OPERATORS SURVEY
Dassault Falcon 7X Another Look

ALSO IN THIS ISSUE
Cockpit Cognitive Biases
Pilot Pushes the Weather and Rules
Managing Spare Parts
Lessons From Bedford Gulfstream Accident
Microbursts: Beware the Wayward Wind
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Theoretical range shown is based on cruise at Mach 0.80 with eight passengers, four crew and NBAA IFR fuel reserves. Actual range will be affected by ATC routing, operating speed, weather, outfitting options and other factors. Flight durations are estimated at best cruise speed and account for 85% annual winds conditions.

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A GENERAL DYNAMICS COMPANY
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True professionals do things the right way

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Fast Five With Brian Barents, Co-Chairman, Aerion Corp.

Avionics makers step up their cyber game

Aviation creates GE Digital in Consolidation

King Air 200 NTSB Report: “Inappropriate Rudder Input”

Jet Aviation Acquires AvJet Corporation

Bell Receives Largest Order in Its History

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Showtime
Flawed, yes, but giddy gatherings for 100 years

It was intended to be a celebration, honoring the victors of the Battle of Britain fought 75 years earlier. Unfortunately, horribly, what occurred was too reminiscent of the war’s worst events.

The day was air show perfect with bright blue skies and despite its age, the vintage Hawker Hunter was performing well. However, the pilot began pulling out of a loop at too low an altitude and the old jet continued down until it smashed onto a busy highway, careening into cars and igniting into a fireball. Eleven people were killed. Amazingly, the pilot, a former Royal Air Force aviator, survived, albeit with severe injuries.

Even though no spectators attending a British air show had been killed in more than a half century, and even though they are among the most popular outdoor gatherings among the U.K. citizenry, the repercussions from the crash at the Shoreham Air Show last August appear to be formidable.

According to Tony Osborne, Aviation Week & Space Technology’s London bureau chief, the Civil Aviation Authority has been reviewing its air show directives and plans to strengthen the accreditation of organizers and the certification of air show pilots. It has also proposed doubling the cost of its administration fees.

As a result, several shows have canceled their events this year and others are expected to follow. Moreover, insurance premiums for the flights that have spiked and there’s real concern that Britain’s air shows will dissipate as has occurred in Germany and Belgium following fatal air show crashes in those countries in 1989 and 1997, respectively.

I think that’s a sad fate for one of the most exciting elements of aviation, an aerial spectacle that demonstrates thrillingly the capability of vessels of the ocean of air when captured by the most skillful of pilots. Yes, sometimes they exceed the limits and pay dearly for that, but those are the notable exceptions.

Not everyone shares my view, I know. Indeed, Larry Rachlin, my former aircraft insurer (former only because I sold the airplane), is my polar opposite on this matter and quite adamant about his position.

“I hate them,” says he regarding air shows. “An air show doesn’t promote flying. It promotes danger.”

A better approach, he believes, is to demonstrate the utility airplanes represent and the ease with which they can be safely flown. He recalls taking families for rides in his aircraft during a weekend event in New Jersey back in 1983. Unfortunately, one afternoon a pilot flying a homebuilt Thorp T-18 overstressed the aircraft during a low pass, causing it to disintegrate, crash and burn in front of 15,000 people. The Thorp pilot was killed and the show was never held again.

“Airplanes are getting bad press” because of such avoidable tragedies, among other things, he maintains.

But as the International Council of Air Shows (ICAS) notes, “Even the sometimes jaded press corps turns out in forces when it’s air show time.” And save for the rare event coverage like that at Shoreham, the videos, stories and photos that follow are usually quite favorable.

And while some spectators, like many at car races, are there to witness calamity, I posit that most are there for the panoply, the excitement, the wonder of it all. By ICAS’s count, there are 350 air shows held annually in North America, and attendance has increased since the great recession of 2008.

Air shows in North America have been among the largest spectator events for the past 100 years and I expect that record will continue. At least I hope it will.

I can’t prove that air shows sell aviation, but I do know that the two sons of mine I took to Oshkosh were riveted that the two sons of mine I took to Oshkosh were riveted by what they saw and heard, and both went on to become military pilots. I’m not for a moment suggesting cause and effect. But those mesmerizing Immelmans, tailslides and vertical rolls toward heaven didn’t hurt.

Honors
Last month, I noted that 2016 is AW&ST’s centennial year. It marked the birthday during its Laureate Awards dinner March 8 in Washington, D.C. A souvenir for those attending was a reprint of the first edition of Aviation and Aeronautical Engineering, the magazine’s forebear. While perusing it, my eyes fixed on this short item: “C.V. Cesna [sic], the Hutchinson (Kan.) aviator, was seriously injured by a bad landing caused by engine trouble.”

Now if you’re a man trying to sell airplanes of his own design and manufacture to a skeptical, even fearful, market, that single sentence was the worst publicity possible.

Still, it all worked out in the end since that same evening Scott Donnelly and Scott Ernest were awarded the Business Aviation Laureate for their leadership and reinvigoration of Cessna and Beech under Textron Aviation.

Congratulations to them, and the other nominees, Gulfstream, FlightSafety International and BBA Aviation.
As a naval aviator, test pilot and astronaut, Mark Kelly has been recognized for his courage and determination. A true pioneer, he appreciates the innovation, craftsmanship and utility of the Exospace B55, the first Breitling connected chronograph. This multifunction electronic instrument, powered by an exclusive COSC chronometer-certified caliber, reinvents the connected watch by dedicating it to the service of aviation professionals. Performance, functionality, and reliability. Welcome to the world of tomorrow’s technology. Welcome to our world.
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You’ll find our facilities in Greenville SC (GYH), Dayton OH (DAY) and Nashville TN (BNA). For more information, contact Phil Stearns, Sales Manager, at 937-470-1851 or pstearns@StevensAviation.com.
SOPs — Timely Topic
I thoroughly enjoyed your article “Sticking With SOPs,” (March 2016, page 52) You nailed it! I’m having it scanned and distributed within NTSB.
Just wanted to thank you for addressing this important and timely topic.
  Robert Sumwalt
  Member
  National Transportation Safety Board
  Washington, D.C.

Get Out of the Way
I’ve just read Mr. Becker’s letter (“Still the Silver Lining,” February 2016) that expands upon your “Finishing Well” (Viewpoint, January 2016).

The regulators are stubbornly blocking advancement and technological evolution of the offerings customers receive from purveyors of aviation solutions for expedient travel.

Even Airbus seems to be in the mix; it’s trying to launch an Uber-style helicopter service. I wonder how long before some court, at the instigation of the FAA (or other entrenched parties) make them pack up and go home.

Speak with anyone who flies more than twice a decade, and they’ll agree that in terms of price, airlines offer a great deal. Conversely, in terms of time and convenience, it is often quicker to drive curb-to-curb than take the legacy bus that has now sprouted wings.

Think about it. Want to do a trip of say 400 mi.? To reach the departure airport, then navigate TSA, then fly to an airport that is not too close to the destination, then wait at the carousel for one’s luggage, then trek to the car rental park, then at last, commence to one’s final destination. Think LAX to Sky Harbor. If one lives in Pasadena and needs to go to Scottsdale: by car, point-to-point, it is approximately 5 hr. No airline does it point-to-point. And their combined, total elapsed time is always more than 4 hