviation Research Group/U.S. and reflects prices reported from over 200 FBOs located within the 48 contiguous United States. Prices are full retail and include all taxes and fees.

For additional information, contact Aviation Research/U.S. Inc. at (513) 852-5110 or on the Internet at www.aviationresearch.com

For the latest news and information, go to **bcadigital.com**

FSI and Jet Aviation Form Partnership



Jet Aviation Staffing and FlightSafety International have formed a global pilot training partnership program powered by the Hullo Aircrew platform.

Under the agreement, FlightSafety provides pilots with recurrent training while Jet Aviation Staffing ensures payment of the upfront costs for eligible pilots and a flexible repayment plan. Meanwhile, Hullo Aircrew connects freelance and contract aircrew members with operators.

In another partnership with Jet Aviation, Hullo is developing technology to become a source for freelancers to find the best trips, receive payment quickly and access a variety of training programs.

PILATUS AIRCRAFT HAS UPGRADED ITS POPULAR PC-12. The new, third generation PC-12 NGX boasts a redesigned cabin with new seats and larger windows as well as a new electronically controlled Pratt & Whitney Canada PT-6 turboprop, with more speed and lower noise and operating costs. The Swiss airframer said the aircraft had been in development for more than three years. The PC-12 NGX is expected to receive FAA and European Aviation Safety Agency (EASA) certification in December, with customer deliveries beginning in the second quarter of 2020. In 2018, Pilatus delivered 80 PC-12s, compared to 85 in 2017. Pilatus has delivered in excess of 1,700 of the turboprop singles since its introduction. The new model carries a list price of $4.39 million typically equipped and $5.37 million for an executive-configured version. It has a range of 1,765 nm with four passengers at long-range cruise power and 1,559 nm with high-speed cruise power. Maximum cruise speed is 290 kt.

By comparison, **Textron Aviation's Cessna Denali, still under development,** is powered by GE Aviation's Catalyst engine, carries a list price of $5.35 million, has a four-passenger range of 1,600 nm at high-speed cruise and a maximum cruise speed of 285 kt. Delays in the Catalyst program has pushed back first flight, which had been expected before year end. The new Pilatus is fitted with a PT6E-67XP, rated at 1,825 shp, and which includes "general aviation's first dual-channel integrated electronic propeller and engine control system" for full digital envelope protection, intuitive engine control, reduced pilot workload and optimized power. The aircraft monitors and records more than 100 engine parameters, which are transmitted wirelessly upon landing, giving operators timely information regarding engine health, it says. Maintenance schedules have been extended from 300 flight hours on the PC-12 NG to 600 flight hours on the PC-12 NGX. Hourly direct operating costs for the engine and airframe are down 9%, the company said, with engine times between overhauls up from 3,500 hr. to 5,000 hr. on the NGX.

FRENCH MANUFACTURER DAHER GROUP HAS COMPLETED ITS PURCHASE of Quest Aircraft Co., maker of the Kodiak 100 utility turboprop and is changing the company's name to Kodiak Aircraft. The acquisition of the Sandpoint, Idaho-based company aligns with Daher Group's strategy to intensify its business footprint in the U.S., said Didier Kayat, Daher's CEO. "In addition to adding the Kodiak to our aircraft portfolio, we have now gained a major competitive advantage for all of Daher's aerospace business lines in North America," he said. In addition to the Kodiak, the Daher manufactures the TBM 940 and TBM 910 as well as aerospace components and systems and offers logistics and services. With Kodiak buy, Daher gains a U.S. manufacturing facility, which employs more than 260 workers. About 278 Kodiaks are in operation; it is certified in 67 countries.

DJI, THE MALL DRONE MANUFACTURER, has unveiled a highly capable quadcopter weighing 249 grams (0.5 lb.), which exempts it by 1 gram from registration requirements in the U.S., Canada, Great Britain, Australia, Germany and other countries. The Chinese company's Mavic Mini, is foldable and features a gimbaled, 2.7K video camera with 30 half hour endurance. It retails at $399. The company's smallest, lightest model to date, the Mavic Mini comes equipped with DJI's GEO 2.0 geofencing system to prevent it from entering airports and other sensitive locations. The communications link between an operator and the aircraft can be monitored by the DJI Aeroscope drone-detection system. DJI also expects the Mavic Mini will be compatible with a future Remote Identification system in the U.S.

FLEXJET MADE NEWS AT OCTOBER'S NBAA-BACE by placing a $1.4 billion order with Embraer for Praetor 500 and 600 aircraft, as well as Legacy 450 and Phenom 300 midsize jets. The order is a huge vote of confidence in Embraer Executive Jets as the parent company spins off its airliner business into a joint venture with Boeing next year. The exact number or division of aircraft was not disclosed, and neither was the delivery timetable, except that Flexjet will start taking aircraft "imminently," according to Embraer Executive Jets President and Chief Executive Officer Michael Amalfitano. "This is a firm order with money in the house, and you will be hearing more news soon," he said. This is the fourth time Flexjet has introduced a new Embraer jet to the fractional market: previous introductions were the Legacy Executive in 2003, the Phenom 300 in 2010 and the Legacy 450 in 2016. Building off of "that exceptional platform," Flexjet will be converting its full Legacy 450 fleet into Praetor 500s, it said.

Flexjet Chief Executive Officer Michael Silvestro said "the spirit of innovation at Embraer keeps us coming back time and again because it dovetails perfectly with our commitment to provide the youngest, most modern fleet to our fractional owners." In anticipation of this order, Flexjet has been aggressive in recruiting pilots this year and recently met its 2019 goal of hiring 175 additional aviators. Flexjet first entered the fractional jet ownership market in 1995. Its fleet now includes the Challenger 300 and 350, Embraer Phenom 300 and Legacy 450, Global Express, the Gulfstream G450, G500 and G650, and has placed an order for 10 Aerion AS2 supersonic business jets.

CAE HAS CONCLUDED A MULTILAYERED ARRANGEMENT with Directional Aviation Capital involving investing $85 million for a 50% stake in Simcom, which in turn purchased five CAE simulators and five flight training devices, and entering a 15-year exclusive contract under which Simcom will provide training for Directional's various flight operations. Those operations include Flexjet, Flight Options, Flairjet, Sirio, Nextant Aerospace and Corporate Wings whose combined fleet numbers 175 business aircraft, with more than another 80 aircraft on order. The new training devices involved in the agreement include full flight simulators for a Gulfstream G650, two Bombardier Challenger CL350s, one Embraer Phenom 300 and one Embraer Legacy 500, along with five CAE 400XR flight training devices. Simcom plans to install the equipment in the new training center which is under development in Lake Nona, Florida.

SPIRIT AEROSYSTEMS IS BUYING BOMBARDIER'S AEROSTRUCTURES BUSINESSES in Belfast. Northern Ireland and Morocco, as well as an MRO business in Dallas. Total value of the deal, which is expected to close in the first half of 2020, will be about $1.1 billion after Spirit assumes pension liabilities and makes other payments. The sale increases Spirit's capabilities to include Airbus and business jet work and aftermarket services. Bombardier employment centers. Bombardier announced its exit from commercial aerospace in May and had already divested its regional jet and turboprop business. The Belfast plant makes composite wings for the A220, plus the tail and fuselage sections for the Global 7500. The former Short Brothers plant is also producing a new engine nacelle for Airbus for the A320neo, and Bombardier had been expanding in Casablanca to produce parts for the new nacelle.

EC135 Accident Ruling

A Scottish Fatal Accident Inquiry into a Nov. 29, 2013 helicopter crash that killed 10 people in Glasgow has concluded the pilot ignored low fuel warnings.

The investigation, published Oct. 30, found that the pilot "took a chance" that the low fuel warnings he received were erroneous, Sheriff Principal Craig Turnball concluded in his report into the accident.

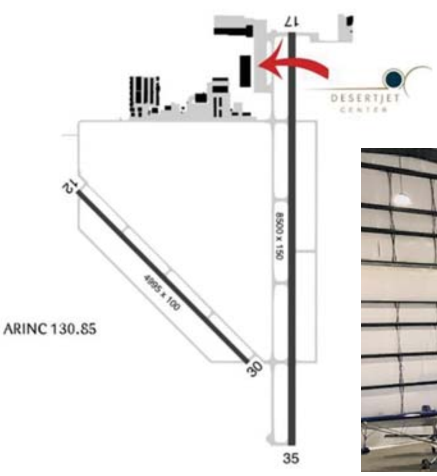
The EC135, operated for Police Scotland by Bond Air Services, crashed onto the roof of public housing, caving in the ceiling and killing six people inside the building. A seventh person later succumbed to injuries.

The pilot, one of three onboard the helicopter who also died, had acknowledged all five of the fuel warnings but did not attempt to land or return to base. Instead, he allowed both engines to become starved of fuel, and they shut down within half a minute of each other.

Jared Fox

Denise Wilson

PHOTOGRAPHY: DESERTJET.COM



DESERT JET HAD ITS BEGINNING in 2007 when pilot Denise Wilson launched the company as an aircraft management, sales and acquisitions center, later adding a charter operation to the mix. The success of the management and charter operations prompted creation of a maintenance center in 2013, and two years later an aircraft fixed-based operation (FBO) — all at Jackie Cochran Regional Airport in Coachella Valley, Calif., some 20 mi. west of Palm Springs. And the success continues. **In January 2020, Desert Jet's new CEO Jared Fox will preside over the opening of an all-new, $7.5 million, 30,000-sq.-ft.** facility that includes a fully air-conditioned, 22,500-sq.-ft. hangar capable of accommodating business jets as large as Bombardier's Global 7500. The FBO had a "soft" opening in early November of last year, planning for an official grand opening, complete with music, food and drink and local dignitaries, in mid-January. According to FBO General Manager Roman Mendez, the FBO is the first new development at the airport in 20 years and he added, "From the moment you land until departure, our FBO stands out."

The facility includes the usual amenities, including a pilot lounge with showers, crew cars, WiFi described by visitors as "off the scale," inflight catering arrangements, and ramp-side passenger pickup and drop-off. There is also an observation deck on the top floor, electric car charging stations, and a pet relief station on the ground level that includes a "paw bar" with treats and water. The busiest times for Desert Jet FBO are special events, among them numerous tennis and golf tournaments and the annual Coachella Valley Music & Arts Festival every April. "We're the busiest FBO in the area for both VIP visitors and participants at the festival," explained Mendez. "We also partner with some of the high-end vendors, and we're the closest airport to the venue." **Giving back is a key part of the Desert Jet mission, including support through Angel Jet of free air transport for those in need of medical treatment far from home. The FBO also supports such Ronald McDonald House charities and the Special Olympics.** Desert Jet Holdings includes an FAR Part 135 aircraft charter business, and Part 145 maintenance facility, as well as a sophisticated aircraft detailing service. The maintenance center includes AOG mobile air service units that can be dispatched throughout southern California by air or ground, and the on-site detailing ranges from carpet and leather cleaning and reconditioning to waxing and machine buffing and polishing the exterior.

According to CEO Fox, Desert Jet is "the only true full-service FBO" in the Palm Springs/Coachella Valley area. It is also the only FBO in the desert southwest region that is IS-BAH-registered with Stage II certification. It also has NATA Safety 1st certification. Looking forward Fox noted that, "Now in the planning stage is the Phase 2 hangar development that will complete the facility campus." To ensure the goal of exceeding the customer's expectations, the FBO **recently launched a new Customer Loyalty Program** that ensures delivery to its customers the 5-Star service they are accustomed to, along with additional cost savings. "Desert Jet is truly an independent FBO," concluded Mendez. "We're working to bring the FBO back to the days when every client is a VIP." — **Kirby Harrison**

Boeing Adds Two More VIP Dreamliners

Boeing reports a single, unidentified customer has ordered two long-range BBJ 787-9 Dreamliners worth $564 million. This brings to 16 the number of orders for VIP Dreamliners.

Extra Gets EASA Type

Years in development, the all-new Extra NG aerobatic single has received in new type certificate from the EASA. The award occurred in October, and production of the all-carbon, single-engine aircraft was to begin immediately. FAA certification is pending.

At the time, the manufacturer reported orders in hand for 15 of the +10g /-10g certified new aircraft, priced at $460,000.

Founded in 1980 by Walter Extra, a world-class aerobatic competition pilot, Extra Aircraft, which is based in Germany, offers a range of high-performance singles, including the Extra 330SC which has won six world and aerobatic championships and the Extra 330LT, designed for pilots who want an aerobatic machine with additional cross-country capability. And now, the Extra NG.

DASSAULT'S STEADY EXPANSION of maintenance capability continues. The French planemaker convinced Luxaviation Group to sell it ExecuJet's global maintenance activities. The sale is subject to the required approvals. Luxaviation ExecuJet Group in 2015, including its maintenance centers, FBOs and aircraft management business; the latter two activities are not part of the sale. ExecuJet operates 15 maintenance and service centers around the world. "The acquisition of ExecuJet's MRO operations will strengthen Dassault Aviation's global footprint, especially in Asia-Pacific, Oceania, [the] Middle East and Africa," said Eric Trappier, Dassault Aviation chairman and CEO. ExecuJet provides maintenance support services for a variety of aircraft types in 42 countries. Earlier Dassault acquired the maintenance operations of RUAG and TAG.

XTI AIRCRAFT SAYS IT HAS SIGNED AN INITIAL AGREEMENT with a potential lead investor in its $25 million Series B funding round. If successfully closed, the funding would support development of the startup's TriFan 600 hybrid-electric vertical-takeoff-and-landing (VTOL) business aircraft. At the same time, Charlie Johnson, former Cessna Aircraft president and CEO and member of XTI's Board of Directors, has joined the company as chief operating officer. Johnson will remain on the board. XTI has signed a term sheet with the potential lead investor for a minimum of $17 million and maximum of $29 million in financing in a combination of equity and convertible debt. Closing is tentatively scheduled for January 2020, the startup says. "We're optimistic that this term sheet will lead to fully funding and closing our Series B round," CEO Robert LaBelle says. "This is the direct result of our progress over the past 12 months, which included conducting a series of successful initial hover tests, our major collaboration with GE Aviation in July, and receiving 81 orders for the airplane so far." XTI completed the first hover tests of a 65%-scale prototype of the TriFan 600 in May. In July, XTI selected GE's Catalyst turboprop as the core of the TriFan's hybrid-electric propulsion system. The engine will generate 1 megawatt of electrical power to drive the aircraft's three ducted fans, two of which tilt to provide thrust for forward flight.

LATERAL SEPARATIONS BETWEEN AIRCRAFT FLYING in North Atlantic airspace have been reduced through the use of space-based automatic dependent surveillance-broadcast (ADS-B) for near real-time aircraft monitoring. The U.K.'s National Air Traffic Services (NATS) reports the minimum lateral or "wing-tip to wing-tip" separation between aircraft flying on oceanic tracks has been reduced from 23 nm to 19 nm, enabling greater flexibility in the use of airspace capacity. The narrowing of separations follows the reduction of longitudinal or "nose-to-tail" aircraft separations within tracks from 40 nm to 14 nm in March as part of the space-based ADS-B operational trial. NATS and NavCanada started using the Aireon system of ADS-B receivers mounted on Iridium Next satellites to track aircraft signaling by transponder in late March. The region they cover is the world's busiest oceanic airspace, accommodating 500,000 flights per year. Space-based ADS-B provides controllers with aircraft position updates every 5-to-8 seconds over the ocean. Under the legacy system, aircraft flying outside of radar range report their position by satellite-routed ADS-Contract at 14-minute intervals and by controller-pilot data link messages or high-frequency radio as needed. NATS reports that since the start of the trial, 4,414 flights were assigned more fuel-efficient flight levels, and 3,400 were able to fly more direct routes compared to the same period in 2018.

Questions for Lance Toland

Lance Toland

President, Lance Toland Associates Aviation Insurance Griffin, Georgia

Orphaned at six and raised by a war-decorated uncle, Toland was hooked by aviation as a grade schooler. He worked part-time for flight time at Griffin-Spalding County Airport (6A2), earning wings while still in his teens. By high school he was right seater in a DC-3 freighter and Beech 18s. Meanwhile, he earned degrees in business and law and demonstrated a special affection for aviation insurance, opening his eponymous agency in 1975. Since then he has become one of the industry's most respected aviation insurance brokers with clients around the globe. He took a special interest in surplus military aircraft, as an operator, broker and insurer and at one point owned 51 such aircraft — the world's 11th largest air force — all based at 6A2. Toland owns and operates a Pilatus PC-12 and P-3, DC-3, two Rockwell Commander 114s and a Eurocopter EC120. An ATP with seven type ratings, he has logged 17,000 hr. and is a major philanthropist supporting education at all levels in his native Peach State.

1

Are single-pilot operations in turbine aircraft especially problematic?

Toland: Yes. To illustrate that fact for a safety committee seminar at the NBAA convention in October, I pulled together a random sampling of recent fatal single-pilot turbine accidents and the list filled the screen. Both professional and non-paid pilots were involved. Two Citation crashes — one near Atlanta and the other in Indianapolis — involved 78-year-old non-professionals who were clearly operating beyond their competencies; one was alone [Ed: See the *Cause & Circumstance* that follows immediately after this Q&A], but the other killed his wife in the crash as well. Then just days after the convention, a professional pilot crashed a company TBM 700 at his home airport; he stalled while making a turn in the pattern. Think about that. He walked away, but the airplane was destroyed. Accidents like these are inexcusable and yet they continue.

2

Is there a common fault?

Toland: One factor is complacency. Some pilots think, "It's just a single-engine aircraft." Well, my PC-12 has a 1,200-hp engine. It can carry nine people and cruise at 275 kt. It's pressurized with a 30,000-ft. service ceiling. It has two electrical systems and an all-digital flight deck. This is serious stuff, gentlemen. Then there are the CEO-pilots who aren't used to someone second-guessing them and are so comfortable leading, they may be unaware of their limitations. Also, there are those who think their aircraft are so advanced, they're bulletproof.

3

But don't new avionics and control systems help compensate for shortcomings?

Toland: Technology has increased the margin of safety enormously, but it has also offset basic flying skills and can give pilots an unwarranted peace of mind. During the seminar we played an ATC tape of a controller alerting another TBM pilot flying of icing conditions. The pilot actually said, "That's not an issue for us." But he ventured into a weather system that overwhelmed his aircraft and him. The six people and a dog aboard that TBM died as a result. Also, you need to master the technology. If you read the investigators' reports, it's clear that those two separate septuagenarian Citation pilots did not understand their aircraft's new digital systems and died confused.

4

So, what's the fix?

Toland: Training and mentoring. Years ago, I was one of the first group of civilian pilots to check out in surplus military jets. At our first meeting in Tucson, there were 25 in the room. A year later, a third of those pilots were dead. That shook me up. They had been operating at high speed and low altitude and weren't prepared. We needed to create a culture of safety. I came up with a three-in-24 plan. That's training at least every eight months — in the aircraft, in a simulator, and then a full 61.58 PIC proficiency check. Some people only train in the aircraft, but a simulator can expose you to conditions that can't be safely replicated in an aircraft. Also, when I was flying night freight in a DC-3, my boss said no one would move into the left seat until flying through two full seasons, and that included winters. A good rule. So, now I advise pilots who want to fly high-performance aircraft solo that they should fly at least two seasons — winters included — with another pilot before going it alone.

5

And if they don't?

Toland: Insurance and even aircraft financing may be unavailable. Both industries are reassessing their criteria. Trust me, this is a real issue. For some, single-pilot turbine aircraft operations may be a thing of the past. Insurance can't be had at any price. And for those who do qualify, they'll pay more for less. The maximum coverage for single-pilot operations today is $25 million, but the average payout per fatality is $7 million. So, if a $5 million airplane crashes with seven or eight people aboard, that's what's called an "excess of limit loss." Don't put yourself in that kind of situation. If conditions aren't right, wait another day. Those are the fellow pilots I want to insure. BCA

Richard N. Aarons
Safety Editor
bcasafety@gmail.com

Alone, Dependent and Confused

A reliance on misunderstood systems **with tragic consequences**

BY **RICHARD N. AARONS** bcasafety@gmail.com

There comes a time when every person simply needs help, but asking for a hand can be difficult for some. Over the years, we've reviewed many accidents that befell business pilots who set themselves up for disaster by failing to take the simple step of inviting or hiring a "companion pilot" to lend a hand in the cockpit. This happened to an experienced older Cessna 500 pilot returning home to Atlanta from business meetings in Ohio. There are lessons here for all who fly alone.

Citation N8DX collided with terrain in a residential neighborhood near Marietta, Georgia, on March 24, 2017, at 1924 EDT killing the lone occupant — a 78-year-old private pilot returning from Cincinnati. The airplane was destroyed by the impact and post-crash fire. The flight had been operated on an IFR plan from Lunken Field (KLUK) and was headed for home at Fulton County Airport-Brown Field (KFTY).

Several witnesses observed the airplane before the accident. One witness — a professional pilot — stated he observed the airplane flying level on a southerly heading about 1,000 ft. below the 5,000-ft. ceiling. He reported seeing nothing unusual about the business jet until it made "a complete 360-deg. roll" to the left before entering a steep 90-deg. bank to the left. He described the turn as similar to a "military high-key turn." The airplane then rolled inverted and entered a sudden vertical nose-down dive. "The plane entered a slow counterclockwise spiral . . . as it started its dive" that continued until the airplane disappeared behind a building.

Another witness stated that she observed the airplane make a "barrel roll" with the nose of the airplane "slightly elevated." She then observed a second roll and stated that the airplane slowed before its nose began to point down and the airplane spiraled downward counterclockwise.

NTSB investigators were able to recover the CVR and, along with ATC recordings, assembled this sequence:

At 1851:36, when the airplane was level at 23,000 ft., an Atlanta Center controller advised the pilot of an amendment to his original flight plan. Ten seconds later, the controller provided new routing information. The controller repeated the new routing at 1852:50 and 1855:17, and the pilot correctly read back the information at 1855:25.

The airplane was equipped with a Garmin GTN 750 GPS that provided navigation, radio tuning and other capabilities. Aural clicks and the sound of knobs turning were heard on the CVR consistent with the pilot attempting to enter the new routing into the Garmin unit.

At 1858:57, the controller instructed the pilot to descend to 22,000 ft., and the pilot acknowledged this instruction. At 1859:04, the pilot told the controller, "I'm having a little trouble with my, ah, GPS. Did you give me direct [unintelligible] on that arrival?" The controller then asked the pilot to repeat his request, and the pilot said, "I'm having difficulty with my GPS. It's not picking up this arrival and I was wondering if you can give me, uh, direct routing then instead of going to the arrival." At 1859:46, the controller cleared the airplane direct to KFTY and, at 1900:10, instructed the pilot to descend the airplane to 11,000 ft.; the pilot acknowledged this information. About 3 min. later the CVR recorded the pilot saying, "I have no idea what's going on here."

At 1907:42, the controller instructed the pilot to descend the airplane to 6,000 ft., and the pilot acknowledged this instruction. At 1910:26, the CVR recorded a sound similar to the autopilot disconnecting.

At 1911:02, the pilot told the controller that the airplane was descending through 8,000 ft. but was experiencing a "steering problem" and that he could not "steer the aircraft very well." The pilot then mentioned that the airplane was "in the clouds." At 1914:29, the controller instructed the pilot to descend the airplane to 4,100 ft., the minimum vectoring altitude. The airplane continued to descend, during which time it entered visual meteorological conditions.

At 1915:44, the controller told the pilot that the airplane had descended to an altitude of 3,600 ft., which was 500 ft. below the minimum vectoring altitude, and instructed the pilot to maintain an altitude of 4,100 ft. At 1915:52, the pilot said, "Yeah, I understand. I'm going back up but I have no . . . I have very little steering on here and I have mountains [around me]. Atlanta doesn't have mountains." The controller then issued a low altitude warning and advised the pilot again to climb the airplane to 4,100 ft. The pilot responded that he had his "autopilot back . . . so it gives me stability."

At 1917:21, the controller instructed the pilot to change to another Atlanta Center frequency; afterward, the pilot reported that the airplane was at 4,100 ft. At 1917:54, the controller confirmed that the airplane was at 4,100 ft. and instructed the pilot to contact Atlanta approach control on a frequency of 121.0

MHz. The pilot reported, at 1918:21 and 1918:26, that "I can't get to one two one point zero" and that, "I'm having a problem with my ah Garmin."

At 1918:33, the pilot asked the controller to "take me in;" the controller agreed. About 1 min. later, the pilot told the controller that he was "just barely able" to keep the airplane straight and its wings level. The pilot also indicated that he was unsure if he would be able to make a right turn into the airport. At 1921:17, the controller told the pilot that the airport was 2 to 3 mi. on a heading of 177 deg., and the pilot responded that he thought that he had a heading of 177 deg. but did not have the airport in sight. At 1922:09, the controller asked the pilot if he wanted to declare an emergency, and the pilot said, "I'm not sure and I think I oughta declare an emergency just in case." The pilot then asked the controller to have the KFTY control tower "turn up" the runway's landing lights, and the controller acknowledged this request.

At 1923:09, the pilot asked the controller, "what runway am I running into . . . is the runway going sideways?" The controller responded that Runway 8 was the active runway. At 1923:44, the pilot said, "well, I've got my landing gear down but I don't know." This statement was the last communication from the pilot to the Atlanta Center controller.

At 1923:55, the CVR recorded the pilot straining. At 1924:00, the pilot is heard on the CVR saying, ". . . it's going down, it's going down" followed by the sound of the autopilot disconnect tone. At 1924:07, the TAWS announced, "sink rate, sink rate" followed by "pull up, pull up." The CVR recording ended at 1924:19.

Data recovered from the TAWS unit, which is part of the onboard EGPWS, recorded the two warnings heard on the CVR. The first warning, a Mode 1 sink rate warning, occurred when the airplane was at an altitude of 4,000 ft. and on a heading of 160 deg. The airplane's descent rate increased from approximately 0 fpm to approximately 8,500 fpm. About 3 sec. later, as the descent rate increased, a Mode 1 pull up warning was triggered at an altitude of 2,900 ft. The data ended approximately 7 sec. later with a recorded descent rate of almost 12,000 fpm.

The weather conditions reported at Cobb County International Airport-McCollum Field (KRYY), located about 3 mi. west of the accident site, 23 min.

A Personal Note

Cause & Circumstance has appeared on these pages for over 30 years and, of course, will continue to be right here every month. My byline has been at the top of most C&C articles, but it is important to understand, I think, that the real authors are the accident investigators themselves — the men and women around the world who work under what are often the worst conditions imaginable to uncover the causes and causal factors of each major incident.

Most countries have some sort of accident investigation organization, among them are the NTSB in the U.S., Canada's Transportation Safety Board, the UK's Air Accident Investigation Branch, France's air accident enquiry bureau (BEA), Germany's Federal Bureau of Aircraft Accident Investigation (BfU) and Australia's Transportation Safety Board. The work products of these organizations, and a dozen others, have provided *BCA* with the lifesaving information that appears each month in C&C.

The investigators themselves — most are members of the International Society of Air Safety Investigators (ISASI) — arguably are the most cooperative specialists extent. They are employed by the world's governments and aviation industries, and they work together tirelessly to determine why airplanes, their crews and passengers meet with misfortune. To do their difficult jobs correctly, they must ignore politics and government unpleasantries, overcome language barriers, adverse terrain and weather, and even operate in hot conflict areas. They comb through the wreckage of machines and lives with the single goal of extracting lessons to prevent similar accidents in the future. Their investigations have led to countless advances in aircraft, avionics and powerplant design, construction and operation and to the ways pilots, cabin attendants, controllers, engineers and technicians approach their daily tasks.

Each major investigation takes a year or more to complete and generates thousands of pages of documentation, analyses, witness statements, FDR and CVR transcripts, maintenance and training records, photos and laboratory reports. Ultimately, the investigators' factual finings become part of the record and the parent organization makes public its findings and recommendations in a document often comprising hundreds of pages.

Our job at *BCA*'s C&C desk has been to digest the steps of the investigations along with the findings and recommendations into a package that you, our readers can consider and use in your own aviation operations.

Over the past 30 years, I've had the opportunity to select, analyze and share with you over 400 investigations that I believed held lifesaving lessons for our business aviation community. In the doing I've had the privilege of working with dozens of field investigators from many agencies around the world and the real pleasure of knowing that some of our C&C synopses have found their way into many business aviation and airline training programs.

Every bit as important is the fact that each month we receive letters from *BCA* readers offering valuable thoughts and suggestions based on C&C articles. These comments often expose important points we've overlooked in our effort to digest hundreds of pages of data into a few thousand words.

Now, after satisfying decades, it is time for me to share this space with other contributors — experienced pilots and accident investigators who will continue to present the work of the world's air safety investigators. From time to time, I'll jump back in with an accident investigation analysis and will continue to work with the C&C contributors to bring you the most useful information possible.

In the meantime, I thank and salute the world's air safety investigators and you Cause & Circumstance readers.

Stay Safe! ***— Richard Aarons***

after the accident were: wind from 160 deg. at 8 kt.; visibility, 10 sm; overcast ceiling at 5,500 ft.; temperature, 21C; and dew point, 9C.

The airplane had impacted the front yard of a home in a residential neighborhood about 15 mi. north of Brown Field. The airplane came to rest in an upright position, and all major components were accounted for at the scene. The wreckage was indicative of the airplane impacting the ground in an approximate nose-level/wings-level attitude with little to no forward momentum. A ground scar just forward of the left wing indicated that the airplane bounced back about 3 ft. after it hit the ground. The wires and trees that were near the impact point showed no indication that they had been struck.

A postimpact fire consumed most of the cockpit, fuselage, left wing and the inboard portion of the right wing. The Garmin GTN 750 unit sustained severe heat and fire damage and could not be examined. The major components of the autopilot system, including the vertical gyros, directional gyros, autopilot servos, flight director computers and the autopilot computer, were identified and examined. They sustained post-crash fire and impact damage; however, no evidence of an autopilot failure was found.

The empennage separated from the airplane at the aft pressure bulkhead. The horizontal and vertical stabilizers remained attached to each other but separated from the fuselage and were found across the street from the main wreckage site. The left elevator and a portion of the right elevator separated from the horizontal stabilizer, and the rudder separated from the vertical stabilizer.

Flight control continuity was established from each primary flight control system to the cockpit. The cable runs were continuous except in areas with structure breaks or severe fire damage. The flaps were in the intermediate flap position, and the flap handle was in the second (takeoff and approach) position. The speed brake on the left wing was consumed by fire, and the speed brake on the right wing was in the down and faired position. The elevator trim actuator measured 2.1 in., which correlated to a 10-deg. tab-up position; the rudder trim actuator measured 1.7 in., which correlated to a 5-deg. tab trailing-edge right position; and the left aileron trim tab actuator measured 1.6 in., which correlated to a tab-down position between 0 deg. and 5 deg. The elevator trim indicator in the cockpit was between neutral and nose down.

The airplane's fuel tanks (one in each wing) were breached from impact. Two fuel cross-feed valves were found in the wreckage in the open position.

The nose landing gear was found folded aft and underneath the fuselage. The left and right landing gear were folded underneath their respective wings. The damage was consistent with the landing gear being extended at the time of the accident.

The left engine had separated from the aft fuselage and came to rest on the right engine. In the cockpit, the left throttle was found out of the power quadrant pedestal, and the right engine throttle was at idle. Both engines sustained heat and impact damage and exhibited damage consistent with the engines operating at the time of impact.

Accidents in Brief

Compiled by Jessica A. Salerno

Selected accidents and incidents in October 2019. The following NTSB information is preliminary.

▶ **October 31 — At 1926 CDT, a Piper** PA32R-301T (N181AG) was destroyed during a forced landing following a total loss of engine power while on approach to the Barkley Regional Airport (PAH), Paducah, Kentucky. The private pilot, who was also the owner of the airplane was killed in the accident. It was VFR and no flight plan was filed for the personal flight that originated at the Mitchell Municipal Airport (MHE), Mitchell, South Dakota, about 1628, and was conducted under Part 91.

Preliminary information obtained from the FAA revealed the purpose of the flight was for the pilot to return to PAH, which was his home airport, after a hunting trip. In a telephone interview, a representative from the FBO at MHE stated that the accident airplane arrived on Nov. 27, 2019, and he serviced the airplane with 31 gal. of fuel, which filled the tanks. He further commented on the smoothness of the engine as the airplane approached the fuel pumps.

In an interview at the accident site, the local controller said he was familiar with the pilot and the accident airplane. He said that the pilot checked in on the tower frequency and he provided the pilot with the current altimeter, wind, and active runway information. The pilot informed him that he was "lined up" for a straight-in landing to Runway 14, which he requested and the controller approved. The controller advised the airplane was "cleared to land" which the pilot acknowledged. Approximately 1.5 min. later, the pilot advised, "I've lost power." The controller asked the pilot if he thought the airplane would reach the runway, and the pilot responded, "Yes." Soon after, the pilot advised, "I'm not going to make it, I'm in the trees." There were no further communications from the accident airplane. The airplane collided with trees and terrain, aligned with Runway 14 at PAH, about 1.5 mi. prior to the landing threshold.

The pilot held a private pilot certificate with a rating for airplane single engine land. His most recent FAA third class medical certificate was issued November 13, 2013. The pilot reported 120 total hours of flight experience on that date. Interpolation of FAA and aircraft records revealed the pilot had an estimated 570 total hours of flight experience, of which 450 hours were in the accident airplane make and model.

According to FAA airworthiness records, the airplane was manufactured in 2006 and was powered by a Lycoming TIO-540-AH1A, 300-horsepower engine. Its most recent annual inspection was completed February 19, 2019 at 1,588.7 total aircraft hours.

▶ **October 27 — About 1055 CDT, a** Piper PA22-150 (N2621P) crashed during takeoff from Benson Airport (6MN9), White Bear Township, Minnesota. The airline transport pilot sustained serious

No preimpact anomalies were noted that would have precluded normal airplane or engine operation.

An autopsy of the pilot was performed by the Cobb County Medical Examiner's Office, Marietta, Georgia. The cause of death was blunt force injuries. Toxicological testing performed at the FAA Forensics Sciences Laboratory identified ethanol and propanol in the pilot's blood and ethanol in the pilot's heart. These findings were consistent with postmortem alcohol production. No medications or other substances were detected.

The Pilot

The investigation turned to the businessman pilot. The CVR and ATC transcripts indicated that he seemed to be having trouble using the airplane's avionics and autopilot systems. He held multiengine land, single-engine land and single-engine sea and instrument ratings. He had purchased the airplane in May 2001 and earned a Cessna 500 type rating in 2002.

The pilot's last FAA third-class medical certificate was issued on Sept. 27, 2016, with the limitation that he possess glasses for near/intermediate vision. At that time, he did not report his total flight time; his previous medical application (dated Sept. 18, 2013) indicated a total flight experience of 6,000 hr. and 50 flight hr. in the previous six months. The pilot's logbooks were not available for review, so investigators could not determine his overall currency and total flight experience in the accident airplane.

The Safety Board said that the 1976 Cessna 500 was originally certified to be operated with a pilot and copilot. To qualify for single-pilot operations, a pilot must successfully complete an FAA-approved single-pilot authorization training course annually.

The previous owner of the accident airplane had been issued a single-pilot conformity certificate by Sierra Industries Ltd., of Uvalde, Texas, which had performed earlier modifications to the airplane. However, no record indicated that the accident pilot received training under Sierra Industries' exemption.

Investigators contacted several other training facilities that offer single-pilot exemption training for the Cessna 500 to see if they had provided such training to the pilot, but none of those facilities had any record showing that the pilot had been trained for and granted single-pilot authority.

A friend of the pilot who was a flight instructor and airplane mechanic and had flown with the pilot several times reported he repeatedly told the pilot that he needed to fly with a copilot. The accident-pilot responded that he preferred to fly alone. The accident-pilot also told his friend that he did not need a single-pilot exemption because the airplane had been given a single-pilot exemption with the Sierra Industries modification.

The friend told investigators he had conducted post-maintenance test flights on the accident airplane and instructed the pilot on operating the Garmin GTN 750, which had been installed in the airplane about 3.5 years before the accident. The Garmin GTN 750 was a more advanced upgrade from the KLN 90 GPS that the pilot had previously been using "for years." The

injuries. The airplane was heavily damaged during the impact. The airplane was registered to and operated by the pilot as a Part 91 personal flight. It was VFR in the area about the time of the accident, and the flight was not operated on a flight plan. The flight was originating from 6MN9 at the time of the accident and its destination is unknown.

According to initial information from the Federal Aviation Administration, the airplane impacted terrain under unknown circumstances during takeoff. The airplane came to rest in a ditch about one-quarter mile northwest of 6MN9.

At 1045, the recorded weather at the Anoka County-Blaine Airport (Janes Field), near Minneapolis, Minnesota, was: Wind 300 deg. at 10 kt., gusting to 15 kt.; visibility 10 sm; sky condition overcast clouds at 2,000 ft.; temperature 7C; dew point 2C; altimeter 29.90 inches of mercury. 6MN9 is a private, non-towered airport, which is owned by White Bear Township, Minnesota. It is located about 3 mi. north of the township. The airport has an estimated elevation of 942 ft. MSL. The airport is serviced by one runway, 12/30, which is 2,000 ft. by 75 ft., with a turf surface.

▶ **October 23 — About 0846 CDT, two** Robinson R22 helicopters (N7189D and N74512,) collided midair while conducting wildlife management operations on private property in Hebbronville, Texas. The commercial pilot and passenger in N7189D were killed. The commercial pilot in N74512 was not injured, and the passenger received serious injuries. It was VFR for the business flights that were conducted under Part 91. No flight plans had been filed. The helicopters departed from the private property about 0800.

According to pilot of N74512, N7189D was operating as the spotter aircraft, responsible for sighting wildlife on the ground. N74512 was the "gunner" aircraft, responsible for capturing the wildlife. The pilot of N7189D had spotted wildlife and called it out to the pilot of N74512 over the radio. N74512 flew to the area where N7189D was flying, and the pilot of N74512 had called out he had wildlife in sight. The pilot of N74512 estimated he was flying about 100 ft. AGL and was approximately 100 ft. behind N7189D, who was flying about 50 ft. AGL. N74512 turned to the right and continued to track the wildlife while descending upon it. N7189D turned to the left announcing on the radio he had spotted another animal. The pilot of N7189D then called over the radio that the animal was not viable, which was the last transmission before the pilot of N74512 felt an impact to his helicopter. He then observed the other helicopter descend and hit the ground.

Two witnesses on the ground stated after the pilot of N74512 announced he had the wildlife in sight, the helicopter turned to the right to follow the wildlife. The pilot of N7189D initially turned to the left, but then came back to the right for some reason and collided with N74512.

The main wreckage of N7189D came to rest in an unimproved field containing scrub brush and mesquite trees. The helicopter came to rest at a magnetic heading of 268 deg. at an elevation of 580 ft. The helicopter hit the ground in a flat, slight left-side low position. The main wreckage included the main rotor, friend said that the pilot was "very confused" with the Garmin GTN 750 unit's operation and would struggle "pulling up pages" and "correlating all the data." If ATC amended a preprogrammed flight plan while en route, the pilot would get confused and not know how to amend the flight plan.

The friend also said that the pilot was "very dependent on the autopilot" and would activate it immediately after takeoff and then deactivate it on short final approach to land. The pilot "never" trimmed the airplane before turning on the autopilot, which resulted in the airplane "fighting" the autopilot. As a result, the pilot was "constantly complaining" that the airplane was "uncontrollable." The friend further stated that the pilot "always assumed" that the autopilot would automatically trim the airplane. In addition, the friend said that he flew to Savannah once to "fix" the airplane because the pilot insisted that it was uncontrollable. When the friend arrived and flew the airplane, he quickly realized that the airplane was not trimmed properly and that there was nothing wrong with the autopilot.

Avionics

The airplane had undergone an avionics retrofit on Aug. 28, 2013. The STC replaced and upgraded the flight panel instruments to a Garmin GTN 750 display that supported navigation/mapping, radio tuning, weather display and terrain/traffic awareness. The unit's navigation capabilities allowed waypoints to be entered that could be used to build and store flight plans for future use. In addition to the touchscreen features, the unit had concentric knobs for data input and radio tuning. Communication and navigation radio information was shown on the top portion of the display. For radio tuning, the unit had electronic touchscreen "tabs" that provided recent, nearby and saved radio frequencies. The radio frequency could also be adjusted using the large and small knobs on the lower right corner of the display. When information was entered using the Garmin GTN 750 touchscreen, an aural "click" sound was annunciated.

The upgrade integrated the Garmin GTN 750 display with a Sperry (now Honeywell) SPZ-500C autopilot/flight director instrument system. When engaged, the autopilot, with the use of the integrated flight director, coupled to the selected modes and flew the airplane automatically while the pilot monitored the autopilot performance on flight instruments. The autopilot/flight director instrument system provided automatic flight control in the pitch, roll and yaw axes with manual, automatic and semiautomatic flight maneuvering options available to the pilot.

According to Honeywell, the autopilot would automatically disconnect in flight if there were a loss of the vertical or directional gyros, a loss of valid 28-volt power to the autopilot or gyros, or a failure of the autopilot torque-limiter. Honeywell also stated that a pilot could disconnect the autopilot in flight using one of the following seven actions:

▶ Press the AP TRIM DISC button.
▶ Press the vertical gyro FAST ERECT button.
▶ Press the compass LH-RH switch.
▶ Press the AP TEST button.
▶ Select AP Go-Around mode.

Accidents in Brief

tail rotor, fuselage, tail boom, and skids. N74512 performed a forced landing on an adjacent roadway. The helicopter was positioned on a magnetic heading of 267 deg. at an elevation of 570 ft. The helicopter was intact, with exception of separated skids and displaced lower frames.

▶ **October 20 — About 1921 EDT, a** Piper PA-32-301 (N534Z) was destroyed following a collision with terrain while on approach to Raleigh-Durham International Airport (RDU), Morrisville, North Carolina. The private pilot and one passenger were fatally injured. The airplane was registered to a corporation and was operated by the pilot under Part 91 as a personal flight. Night VFR prevailed and an IFR flight plan was filed for the flight that originated at Columbus Airport (CSG), Columbus, Georgia about 1605 and was destined for RDU.

According to preliminary ATC data provided by the FAA, the pilot initially requested the RNAV GPS Runway 5R approach to RDU; however, due to local traffic he was told to expect the RNAV GPS Runway 32 approach. The pilot subsequently reported that he had GPS and autopilot issues and the controller subsequently provided radar vectors to NOSIC waypoint for the straight-in approach to Runway 32. The controller asked the pilot if he had NOSIC identified, and the pilot reported that he did. The pilot continued the approach and intercepted the final approach course inbound for Runway 32. The pilot reportedly "broke out" of the clouds on a 7-mi. final at an altitude of 1,800 ft. MSL. The controller cleared the pilot for the visual approach to Runway 32, and the pilot responded that he saw "lots of lights" but he did not see the runway. Between 6 and 7 mi. from the runway, at 1,300 ft. MSL, the controller issued the pilot a low altitude alert with instructions to climb to 2,000 ft. The pilot responded that he thought he had the airport beacon in sight and the controller again cleared him for the visual approach to Runway 32; the pilot did not respond. About 5 mi. from the runway, at 1,400 ft., the pilot asked, "How am I doing on altitude?" The controller responded that he was "fine" and confirmed 1,400 ft. The controller again asked the pilot if he had the runway in sight, and stated that if he did, he was cleared for the visual approach. The pilot responded that he only could identify the beacon, so the controller told him that he would turn up the intensity of the runway lights. When the airplane was between 3 and 4 mi. on final and at 1,000 ft., the controller again asked him if he had the runway in sight, and the pilot responded that he believed it was coming into view.

The pilot was directed to contact RDU tower and communication was established with tower when the airplane was about 1,000 ft. MSL and 3 mi. from the runway. The tower controller asked the pilot if he had the runway in sight; the pilot confirmed that he did. The controller then asked the pilot if he was on a 2-mi. final; the pilot did not

▶ Pull the autopilot AC or DC circuit breaker.

▶ Use manual electric elevator trim.

The airplane was also equipped with a Bendix/King (now Honeywell) KGP560 GA EGPWS.

Aircraft maintenance was being managed by CESCOM, which is a division of CAMP Systems, the exclusive factory-endorsed maintenance program for Cessna aircraft. This is a continuous airworthiness maintenance program, which is a combined program of maintenance and inspections. The airplane's maintenance logbooks were not located.

The last Phase 5 inspection was done in 2016, and the post-maintenance flight test found no items related to the circumstances of the accident. The mechanic stated that he had never seen the airplane's maintenance logbooks and that he would prepare maintenance entries in the CESCOM system. The mechanic said that he last spoke with the pilot about two weeks before the accident. He reported that, at that time, the pilot told him that "the airplane was flying better than ever."

The mechanic indicated that the pilot had not mentioned any maintenance issues regarding the autopilot, gyro instruments, the Garmin GTN 750 or the flight controls. The mechanic further indicated that the only time the pilot had mentioned the Garmin GTN 750 was when he had asked him to help find a pilot in the Atlanta area who could help him become more comfortable using the unit.

Findings

The NTSB determined the probable cause(s) of this accident to be: "The pilot's failure to maintain adequate airspeed while manually flying the airplane, which resulted in the airplane exceeding its critical angle of attack and experiencing an aerodynamic stall. Contributing to the accident was the pilot's inability [to] control the airplane without the aid of the autopilot."

In its analysis of this accident, the Safety Board took note of the comments from the pilot's friend who, referring to the GTN 750, said, "that the pilot generally was confused about how the unit operated and struggled with pulling up pages and correlating data" and did not trim the airplane or understand the autopilot system.

"This information suggests that the pilot historically had difficulty flying the airplane without the aid of the autopilot," said the Safety Board. "When coupled with his performance flying the airplane during the accident flight without the aid of the autopilot, it further suggests that the pilot was consistently unable to manually fly the airplane.

"Additionally, given the pilot's previous experience with the GPS installed on the airplane, it is likely that during the accident flight the pilot became confused about how to operate the GPS and ultimately was unable to properly control the airplane without the autopilot engaged. Based on witness information, it is likely that during the final moments of the flight the pilot lost control of the airplane and it entered an aerodynamic stall. The pilot was then unable to regain control of the airplane as it spun 4,000 ft. to the ground." **BCA**

respond. No further communications were received from the pilot and radar contact was lost. The wreckage was subsequently located about 1000 on October 21.

The airplane crashed in a thickly wooded area within the confines of the 5,579-acre William B. Umstead State Park. The main wreckage was located about 1.2 mi. southeast of the Runway 32 threshold. The initial point of impact was a 100-ft.-tall pine tree, and a large section of the right wing remained lodged near the top of the tree. There was no fire. The engine was found separated from the airframe and the propeller assembly was separated from the engine.

The pilot, who co-owned the airplane, held a private pilot certificate with ratings for multi-engine land, single-engine land, and instrument airplane. The pilot had 4,000 hr. of flight experience. Reported weather conditions at RDU, at 1951, included overcast clouds at 1,400 ft., greater than 10 mi. visibility, and no precipitation. Sunset occurred at 1831 and evening civil twilight ended at 1857.

▶ **October 17 — About 1650 CDT, an** Aeronca 7AC Champion (N82308) hit a moving vehicle during short final approach to Martins Aerodrome (WI78), Green Bay, Wisconsin. The private pilot and the vehicle occupant sustained fatal injuries and the airplane was heavily damaged. The Aeronca was registered to and operated by the pilot under Part 91 as a personal flight. It was VFR for the flight that departed the Brennand Airport (79C), Neenah, Wisconsin, about 1600 and was destined for WI78. The pilot departed WI78 earlier in the morning and arrived at 79C to meet with a mechanic to complete the airplane's annual inspection. The pilot and mechanic ate lunch together and then the pilot departed 79C for WI78. During their conversation, the pilot mentioned to the mechanic that he was concerned about the wet turf runway at WI78 and that he preferred to land near the end of the runway.

According to witnesses who were traveling in vehicles near the accident location, and a vehicle dashboard camera, the airplane was about 5 ft. over the county highway adjacent to the end of Runway 1 when it impacted the front left side of the westbound vehicle. The airplane remained on top of the truck after the collision. The truck departed the right side of the county highway, entered a ditch, and came to rest near a residential driveway.

▶ **October 17 — About 1538 EDT, a** Bell 206B (N167AG) was heavily damaged when it hit powerlines and terrain near New Salem, North Carolina. The commercial pilot was killed in the accident. The Bell was owned and operated by Vertical Flight Technologies under Part 137. It was VFR for the 22nd aerial application of the day. The pilot departed to the north and made a left turn to a southerly heading, then tracked to the south while flying along the west side of the field. The pilot then turned north near the service road to the field. After the helicopter had been flying for about two minutes, the lead heard a "pop" and when he turned around to look at the helicopter, he saw it travel about 30 yd. before impacting terrain. He then ran toward the accident site and attempted to render assistance to the pilot. **BCA**

The Red Button

Garmin's **emergency autoland**

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

You're the owner/operator of a single-engine turboprop. You've launched from Colorado Springs Municipal Airport bound for San Jose, California, during monsoon season. The evening departure and climb-out are uneventful, but it starts to get bumpy as you enter the cloud layers abeam Pikes Peak. Even though you've flown through plenty of turbulence, tonight you aren't comfortable. Your stomach is queasy. You're short of breath. And then you feel sharp little pangs in your chest.

Keep this to yourself, you reason. No need to alarm the family members aboard. After all, they're depending on you to get them back on the ground safely, because you're the only pilot.

A half hour into the flight, however, it becomes hard for you to focus on the instruments and maintain your mental plot. The others notice and they're worried.

"Are you OK?" is the last thing you remember hearing from your spouse. Your breathing is hard and shallow. Your chest aches. You think you're about to pass out.

The scenario very well could end with fatal consequences in most single-pilot general aviation aircraft. Pilot incapacitation is a nightmare no passenger wants to imagine, especially with only one aviator up front. The history of owner-flown single-pilot turbine aircraft is peppered with dozens of fatal accidents caused by pilot error, disorientation or incapacitation.

This airplane, though, is equipped with the latest Garmin G3000 NX avionics package. A guarded red button has been added to the flight deck layout, within easy reach of the passengers. It very well could be called the "No Panic Button." When pushed by anybody — including the pilot — it activates an emergency autoland function. This is essentially a virtual, digital copilot that can take over control of the aircraft, evaluate winds, weather and fuel reserves, then select a suitable divert field and fly the aircraft to the best runway at the landing facility.

The system also switches the transponder to a special emergency autoland squawk code pre-assigned by the FAA, makes all required radio calls to advise ATC of the situation and uses the EFIS screens and the aircraft intercom system to brief those aboard and keep them updated as to where and when the aircraft will land. And, if the need arises, passengers can communicate directly with ATC by following simple instructions displayed on screen.

Emergency autoland can control the aircraft in all three axes, adjust the throttle, extend the landing gear and flaps as appropriate and guide the aircraft to the touchdown zone. It will crab into a crosswind and then transition to wing down/top rudder to align the aircraft with runway centerline. After landing, it uses differential braking to stay on center and bring the aircraft to a smooth stop. It even has an anti-skid function to modulate braking on slippery surfaces. It also can shut down the engine to prevent a prop strike injury

GARMIN (2)

The Red "No Panic" Button. Press it and a virtual copilot takes control of the airplane, evaluates winds, weather and divert field choices, then guides the aircraft to a safe, full-stop landing.

Cockpit displays keep the passengers "in the loop" by showing where the aircraft is located, what divert field has been selected, how the aircraft will be maneuvered and when it will arrive at the airport.

as people exit the aircraft.

Mind you, autoland is no laboratory experiment. Garmin started to have discussions about the feature in 2001. The program officially was launched in 2010 and eventually more than 100 hardware and software engineers, plus human factors experts and sales executives became involved. Flight tests using a Cessna Corvalis 400 began in 2014 and eventually 329 test landings were completed. Another 300 landings were flown in various other aircraft. In early 2018, Piper and Garmin began flight tests in a modified Piper M600 single-engine turboprop to validate the technology for pending FAA approval. More than 170 landings now have been completed.

By late 2019, Piper and Garmin expected FAA certification of the system aboard the Piper M600. It's slated to be cut into production as standard equipment for 2020 models. Autoland is part of Garmin's newly branded Autonomí package, which also includes emergency descent mode and electronic stability and protection. Expect similar emergency autoland capability announcements from Cirrus by the end of this year and Daher in mid-2020.

Flight Demo of Piper's Halo System

To see emergency autoland in action, we belted into the right seat of an M600 equipped with the system at Garmin's New Century AirCenter Airport (KIXD), Olathe, Kansas, facility. Eric Sargent, engineer and flight test pilot, flew the aircraft from the left seat. Bailey Scheel, aviation systems engineer who leads the M600 development program, and media relations specialist Jessica Koss accompanied us in the main cabin.

Emergency autoland is part of Piper's 2020 M600 Halo system, a standard bundle of advanced safety equipment for the new model year that also includes stability and underspeed protection, emergency descent mode, pitch and wings level mode and coupled go-around. Key to some of these features is the model's new autothrottle capability. It first will have limited functionality for safety functions. Piper plans to offer a full-function autothrottle by year-end.

Garmin provides a basic functionality template package to aircraft manufacturers, enabling them to customize autoland to best fit the needs of their customers, explained Scheel. The airframers are given options for how the system should interact with flap actuators, anti-ice and other aircraft systems, wheel brakes and steering. They can also decide what kind of en route and destination winds and weather criteria should be used for choosing a suitable divert airport. In addition, the system can assess weather reports to screen out divert fields with hazardous meteorological conditions.

In the case of that hypothetical single-engine turboprop flying from Colorado Springs to San Jose, activation of autoland overhead Central Colorado Regional Airport (KAEJ) in Buena Vista, Colorado, might cause the system instead to choose Grand Junction Regional (KGJT) as the divert field, about 115 nm away, to avoid storms over the Rockies. It also uses its digital terrain database to assure the aircraft stays safely above the rocks while it maneuvers toward the divert field and descends for approach and landing. Furthermore, it would change the landing field elevation used by the pressurization system from 62 ft. for San Jose to 4,861 ft. for KGJT.

The first version of autoland can only use runway ends served by GPS LPV or LNAV/VNAV approaches. Close to 12,000 such procedures are available, but not all landing strips meet each aircraft manufacturer's specific needs of minimum requirements for runway surface, length and width, along with weather observation broadcasting at the landing facility.

Scheel says 7,000 ft. of pavement would have been the minimum practical stopping distance for the M600 using no flaps. Such high minimums would have been too restrictive, as there just aren't that many airports with long runways and GPS approaches in the U.S. Using full flaps would have provided access to 9,600 runways. But Piper chose to use takeoff/approach flaps as the best compromise because of the possibility of operating in icing conditions causing ice accretion on the airframe. The minimum landing distance thus became 4,500 ft., which still provides access to more than 9,000 runways. Autoland ties into the M600's ice protection systems. If the OAT drops below the threshold for icing, they're activated, even if the aircraft is not flying through visible moisture. The entire autoland package adds only 25 lb. to aircraft empty weight.

We departed KIXD to the southwest, climbing to 4,500 ft. MSL. When we were about 15 mi. from the airport, Sargent gave me the OK to lift the guard and press the red button.

Smoothly, the autopilot and autothrottle engaged. The aircraft headed for KIXD, the closest suitable airport with sufficiently long and wide runways, plus GPS precision approaches. A direct route to New Century Airport was also free of weather hazards.

The aircraft accelerated to 230 KIAS, 20 kt. shy of redline. Piper chose that speed to get the aircraft on the ground expeditiously, in case the pilot needs


GARMIN

Pressing the red "No Panic" button activates a simple audio-visual passenger briefing system, instructing them what to do, how to communiate with ATC, if needed, and where they are being flown.

immediate medical treatment.

Because this was a demo, emergency autoland did not switch the comm radios to 121.5 MHz, wait for silence on frequency and then transmit the aircraft's intentions. It also did not switch the transponder to an emergency code. Sargent instead informed New Century tower of our intention to fly the RNAV (GPS) Runway 36 approach in VFR conditions.

Just after the aircraft started to turn back to the airport, all three EFIS screens and both touchscreen control panels switched from avionics mode to passenger advisory mode.

"Emergency Autoland Has Been Activated" appeared on the MFD. "No Action Required" popped up on the bottom of the display. "Calculating ETA," advised the system. An animated graphic then appeared, highlighting the yokes and rudder pedals. "Keep Hands and Feet Away from Aircraft Controls."

The PFDs transition to combined synthetic vision and moving map displays, keeping all of us well informed of the aircraft's progress en route to the divert airport. The top displayed "Landing in 9 minutes" while the bottom showed "En route to New Century Aircenter — Olathe, KS." The screen showed that we were headed to the approach end of Runway 36.

As we neared the airport, the aircraft was too high and fast to commence the RNAV approach. It automatically slowed to 140 KIAS, followed the holding pattern depicted in lieu of procedure turn and descended to 3,100 ft. as required by the approach procedure. When level, it automatically extended the landing gear and flaps to takeoff/approach.

Aligned with the final approach course inbound, it slowed to 105 KIAS and started down on the glidepath. The MFD screen alternated between a moving map with time and distance-to-go advisories and various passenger advisory messages, including how to use the comm radio, check seat belts and shoulder harnesses fastened, stow loose items in seat-back pockets and wait for the aircraft to stop before exiting.

Sargent commented that the hardest part of refining autoland was the flare phase in the last 5 to 10 ft. above the pavement. The aircraft has to make crosswind corrections, respond to gusts, adjust to runway undulations, slowly retard the throttle to idle and steer to maintain center runway alignment. Touchdown must be both smooth and precise to stop on the available pavement. In the end, the system landed us as well as an accomplished M600 human pilot.

It also has to use differential braking for steering and stopping, accounting for undulations in the surface and runway contamination. Aboard the M600, dual autothrottle servos actuate a hidden set of brake master cylinders to modulate brake pressure while monitoring wheel speed deceleration to avoid skidding on slippery surfaces.

After touchdown, animations on the MFD advised us of how to unbuckle our seat belts and how to open the cabin door. If we had let the system run through all its functions, it would also have shut down the engine.

Sargent commented that emergency autoland also can automatically activate in extreme circumstances. Following an emergency descent, for instance, the G3000 will prompt pilots for responses to assure they're conscious. If they respond, the system remains unarmed. But if they don't respond, emergency autoland would activate.

At any time, emergency autoland can be disarmed by pressing the disconnect

GARMIN

The Piper M600 is slated to be the first aircraft to feature emergency Autoland. It was tested at several airports, including Port Angeles in the Strait of Juan de Fuca.

button on the yoke. Sargent says that anyone aboard the aircraft can intervene. A pilot who regains consciousness, for instance, might take over from the system as the aircraft nears the autoland divert destination. A passenger with limited flying experience could disconnect the system after landing and taxi the aircraft clear of the runway.

Piper says the entire Halo system, including extra cost equipment now made standard, has a $170,000 market value. Interior upgrades and a five-year tip-to-tail warranty add another $130,000 of value. But the retail price increase is being held to 2%.


GARMIN

Emergency Autoland can be disconnected at any time, enabling a qualified pilot to taxi clear of the runway to the ramp for a normal shut-down and occupant egress.

Cirrus SF50 Vision Jet

Slated for certification this year and for 2020 deliveries, Cirrus brands its system "safe return autoland," according to Matthew Bergwall, director of the Vision Jet product line.

"It's part of a total safety solution that also includes Cirrus Aircraft Parachute System [CAPS]," says Bergwall. "In case autoland is not available, the G3000 screens will provide instructions as to how to activate CAPS. We bookend all the risk scenarios you could have in flight." For instance, CAPS is available as an escape from loss of control inflight (LOCI).

Similar to the M600 autoland system, the Vision Jet's safe return autoland will tie into the autopilot, autothrottle, pressurization, landing gear and flap, plus wheel brake systems. Runways must be served by a GPS approach capable of vertical guidance. The system will be programmed to fly 160 to 180 KIAS to the initial approach fix, 140 KIAS during maneuvering with the final approach course inbound and 100 KIAS on final approach. Bergwall says the top mount location of the FJ33 turbofan and low idle thrust eliminate the need to shut down the engine after the aircraft comes to a stop on the runway.

As with the M600, autoland will configure the aircraft with takeoff/approach flaps for landing. To account for degraded stopping on contaminated runways, Cirrus uses a 5,836-ft. minimum landing runway length. Incremental empty weight gain of safe return autoland should be close to 25 lb.

Daher TBM

Nicolas Chabbert, Daher's senior vice president, says emergency autoland definitely will be offered on its TBM 900 series aircraft. But he's taking a go-slow approach because of the complexities of implementing it on an aircraft that cruises as fast as 330 KTAS and as far as 1,500 nm. At FL 310, for instance, there may be dozens of candidate divert fields because of the aircraft's high-altitude fuel efficiency. The number diminishes considerably at low altitude because of increased fuel consumption and lower cruise speeds. Those factors need to be incorporated into such a system for the TBM.

Daher is also exploring an automatic ditching capability for the system for extended overwater flights during which no suitable divert field is available.

The current system requires a GPS approach with vertical guidance to the runway end of the divert field. And only paved runways are in the airport database. Chabbert believes those limitations may be too restrictive. Thus, Daher wants to evaluate the potential use of shorter, unpaved strips without precision GPS approaches.

Chabbert believes the G3000 needs more computing power and more memory "for the dynamic environment in which our aircraft operates." He's also concerned that while the FAA may approve the system, the European Aviation Safety Agency may impose stricter certification requirements. Politics, as well as science, must be considered. As an example, he believes that the high traffic density within Berlin, Paris and London airspace may cause EASA to outlaw using major air carrier airports as autoland divert fields. "EASA certification may be a challenge," he said.

Chabbert adds "Our target audience is not the pilot. It's the passengers. We're totally committed to safety and we'll offer it when we have a finalized product."

Other OEM Applications

Industry observers tell BCA that emergency autoland will become a compelling sales advantage in the single-pilot turbine business aircraft market, as well as in the single-engine turbine segment. Aircraft equipped with G1000 systems don't have the capability to support the function. Thus, airframers that currently equip their aircraft with G1000 avionics packages must consider upgrading to the G3000.

Garmin is the only avionics manufacturer to offer emergency autoland at present. Some believe the firm has invested as much as $20 million, or more, in the technology. One can only speculate whether any competitors are willing to make such a sizable investment to develop the capability.

Reflecting on Chabbert's comment about passengers being autoland's target audience, if one is considering purchasing one of two closely matched aircraft, but one features Garmin's G3000 with emergency autoland and the other does not have that capability, the buyer's spouse, family and friends, company leaders, board members and other stakeholders may sway the purchase decision.

In the near future, the "No Panic Button" autoland system could become perceived as minimum required safety equipment, along with oxygen masks, seat belts, fire extinguishers and emergency exits. Garmin isn't just creating a breakthrough avionics technology. It's changing customer expectations for minimum equipment lists on single-pilot aircraft. BCA

CAN
CORPORATE ANGEL NETWORK

CORPORATE ANGEL AWARD

NETJETS

THANK YOU NETJETS FOR GIVING CANCER PATIENTS A LIFT.

An Unmatched Experience Bringing Patients Closer To Their Cure.

Congratulations to NetJets, the latest recipient of the Corporate Angel Award presented by Corporate Angel Network (CAN), Phillips 66® Aviation, Safe Flight Instrument Corporation and *Business & Commercial Aviation Magazine.*

NetJets, like more than 500 other major corporations, is a participant in CAN, a national public charity that arranges free passage for cancer patients using empty seats on corporate jets. Since joining CAN in 1997, NetJets has transported hundreds of men, women and children to recognized cancer treatment centers across the country.

Corporate Angel Network, Phillips 66 Aviation, Safe Flight Instrument Corporation and *Business & Commercial Aviation* are proud to honor NetJets for giving cancer patients a lift in both body and spirit.

BECOME A CORPORATE ANGEL:
CALL US AT 866-328-1313 OR GO TO CORPANGELNETWORK.ORG.

BCA

SAFE FLIGHT
INSTRUMENT CORPORATION

PHILLIPS 66

Cabin Connectivity, 2019

New ventures and faster delivery keep business aircraft passengers and crews in contact **with the world**

COLLINS AEROSPACE

BY **MAL GORMLEY** malgormley@gmail.com

Exciting new partnerships continue to emerge in the realm of business aircraft cabin electronics and online services. Providers are taking full advantage of bandwidth breakthroughs to offer customers the speeds required by many devices to perform well without annoying signal dropouts and latency issues. The airborne office isn't quite as quick or responsive as its ground-bound counterpart, but it's much improved over its earlier iterations, and those not all that many years ago.

Collins, Thales, Gogo, Inmarsat, Honeywell, Intelsat, SES, OneWeb, Satcom Direct, Savcom, SmartSky and Viasat are among the providers that can legitimately call their business aviation offerings and applications state-of-the-art.

Meanwhile, airtime services are exploring new ways of packaging their various offerings that operators will find more appealing than the too-familiar monthly gigabyte fees. New plan options including pay-as-you-go, varying bandwidth controls and lowering per-gig prices based on total monthly usage are in the offing. And at least one compamy — Bellevue, Washington-based Savcom — has developed a comprehensive approach to aircraft cybersecurity.

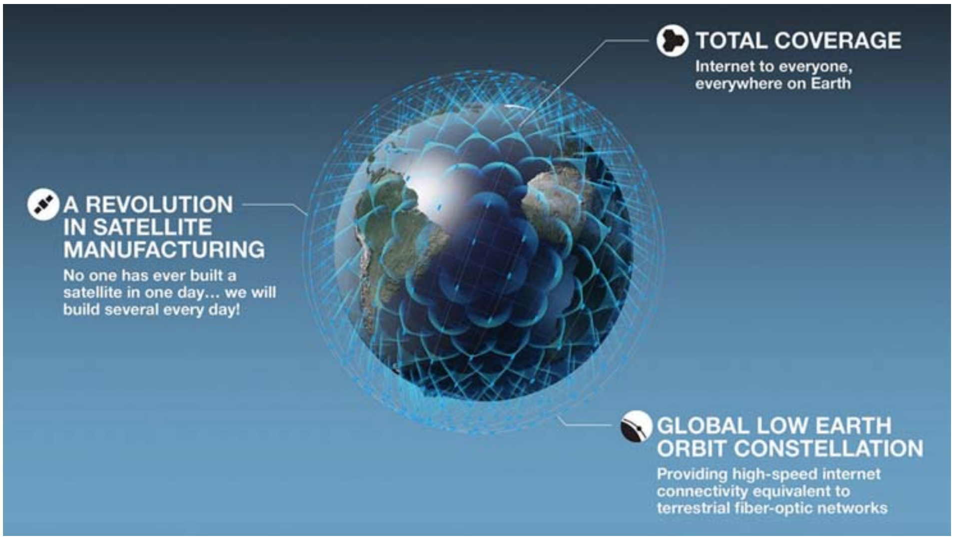
The last 12 months have seen individual providers and joint ventures delivering new inflight connectivity options for business aviation users. Herewith are the highlights, beginning with the partnerships and followed by individual companies:

Iridium and OneWeb

Low Earth orbit (LEO) satellite companies Iridium and relative newcomer OneWeb will offer bundled offerings of their respective L-band and Ku-band services. OneWeb's Ku-band network plan is to deliver high-speed broadband connectivity for applications including inflight Wi-Fi and government and maritime network communications.

The memorandum of understanding (MOU) announced in September represents the first time that the two companies have agreed to combine services in those bands: Iridium's Certus L-band for safety-critical flight deck communications and

OneWeb's constellation of 648 LEO mini-satellites built by Airbus Defense and Space.



AIRBUS DS

other applications, and OneWeb's Ku-band for inflight entertainment and connectivity.

Working with key industry partners and delivering globally, beginning in 2021 OneWeb will connect remote routes, such as those traversing the Arctic, from the outset. That will enable business aircraft passengers to conduct routine business operations including simultaneous live videoconferencing, accessing cloud services, watching live TV, and using content streaming apps such as Netflix and Amazon Prime Video.

OneWeb's satellites are built in Florida by a joint venture between OneWeb and Airbus. OneWeb will deploy more than 30 satellites on a monthly basis starting this month, as it grows its full constellation. The ambitious plan calls for OneWeb to place 650 broadband satcoms initially and another 1,260 later; thus far, it has placed only six into orbit. Parenthetically, such mega-constellations — SpaceX plans to loft some 12,000 minisats — could make space a more congested and collision-prone place. NASA is recommending that these companies make sure their future satellites are taken out of orbit as soon as they complete their missions to reduce the collision threat over the next few centuries.

In recent months, OneWeb has been focused on growing its business aviation team and recently welcomed veteran satellite mobility expert Carole Plessy, who previously headed product development at Inmarsat. Plessy joins Ed Slater, who led airborne communication systems and planning for Air Force One

Thales has partnered with satcom service provider SES and others to provide regional Ka and Ku satellite connectivity systems for regional fleet carriers and business aircraft. Collins also offers SES's 70-sat constellation for business aviation broadband services.

SES

during the terms of presidents George W. Bush and Barack Obama.

"There is a full wave of new investment in this [smallsat] space. OneWeb is a leading player, certainly one of the earlier ones out of the blocks with a lot of investment," says Iridium CEO Matthew Desch, explaining his company's interest in OneWeb. "Now that we've been in the market for 30 years, we have a little bit of knowledge to impart on what they have ahead of them still."

The agreement involves no risk on Iridium's part, he says, and does not prevent the company from other future partnerships.

LuxStream

Collins Aerospace is teaming with Luxembourg-based SES and charter operator Vista Global to bring business aviation customers the fastest broadband speeds available within the US. SES has over 70 satellites in two different orbits, geostationary (GEO) and medium earth (MEO).

LuxStream is being touted as the only service that will offer speeds up to 25 Mbps in the U.S. and 15 Mbps globally via SES's managed Ku-band satellite network.

Collins will deliver the LuxStream service, as well as its new Collins cabin router, on Vista Global's fleet, starting with the latter's 36 business jets.

Astronics will provide its Ku-band tail-mounted satcom antennas for the Collins KuSAT-2000 and LuxStream.

SES and Thales

SES Alenia Space and Thales are literally taking inflight connectivity to a new level. The two companies recently demonstrated uninterrupted access to high-throughput broadband applications for the first time over a platform supporting multi-orbit interoperability, switching seamlessly between SES's GEO and O3b MEO satellite beams. The demo flight from Melbourne, Florida, to the Atlantic coast of Nicaragua saw dozens of switches successfully completed between GEO and MEO beams, and between multiple MEO satellites within a beam, using the Hughes Jupiter airborne modem system.

O3b is SES's ultra-high-capacity, low-latency Meosat data communications system previously validated in the cruise ship industry.

The O3b constellation of 20 Meosats is manufactured by Thales. SES expects upcoming GEO/MEO trials to deliver even higher connectivity speeds, a precursor of things to come for both the airline and business aviation communities as SES nears the scheduled 2021 launch of its O3b mPower system.

GX

Meanwhile, Thales has teamed with Inmarsat to offer Global Xpress (GX) as a value-added reseller to provide a global solution with a seamless connectivity experience. The solution is currently line-fit offerable on the Airbus A350 and soon to


SATCOMDIRECT

Inmarsat has partnered with Honeywell for its connectivity equipment needs, seen here in Honeywell's Jetwave antenna.

be available on other Airbus and Boeing models. As a long-standing hardware provider for Inmarsat SwiftBroadband, Thales provides safety along with passenger services via the L-band SwiftBroadband network.

Thales has partnered with SES and other satellite firms to provide regional Ka and Ku satellite connectivity systems for regional fleet carriers and business aircraft.

With the soon-to-launch Iridium NEXT constellation, Thales will be able to provide safety services globally. The standalone service can be combined with additional Thales broadband offerings for a comprehensive passenger, crew and operations package.

Collins

Collins Aerospace is first-to-market with its Venue CMS 4K video capabilities for Bombardier's new Global 5500 and Global 6500 aircraft cabins. Delivered through the Collins Venue cabin management system (CMS), it provides sharp images, vibrant colors, and a cinematic and immersive entertainment experience. Compared to a full HD 1080p image, 4K resolution provides four times the pixels, making for a clearer and more defined picture.

Venue is the industry's most-fielded CMS with more than 1,300 aircraft currently equipped. It has been customized for Bombardier to best meet the needs of its passengers and to offer the same ultra-fast, flexible, reliable and intuitive system.

GoGo

Gogo Business Aviation's user base is expanding. More than 1,000 Gogo Avance systems are now flying. Those, including the Avance L5 and Avance L3, have flown more than 175,000 flights totaling more than 100 million mi. The milestone took just two years to reach following the initial launch of the Avance L5 in late 2017 and highlights how extensively the two systems have been used onboard business aircraft. Of those, nearly 750 Avance L5s and more than 300 Avance L3s are installed in business aircraft ranging from single-engine turboprops to intercontinental jets.

The two systems operate on the Gogo Avance platform — a combination of hardware and software that is the foundation of all of the company's latest inflight offerings. Being software-centric, the Avance systems are capable of a new type of remote, cloud-based service and support. With Avance, Gogo can now activate and deactivate features remotely — no license keys or onsite support required — so Avance L3 customers now have the ability to choose from one of three configuration options with the ability to transition between them at any time, without anyone having to step onboard an aircraft.

The Avance L5 system connects to the Gogo 4G network, delivering capabilities such as live streaming video and audio, videoconferencing, on-demand movies, faster web browsing, personal smartphone use, real-time data for cockpit apps, and remote diagnostics and support while in flight. The L5 also provides an upgrade path for anyone who wants to add Gogo 5G when the network launches in 2021.

Early in 2018, Gogo launched the Avance L3, a system that delivers the benefits of the Avance platform to passengers and flight departments in a lightweight, smaller form factor compared to the L5. It allows users to customize their inflight experience. While it can be installed on any business aircraft, it is particularly well-suited for smaller aircraft such as turboprops and light jets.


ASTRONICS

Astronics wireless charging module

Tech Trends

A sampling of noteworthy and new cabin connectivity ancillaries.

aeroIT

In response to the growing demand for more qualified information technology experts in the business aviation sector, Satcom Direct is strengthening its industry-focused training program. The second edition of aeroIT, the company's aviation IT certification training, is now available with renewed content and an exam updated to reflect the changes. The training program has been added to the curricula offered at FlightSafety International and Embry-Riddle Aeronautical University, and the number of Satcom Direct digital self-learning courses has grown.

Revisions to the aeroIT course place more focus on cybersecurity, the latest communications systems and IT advances to ensure aviation IT professionals' knowledge base is up to date with recent developments.

CCX Technologies

Ottawa, Canada-based CCX Technologies' SystemX cybersecurity platform is approved for the SmartSky Networks Skytelligence digital services framework. SystemX helps business aircraft operators recognize, understand and defend against cybersecurity threats through real-time actionable data.

The SystemX platform is a combination of software and hardware that helps protect an aircraft's onboard network by monitoring data transmissions between avionics systems and the ground network. While monitoring the former, the system collects data and provides alerts with real-time, actionable information. Amalgamated, anonymized data will offer a broad view of cybersecurity threats on flight routes and highlight potential vulnerabilities on a subscriber's aircraft. Once implemented, users gain access to big-picture data plus important statistics including the number of alerts by route, how many alerts are under investigation and resolved, and aircraft and network types.

The AP-250 cybersecurity appliance, a compact device installed on the aircraft and powered by SystemX software, can be implemented on third-party hardware. SystemX is designed to operate over bandwidth- and latency-restrictive communications links such as satellite and terrestrial radio. Along with monitoring and alerts, the system collects and aggregates data for presentation to users. It can be configured via remote access and has advanced intrusion detection and prevention systems as well as firewall capabilities.

Li-Fi

Latecoere, a Marseille, France-based aerostructure and wiring specialist, has been demonstrating the use of Li-Fi light fidelity signal transmission via optical fiber and light-modulation infrared LEDs as the infrastructure for faster inflight entertainment and communications systems. Li-Fi wireless technology uses light instead of radio frequencies to transmit data.

Some major telecommunications satellite operators are concerned that 5G, the 5th-generation, partly satcom-based mobile communications network, may not live up to its promise for delivering applications such as streaming content to passengers or uploading/downloading data to/from the aircraft on the ground. Li-Fi is immune to radio signal "noise," but its light transmission must be shielded from physical interruption.

Meanwhile, as noted, in 2021 Gogo is to initiate a 5G air-to-ground (ATG) network designed for use on business aircraft, commercial regional jets and smaller mainline jets operating within the contiguous U.S. and Canada. The network will use Gogo's existing infrastructure of more than 250 towers and the unlicensed spectrum in the 2.4-GHz range, along with a proprietary modem and advanced beamforming technology. The 5G service will support all spectrum types (licensed, shared, unlicensed) and bands (mid, high, low), and will allow Gogo to take advantage of new advances in technology as they are developed. Similar to how wireless carriers provide redundancy across their networks, Gogo will continue to employ its 3G and 4G networks through the continental U.S. and in Canada, and they will provide backup to the 5G network when needed.

Three U.S.-based strategic partners — Cisco, Airspan Networks and First RF — will play key roles in the network's development.

Honeywell

Honeywell will provide its JetWave satcom system for 70 C-17 Globemaster III transports operated by the U.S. Air Force. The beyond-line-of-sight communications system is to support and improve the fleet's en route communication capabilities. JetWave's Ka-band hardware and Inmarsat's Global Xpress satellite network combine to deliver global coverage for the command-and-control link, including over water, on nontraditional flight paths and in remote areas.

And, early in 2020, Honeywell is set to begin deliveries of its new Aspire 150 satcom terminals and antennas for business jet operators, providing access to Iridium's Certus satellite network. With data speeds of up to 700 Kbps, Certus will allow flight deck and cabin connectivity including accessing the internet, email, flight-plan filing, weather information and video chatting.

Inmarsat

Inmarsat's new Jet ConneX inflight broadband package for business aviation is gaining favor among operators. The company's new "JX-Pro" package provides new and existing Jet ConneX customers with fast and reliable connectivity, similar to what has previously only been available on the ground, with coverage across 100% of major routes.

More than 600 installations have been completed in the business aviation market. Jet ConneX will benefit from Inmarsat's investment in new Ka-band payloads to further enhance its global service, with new satellite launches scheduled in 2020 and 2021. In addition, planning is underway for Inmarsat's next generation of satellites.

Jet ConneX service offers unlimited data usage and 33% higher speeds compared to the service's previous fastest plan.

The latest installation milestone follows a series of announcements in 2019 detailing Inmarsat's development roadmap for Global Xpress (GX), its global Ka-band network, which consists of four high-throughput satellites. The next evolution of the network will deliver eight additional payloads, marking a transformative step-change in inflight broadband capabilities. The GX network will offer focused, ultra-high-power capacity that can be immediately relocated in line with high-demand flight patterns and seasonal demand surges across the globe.

Jet ConneX is available on Bombardier, Dassault and Gulfstream business jets. In addition, Inmarsat has received FAA and EASA type certificate and STC approvals for aftermarket MROs. Aircraft connect to the service using JetWave hardware, offered by Honeywell.

Intelsat

Luxembourg-based global satellite network provider Intelsat announced in early 2019 that an anomaly had resulted in a total loss of the Intelsat 29e spacecraft. Restoration paths on other Intelsat satellites serving the region and third-party satellites have been provided for a majority of disrupted services. The company says migration and service restoration are well underway, highlighting the resiliency of the Intelsat fleet and the benefit of its Ku-band open architecture system.

In October 2018, Intelsat chose Satcom Direct to serve as master distributor of FlexExec, as part of the new SD Xperience platform. Since FlexExec uses the Intelsat system, Satcom Direct decided to temporarily suspend its near-term installations while the restoration plan developed. Once the system is extensively validated, further installations will resume.

L'Opera

A high-fidelity audio system designed for Bombardier's Global 7500, l'Opera includes full-range speakers with digital signal processing and seat-centric sound technology that creates a rich audio field at the ear level of the listener, with up to 1,275 watts of power.

The four-zone Global 7500 includes passenger features such as specially designed seating, a lighting system with color spectrums to combat the effects of jet lag, and l'Opera. Each zone has been customized for sound, which can be adjusted by passengers using a touch interface. The entertainment suite has a dedicated home theater space with a large monitor and Dolby Digital surround sound.

In creating the audio system, Bombardier worked with Lufthansa, which builds the aircraft's cabin management system.

SAVCOM

Based in Olympia, Washington, Savcom has introduced a new communications service for business aviation operators and the companies that support them. Savcom, which stands for "secure aviation communication," provides a platform allowing 256-bit end-to-end encrypted phone calls, and encrypted text, audio-videoconferencing and file sharing on users' personal mobile devices such as phones, tablets and electronic flight bags, as well as a desktop browser-based interface.

The company maintains client security through a proprietary, closed, private network not available to — or accessible by — the general public. The system works with any domestic or foreign telecom data provider, internet service provider, public Wi-Fi or aircraft internet data system. Operators can set up unique communications groups and one-way broadcasts, allowing them to rapidly disseminate information to specific people. Savcom's encrypted audio-videoconferencing feature gives users the ability to either schedule a videoconference or have an impromptu meeting with multiple personnel. No browser plug-ins, conference codes or dial-in numbers are required because the feature is built into the user app.

Savcom also offers potential applications for emergency responders and telemedical services, where the ability to rapidly assemble a team and communicate securely from multiple locations are key.

Super-Chargers

Astronics is delivering new wireless charging modules for business aircraft to provide fast, safe charging for passenger smartphones and other electronic devices. The module can be placed in passenger seats, furniture or galleys, and provides quick charging of Qi-enabled open interface wireless devices. The system uses a charging pad and a compatible device, which is placed on top of the pad, charging via resonant inductive coupling.

The module, called EmPower, is installed in more than 280 airliners and business aircraft. The 15-watt charger is compatible with many popular mobile devices offered by Apple, Samsung and others, and is the only Qi-certified wireless charging module available for aircraft.

Meanwhile, True Blue Power says its ultra-fast charger, the TA360 Series USB-PD Charging Port, is designed to power new and future electronic devices and provides four times more power than traditional USB-A and USB-C chargers. USB-PD charging ports offer intelligent voltage output, allowing each device to receive the maximum level of power possible. The TA360 Series also supports traditional USB-A and USB-C devices.

The charger is TSO-certified and offers in-seat, cabin, cockpit and galley installation, and protects itself and the electronic device from short circuits, power surges, overload and over-temperature. BCA

Satcom Direct

Melbourne, Florida-based Satcom Direct is now offering Inmarsat's newest Jet ConneX plan, JX-Pro. The program is designed for data-hungry business aviation customers who are looking for fast inflight connectivity with unlimited data usage. The plan boasts maximum download and upload rates of 20 Mbps and 1 Mbps, respectively, or 33% faster than Jet ConneX's previous fastest plan.

As noted, Satcom Direct added Intelsat's FlexExec as part of its SD Xperience portfolio. The first high-speed, managed, end-to-end broadband service designed specifically for the business aviation sector, FlexExec is delivered in partnership with Intelsat and Astronics AeroSat.

At service introduction, four aircraft types using the system included a Dassault Falcon 7X and Gulfstream GIV, G450 and G550.

In addition, the new service enables business aircraft operators to budget hourly connectivity rates. The "Power-by-the-Hour" plan, only available through the SD Xperience portfolio, includes the full array of Satcom Direct services, including cabin connectivity, data link, scheduling, cybersecurity, post-flight reporting and more — all on a single consolidated monthly invoice. Also, SD Xperience synchronizes aircraft with flight operations through its integrated software, hardware and connectivity.

Notably, customers are not subject to data speed caps as consistent delivery of up to 10 Mbps into the cabin, and 2 Mbps out, gives enough bandwidth to support streaming, large file transfers and videoconferencing on multiple Wi-Fi devices simultaneously. Consistent delivery is augmented by the secure Satcom Direct network infrastructure consisting of its data center and global points of presence.

In the air, Satcom Direct provides cabin networking hardware to give customers advanced network management options. The Pro Operating System delivers predictive connective mapping, cybersecurity threat monitoring, flight tracking and account management tools, among other options. On the ground, the FlexExec service is integrated with Satcom Direct's support team, available 24/7/365, ensuring bandwidth is available wherever customer aircraft are flying. The network architecture is delivered to aircraft via the AeroSat FliteStream (T-310) tail-mounted antenna system, available through approved service centers.

Thales

Thales will now provide both the avionics and connectivity for Iridium's Certus satcom service. Thales FlytLINK, the Iridium Certus-based terminal and antenna, will be available for customer delivery in the first half of 2020. The terminals and Iridium Certus connectivity services can be utilized by business jets, airliners, rotorcraft, general aviation and military aircraft, and drones.

Thales will begin delivering FlytLINK terminals and antennas to customers in the first half of 2020, being first to market with an Iridium Certus aviation system capable of 352 Kbps transmit and 704 Kbps receive speeds using the L-band broadband platform. This includes a hybrid FlytLINK system that combines Iridium Certus capabilities with Iridium's traditional narrowband services, which will be available with its initial release. Its safety features include support for current and next-generation ATC systems, voice, ACARS and IP data up to 704 Kbps. It also supports electronic flight bag pairing, real-time weather, secure pilot and crew Wi-Fi access, and enhanced calling.

Viasat

Viasat's new high-speed connectivity packages for business aviation are designed to provide new and existing Ku-band customers the ability to upgrade their cabins with faster speeds and enhanced experiences across the world's most heavily traveled flight routes.

The new Viasat Ku Advanced packages increase speeds up to 10 Mbps (resulting in a doubling of speeds for most existing customers), rollover of unused data allowances, regional and hourly service plans, and the ability to stream audio and video content. Current and future Viasat business aviation customers are now able to upgrade to Viasat's Ka-band system using existing aircraft wiring.

Meanwhile, Viasat recently announced the availability of a government-focused terminal modification kit that will provide third-party terminal vendors with regional access to high-capacity satcom architectures, including hybrid, multi-network architectures, allowing users to easily roam among commercial and purpose-built military satcom networks. The mod kit is available for immediate purchase and testing by third-party terminal providers working with the U.S. Department of Defense and international coalition militaries.

VIASAT

Equipping your aircraft

The Viasat Aero Mobile Terminal is an integral part in bringing high-speed internet service to large cabin business jets. The terminal, comprised of a small antenna, modem, and antenna control unit, integrates into the aircraft's cabin network and communicates on our network of satellites.

Collectively, in partnerships and individually, the community of cabin connectivity providers (and users) continues to leverage technologies that were nonexistent only a few decades ago and have transformed business aviation forever. The choices are expanding rapidly — and can be daunting for those considering or seeking additional capabilities.

The primary consideration when evaluating cabin connectivity services should be which satcom and/or ground-based band(s) will best suit most, or even all, missions? Operators need to determine which services are available and affordable and whether they would satisfy those in back. Conferring with frequent passengers is essential to ensure that the flow between their aircraft and the networks is seamless and provides uninterrupted access to their high-throughput broadband applications. And, finally, don't hesitate to let the providers know when the connectivity you've bought isn't meeting your passengers' needs since satisfying them is what keeps the technology evolving and services expanding. BCA


Winter Edition
Now Available
to Order!
AircraftBluebook
PRINT & DIGITAL SUBSCRIPTIONS | APPRAISAL SERVICES | DATA LICENSING
CONVERSIONS &
MODIFICATIONS
SERIALIZATION
BY MODEL YEAR
MAINTENANCE PROGRAMS
NEXT GEN AVIONICS
TRUST
~~Know~~ the Value
For over 65 years, Aircraft Bluebook has been the industry's go-to source for reliable and accurate aircraft valuations, providing in-depth data and information to the global business and general aviation community.
AircraftBluebook
AVIATION WEEK
NETWORK
Visit aircraftbluebook.com for more info.

JAMES ALBRIGHT/BCA

The Connected Cockpit

Is inflight internet access a **safety tool or a hazard?**

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

When we bought our current airplane, just over 10 years ago, I had a decision to make that I'd never faced previously: Do we want access to the internet? Back then, the system of choice was expensive and slow, but since it would be useful for email and limited downloads, it was still worth considering. Interestingly, the passengers were strongly opposed. They regarded the airplane as their refuge from the world and a chance to unplug for several hours. While it would have been nice for we pilots to download weather products and flight plans, the system was so sluggish as to be of limited use. So, I decided against any internet access at all.

During the decade that followed, I heard from my more "connected" peers about pilots who quickly bring up social media accounts just a few minutes after the wheels are in the well. Some started out saying the internet was for flight-related purposes only, then they added access to online aviation magazines — that's flight related, isn't it? — and then came an aviation flick or two. After all, if "The Right Stuff" isn't aviation related, what is? A contract pilot friend of mine tells me of a pilot who became so engrossed in a "flight-related" video game, he was surprised by his aircraft's top of descent chime. As the years went on, I felt my original decision was vindicated. But I also realized there were times when having that internet connection would have saved me a last-minute divert or could have rescued us from an hours-long ATC delay.

Even crews with the best of internet intentions may end up as passengers in the cockpit.

And now that we are about to take delivery of another new airplane, I was faced with the same internet question. The passengers still wanted refuge from the connected world and the new systems were still very expensive, but the capability of the new equipment has improved dramatically. Not only can we now rapidly download weather and flight plans, but we can also view nearly real-time weather radar animations. Most of the aviation world has embraced the internet allowing us to negotiate slot times, adjust ETAs, arrange destination support, get maintenance help and do just about anything from the air that was once reserved for before takeoff or after landing. So, my decision this time was different. We will have broadband internet access in our new cockpit. The only thing left to do about that was to come up with a policy to avoid all those horror stories involving pilots disconnecting from their airplane as they connect to the World Wide Web.

The Regs

Relevant U.S. Federal Regulations point only to 14 CFR 121.542(d), which says "no flight crewmember may use, nor may any pilot in command permit the use of, a personal wireless communications device (as defined in 49 U.S.C. 44732(d)) or laptop computer while at a flight crewmember duty station unless the purpose is directly related to operation of the aircraft, or for emergency, safety-related or employment-related communications, in accordance with air carrier procedures approved by the administrator." This doesn't apply to us in the non-Part 121 world, but what about using a company-provided "non-personal" device or something you could broadly classify as a "non-communications device."

The FAA clarifies the prohibition in Vol. 79, No. 29 of the Federal Register (Feb. 12, 2014): The final rule does not require an "ownership" test regarding the laptop computer or personal wireless communications device. It doesn't matter who owns the device. The Federal Register also retains a broad category of included devices because a list of specific devices would ignore the reality of evolving technology. This broad category includes, but is not limited to, devices such as cellphones, smartphones, personal digital assistants, tablets, e-readers, some (but not all) gaming systems, iPods and MP3 players, as well as netbooks and notebook computers.

It appears Part 121 crews are tightly restricted but the rest of us are not, unless we operators have come up with rules of our own. As a Part 91 operator, that responsibility fell on my shoulders. Advisory Circular 91.21-D, "Use of Portable Electronic Devices Aboard Aircraft," guides Part 91 operators on how to ensure these devices can be used but is silent on the subject of internet access. Should I restrict my crews (and myself) or should that mystical concept of "pilot judgment" be allowed to rule the day? When I don't know what to do, my first step is to find out what everyone else is doing.

A Non-Scientific Poll

Most of the flight departments that I asked rely on sound pilot judgment when deciding when the internet can be accessed in the cockpit and for what purposes. How's that working out? Many claim no problems, at least no problems worth noting. But many others admit things have gotten out of hand. Those flight departments with set SOPs usually recognize critical phases of flight and the nature of the internet browsing as key factors in the when and what questions. But these aren't the only factors.

Phases of flight. Most, but not all, SOPs recognized that internet browsing should be limited to non-critical phases of flight. Critical phases were usually defined as whenever below 10,000 ft. but sometimes included whenever the aircraft was in a climb or descent. While no canvassed operator included it, I thought I might consider short versus long flights or oceanic versus non-oceanic flights when deciding for or against internet usage.

Permissible Uses. Everyone I asked agreed that using the internet for weather, air traffic delay information and other flight-related needs was acceptable. Some operators specified that "flight-related" meant pertaining only to that particular flight. Many allowed crewmembers to check personal email, but some restricted this to just a few minutes each hour. (One operator scheduled this so one pilot checks at the top of the hour, the other at the bottom.) Social media usage was specifically banned by some but not mentioned at all by others. A few specifically allowed pilots to use the internet to do a brief check of the news and sports. Those without any kind of internet policy admitted that some pilots would watch entire games or spend hours browsing on subjects completely unrelated to the flight in progress.

Most of the SOPs seem to deal with holding costs down more than reducing cockpit distractions. Streaming video is an obvious way to up the monthly charges, but other, more insidious expenses often play as big a role. One company found that its passengers were allowing software updates and other downloads that didn't need to be done from 35,000 ft. Their typical passenger was boarding with three internet devices, each serving to monopolize the bandwidth, especially if an automatic company or device update was in progress. Although cabin SOP to reduce monthly charges is certainly useful, what I needed was an internet SOP for the cockpit crew.

The most complete SOP I found for internet usage by pilots is a hybrid approach that gives wide latitude during non-critical phases of flight but permits only flight-related activities otherwise:

"On aircraft equipped with inflight internet, flight crews must not allow the internet to become a distraction. Crews may connect their internet-enabled devices and may use the internet. Crew devices must not be utilized during any portion of a climb or descent unless they are being used for flight-critical functions such as checking weather, NOTAMs, etc. In these situations, one crewmember must be heads up and dedicated to monitoring the aircraft. Playing games, watching movies or similar distracting activities are never authorized during climb, cruise or descent."

When this policy was instituted a pilot asked about reading internet websites and was told only aviation-related websites were permitted. The pilot then cheekily commented that, "It is OK to be distracted as long as you were reading an article about removing distractions in the cockpit."

I came away from this investigation wondering why there haven't been any aviation accidents due to this kind of "distracted driving" that is illegal on the streets and highways of many states. I set out to prove a case against inflight internet browsing using the many, many aviation accidents that surely happened as a result of pilots distracted by a phone, iPad or other connected device.

Accidents: Real and Imagined

That list of many, many accidents turned out to contain just one. There must be more, but I found only one. On Aug. 26, 2011, a Eurocopter AS350 B2, operating under Part 135, impacted terrain following an engine failure near the airport in Mosby, Missouri. The helicopter experienced fuel exhaustion because the pilot departed without ensuring that the aircraft had an adequate supply of Jet-A. The investigation determined that the pilot engaged in frequent personal texting, both before and during the accident flight. He, the flight nurse, flight paramedic and patient were all killed as a result.

An addendum to that list might be the Oct. 21, 2009, flight of a Northwest Airlines Airbus A320 that continued on past Minneapolis-St. Paul International Airport (KMSP), its intended terminus. Early speculation was that both pilots fell asleep, but the NTSB later determined that they were using their laptop computers while discussing the airline's crew scheduling process. The NTSB report concluded, "The computers not only restricted the pilots' direct visual scan of all cockpit instruments but also further focused their attention on non-operational issues, contributing to a reduction in their monitoring activities, loss of situational awareness and lack of awareness of the passage of time." They were only alerted to their situation when a flight attendant asked about their arrival time.

Although there has only been a single reported accident involving internet distraction, I suspected there have been many close calls. Yet a scan of thousands of NASA's Aviation Safety Reporting System (ASRS) reports turned up only 243 incidents containing the word "internet" and of those only five involved distractions. And of those, three involved air traffic control towers or centers. The two pilot reports were both of captains complaining about their first officers.

Since there has been only one solitary accident from texting, cellphone use or internet access, should we conclude the risk is negligible? Or have we just been lucky all these years?

Internet Temptations

I've noticed a common theme among many cockpit internet users: Once allowed a limited number of acceptable uses, they gradually so expand the list that any limit becomes meaningless. I am worried about seeing this happen in my flight department because so many aviators I thought impervious to temptation have succumbed. The list of legitimate internet uses is a slippery slope indeed:

(1) Email and texts. It can't hurt to check now and then, especially considering many of these are work related. A message from a family member might be urgent. Or there may be a job opening you've been working on. Opportunity, they say, only knocks once.

(2) News. Wouldn't it be useful to know the president is showing up at or near your destination at about the same time? Indeed, there is a lot of news that can impact the success of your trip: blackouts, floods, earthquakes and forest fires, to name just a few. News can affect your livelihood as well. Just because you are flying doesn't mean your stock portfolio needs to suffer.

(3) Personal self-development. Some call it surfing and others call it browsing. Perhaps we can call it education. Why not spend those idle hours at altitude learning to be a better pilot? There are lots of good aviation websites and "e-zines" ready for that very purpose. Who couldn't benefit from a how-to in the most recent bow hunting magazine?

(4) Entertainment. A happy pilot is a safe pilot, everyone knows. (If they don't know that, they should.) As aviators we are professional multi-taskers and switching between a 4 DVD set of "Godfather" movies and your oceanic crossing post position plotting is child's play for any seasoned international pilot.

I am still a few months away from delivery of my new airplane, equipped with Ka-band high-speed internet. I am told we will be able to download a complete weather package with satellite imagery just as easily as we can stream the latest blockbuster from Hollywood. My initial attitude is to forbid anything remotely connected to entertainment or personal communications while in flight. But so many others have felt this way when starting out on the cockpit information superhighway and have given in. Will I be next?

Advantages of Cockpit Internet

The pilots of my flight department were starting to suspect that I had already made a decision about internet usage, focusing only on the negative. On our last flight to Europe my cockpit partner wondered out loud how nice it would be to have real-time weather for the Continent. Flying from Florida to the Northeast, he wondered aloud about ground stops in the New York area. His hints were obvious, of course. But they had the intended effect. I needed to explore the pluses as well as the minuses.

JAMES ALBRIGHT/BCA

Gulfstream G500 pilot Steve Testerman updates Equal Time Point airport weather during an oceanic crossing, using an internet connection and the ForeFlight application.

Our flight department is paperless: each pilot has an iPad with an international cellular account and we don't spare expenses when it comes to quality applications. There are a number of apps that we use during flight that would be even more useful if connected to the internet. We also use several websites that are only accessible with an active internet connection.

ARINCDirect. We do all of our flight planning through Collins' ARINCDirect application. The company's iPad app gives us access to updated winds, turbulence and icing reports; destination weather reports; updated NOTAMs; flight hazards; TFRs; and other reports we normally get before departure but never while en route. Having all of this real-time information can be a useful decision-making tool.

ForeFlight. Our favorite weather tool is the suite of imagery available in ForeFlight. Here you will find just about everything available in the U.S. government-provided weather sites, but they seem to download more quickly and getting to the page you want is easier. Weather charts are available for most of the Americas, Europe, the Atlantic and the Pacific.

MyRadar NOAA Weather Radar. If you are tracking a system along your flight path or at your destination, the MyRadar app is a good one to keep open because it updates quickly and the continuous loop gives a good sense of what the weather is doing and how it is moving.

Turbulence Forecast. This app is our "go to" source of U.S. turbulence information. The information is available in some of the other applications, but this is a quick way to get it, if that is all you want.

We normally update these applications prior to engine start, so as to have the most recent information. We also use a number of internet websites that are only available to us through our cellular connections; they are inaccessible in flight without an internet connection. We frequently check **http://www.faa.gov** for airport status and delays. And when things in the national airspace get really messy, we check **http://www.fly.faa.gov/ois/**

GREG BONGIORNO

A Gulfstream G450 pilot accesses faa.gov website while inflight to check Teterboro delays.

for any ground stops or airspace flow programs.

I was starting to soften on the subject of internet access, thinking maybe a very strict policy of only using a specified list of applications and websites might do the trick. On our way back from Europe last month I noticed the other pilot nod off once and I have to admit I felt the urge as well. We got a "Resume Normal Speed" message through data link, a first for us both, and that set off a mad scramble through our available resources to find out what it meant. Once we landed, I quickly found out — using the internet — that the ICAO EUR/NAT office had just released a new Ops Bulletin allowing "Operations Without an Assigned Fixed Speed (OWAFS) in the NAT." (If you haven't heard of OWAFS, check out NAT OPS Bulletin 2019_001.)

Thinking about the flight, I realized that with an internet connection we could have taken advantage of the resume normal speed message. But I also realized that our bout of sleepiness was instantly cured by the task at hand. Having something engaging to do solved any drowsiness for the remainder of the flight. I remember more than a few oceanic crossings when the urge to nod off was cured by having an interesting discussion topic come up. Perhaps there was something to be said for allowing other types of internet access.

Our Cockpit Internet SOP

Our team concluded that we should take advantage of the great situational awareness afforded by having internet access in the cockpit, as well as the ability to keep pilots from nodding off on those long oceanic trips. But we needed to avoid the distractions caused by keeping connected with email, text messages, sports, news and all other things pulling our brains out of the cockpit. We mulled this over and came up with our first cockpit internet SOP:

(1) Two types of cockpit internet usage are permitted: flight-related and non-flight related. Flight-related usage pertains to internet access that has a direct bearing on the trip currently in progress. This category includes downloading weather products, making passenger arrangements, adjusting subsequent flight plans or anything needed to assure the success of the current trip. Everything else, even if tied to company business or aviation, is considered non-flight related.

(2) No internet access is permitted during critical phases of flight, which we defined as any flight time below 10,000 ft. (except while in cruise flight with the autopilot engaged), or whenever within 1,000 ft. of a level-off, even above 10,000 ft.

(3) Non-flight-related internet access is only permitted during flights with more than 1 hr. in cruise flight, and is limited to 5 min. continuous time per pilot each hour.

(4) Any internet access (flight- or non-flight-related) can only be made by one pilot at a time and will be treated as if that pilot was absent from the flight deck. Before "departing," the pilot flying (PF) will give a situational awareness briefing. For example: "The autopilot is engaged using long-range navigation. We are in cruise condition talking to New York center. You are cleared off." Upon completion, the PF will again brief the returning pilot, *e.g.*: "There have been no changes to aircraft configuration or navigation, but we are now talking to Boston Center and have been given a pilot's discretion descent to flight level three two zero."

(5) All internet-capable devices will be placed in "airplane mode" prior to engine start and will remain so until after engine shutdown. Audible notifications will be silenced for the duration of the flight. Pilots will ensure devices are not allowed to download software updates that may restrict internet bandwidth needed by the passengers or flight-related cockpit use.

(6) Crews will add a discussion of cockpit distractions to each day's post-flight critique. Our traditional "What's the DEAL?" check will become the "Were we IDEAL?" check:

I — Internet and other distractions: Did we live up to our SOP?

D — Departure: How did everything go from planning to wheels in the well?

E — En route: How was the en route portion?

A — Arrival: How did we handle the approach, landing and shutdown?

L — Logbook: Was there anything to report as far as maintenance or other record-keeping requirements?

So, the deed is done. We created our first cockpit internet SOP just in time to receive our new airplane. Not every flight department is this proactive. But even those that start with a well-intentioned internet SOP soon seem to abandon it because the lure of connectedness is too great. I hope to avoid this and have come up with a way to give us a "reality check" after we've grown accustomed to our new connected cockpit lives. We'll add inflight internet usage as a topic to our quarterly safety meetings.

In addition, I've asked each pilot to come up with a list of safety of flight risks that we "promise" to avoid. I'll put these in a sealed envelope and one year after delivery we'll see how we made out. I am hoping those risks remain avoided. If not, we may have to rethink all of this. **BCA**

Stall by Surprise

Your aircraft's **critical angle of attack** may **not be or behave as you believe**

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

Angle of attack (AOA) is an important parameter to an aircraft's performance, stability and control. A wing has a limited range of AOA in which to function efficiently, and going beyond those limits has negative consequences.

Ground school during the primary stages of pilot training imbeds the concept that a wing always stalls at the same angle regardless of the airplane's speed and pitch attitude. In truth, a wing's critical AOA is affected by a number of other factors, sometimes surprising even professional flight crews when their aircraft stalls at an angle far below normal.

On June 28, 2002, a Saab 340B departed Sydney on a 35-min. flight to Bathurst, New South Wales, Australia. At the controls were a pilot in command (PIC) with nearly 10,000 total flight hours, with 1,939 hr. in type, and a second in command (SIC) with 6,620 total flight hours of which 1,451 hr. were in the twin commuter. They were flying their sixth leg of the day.

The area forecast indicated the freezing level would be near 4,000 ft. and that moderate icing conditions could be expected in clouds above that. The forecast for Bathurst included snow showers, a surface temperature of 2C, a broken ceiling of 800 ft. and southwesterly winds gusting to 28 kt., necessitating a circling approach that night.

The pilot was flying the aircraft on autopilot and during descent from 12,000 ft., entered clouds several times before reaching the initial approach altitude of 5,700 ft., then continued down to 3,810 ft., the minimum descent altitude for the GPS approach. The pilots observed ice accumulating on the windshield wipers but not on the wings' leading edges. However, due to conflicting information among the SOPs, airplane flight manual (AFM) and the aircraft operating manual (AOM), the crew activated the engine anti-ice system but not the prop deice or deice boots on the wing and tail leading edges.

A circling approach at night and in icing conditions comprised a triple threat. To make matters worse, the GPS approach was quite steep, so even with the flaps extended to 20 deg., landing gear extended and the torque reduced to flight idle, the aircraft arrived at MDA traveling significantly faster than the normal 130-kt. circling speed. The PIC left the power levers at idle to begin slowing to the appropriate speed while beginning a right-hand turn to track downwind for Runway 17. The SIC pointed out that the airspeed had begun to decay below target speed, and as the PIC added power and began to roll out of the right turn, the aircraft suddenly rolled left past the vertical and pitched nose-down without warning.

The FDR recorded the AOA at 9.5 deg. at the moment, far below the normal critical angle for the wing. Normally the stick shaker wouldn't activate until 13.1 deg. AOA to warn the pilots of an impending stall. Why the sudden and abrupt stall? The


ALEXANDRA IAKOVLEVA /ISTOCK

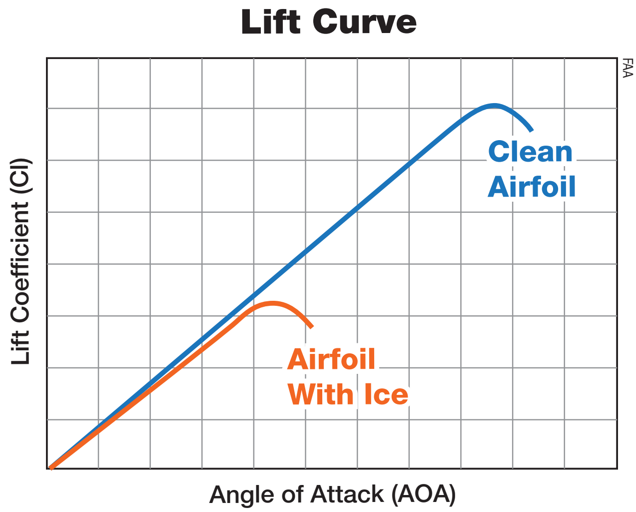
wing leading edges were contaminated with a relatively small but aerodynamically significant 0.5-in. layer of ice and that is what caused the left wing to stall so prematurely.

The PIC overpowered the autopilot, aided no doubt by the adrenaline surging through his veins, and rolled the aircraft back from 109-deg. left bank to approximately 35 deg. At that point the right wing stalled, rolling the aircraft to about 56-deg. right-wing down. According to the Australian Transport Safety Bureau's Air Safety Investigation Report 200203074, as the aircraft passed through 688 ft. AGL, its pitch attitude was 19-deg. nose down! The PIC then rolled the aircraft to a wings-level attitude, increased power to 100% torque, applied nose-up pitch inputs and the crew recovered the aircraft from what might have been disaster.

During its investigation of the incident, Australian authorities quickly found five other Saab 340 incidents involving trace to light amounts of icing leading to premature stalls with little or no warning to flight crews.

One of the effects of airfoil contamination is a reduction in the critical AOA. If a flight crew unintentionally allows the AOA to reach this contamination-induced critical angle, the first obvious sign to the flight crew can be an abrupt uncommanded roll, buffet or other aerodynamic cues without stick-shaker activation. Data collected from a British Aerospace ATP that was involved in an icing upset in 1991 determined that the ice-induced stall occurred at about 140 kt., compared with a normal stall speed of about 110 kt.

According to George Bershinsky, pilot of the University of Wyoming's King Air being used in icing research for the National Center for Atmospheric Research (NCAR), "less than 1/16th inch of icing can reduce a wing's lift by 25%. This little is sometimes hard to see, but the stall speed increases by around 20%."



Notice that an airfoil contaminated by ice suffers a severe reduction in the critical angle of attack as well as a large reduction in its maximum lift ability.

It is important to realize that the wing's critical angle of attack may change with no apparent visual, tactile or performance cues associated with a contaminated condition. In many of the ice-induced accidents and the inflight icing research conducted by agencies such as NASA-Glenn and the NCAR, the airplane provided no advanced warning to these experienced engineering test pilots. NCAR test pilots have noted airplane response and kinesthetic cues to an ice-related stall can be substantially different from those in simulator training scenarios. Given this information, it shouldn't be surprising that there have been accidents in which the stall and upset occurred prior to stick-shaker activation in ice-contaminated airplanes.

When you think of airfoil contamination, frost and ice come immediately to mind. But what about rain? Might it affect a wing's boundary layer enough to cause a premature stall? Dr. John Hansman, professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology (MIT), is among the select group of researchers who have studied the performance of airfoils in a "heavy rain" environment. His research, along with that of several dozen other highly respected scientists in this specialized area of boundary layer aerodynamics, identifies two mechanisms, a "splash-back" effect and a roughened airfoil surface, that contribute to a degradation of the boundary layer. As raindrops strike an airfoil, they form an "ejecta fog" of splashed-back droplets. These rob momentum from the air particles in the boundary layer, or more simply, slow the airflow. (The rainfall rates to create this effect exist in severe downbursts.)

Dr. James Valentine, a fluid dynamicist whose work has been recognized by the National Research Council's Transportation Research Board, found that a thin water film forms on the airfoil surface by the fraction of the raindrop that is not splashed back. The raindrops form small impact craters and surface waves in the water film, which roughens the airfoil surface.

So, as with ice and frost, this creates additional surface friction on the boundary layer, with the net effect of loss of lift, increase in drag and a premature separation of the boundary layer, all of which compromise an airfoil's performance. A typical airfoil experiences a decrease in maximum lift of up to 18%, a drag increase of up to 40% and, perhaps most importantly, a decrease in stall AOA of up to 8 deg. An "average" airfoil typically stalls around 17 deg., thus one with a contaminated surface could stall at just 9 deg. AOA.

During a microburst/wind-shear recovery procedure, the goal for the pilot is to attain the maximum possible lift without proceeding into a stall. This is why many aircraft wind-shear recovery procedures recommend the pilot pitch the aircraft to a fairly significant attitude, while also "respecting the stick shaker." However, this procedure is based on a dry and uncontaminated airfoil's performance curve.

With that in mind, assume the airfoil on your wing typically stalls around 17 deg. AOA and during a wind-shear recovery procedure, ideally you are just shy of that — say, 16 deg. Now, if the airfoil is contaminated by a heavy rain encounter in a "wet" microburst and you apply the wind-shear recovery technique to arrest the alarming sink rate, that airfoil is deep into the stall at 16 deg. AOA. So, you've actually worsened the aircraft's ability to "max perform" in that situation.

Meanwhile, stall warning systems do not provide accurate, preemptive stall warning indications when the wing is contaminated. This isn't the fault of the manufacturers. There currently is no accurate method to detect the surface condition of a wing and accurately predict the behavior of the boundary layer under that exact condition. (See "Limited Measures" sidebar.)

A wing's critical AOA is substantially changed during transonic flight with the presence of Mach waves, as discussed extensively in "Low-Speed Buffet" (*BCA,* September 2018). A flight test project conducted by the National Research Council of Canada and presented at the 24th International Congress of the Aeronautical Sciences used a highly swept-wing high-speed business jet to conduct low-speed buffet testing. At an altitude of approximately 13,000 ft. and an aircraft weight of 29,270 lb., the buffet onset AOA occurred at 16.84 deg. By contrast, when flying straight and level flight at FL 450 and 31,000 lb., the buffet onset AOA was 6.95 deg. — a difference of almost 10 deg.

Consider cruising your aircraft at FL 340 and Mach 0.55 and you roll into a turn. The additional AOA required to maintain altitude causes the airflow to accelerate markedly over the leading edge to the point where a strong Mach wave is created just behind the leading edge. The associated strong pressure gradient causes a separated boundary layer immediately behind the Mach wave, leading to buffet. The aircraft utilized in the Canadian research project in this maneuver demonstrated buffet onset at 8.5-deg. AOA.

The air is even thinner at FL 450, which means an aircraft needs to fly even faster and/or at a higher AOA to produce sufficient lift. In the Canadian flight test program, as the airplane slowed to Mach 0.65, the buffet occurred at 6.95 deg. This was an even lower buffet AOA than was experienced at FL 340. The buffet onset AOA varies inversely with the Mach number, meaning that the higher the Mach numbers, the onset of buffet occurs at lower AOAs. This also means that the airspeed for low-speed buffet increases with altitude.

Most business aircraft depend upon high-lift devices for takeoff and landing. The deployment of trailing-edge flaps, leading-edge devices and spoilers will change the airfoil's critical AOA. As trailing-edge flaps are extended, the camber (and depending on flap design, the wing area) is increased. Although the amount of maximum lift is increased, the critical AOA is decreased because the airflow separates earlier. Even though trailing-edge flaps provide increases in the airfoil's maximum lift, their use markedly decreases the critical AOA.

However, airflow separation is delayed by Krueger flaps and slats, allowing a substantial increase in the critical AOA, and thus provide a better margin over the stall when deployed.

Note, that if you fly an aircraft equipped with both trailing- and leading-edge high-lift devices and experience a hydraulic failure that prevents their normal deployment, the backup extension system often puts priority on extending the leading-edge devices because of the added AOA margin they provide.

The tragic loss of a Gulfstream G650 and its crew during flight testing at Roswell, New Mexico, on April 2, 2011, highlighted some of the negative effects on critical AOA when in ground effect. The experimental aircraft was conducting a planned one-engine-inoperative (OEI) takeoff when a stall on

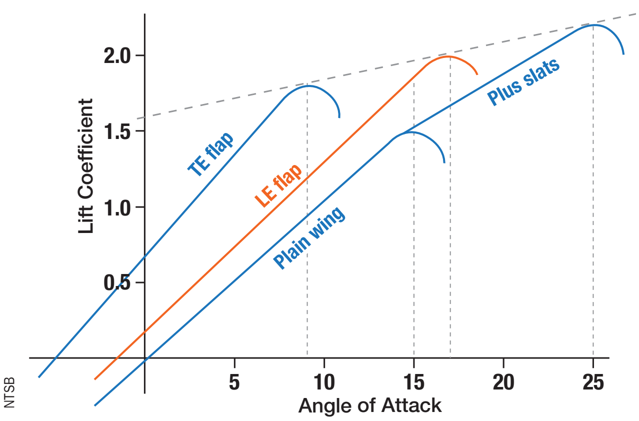
Propwash Effects

If your aircraft has wing-mounted propellers, you might wonder if the airflow behind them has any influence on the wing's aerodynamics. The simple answer is yes, most definitely.

At high engine power, the air moving through the props is accelerated in order to produce thrust. This also increases the local velocity of air flowing over the parts of the wing behind the propellers, generating more lift and reducing the angle of attack (AOA). While turboprop airplanes are generally more tolerant to low airspeed because of the powered lift produced, be aware that stall warning is based on the AOA with the engine at idle. This results in an increased margin above the stall angle.

However, when combined with an engine failure, this margin disappears and the airplane can stall and roll abruptly due to the resulting lift asymmetry. In a one-engine-inoperative condition during takeoff, airplane controllability and climb performance capability are based on the assumption the propeller of the failed engine is feathered and the airspeed is maintained at or above the minimum airspeeds defined in the AFM.

The consequences of attempting to fly at airspeeds below AFM minimum speeds (V_2 or Vga) at high power will be reduced control effectiveness and the potential for a very abrupt stall in the event the stall AOA is exceeded or engine power is lost. As a consequence, turboprop pilots must adhere to the applicable minimum speeds to avoid inadvertently allowing the airplane to slow to airspeeds below published stall speeds. BCA

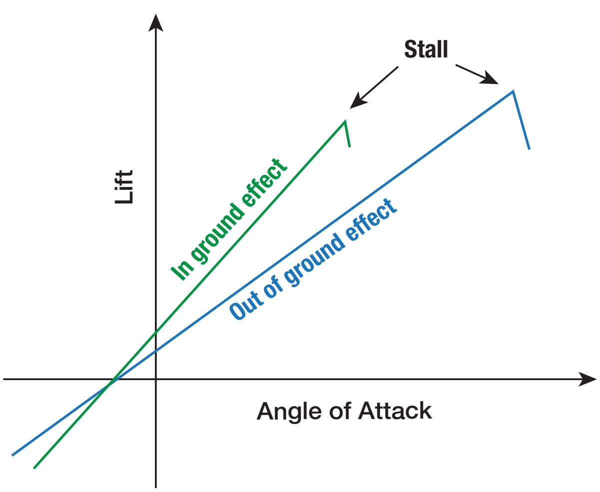


The plain wing in this graph has a critical angle of attack at 15 deg. Extension of trailing-edge flaps reduces the critical AOA to 9 deg. In contrast, extension of leading-edge flaps on this wing would increase the critical AOA 17 deg.

the right outboard wing produced a rolling moment that the highly experienced flight test crew was unable to control. The right wingtip contacted the runway, and the aircraft departed the right side of the runway and struck a concrete structure and airport weather station, destroying the aircraft and killing those within. The NTSB found that the airplane had stalled and its report highlighted some common misconceptions and misunderstandings about ground effect.

When an aircraft is close to the ground, negative changes occur to its aerodynamics, which especially affect swept-wing jets. This is particularly the case during the landing flare and takeoff rotation when the aircraft is at a precarious energy state with very little margin for error. As a swept-wing aircraft is rotated, the wingtips are momentarily closer to the runway, changing the airflow significantly, further increasing the negative effects of ground effect.

This figure shows the differences in a wing's lift as a function of angle of attack. Notice that the stall AOA for a wing in ground effect occurs at a lower AOA, and the maximum lift of the wing is also reduced.



Credit: NTSB, accident report of Gulfstream G650, Roswell, New Mexico, April 2, 2011

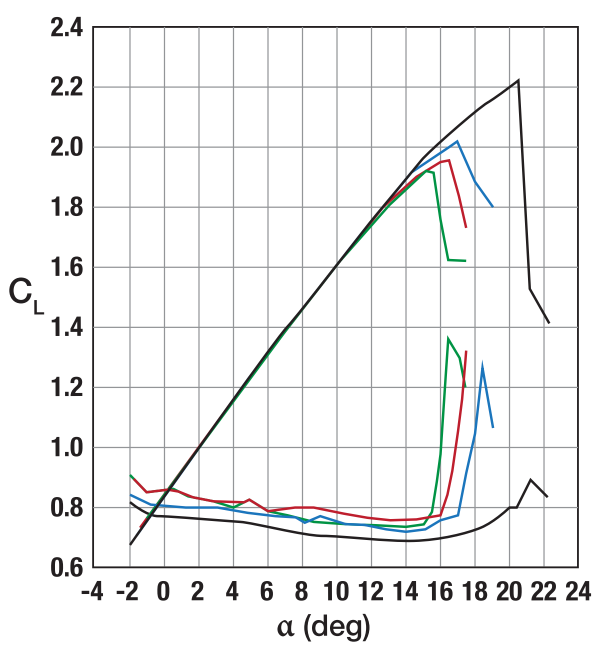
The NTSB's John O'Callaghan, a national resource specialist in aircraft performance, noted that the stall of all types of aircraft occurs approximately 2-4 deg. AOA lower with its wheels on the ground. The flight test reports noted "post-stall roll-off is abrupt and will saturate lateral control power."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

Be advised that the AOA gauge should not be used as a direct indication of the wing's condition during takeoff. Ground effect and crosswinds will affect the AOA sensor reading. It will not provide valid information until the aircraft is airborne and at a sufficient altitude.

On a day in which falling precipitation necessitates the need for anti-icing fluids, an application is meant to keep the wing from suffering the substantial loss of lift from surface contamination. This does not mean that a deiced wing coated with a layer of anti-icing fluid is without performance degradation. According to a study by NASA Glenn Research Center and the National Research Council of Canada, the application of anti-icing fluids has a significant negative effect on aerodynamic performance. The study discovered the stall angle was reduced to 15 deg. compared to the clean value of 20 deg. (reference: Andy Broeren of NASA Glenn, Sam Lee of Vantage Partners, Catherine Clark of NRC Canada. "Aerodynamic Characterization of a Thin, High-Performance Airfoil for Use in Ground Fluids Testing." Fifth AIAA Atmospheric and Space Environments Conference, Fluid Dynamics and Co-located Conferences, AIAA 2013-2933).

Crosswinds can likewise create a stall at a lower AOA.

The upper lines represent the airfoil's lift production vs. angle of attack, and the lower curve is the pitching moment of the airfoil vs. AOA. The black upper line exhibits classic leading-edge stall behavior of a clean airfoil at 20 deg. The blue and green lines indicate tests mimicking anti-icing fluid application. The stall AOA is reduced to 15.3 deg. by the fluids.



Credit: Andy Broeren of NASA Glenn, Sam Lee of Vantage Partners, Catherine Clark of NRC Canada. "Aerodynamic Characterization of a Thin, High-Performance Airfoil for Use in Ground Fluids Testing." Fifth AIAA Atmospheric and Space Environments Conference, Fluid Dynamics and Co-located Conferences, (AIAA 2013-2933).

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.

For example, a crosswind from the right effectively increases the sweep of the left wing and reduces the sweep of the right wing. Clinton E. Tanner, Bombardier's senior technical advisor in flight sciences, cites flight test results showing that sideslip reduces the stall AOA of the left wing by up to 3.5 deg. when it experiences a sideslip of 20 deg. Large rudder applications during a highly dynamic stall event will also generate high sideslip angles. Either of these conditions may result in asymmetric stall of the downwind wing.

Tanner is concerned about the combined effects of anti-icing fluids, ground effect and crosswinds on lowering the overall margin of safety during takeoffs. Given the very real possibility that the negative influence of ground effect, crosswinds and deicing fluids have an additive effect on the reduction in stall AOA, the margins over an actual aerodynamic stall during a takeoff decrease. The possibility of an aircraft encountering an actual aerodynamic stall is real, and particularly without aerodynamic warning.

Incidentally, during preflight inspections you should examine the condition of the aerodynamic seals on your wing, particularly on "hard wing" regional and business jets. Deteriorated aerodynamic seals, especially those near the leading edge of the wing, cause a significant loss in the maximum lift of a wing as well as decrease the stall AOA. Is your aircraft allowed to operate with deteriorated wing seals? It depends. The MEL or the CDL for your aircraft might contain relief for minor wing seal protrusion and deterioration.

If you fly an aircraft with a TKS system be aware that

FAA

The wing sealant along this CRJ's leading edge shows clear signs of deterioration and protrusion into the boundary layer. The aircraft's Configuration Deviation List contains a "weight penalty" to be applied to takeoff due to the lessened lift created by the negative effect on the wing's boundary layer.

Limited Measures

A wing's true angle of attack (AOA) is unknown; it can only be estimated by a measuring device mounted on the airplane somewhere. Furthermore, these devices have inherent errors that must be addressed.

Many aircraft have stall sensors mounted on the fuselage to reduce the effects of changes in wing configuration. Nearer to the aircraft's nose, the airflow is cleaner and the boundary layer is thin, minimizing the required probe height. But the angle of airflow around the nose is not the same as at the wing. Nose landing-gear doors will influence the airflow near the sensor. While pitching the nose up, the local flow angle is reduced, causing the reading to be too low. Errors can be significant at sideslip angles that may occur during short final approaches or with an engine out.

According to John P. Dow Sr., a consultant in aircraft certification and icing, the reasons the systems fail to provide accurate, pre-emptive stall warning indications in icing conditions are several.

"There are an infinite variety of shapes, thicknesses and textures of ice that can accrete at various locations on the airfoil," he explains. "Each ice shape essentially produces a new airfoil with unique lift, drag, stall angle and pitching moment characteristics that are different from the host airfoil and from other ice shapes. There is a range of effects from these shapes. Some effects are relatively benign and are almost indistinguishable from the host airfoil. Others may alter the aerodynamic characteristics so drastically that all or part of the airfoil stalls suddenly and without warning. Sometimes the difference in ice accretion between a benign shape and a more hazardous shape appears relatively insignificant. There is no way for the pilot to know what the resulting stall AOA is at any given time."

Some stall warning systems are calibrated with reference to a dry, uncontaminated wing, while others, such as Safe Flight Instrument's Angle of Attack/Stall Warning System, incorporate dual modes — one for normal conditions and one for icing conditions. In normal mode, the stick shaker activation, AOA meter, AOA indexer and low airspeed awareness are all referenced to standard airplane stall speeds (think "dry uncontaminated airfoil"). In the Ice Mode, these are all referenced to the standard airplane stall speeds plus 5 kt. This is to account for residual airframe ice present during or after an icing encounter. In the air, the Ice Mode is activated in some aircraft when either or both engine anti-ice switches are ON. BCA removal of the TKS panels for maintenance requires extreme care for replacement to make certain that the panels are aligned with laser-like precision on the proper location along the leading edge of the wing.

Secondly, the adhesive used to reseal the TKS panel to the wing must not protrude above the metal edges. That seemingly miniscule protrusion of adhesive can negatively affect the wing's critical angle of attack. Good friends who were Non-Routine Flight Operations captains in TKS-equipped aircraft cite incidents in which the aircraft rolled to beyond 90 deg. of bank during post-maintenance test flights due to very slight misalignments of TKS panels after removal and reinstallation.

While on the topic of TKS panels, it is recommended that they be frequently operated even in the summer to keep the plastic supply tubes from cracking due to dryness as well as the micro-pores from clogging up. Astute colleagues who have paid close attention to the preflight of Hawker 800XP aircraft during aircraft acceptance checks have noted that TKS panels did not exude a proper distribution of TKS fluid during preflight checks. This would create a condition in which part of the wing would not be deiced or anti-iced in flight when the TKS system was applied, leading to a dangerous wing condition of an ice mass building up on a portion of the wing. At this point you have involuntarily become a test pilot with no certainty of the aerodynamic performance of your wing. (See "TKS Considerations" sidebar.)

If you learned to fly in light general aviation aircraft, you might have been exposed to the tactile indications of an aircraft nearing the critical angle of attack. However, many of the transport aircraft used by business flight departments do not provide tactile indications, a fact especially true for swept-wing aircraft or high-performance aircraft equipped with sharp leading-edge airfoils. Such aircraft are particularly prone to stalling abruptly without warning and are even more susceptible to aerodynamic performance degradation from airfoil frost, ice, anti-ice fluid, decaying aerodynamic seals and such near their leading edges.

A professional pilot must know an aircraft's aerodynamic limitations in all phases of flight, with varying flap conditions, from changes caused by environmental conditions, and must also be familiar with conditions that cause instruments to display misleading information. BCA

TKS Considerations

If you fly an aircraft with TKS, be aware that replacement of the system's panels after maintenance requires extreme care to ensure they're aligned precisely along the wings' leading edges. Additionally, the adhesive used to reseal them to the wing must not protrude above the metal edges since that seemingly miniscule error can negatively affect the wing's critical angle of attack. Good friends cite incidents in which their aircraft rolled to beyond 90 deg. of bank during post-maintenance test flights due to such slight misalignments.

Additionally, all TKS systems should be operated frequently in all seasons to prevent their plastic supply tubes from cracking due to dryness and to keep their micro-pores from clogging. During a preflight of a Hawker 800XP, some astute colleagues noted that the TKS panels did not exude a proper amount of fluid, a dangerous condition since that could result in an ice buildup on a wing section and significantly compromise its behavior.

Most important is the need to activate the TKS system when conditions warrant, as one crew discovered.

On May 4, 2006, a Hawker 800A had just come out of extensive maintenance and refurbishment, and two Raytheon test pilots, along with four passengers the company considered key to the activity, launched on the test flight. The first maneuver to be performed was a clean stall.

Prior to the flight, the crew calculated the stick-shaker activation speed, pusher speed and aerodynamic buffet speed at 115 kt., 107.5 kt. and 105.5 kt., respectively. The aircraft was level at 17,000 ft. MSL in eastern Nebraska with the autopilot in altitude and heading hold modes. But as the business jet slowed to approximately 126 kt., the right wing suddenly stalled, the nose dropped through the horizon and the aircraft rolled to the right in a near-vertical descent.

At that point, the twin jet entered a cloud layer and due to its extreme attitude the gyros tumbled, preventing the pilots from determining their aircraft's actual attitude until exiting the bottom of the layer. While in cloud, the aircraft continued to roll to the right for about three turns and then experienced a rapid reversal to the left, rolling two to three more times. When finally escaping the cloud base, the captain saw only ground through the windshield and immediately pulled back on the yoke, regaining control at approximately 7,000 ft. MSL. The crew declared an emergency, returned to the airport and made a no-flap landing.

The resulting investigation noted that the crew had difficulty in locating an area with visual conditions for their stall tests. Two of the passengers stated they had seen ice on the wing leading edges and the pilots said they had not activated the TKS system.

The aircraft flight manual states that prior to conducting intentional stalls, clouds should be at least 10,000 ft. below, the autopilot disengaged and, notably, the aircraft should be clear of icing conditions. However, company maintenance test flight procedures required the autopilot be engaged in order to verify autopilot disconnect at stick shaker prior to approving the aircraft's return to service. The AFM also specifically noted that all external airframe surfaces must be free of ice. BCA

E1000 Cleared for Takeoff

Long in coming, the **Epic turboprop finally earns its TC**

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

It took precisely 27 min. from the time that Epic Aircraft CEO Douglas King, company owner Vladislav Filev and 11 top Epic engineers arrived at the Seattle FAA Aircraft Certification Office at 9:00 a.m. on Wednesday, Nov. 6, 2019, to walk out with a freshly signed type certificate (TC) for the all-composite Epic E1000 single-engine turboprop.

Their collective sigh of relief just might have been heard 220 nm to the southeast at the firm's Bend, Oregon, headquarters. The Epic team had anticipated as much as 8 hr. of intense negotiations with the FAA might have been required to work through final certification issues before they could earn the TC.

As late as 7:30 p.m. the previous evening, it appeared that the Wednesday meeting might be yet another occasion during which regulators raised more questions, posed more challenges, and created more delays en route to earning final approval.

Only two days before the meeting, for instance, the FAA expressed concerns about non-destructive inspection test methods, immunity of the stall barrier system to high-intensity radiated fields and lightning, EICAS warning versus alert indications and interior night cockpit lighting. These last-minute pop-ups caught Epic engineers by surprise, as they had received Type Inspection Authorization in July 2019 after submitting more than 400,000 pages of detailed certification documents to the FAA. TIA historically has been the FAA's signal that TC can be expected with no major roadblocks.

No one was more elated on Wednesday than King, who in mid-2010 bought the then-bankrupt kitplane factory with four other investors for $4.3 million, naming it the Epic LT Builders Group. The group bought the firm partially to rescue their unassembled LT parts that had been seized as assets by the bankruptcy court. The last kitplane has now been completed and Epic LT has become Epic Flight Support, the MRO for all models.

"I was spending a lot of time in Bend,

Seven years and $200 million in the making, the $3.25 million Epic E1000 promises 325 KTAS cruise speed, 1,650 nm-range and four to five passengers/ full-fuel payload.

EPIC

working on my airplane and staying at the Comfort Inn," King recounted recently. "In September [2009], when Epic declared bankruptcy, I moved into the Comfort Inn and I've been here ever since. I don't think you can do something like this by remote control. You've got to be here."

Serious development of the E1000, the production model that evolved from the original kitplane, began in November 2012. King says the years-long struggle since then to earn the TC was the most difficult undertaking of his professional life. He has related the story many times, explaining how he originally just wanted to complete his Epic LT kitplane when the company went broke due to rampant corruption cloaked by shoddy accounting.

"This was my dream aircraft. And it was like somebody stealing my dream," King recalled. "Our goal was just to get the company turned around and cash flowing. Many people have said, 'You just wanted to finish your airplanes.' That's not true. I wouldn't have done it just to finish my airplane. It was a decision. If I were going to do it, I was going to do it to make a profit. And it's hard to make a profit in aviation. It was even harder in 2010.

"Then, I was the only one who worked here. I made a compelling argument that I should run it because I put in most of the money [60%] and didn't take a salary."

The kit airplane market is a small niche in general aviation, accounting for less than 10% of sales. It was especially hard hit during the Great Recession as potential kit builders channeled discretionary funds into other ventures. King, nonetheless, turned around the company by mid-2011. He raised LT kit prices to $2 million, convinced kit owners they'd be treated fairly and supported the kit fleet with technical assistance and spare parts. In the next four years, the revitalized company would succeed in manufacturing close to 50 Epic LT kits.

King could afford to work as an unpaid volunteer in his early years at Epic because he was financially self-sufficient, having built a comfortable cushion in banking and credit card software and systems in the 1990s. His years in the finance sector also baptized him into the deep sea of federal banking regulations that require skillful navigation and strict compliance to avoid running afoul of arcane statutes. Overcoming such federal regulatory challenges in banking later would prove valuable as he delved into complying with myriad federal aircraft certification regulations.

"Well, it mainly was figuring out the similarities and differences between Federal Aviation Regulations and Federal Banking Regulations, which I had a lot more experience with at the time," he said. "And, honestly, they're not that different. The manner in which you address them is not that different."

The complexities of aircraft certification quickly became apparent as King embarked upon morphing the LT into a certified aircraft. He knew a certificated production airplane had to be forthcoming if the company were not only to survive, but thrive. Hence, the E1000 was born.

King also was no stranger to the aviation industry. Prior to his assuming the left seat at Epic, he had run Syncro, a Van Nuys, California, business jet refurbishing company, specializing in Gulfstream and Learjet interiors. It was hit very hard in 2001, in the aftermath of 9/11.

FRED GEORGE

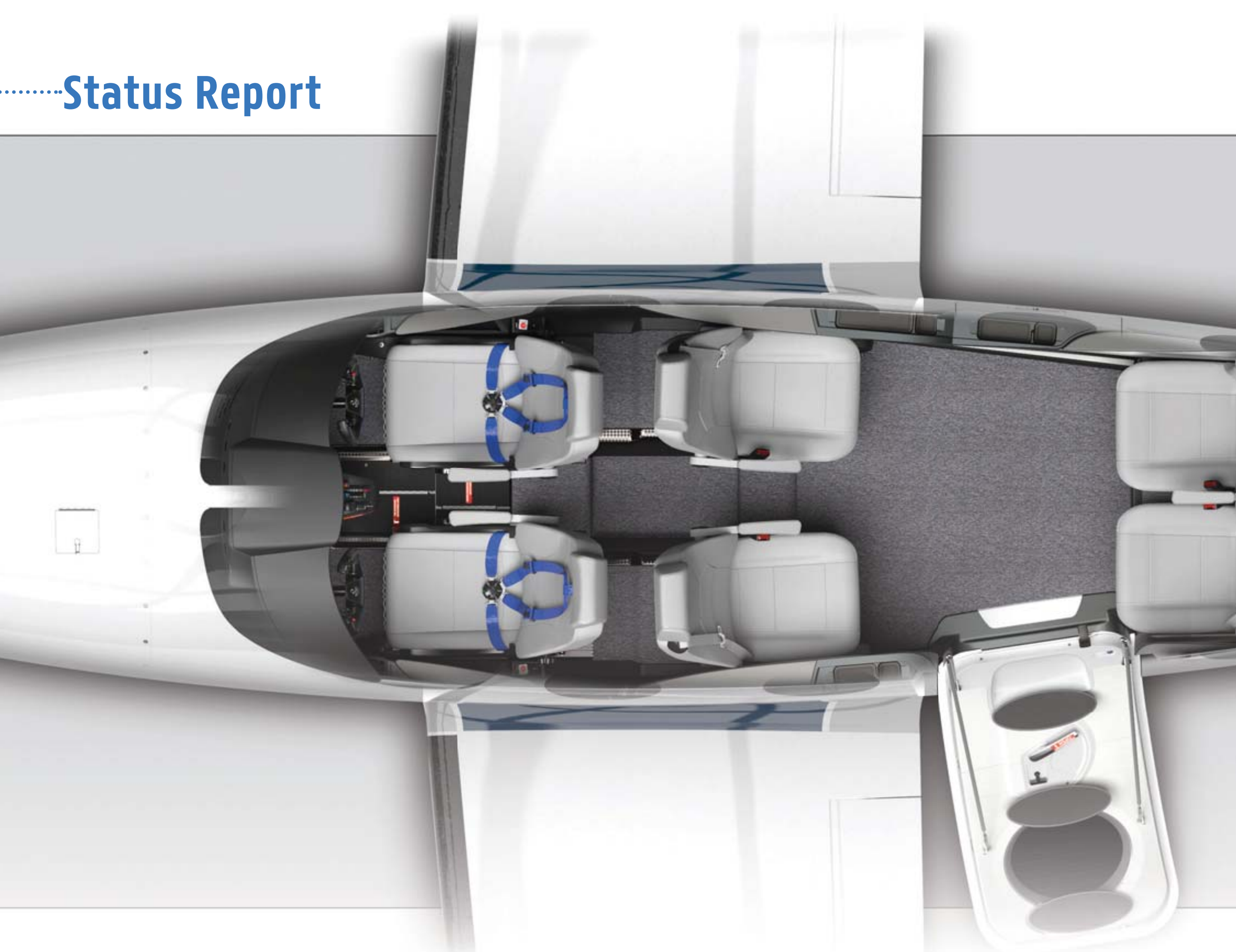
Doug King, Epic Aircraft CEO and Vladislav Filev, Epic Aircraft owner, celebrate FAA's awarding the type certificate for E1000 on Wednesday Nov. 6, 2019.

"Long story short, I came in to help them recapitalize the business, turned it around, got it going, made it profitable and I liked it, I liked being in aviation," he said. Goodbye plastic cards and electronic banking.

King says he's been an active, current private pilot since he was 17 when he earned his pilot's license as a high school student. He paid for flying lessons by scrubbing the bottoms of airplanes and later running an aircraft paint shop in Santa Maria, California. He had only flown piston singles until buying his Epic LT kit.

"Aviation is a much more technical business [than banking]. And I love that," King said. "I hired an IA [A&P with Inspection Authorization] to watch me overhaul the engine of my 182 myself. And I'd also done a top-end overhaul on it. I flew a lot of hours on that 182. So, for me, getting involved in the mechanical and technical aspects of airplanes is what I love to do."

King still has his Cessna Skylane. It's now used by Epic employees as a flying club airplane that they can fly for the price of gas. The company picks up the maintenance and the insurance.



Passion . . . and Money

The Epic LT Builders Group slowly rebuilt trust with customers, vendors and the FAA. Meanwhile, King kept searching for ways to propel the Epic E1000 to certification.

"I actually prepared a business plan for doing it, went around and talked to people who had worked on other certification programs. And I looked at 'How do you do this?' The dollar amount and time looked staggering to me. Nonetheless, I created a business plan with an aggressive goal in the form of time and money," King recalled. A skeleton crew of consulting engineers and technicians kept the program alive, but it was going nowhere.

All that was about to change in November 2011. At a New York cocktail lounge, Vladislav Filev, a passionate, long-time Russian private pilot, was enjoying an adult beverage with another aviation enthusiast. They talked about what model would be the ultimate owner-flown, high-performance aircraft. The American showed Filev a picture of the Epic LT in an aviation magazine. Intrigued, the Russian wanted to look at the airplane in person.

"Passion? It's really an illness," Filev said recently about his instant attraction to the Epic LT.

Filev had business in Los Angeles later in the week. So, he changed his itinerary and traveled to Bend to visit the Epic LT Builders Group. He met with King and went for a demo flight in King's Epic LT. With 1,200 shp and a light fuel load, the aircraft leaped off the Bend runway and climbed at more than 3,500 fpm. In less than an hour, Filev was hooked.

King had given dozens of demo flights to potential customers. "Who was this Vladislav Filev?" King asked. "He called me out of the blue. I didn't know what or who S7 was." King didn't know that Filev was the cofounder of Russia's S7 Group and owner of S7 Airlines, a brand that has grown to be worth more than $30 billion.

How Filev came to own Epic was "just by chance," Filev said. "Actually, you wouldn't believe it, but I arrived at Bend with no expectation to buy a factory. My idea was to buy an airplane. At that time, there was only one employee, Mr. Douglas King. He met me here and showed me [his airplane]. I understood the situation [with kitplanes]. I had no chance to get the airplane I dreamed for. And somehow, I started to talk with him [King] and I decided to be part of this story." A deal for one airplane was about to become a deal for one company.

"Needless to say, I did pretty good," King recalled. "I gave him a price. We agreed. I wrote up a one-page agreement. He asked, 'When can I have an agreement to sign?' I said, 'Tomorrow morning at 7:00 a.m.'"

"It was very fast," said Filev. "It was a pretty funny story. I was calling to my wife and said, instead of a $2 million airplane, I'm going to buy the factory. Because I didn't sleep well because of all the jet lag and I'd traveled a lot, I told her the numbers. I said I was going to buy the factory for $200 million.

"And, my wife went furious and started to hate me. I was listening to her and said 'Mom, why are you [yelling] that much for that relatively reasonable money?'

"'How reasonable? It's $200 million!' she shouted."

After a prolonged discussion, one

The E1000's cabin is longer, wider and taller than that of arch-rival TBM940. Light-weight carbon-fiber composite construction allowed for the use of a hefty acoustical insulation package, creating one of the quietest interiors in class.

FAA required the composite wing structure to be tested to considerably higher ultimate loads than would be required for an aluminum wing.

that involved considerable backpedaling and bold downplaying of the short-term costs, Filev won the approval of his wife.

"And this is why I didn't have [much opposition] from my family," Filev recounted. "It was lucky."

King well remembers the day: "I wrote the agreement and Filev said, 'Change this, change that.' I said 'OK' and we both signed the piece of paper. That was what guided the attorneys to write up the deal. It was our deal between two aviation fanatics. And that deal stood through all of the due diligence and everything else. It ended up being the deal.

"It was a deal between two people. He had the money and the passion to go after this dream of certifying the airplane. That's what made it exciting, that's why I sold him the business. It was because there was no way that I was going to be able to get somebody to invest in the certification effort without [their] really taking a controlling interest. He's become a friend over the last eight years, but back then, I didn't know him at all. And, so we sold him the whole company," recalled King. That day King also stopped working pro bono for Epic.

In March 2012, Engineering LLC, an MRO subsidiary of S7 Airlines, became the official owner of Epic Aircraft, a new firm that would design, develop and certify the E1000. Under the aegis of Epic LT Builders Group, Filev acquired his own Epic LT in late August 2013. King personally flew the airplane from Bend to Moscow, just in time for Filev's 50th birthday.

King originally believed it would take three years and $20 million to earn FAA certification.

"That was crazy," he laughed. "The actual cost was about the same as the aircraft's empty weight in hundred-dollar bills," King explained, or roughly equivalent to the $200 million Filev paid for Epic.

During the years it took to develop the E1000, there were several setbacks and challenges. King says the FAA doesn't yet have a high level of comfort with composites, even with the pioneering work done by Boeing with the B787 Dreamliner and Airbus with its A350. He says that many ultimate strength tests, for example, require 50% higher loads than those required of aluminum structures. He also didn't anticipate miles of red tape.

"I just didn't expect the bureaucracy we ran into," King explained. "The FAA drives the bureaucracy into you. It's not that they necessarily require any particular method of bureaucracy, but it's sort of pushed into you. And maybe not all a bad thing, because it forces you to build quality systems, build checks and balances into the system. When you're building a kitplane, it's all about the product and if it looks 'about right' and you can make it work. And now, is it certifiable and can you get

EPIC

Long-term fatigue testing now is in progress to assure 20,000-hr.airframe life limit.

the paperwork on it? It really changes things. [For example,] you can't use a marine-grade hydraulic pump any more, even though it's fantastic because it's salt water [proof], sealed up, does a great job and all that. You just can't do that. On a kitplane, it's no problem."

He continued, "You have to have paper trails on all components, all the way back to the mine. So, it makes supply chain management much more difficult. It's not difficult from the standpoint that you expect it to be difficult. It's difficult because you learn the path of least resistance is to use experienced aviation suppliers. And they [suppliers] don't have the 'go get 'em, go fast, break things' attitude. It sort of knocks the entrepreneurial spirit out of you a bit. I find myself fighting for sanity in paperwork, trying to automate systems and controls within the organization. I didn't expect that to be as big a fight.

"When our first production airplane is ready to go out the door in December 2019," he said, "it will have 400,000 pages of documentation with it — 400,000 pages. It's every purchase order, the certifications that go with every nut, bolt, part, everything, all gathered together. It's all digital, it's all PDFs, but it's a ridiculous amount of paperwork that goes into the process. That was unexpected. I knew there would be bureaucracy, I expected it, [but] it's quite a bit."

King also says that regulatory compliance and safety are tough to achieve affordably. "Many people think that safety and regulatory compliance go hand in hand. They do often, but not completely," he said." You could do things that are safer to do that are not compliant, but you don't have a choice. You have to be compliant. And you don't have a choice, you have to be safe. So, you have to find the intersection of those [two] things — and in a profitable way. So, it's hard. The aviation industry is difficult."

Supply chain management is difficult because "you can't buy landing gear at Walmart" King noted. "It has to be designed around the airplane. So, we designed it, then we have to find somebody to make it and that takes an aerospace supplier. There are a lot of parts and it's a really low volume, comparatively. The experienced guys want to be making parts for Airbus and for Boeing, not for some start-up out of Bend, Oregon."

The difficulties of supply chain management, extreme lead times and component expense all drive vertical integration by airframe manufacturers. "By being more vertical you control more of the supply chain issues. And you're simply buying raw materials," King observed. "Consequently, we're a very vertically organized business. The 587 composite parts, we make here in house. And primarily that's because we couldn't get it done anywhere else. We build the molds here because we can control the process."

Initially, Epic tried to outsource some composite parts, but it couldn't get acceptable quality, repeatability or on-time delivery. That gave impetus to going vertical.

There was another setback in summer 2018 when Epic found that the E1000 fell 10 to 20 kt. short of its promised cruise performance. King says the problem was ram recovery loss in the engine air intake manifold.

"The [Epic LT] kit intake did not require meeting Pratt & Whitney [Canada] intake guidelines for certified aircraft. It didn't need to be approved," King said. "We had to change the intake when we went to the E1000 to something that Pratt & Whitney [Canada] would approve. We designed something that met their specifications, but it didn't perform nearly as good as the kitplane's [intake]. That was very frustrating.

EPIC

Fuselage is built in left and right molds, then glued together at the top and bottom. Cabin pressurization is 6.6 psi, providing a 9,500 ft cabin at FL340, the aircraft's maximum cruise altitude.

"So, we made the decision to redesign the intake. Then, we would have to re-fly some of the flight tests. It was really a shame, because the issue was, were we going to finish or not," King recalled. The issue was coming to market with an aircraft that would be considerably slower than the archrival Daher TBM 940. But it also delayed final certification by more than six months.

King believes the production aircraft will reach 325 KTAS in the high twenties, as promised. "We've seen more than that in flight test, but Pratt wants to run the engine a certain way. They'll allow you to run another way. Our competitors have the same kind of pilots operating handbook that we're going to have. The 'should run it this way' numbers are going to be less than the 'can run it this way' numbers. That's a 10-kt. difference," King said. Plan on 315 KTAS at maximum recommended power and 325 KTAS at maximum allowable continuous power.

He believes the aircraft will have faster block-to-block mission times than the TBM 940 because of the engine's 1,200-shp 5-min. takeoff rating and 1,000-shp maximum continuous rating. The French competitor is rated at 850 shp. Both aircraft have essentially the same power available at high altitude.

About the E1000's performance, King said, "The great thing is that you have all this extra power on takeoff and climb. You can get up to altitude. The ceiling up at FL 340 really makes a difference, to get over weather." And he claims that every 1,000 ft. of increased altitude also reduces fuel consumption by 2%.

The E1000 also will have a maximum range of more than 1,600 nm. King says fuel flows drop to less than 50 gph at FL 340, the aircraft's maximum cruise altitude. He's comfortable flying his Epic LT 4.5 hr.

"The real question is: How much can a human go without a toilet?" he asks. He says his wife wants out of the airplane in 3 hrs. So, he flies it at maximum cruise and plans on 900-mi. legs. "Flight plan it at 300 kt. and 60 gal. per hour. That's roughly what you're going to spend and how long it's going to take you," King said. The E1000 performs about as well as the Epic LT. It's heavier, so it climbs a little slower. But it cruises faster because of an aerodynamic clean-up.

Will it be faster than a TBM 900-series airplane? "Point-to-point, 100%," King asserted. "We get up to altitude quicker, we climb better. So, yeah, you'll get there faster." But he's underplaying speed promises, reining in the enthusiasm of his marketing team.

"And, we're bigger inside. The airplanes are about the same size outside, but our cabin is a bigger proportion of that size. And we're wider and taller," he said. "What you'll see is when you get into an Epic, sitting in the pilot's seat, you're a long ways from the person next you. You're not rubbing elbows. In the back, you're not knocking knees. It's a couple feet longer inside."


EPIC

The E1000's PT6A-67A engine is rated at 1,200 hp for 5-min. takeoff limit. Having the highest power-to-weight ratio of any single-engine turboprop in *BCA*'s June 2019 *Purchase Planning Handbook* enables the aircraft to take off over a 50-ft. obstacle in 2,252 ft.

He says there's more aisle room between the pilot and forward cabin seats. "You can walk up to the front from the entry door and sit down. We don't have a center console that you have to step over. It's quite a difference climbing in and out of an Epic than climbing in and out of a TBM."

The baggage compartment behind the two aft-most cabin chairs has a recessed floor to accommodate tall items. King says it will hold golf club bags standing up, including the drivers, adding, "I don't think you can do that in a TBM.

"We're going to have some performance and size that they would like," he said, claiming, "If you're six and half feet tall, you're probably buying an Epic, not a TBM."

Hard Work Ahead

"Seven years is a very long pregnancy," said Filev while enjoying Epic Aircraft's evening gala held on certification day, attended by more than 500 customers, employees and vendors. "But now we have our baby and we want to watch it grow up."

"We have more than 80 orders, but we plan a slow ramp [up] in production," said King. For the first half of 2020, he plans four weeks to build each aircraft. The first few aircraft will have to be individually approved by the FAA in accordance with the type certificate specifications. Epic hopes to earn its production certificate by the second quarter of the year, enabling the firm to clone production aircraft and sign them off with airworthiness certificates on its own.

Production will be increased to one aircraft every three weeks in the second half of 2020, one every two weeks in the first half of 2021 and one aircraft per week after that. Mature production rate will be 50 aircraft per year, starting in 2022.

"I have learned not to ignore the history of aviation. When you try to say you're going to do something that nobody else has been able to do, you better be really sure that you can do it," King said.

Once production deliveries begin, Epic officials believe that the E1000 order book will swell.

"For the foreseeable future, the [single-engine turboprop] market can handle a couple of hundred airplanes per year," said King. "It's going to be a mix of planes. Daher has a heck of a head start with the TBM. They have a very loyal following. . . .

"But we're a million dollars cheaper," he added. "That buys a lot of jet fuel. A million dollars cheaper to buy a bigger, more comfortable, faster airplane."

Most E1000 customers are stepping up from high-performance

Flight deck features Garmin G1000 NXi avionics, with left and right 10-in. PFDs and a center 12-in. MFD, plus Genesys (née S-TEC) IntelliFlight 2100 autopilot, ADS-B weather and traffic, and XM satellite radio weather. Onboard weather radar is optional.

EPIC

single-engine piston aircraft, such as the Cirrus SR22 or Bonanza 36-series. Some are migrating from used jets that were cheap to buy but expensive to fly. A few are coming from Epic LTs, as well.

"One of the issues is that the Epic LT still is a good airplane. So, people are saying, 'Why would I do this?' The questions are 'Do you want to go higher? Do want some additional safety features? Do you want a certified airplane?'" said King.

"All my friends who are private pilots are jealous of me," Filev said. "Of course, Russia is not a rich country like the U.S. As you know, 75% of airplanes like this are in the U.S. market. I believe it's a great airplane and it has potential in Russia and CIS countries as well."

"The E1000 shows that we can still innovate and manufacture in the U.S. a high-quality product that performs well, that people want to buy. We're still in this. American companies can still do this," said King. "This is still the best place to be in aviation."

"There are plenty of people wanting to buy airplanes around the world. This is a great airplane. We're going to sell a lot of airplanes," said Filev, adding that the E1000 is the first of a family of new Epic aircraft.

All it takes for other general aviation start-ups to succeed in bringing innovative new turbine-powered personal aircraft to market is exceptional leadership, unbridled passion for aviation, a decade or more of hard work and $200+ million of investment. Hats off to King, Filev and their team at Epic. **BCA**

EPIC

Maximum cabin width is 4.6 ft. and there is no center console upfront. This affords easy access to flight deck from the passenger cabin.

Squawk This!

ISTOCK

Making **effective** maintenance write-ups

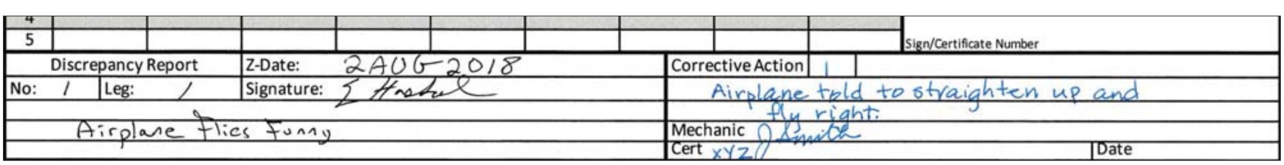
BY **JAMES ALBRIGHT** james@code7700.com

An early initiation for most pilots includes the humor of poorly written maintenance write-ups, or "squawks." We all laugh about the nonsensical pilot entries made on the left side of an aircraft's maintenance log destined to be corrected by a funnier mechanic's entry on the right.

Even when flying the simplest single-engine trainer, we pilots understand a mechanic will need more than just a terse "it's broken" write-up. But once the flying is done, our pilot personas transition seamlessly to whatever else that interests us and the mechanic is left with a bit of detective work. Much of a mechanic's troubleshooting is handicapped, since he or she cannot re-create the conditions of the problem during flight. Our efforts to capture the problem with written words can also be handicapped just a few hours after the

JAMES ALBRIGHT/BCA

Maintaining an airplane to the standards of a licensed airframe & powerplant mechanic involves more than just "turning wrenches"



4
5
Sign/Certificate Number
Discrepancy Report
Z-Date: 2AUG2018
No: 1 Leg: 1
Signature:
Airplane flies funny
Corrective Action
Airplane told to straighten up and fly right.
Mechanic J Smith
Cert XYZ
Date

JAMES ALBRIGHT/BCA

Discrepancy: Airplane handles funny.
Corrective Action: Aircraft warned to straighten up, fly right.

JAMES ALBRIGHT/BCA

Many airplanes will self-diagnose and report the trouble. An unsuspecting pilot may think this is the root cause, but it may in fact just be the first step of many in the troubleshooting adventure.

event. Let's say that the engine coughed after a sudden power change halfway through the flight. Knowing the altitude, power settings and flight conditions can help a good mechanic narrow the search. But if you don't remember those after you land, the problem may have to go unsolved until the next flight.

As we progress from renting airplanes to flying professionally, the complexity of the airplanes increases as does the likelihood that we will have a squawk or two following a flight. If the airplane becomes more complex for the pilot, you can imagine that the task confronting the mechanic has increased as well. If you aren't providing your technicians with complete and accurate write-ups, you are setting everyone up for failure.

You might wonder why any write-up from the pilot is needed at all in these days of computerized airplanes. Many business jets are equipped with a central maintenance computer (CMC), maintenance diagnostic computer (MDC), or something equivalent that monitors the health of the airplane full time. Some airplanes send text messages to home base periodically while in flight and upload reams of information via wireless connections as soon as the airplane pulls into its own hangar. With this level of technology, does a pilot squawk provide any additional, meaningful information?

It has been my experience that a computerized diagnostic health system can be of great help or it can lead a mechanic down the rabbit hole. Many of my Gulfstream G450's systems have multiple layers of redundancies and when one lane of one channel of a certain system becomes unhappy, another lane of another channel quickly takes over. The computerized tattletale can spit out reams of squawks that lead to multiple dead ends. A pilot's squawk could add the needed context if it includes as much information as possible about what was happening at the time.

While a mysterious fault code could lead your technician to the right black box to test or replace, it could also be that the fault in question was triggered by something upstream. For example, we spent several hours tracking down a data-link issue that was really a problem with a VHF radio. Had we remembered the error occurred during coast out over Gander, Newfoundland, our team could have realized it was an issue between our terrestrial and satellite data systems, not the data-link processor itself. But even without the help of onboard computer diagnostics or confusion over fault codes, a pilot's accurate write-up can be the difference between a "no fault found" return to service and a properly repaired airplane.

In one of my flight departments we were plagued by a radar that worked well one day and appeared blind to the weather on the next. Pilot write-ups were usually of the "radar inop" category but sometimes wandered into the "I told you to fix this radar!" territory. No matter the tenor of the squawk, the result was always the same: "No fault found." The aircraft's maintenance computer was as happy with the radar as the pilots were miserable. The issue threatened to tear us apart. It seemed a binary choice: The pilots didn't know how to use the radar, or the mechanics didn't know what they were doing. In a fit of desperation, our mechanics ordered bench-testing gear, pulled the radar, tested it, and gave it a clean bill of health.

We were at an impasse until I flew the airplane on a day when we saw several thunderstorm cells from hundreds of miles away and watched the radar carefully. We discovered the radar had random blind spots. It didn't make any sense because the radar showed the same blind spots no matter which screen we used. So, we pulled the radar and sent it to the manufacturer with a photo of the blind spots. It was only then we discovered that a bank of circuits in the radar's receiver had burned out. The maintenance computer and bench test were oblivious to this because their tests only went as far as the signal processor. In the end we had a repaired radar, but we had wasted a lot of time with incomplete write-ups and frayed a lot of good will between our pilots and mechanics.

The lessons here may seem to be more common sense than anything else. But we pilots tend to lose all common sense when frustrated by an airplane system not behaving as it should. A little professionalism will go a long way in solving this problem, but it is only the first step.

Be Professional: Fly Like a Test Pilot

Some aircraft problems happen suddenly with no warning and the job of the mechanic becomes that of detective work. In many cases this can be as simple as replacing a bulb that has burned out; in others it will be hours of research, swapping parts or educated guessing. There are times, however, where there are signs leading up to the failure. Since the mechanic is rarely with the airplane during a write-up flight, it will be up to the pilot to do the detective work before the failure.

On Aug. 13, 2005, the cabin crew of a Helios Airways Boeing 737 made an entry into the cabin defect log stating that "aft service door seal around door freezes and hard bangs are heard during flight." The flight crew transferred this to the aircraft technical log as "aft service door requires full inspection." That night the maintenance team visually inspected the door and performed a cabin leak check. The ground engineer ran the pressurization system in manual mode to maximum differential, verified the safety valve worked, and signed off the write-up as "Nil defects." Unfortunately, he forgot to reset the system from manual to auto and the next day the flight crew failed to catch his oversight.

Passing 12,000 ft., the cockpit crew mistook the cabin altitude warning horn to be a faulty takeoff configuration warning (it was the same horn, repurposed). Within a few hours, everyone on board the airplane had passed out. The airplane continued to fly on autopilot at 34,000 ft., flying the ground track of the arrival, instrument approach, missed approach and missed approach holding. Almost 3 hr. after taking off from Larnaca, Cyprus, the aircraft ran out of fuel and crashed into terrain just northwest of Athens International Airport, Greece, killing all 121 passengers and crew.

Going back in time from the crash, the crew made a number of mistakes. They failed to recognize the airplane had not pressurized. They failed to confirm that the pressurization system was in its automatic mode. The ground engineer failed to return that switch from manual to auto, and had applied the wrong procedure to check for a pressurization leak. But, starting it all, the previous crew made an improper maintenance squawk. As it turns out the aft service door seal was leaking. The ground engineer's use of maximum cabin differential masked the leak by giving it more air than it would receive during normal flight conditions. It is speculation on my part, but I think had the ground engineer read the original squawk, his corrective action may have been different.

I think the pilots before the mishap flight could have done a better job investigating the "hard bangs" and should have shown more interest in an aircraft seal freezing in flight. But that might be unfair of me. Many of us in business aviation have a distinct advantage over our peers in the airline world because we tend to fly a smaller number of aircraft. We learn by rote what is normal and what deserves greater attention. Having a flight crewmember record meaningful information with enough detail to give the technician a good sense of what happened and when, will improve the odds of a successful corrective action.

I admire the talent of a good test pilot who can fly the airplane while making note of what the airplane is doing with enough detail to record everything important. But even the best test pilot these days will have the help of a countless number of sensors and computers to record it all. In some cases they will employ chase aircraft. What do we in the operational world have?

Years ago, some of our pilots started complaining about adverse yaw during landing gear extension and retraction in our Gulfstream G450. Our original squawks must have seemed like the "airplane flies funny" write-up. "Feels like a little yaw for a few seconds when we extend the landing gear" hardly gives the mechanic much with which to start. After a few weeks of this, we began to notice a time difference of a few seconds between the green lights on one main gear versus the other. Noting "Right gear retracted 2 sec. after left gear" improved the troubleshooting. Our mechanics inspected the system thoroughly and still came up empty. Our airplane has a full set of cameras on the tail and belly, but no way to record the results.

JAMES ALBRIGHT/BCA

A camcorder on a tripod secured to a divan to capture airplane video

I secured a portable video recorder onto a tripod and that tripod onto our forward divan with the cushions removed. I secured that setup with divan seat belts and a set of C-clamps. After one flight around the visual pattern we had a recorded history of the delay of our right landing gear to retract and extend; the delay was clearly with the right inboard gear door. Armed with this information, technicians were able to trace the problem to a worn bearing in the right landing gear door. The problem would have gotten worse and we could have been put into a situation where the gear would not retract, or worse yet, would not extend.

Be Skeptical: Think Like a Mechanic

There is a story in a NASA Aviation Safety Reporting System (ASRS) newsletter about a British airline test pilot who was charged with testing the autoland equipment that his airline was installing on its fleet. He carried out a test on an airplane and squawked: "Autoland carried out. The aircraft landed very firmly and well to the left of centerline. Most unsatisfactory." In response, the engineer in charge wrote: "Autoland not fitted (installed) to this aircraft."

It is well and good to have a laugh at this test pilot's expense, but the lesson here is we should look at every squawk with a skeptic's eye. What is the mechanic going to do with this? You should examine every write-up and look for a simple solution before sending the maintenance team on a wild goose chase.

Years ago, a Boeing B-52 crew returned from a flight squawking the fuel-low light as coming on too early. The crew chief quickly determined the bomber had landed with less than 10 min. of fuel remaining, certainly qualifying as low fuel in just about anyone's book.

Even with a valid squawk, pilots should realize that what seems obvious at altitude and noted in pilot speak may be nothing more than gibberish hours later on the ground in mechanic lingo.

Be Precise: Write Like an Engineer

As a Purdue engineering student, one of my most prized possessions was a T-shirt that said, "I Are An Engineer." Yes, we took pride in our inarticulate illiteracy because that somehow meant we were technically pure. We were taught to place a priority on "data in" and the engineering work, at the expense of the "data out." Engineering degree in hand, I quickly figured out the world is not run by engineers and that if the customer didn't understand the output, the input and engineering effort were pointless. But even with this backdrop, my pilot actions often overpower my engineering intentions.

Years ago, my aircraft had a series of standby altimeter problems. Passing about 20,000 ft. it stopped working. A few hours later, it was OK. How does a pilot squawk this? "Standby altimeter intermittent." You can predict the corrective action: "No fault found. Returned to service."

My fellow pilots were no better, and the airplane racked up an impressive six flights with the same problem. This was years before the GoPro had been invented, but I did have my trusty pencil and notebook, so on the next flight I recorded everything. (If you have already figured this out, you are smarter than me.)

The standby altimeter stopped working not as a function of altitude, but of temperature. When the Outside Air Temperature (OAT) dipped below 0C or so, the altimeter — wait for it — froze. Now our mechanics had something to go on. They took the static lines apart and out came about a half cup of water. A drain hole had clogged with debris, causing the water to act as a pressure conduit when warm but blocking all sensed pressure when frozen. Once the water was drained and the blocked hole cleaned, everything worked as it should again.

Be Purposeful

I once returned from a month's vacation and picked up a maintenance logbook where a discrepancy sign-off promised a story more interesting than the squawk it corrected. I had to investigate.

A few weeks prior, one of our pilots squawked the HF after returning from an overseas trip: "HF inop." The signoff was predictable: "Ops check good." A few days later following a domestic trip that didn't require the HF, the same pilot wrote: "HF still inop," which was followed by "Ops check good" but I think could have been improved by "Ops check still good." This was followed by another domestic trip with this post-flight note: "I told you guys the HF is broken. Can't you do anything right?" Our mechanics showed great restraint with a simple, "Ops check good" again.

The next week, another pilot returned from an overseas trip with a more detailed squawk: "HF1 transmit unreadable when keyed from pilot's control head, works OK from copilot's side. Receiver unaffected. HF2 works without issue." The discrepancy sign-off was again sterile, but correct: "Pilot's intercom panel HF switch open circuit, removed/replaced intercom panel, HF 1 ops check good." And to the right of that in the margin was a comment in the original pilot's handwriting, "Finally!"

All of that may sound petty but it was an accurate predictor of the frosty relations that followed. The "I told you" pilot never hesitated to bad mouth the maintenance team, which never hesitated to vent their frustration behind his back. A sloppy squawk was followed by implicit accusations of incompetence. We pilots need to remember the mechanics are on our side but simply removing and replacing parts without cause is expensive and time-consuming. We should expect the best of intentions on both sides of the squawk sheet and that will pay dividends in the future.

Years later, I returned from a trip and felt a tremor in the brakes that I had never felt in many years. In older aircraft the anti-skid would chatter at your feet. A newer system may kick at you when you are applying maximum pressure but should otherwise be quiet. I squawked the brakes, mindful of the qualitative nature of my write-up: "Applied brakes at 100 kt. using moderate pressure and felt vibration from right brake pedal, a forceful pushback in the pedal two times a second until we were at taxi speed. Copilot did not sense this and aircraft's braking performance unimpacted."

Our mechanics spent hours looking for a problem to no avail and one of them called me at home. I described the problem in more detail and thanked him for the call. The next morning, I found a plastic bag filled with metal parts that looked like they had been through a bartender's blender. The mechanic on duty explained that they removed the hubs from both wheels and verified everything looked OK. So, they replaced the hubs, taxied the airplane at low speed and verified the brakes worked. They told the director of maintenance that all ops checked good. But he told them to look again since, "This pilot doesn't write things up for no reason. There has to be something wrong." The mechanics repeated this step, this time removing the anti-skid speed sensors from the hubs. One of those sensors fell apart in their hands and found a new home in the see-through bag on my desk.

You can spend your career flying like a test pilot, thinking like a mechanic and writing like an engineer; but none of that will do you any good if you don't have the respect and trust of your maintenance team. Never use a squawk sheet to vent your frustration; rather write your squawk as if you were the reader. You and the mechanic are in this together and both want the same thing: a repaired aircraft. Today's write-up will impact future sign-offs. BCA

JAMES ALBRIGHT/BCA

Mechanic John Chambers "chases" a hydraulic system write-up on a Gulfstream G450.

FAST FIVE WITH HONEYWELL

LEA KIESEL

Sr. Director Coating Solutions for Mechanical Components and Systems

Lea Kiesel joined Honeywell Aerospace in 2003 and has worked in engineering and supply chain management. Today, she leads a team of business, engineering and industrialization professionals responsible for developing coating solutions for large-scale production.

What is Honeywell's components business and specifically thermal barrier coatings business?

A. Thermal barrier coatings are the ultra-thin material that protects vital parts from high heat in a turbine engine. We have decades of experience making jet engines, and we know a thing or two about thermal barrier coatings. Our patented coating has been the industry standard for nearly 25 years and is used on more than 10 million airfoils worldwide.

What is so special about Honeywell's thermal barrier coating?

A. Honeywell uses electron-beam physical vapor deposition (EB-PVD). The Honeywell advanced EB-PVD coating lasts two to four times longer than the industry standard, lowering the overhaul costs for the engine. This coating also has improved toughness and can withstand temperatures up to 3,000 degrees Fahrenheit. That means new and future engines can be configured to run hotter, extracting up to 10% more power and up to a 1% improvement in fuel consumption. It has 33% lower conductivity than competing coatings and its three times tougher. There is also an air plasma spray version that provides similar benefits, expanding the market size.

I look at thermal barrier coating as sunscreen for the part—it extends the life and allows you to get sun without getting a burn.

What is the business model you use to provide the EB-PVD?

A. We provide a quick-turn service to our customers. They send a machined part to us, without any coating on it. We then apply the thin layer of coating and send it back. The customer finishes the part and sells it as a spare or installs it in a jet engine or a small industrial gas turbine.

What's so unique about EB-PVD?

A. This is a capital-intensive operation based on the sheer size of the coater—the coater itself requires up to 5,000 sq ft of floor space and is almost three stories high. In our process, atoms from an ingot are transformed into a gaseous state and then precipitate in solid form in an acceptable microstructure on the foil, which is several inches tall.

And, the microstructure of the coating is unique. The process creates a crystalline structure that in turn gives strain compliance—giving much longer life when compared to a porous air plasma spray. EB-PVD is automated, a software-intensive process, with our team loading and unloading the parts into the coater and ensuring the appropriate microstructure and thickness are consistently maintained over the entire part.

Beyond aerospace, what other industries use this technology?

A. In addition to aerospace and defense, EB-PVD is used in power generation and the oil and gas sectors on small industrial gas turbine parts. Our engineers are constantly looking at ways to support other applications, including supersonic civilian aircraft, whether those needs are coming tomorrow or 15 years in the future.


Know.
Predict.
Connect.
Business-critical information, predictive intelligence and connections with opportunities and people. That's how the Aviation Week Network helps you make decisions and build your business.
Delivering award-winning journalism, deep data and analytics, world-class events, and content-driven marketing services, our core principle is helping our customers succeed.
Let's grow your business.
AviationWeek.com/KnowPredictConnect
AVIATION WEEK
NETWORK
Know. Predict. Connect.
Intelligence

Kent S. Jackson
Contributing Editor
kjackson@jetlaw.com

Back Into the Fire Swamp

Rewriting FAR Part 135 rest and duty regs

IN ONE OF MY FAVORITE MOVIE SCENES FROM "THE PRINCESS Bride," a swashbuckling pirate is about to lead the beautiful heroine into a dark morass of vegetation. But she stops short and says, "We can't go in there! It's the Fire Swamp! We will never come out alive!" To which the pirate confidently replies, "Nonsense. You're only saying that because no one ever has." He slashes a vine with his sword, and they step into the darkness as the music sounds a dour note.

At our first meeting, I and the other members of the new Flight and Duty Time Limitations and Rest Requirements Aviation Rulemaking Committee (ARC) had the eerie feeling of slashing into a Fire Swamp, with its multiple dangers of getting tangled and drowned by details or burned by unintended consequences.

I devoted this very column to the same effort back in 2003, when I was a member of the newly formed Part 135/125 ARC. We undertook a complete re-write of Part 135, including its rest and duty provisions, and succeeded in producing a comprehensive package. But our good efforts were for naught. It never made it to the Notice of Proposed Rulemaking (NPRM) stage.

In spite of that venture into the Fire Swamp, I now am optimistic that we'll emerge. Congress mandated the creation of this ARC, and the industry needs an up-to-date set of rest and duty rules for Part 135, particularly for on-demand operations. Congress asked the FAA to review the prior ARC work, and since I am one of the last members of that group, I was named as the industry chairman of the new ARC.

The ARC rulemaking process began with the Fractional Ownership ARC, which, in the geological time of rulemaking, seems like yesterday. To understand the worth of the current process, it is important to understand how bad were the old methods. In the regulatory Stone Age, the FAA conceived an N PRM all by its lonesome, solicited written comments from the public, considered the comments in silence, and then published a Final Rule. When industry input is limited to written comments, the FAA shoulders the entire burden of drafting the rule, and only those with the best writing skills can hope to help shape the final product.

The next step in the evolution of FAA rulemaking was the Aviation Rulemaking Advisory Committee, or ARAC. This new entity was to provide "advice and recommendations to the FAA administrator on the FAA's rulemaking activities." In other words, the industry took a great leap forward, because the industry had a chance to provide input before a rule was drafted.

The fundamental difference between an ARAC and an ARC is that the former would work hard toward its regulatory objective with little or no ongoing guidance from the FAA. By contrast, the ARC process allows representatives from the agency and the industry it regulates to hash out issues face-to-face, facilitating a more productive exchange than with the papers that bogged down previous rulemaking methods.

The fundamental difference between an ARAC and an ARC is that the former would work hard **toward its regulatory objective with little or no ongoing guidance from the FAA.**

Like the ARACs, an ARC has no final say as to the content of the ultimate rule. Rather, it makes recommendations to be considered by the FAA. And, as noted, sometimes an ARC's work fails to result in any rule. But Congress is watching this effort now. While that is no guarantee of final success, it could help.

What are the meetings actually like? My idea of hell is to be locked in a room for eternity with nothing to read except my own books about the FARs. But the pathetic truth is that I have been a student of the FARs since I soloed 40 years ago, I have been writing books about them for 25 years, and I am still fascinated by the challenge of regulating flying. Being holed up with a group of aviators arguing about FARs might sound like hell, but great ideas can emerge from the chaos. And there are plenty of lighter moments, like the drafter of a regulation trying to remember what it means, or a senior committee member objecting to the age 65 rule, but not remembering why.

The rest and duty rules for Part 135 are complex in part because a pilot cannot rely on the regulations alone. There are decades of FAA Legal Interpretations that are required reading for anyone who needs to comply with those requirements. But now, rather than regulate through exemption, deviation, interpretation and enforcement, the FAA wisely decided to start with a clean sheet of paper. So, back into the Fire Swamp, swashbucklers all. BCA

Fred George
Senior Editor
fred.george@informa.com

King Air C90GTx

More Range, More Payload, **More Capability Up Front**

THE BUILT-FOR-COMFORT, NOT-FOR-SPEED C90 KING AIR UNDER-went a major upgrade in 2005 when Raytheon Aircraft Company swapped out the pair of anemic PT6A-21 turboprops for a brace of PT6A-135A engines, thereby creating the C90GT. The engines retain the 550 shp takeoff rating, but they're highly flat-rated, enabling the aircraft to cruise 35 to 60 kt. faster, depending upon altitude. Finally, there was an entry level King Air was competitive in speed with Pilatus PC-12.

The C90GT was superseded by the C90GTx in 2007, offering Pro Line 21 avionics and a plusher interior. Both aircraft, though, could only carry one or two passengers with full fuel. This was remedied in 2010 when Textron upgraded the C90GTi with STC SA10747SC that increases MTOW by 385 lb. and STC SA02054SE that adds BLR winglets to boost range. So equipped, the C90GTi was given the marketing designation C90GTx. The new model also was upgraded with Collins Pro Line Fusion touchscreens. Typically equipped, the C90GTx can fly four passengers 975 nm in less than 4 hr. and arrive with 100-nm NBAA IFR reserves.

The pair of -135A engines, having 400 more thermodynamic horsepower than -21 turboprops, enabled Beech flight test engineers to use partial wing flaps for shorter takeoffs. The result is a heavier aircraft that needs 726 ft. less runway when departing a standard-day airport and 1,228 ft. less pavement when departing *BCA*'s 5,000-ft. elevation, ISA+20C airport.

The extra power of the -135A engines improves average climb performance by 20 percent and it enables the aircraft to cruise efficiently in the mid to upper twenties. Operators typically plan 260 to 270 block speeds for most trips. Fuel efficiency is virtually the same as on earlier -21 powered aircraft because of improved climb performance and use of higher cruising altitudes.

The C90GTx is significantly quieter than earlier C90 models because the props turn 1,900 instead of 2,200 for takeoff. Dynamic vibration absorbers in the aircraft are tuned to soak up resonance at 1,900 rpm for takeoff, climb and cruise. For normal operations, there's no need to touch the prop levers after engine start.

Passengers can spread out in a cabin that's considerably larger than the interior of a VLJ. The main four-chair club seating section is about 4.8 ft. tall, 4.5 ft wide and 7.5 ft. long. There's a lavatory and inflight accessible luggage compartment in the aft cabin. An air-stair door provides easy access to the aircraft interior and luggage compartment. The 5.0 psi pressurization system, though, provides a relatively high 11,000 to 12,000 ft. cabin altitude at FL 280 to FL 300. Cabin altitude at FL 250 is close to 9,000 ft.

The smallest King Air is easy to fly, having evolved from the piston-powered Model 65 Queen Air. Automatic prop feathering reduces pilot workload should an engine fail and the highly robust -135A engines endow the aircraft with healthy one-engine-inoperative performance, especially on warm days. However, the plethora of levers, switches and knobs on the flight deck harkens back to earlier days when pilots had to double as flight engineers and mechanics.

The Raisbeck Epic performance modification package is standard on LJ-2129 and subsequent models, starting in 2016. The upgrade bumps up MTOW to 10,500 lb., reduces FAR Part 36 noise by 1.2 dBA and improves runway performance.

The C90GTx's main competitors are larger single engine turboprops, such as the Epic E1000, Pilatus PC-12 and TBM700-series aircraft. The newer single-engine turboprops fly faster and farther, plus they offer lower cabin altitudes. C90GTx, though, features four-chair club seating, a well appointed interior, forward refreshment center and fully-enclosed aft lavatory. The 48 cubic foot aft compartment holds plenty of baggage and it also can accommodate a fifth and sixth passenger, if needed.

TEXTRON

The C90GTx is a stronger performer, especially with the Raisbeck Epic package, so asking resale prices run in the $2.0-$2.2 million range. Few owners are interesting in parting with them. Currently, there only are a half dozen on the market of the 190 units produced in the last ten years.

But, there are dozens more C90A and C90B models that have been upgraded with Blackhawk's 135XP engine upgrade that offer the same performance as the C90GT and that have virtually identical same airframe systems. At $700,000+, the 135XP conversion is pricey. But, second-round overhauls on -21 engines easily can rival that investment, so the 135XP conversion is an attractive upgrade for aircraft nearing 7,200 hr. total time on the engines.

Model 90-series King Airs have been in continuous production since 1964, a tribute to their basic design qualities. The C90GTx, with the latest Raisbeck Epic modifications is the most capable derivate yet produced. It can't fly as fast or as far as many of its single-engine turboprop competitors, but it offers twin engine redundancy, roomy, quiet cabin, a copious, pressurized aft baggage bay and unsurpassed after-market factory support. BCA

On Duty

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

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

▶ **Aeronautical Repair Station Association,** Alexandria, Virginia, elected **W. Ian Cheyne** president of the board of directors. Cheyne is chief technical and regulatory officer for Dallas Airmotive. It is his second presidency. He has also served as director of ARSA since 2002. **David Latimer,** the association's immediate past president, will continue on the board for the next year. In addition, **Gary Fortner** was elected vice president and **Terrell Seigfreid** was elected treasurer. Fortner is vice president of engineering and quality control for Fortner Engineering. Seigfreid is assistant general counsel for the Nordam Group. **Josh Krotec,** senior vice president of First Aviation Services, and **Scott Jacob,** director of quality for Columbia Helicopters, begin their inaugural terms on the board.

▶ **International Business Aviation Council,** Montreal, Canada, announced that **Ali Alnaqb**i has been selected chairman of the governing board and will begin his term Jan. 1, 2020. Alnaqbi is currently vice chairman of the board. He is also founder and chairman of the Middle East and North Africa Business Aviation Association. **Juergen Wiese,** chairman of the European Business Aviation Association, will become vice chairman. **Sudhir Nayak** of the Business Aircraft Operators Association of India will continue to serve as treasurer.

▶ **Luxaviation,** U.K., **George Galanopoulos,** managing director of, has been appointed head of charter sales in Europe for the Luxaviation Group. Galanopoulos' new position is in addition to his existing role and is effective immediately.

▶ **Elliott Aviation,** Moline, Illinois, hired **David Fenton** as chief administrative and financial officer at their headquarters. Fenton has over 25 years of experience in finance, technology, and operations. David will be replacing **Jeff Hyland** who served as Elliott's CFO for the last 28 years.

▶ **Embraer,** Sao Paulo, Brazil, elected **Antonio Garcia** chief financial officer of. Garcia replaces **Nelson Salgado,** who will serve as chief operations officer. The change is effective Jan. 1, 2020. Previously, Garcia served as global CFO of ThyssenKrupp's Forged Technologies unit in Germany. He also spent nine years at ZF Group in Brazil and 18 years at Siemens.

▶ **JetHQ,** Kansas City, Missouri, announced that Jamie Roberts and **Steven Pinkerton** have joined the company. Roberts was named sales manager, while Pinkerton is a technical analyst. **Aman Kapur** has been appointed sales manager at the company's Dubai international headquarters. Previously, Roberts was marketing director for Airport Systems International. Pinkerton was an FAA-licensed aircraft engineer in Kansas City, while Kapur worked in sales for India's Arrow Aircraft.

▶ **Guardian Jet,** Guilford, Connecticut, announced that **Casey Crafton** has joined the company as technical services manager. Crafton, an airframe and powerplant mechanic, was an assembly technician at Pratt & Whitney and lead aircraft technician at Embraer Executive Jet Services.

▶ **Duncan Aviation,** Lincoln, Nebraska, announced that **Dave Coleman** has been named an International Aircraft Dealers Association-certified aircraft sales broker. Coleman is part of Duncan Aviation's aircraft sales and acquisition team.

CASEY CRAFTON

DAVE COLEMAN

JAKE HARVEY

▶ **xCraft Enterprises,** Coeur d'Alene, Idaho, announced that **Burt Rutan** has joined the board of directors. Rutan designed and developed SpaceShipOne. He won the $10 million Ansari X Prize designed to spur the development of affordable space tourism.

▶ **Unmanned Systems Canada/Systemes Telecommandes,**Ottawa, Ontario, named **Michael Cohen** chairman. He succeeds outgoing Chairman **Mark Aruja,** who will continue as chairman emeritus. Cohen is president and CEO of Industrial SkyWorks.

▶ **Globaljet,** Avon, Connecticut, announced that **Arthur Risco and Walter "Jake" Harvey** will receive the FAA's Charles Taylor Master Mechanic Award.

▶ **Guardian Jet,** Guilford, Connecticut, announced that **Casey Crafton** has joined the in-house maintenance team as a technical services manager responsible for on-site aircraft evaluations and overseeing aircraft prebuy inspections.

▶ **GKN Aerospace Redditch,** U.K., appointed **Krisstie Kondrotis** GKN president of defense and **Julie Smyth** has been named general counsel based in London. Both will join the GKN Aerospace executive committee. Kondrotis most recently served as senior vice president of defense programs and business development at Spirit AeroSystems. Smyth previously served as chief counsel for the air sector of BAE Systems.

▶ **National Business Aviation Association' (NBAA),** Washington. D.C, announced that **Elizabeth Dornak** of DuPont Aviation was named chairman of the board of directors during NBAA-BACE in Las Vegas. Dornak succeeds **Gen. Lloyd "Fig" Newton** of L3 Harris Technologies. **Monte Koch** of Falconshare will serve as the new vice chairman and treasurer. Leadership on NBAA's advisory council also changed with **Sheryl Barden** of Aviation Personnel International replacing Todd Duncan of Duncan Aviation as chair. **David Davenport** of FlightSafety International is now vice chair. Barden and Davenport will serve as business member advisors on the board.

▶ **European Business Aviation Association (EBAA),** Brussel, Belgium, elected **Janine Iannarelli** vice chair of the board of directors of the Associate Members Advisory Council (AMAC). Iannareli is founder and president of Par Avion in Houston.

▶ **Boeing Commercial Airplanes,** Seattle, Washington, announced that **Stan Deal** has been named president and CEO. Ted Colbert will succeed Deal as president and CEO of Boeing

Global Services. **Vishwa Uddanwadiker** has been named to Colbert's former role as interim chief information officer and senior vice president of Information Technology & Data Analytics. Deal joined Boeing in 1986. Colbert joined Boeing in 2009 and is executive vice president of Boeing and a member of the Boeing executive council. Uddanwadiker most recently served as vice president of information technology for Boeing Commercial Airplanes.

▶ **Elevate Jet,** Bedford, Massachussetts, announced that **Wayne Lockley** has joined the company to lead development of a robust safety management system to support growth initiatives. Lockley was previously a member of the International Society of Aviation Safety Investigators, a Naval pilot and Naval Test Wing Safety Officer. **Patti Ann Sullivan** has joined Elevate Jet, based in Bedford, as executive vice president of aircraft management. Sullivan previously held executive and consultancy roles with Key Bank, Textron Financial, Debis, Aviation Resource Group and Executive Jet Management.

▶ **Acropolis Aviation**, Farnborough, U.K., announced that **Mark Bird** has joined the company as ground operations manager. Bird most recently served at Air Tanker as operations duty manager.

▶ **Sandel Avionics,** Vista, California, named **Steve Jackson** president and CEO, replacing founder **Gerry Block,** who announced his retirement in September. Jackson joined Sandel Avionics in 2016 as chief financial officer. David Lanning, vice president of engineering, will replace Block as head of engineering. Lanning joined the company in 2005.

▶ **VisionSafe,** Kaneohe, Hawaii, promoted **Kurt Poruks** to vice president of global sales. Poruks joined the company in 2001 and has held a variety of positions. Michael Hines has been appointed director of sales for Part 121, and **Chris Skurat** has been named director of sales for business aviation. Hines most recently served as president for Evergreen International Aviation. Skurat was with AMSTAT.

▶ **Boom Supersonic,** Dove Valley, Colorado, named **Ryan Scott** senior vice president of global sales. Scott was previously a founding member of the Embraer Executive Jets team.

▶ **Safran,** Munich, Germany, said its board has chosen the head of Safran Aircraft Engines, **Oliver Andries** to be group CEO from January 2021. Andries, 57, will take the helm from Philippe Petitcolin after a year-long transition period to start in January 2020. Petitcolin has led Safran since April 2015 leading the company's takeover of Zodiac and bought the company's various subsidiaries under a single branding, securing the France-headquartered company's positions as one of the world's largest aerospace equipment manufacturers. The board of directors had already extended Petitcolin's term of office until Dec. 31, 2020, enabling what Petitcolin describes as the "basis for a seamless transition," for Andries to take the helm.

▶ **Signum Aviation,** Manchester, U.K., appointed **Kyle Ferguson** director of operations for North America. Ferguson joins the company from Avianis Systems. BCA

Advertisers' Index

Products & Services Previews

By Jessica A. Salerno jessica.salerno@informa.com

1. Townsend Leather Expands

Townsend Leather, a manufacturer of upholstery hides and decorative leathers, has purchased and restored the former Diana Knitting Mill, a 66,000-sq.-ft. multibuilding complex built in 1900 in Johnstown, New York. Townsend nicknamed the site “The Stitch.” This site is the company’s new home for sales, marketing, accounting, human resources and management along with its warehouse of raw materials. Townsend also plans to lease several areas of the office space to other parties.

Townsend Leather
www.townsendleather.com

1

2. Spire Aviation Launches AirSafe

Spire Aviation, a space-to-cloud data analytics company, has launched new aircraft tracking technology called AirSafe API. It is the company’s first ADS-B product. AirSafe uses low Earth orbit ADS-B technology and ground-based collection to provide details on global aircraft position reports for aircraft fleet operations around the world. The product solves the need for flight tracking data covering both land and oceans, the company says.

Spire Aviation
www.spire.com

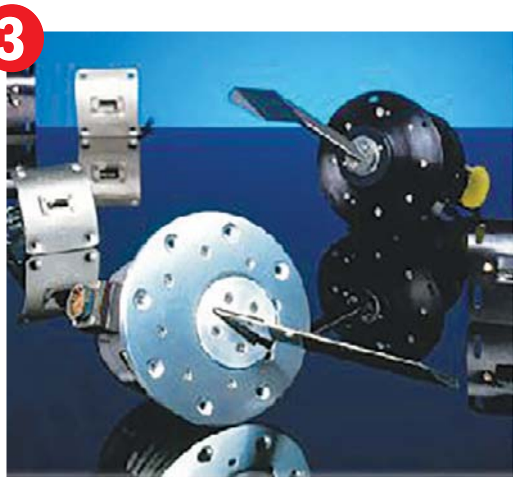
2

3. Textron Selects Safe Flight Systems for SkyCourier

Safe Flight Instrument has been chosen by Textron Aviation to provide its Stall Warning/Angle of Attack (AoA) System on the Cessna SkyCourier. The system consists of a mounted wing lift transducer and an angle of attack stall warning computer which measures stagnation point location and flows, providing AoA sensing regardless of aircraft weight, wing loading, flap position or center of gravity. Safe Flight has been providing primary Stall Warning and AoA Systems for Textron Aviation’s Cessna and Beechcraft aircraft dating back to the Beechcraft Bonanza in 1947 and the Cessna 190 in 1949. Safe Flight currently provides equipment to Textron Aviation on every piston and turboprop aircraft the company manufactures, as well as all the Cessna Citation business jets.

Safe Flight Instrument
www.safeflight.com

3



4. Startup Tuvoli Partners With Air Charter Guide

Air Charter Guide, a business aviation market intelligence tool, has partnered with startup company Tuvoli, which offers an open technology platform that enables charter aircraft brokers and operators to seamlessly buy or sell flights with instant guaranteed payments for flight services. Tuvoli, a division of Directional Aviation, is Italian for “you fly.” Under the partnership, Tuvoli customers will provide Air Charter Guide users access to the Tuvoli platform, while Tuvoli customers will have access to charter market intelligence. Air Charter Guide provides users with on-demand air charter resources of more than 2,500 operators and 15,000 aircraft. Greg Johnson, Tuvoli president and chief technology officer, said the partnership will bring real-time availability of information and access to real-time transaction capabilities.

Tuvoli
Boston, Massachusetts
(617) 729-3400
www. Tuvoli.com

5. Strato Jet Introduces Stratos Air Charter Marketplace

Stratos Jet Charters in Orlando, Florida, an air charter brokerage company, has developed the Stratos Air Charter Marketplace,

6

a new software as a service (SaaS) technology designed to connect buyers and sellers of private air travel. The system gives customers access to the best positioned aircraft and gives air carriers visibility of their aircraft whether located at their base or transient, it said. It also allows air carriers to market empty or positioning flights to customers who have flown or sought similar routes in the past. The goal is to provide more revenue to private jet owners and air carriers, reduce unoccupied flights and increase the potential of transient bookings.

Stratos Jet Charters
www.stratosjets.com

6. Aircraft ADS-B Equipage Reaches 85%

According to FlightAware, 85% of turbine-powered business aircraft registered in the U.S. are ADS-B equipped to meet the FAA's Jan. 1 deadline, up from 62% a year ago. In October, 9,859 aircraft met ADS-B compliance out of 15,981 in the fleet. The Cirrus Vision SF50 has the highest compliance rate at 99%, followed by the HondaJet fleet at 98%, Citation CJ4 at 96% and Embraer Legacy at 95%. The lowest compliance rates belong to the Gulfstream III at 52%, Falcon 20 at 65% and Cessna 650 Citation 3 at 66%.

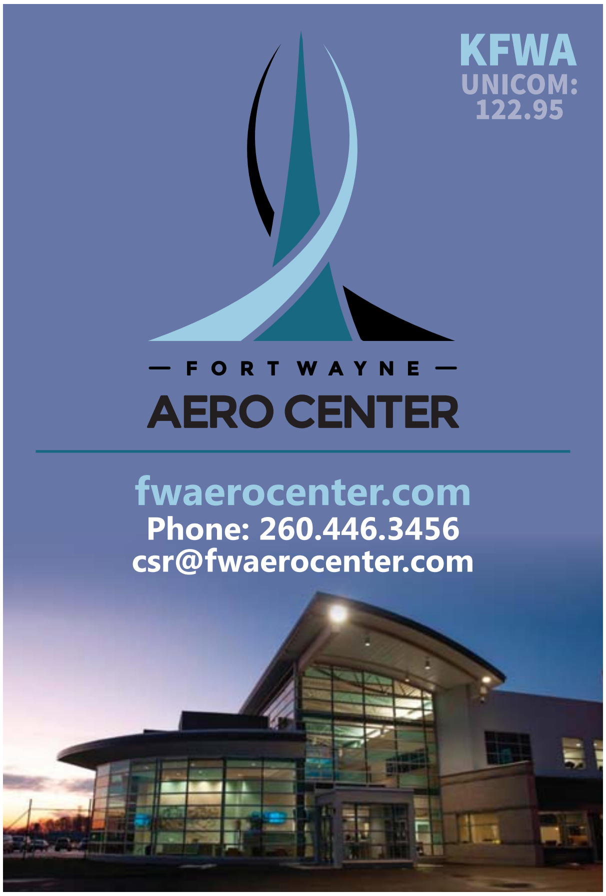
FlightAware
www.flightaware.com

7. Skyservice Expands Maintenance Services

Canadian business aviation services provider Skyservice has purchased the Muskoka Aircraft Center hangar and Part 145 approved maintenance organization (AMO) in Gravenhurst, Ontario.

The 60,000-sq.-ft center at Muskoka Airport will complement service centers already in place by Skyservice in Calgary, Montreal and Toronto and provide customers with maintenance of corporate, as well as regional and commercial aircraft, it said. Skyservice President and CEO Emlyn David described the location as "a one-stop shop for all aircraft needs, with safety and service at the forefront." The most recent sale of a HondaJet Elite will bring to four the number of HondaJets sold in 2019. Skyservice also operates FBO services at four Canadian locations: Calgary, Montreal, Ottawa and Toronto.

Skyservice
www.skyservice.com


KFWA
UNICOM:
122.95
— FORT WAYNE —
AERO CENTER
fwaerocenter.com
Phone: 260.446.3456
csr@fwaerocenter.com


ASERTEC
AeroServicios
Not only do our facilities distinguish us, but we are the best way to arrive!
Everyday flight operations
Aircraft and crew administration
Charters
Handlers
Maintenance
Available 24/7
MMAN Monterrey | MMTO Toluca
Mexico the Country Friend!
www.asertecfbo.com


BCA
Media Planners:
High-Impact Bonus Distribution
Look for BCA at these upcoming 2020 Q1 events.
January
• HAI HeliExpo, Jan. 27-30, Anaheim, California
February
• Singapore Airshow, Feb. 11-16, Singapore
March
• S&D, March 10-13, Charlotte, NC
• IOC, March 16-19, Charlotte, NC
AVIATION WEEK NETWORK

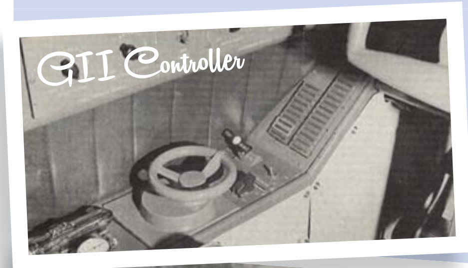

KAISERAIR
KOAK / KSTS
No Games, No Gimmicks, No Restrictive Fuel Programs – Just good old fashioned service with YOUR best interests and bottom line in mind.
Still the BEST VALUE in the San Francisco Bay Area and Wine Country.
www.kaiserair.com
510-569-9622 (KOAK) | 707-528-7400 (KSTS)
FULL SERVICE FBOs – AIRCRAFT MANAGEMENT SERVICES – WHEEL, BRAKE AND BATTERY SHOP, PART 91, 135, 121 FLIGHT OPERATIONS

December 1969 News

We at BCA hope **Santa finds your house.** We wish you a Merry Christmas and happy holidays, and many shining **hours for business aviation in 1970.** – *BCA Staff*

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

Certification of the Interceptor 400, a four-place, single-engine turboprop built by Interceptor Corp., Norman, Oklahoma, is expected in January 1970. First delivery is to lawyer F. Lee Bailey. Base price, excluding avionics, is firm at $88,000.



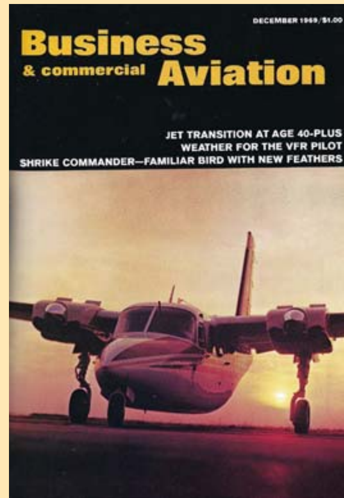
Complaints of Gulfstream GI and GII: Pilots regarding poor nosewheel steering capabilities due to limited sensitivity of cockpit tiller bar control have been heeded not by the factory but by corporate pilot B.K. Moses who flies a GI out of Dallas. He designed a nosewheel steering control wheel similar to that used in the JetStar, got FAA approval (STC-PMA) and now markets the 2-lb. unit through BKM Co. Called the Guidemaster, it lists for $985.

STOL Commuter: A 36-passenger STOL GAC-100 airliner is being developed by General Aircraft Corp. and Pacific Airmotive at Santa Monica. Assembly of the four-engine PT6A-40s turboprop is slated for 1971. The cabin will be air conditioned and pressurized. The airplane will be certificated under FAR Part 25.

Finishing Touches: A technician at Sperry Flight Systems Division in Phoenix completes final assembly of a horizon flight indicator used in SARS (Sperry Three-Axis Reference System). It provides a three-axis attitude and heading reference plus flight director commands and furnishes attitude electrical outputs for autopilot use.

Change in Style: In adapting its 400-hp 10-place helicopter to PT6B turboshaft power, Doman Helicopters will introduce various stylistic changes resulting in its new D-10C. The rear fuselage will be refaired to reduce drag and the main cabin lengthened 16 in. Target price for the D-10C, now in the development stage, is $200,000. BCA

THE ARCHIVE



With power on and props spinning, here comes Aero Commander's Shrike/Esquire, a familiar bird with new feathers. Although the promotional corn is as high as an elephant's eye, the approach is reaping a rewarding harvest. For an ornithological look at this tough bird from A-C's aviation aviary, see our report this month.

The sleek new Metro flies twenty passengers at more than 300 mph in a sea level cabin up to 16,800 ft. Fairchild is marketing the aircraft as the first of a new breed . . . designed exclusively for the dynamic, young commuter airline industry.


HONDA
BEND TIME.
BLUR LINES.
EXPERIENCE THE FASTEST JET IN ITS CLASS.
SAVE FUEL.
SPARK ADVENTURE.
EXPERIENCE THE MOST FUEL-EFFICIENT JET IN ITS CLASS.
Conquer new frontiers, venture farther, and climb higher. With HondaJet Elite, your destinations and passions are within reach and more.
RELENTLESSLYPURSUE.COM
1.336.387.0707
HondaJet ELITE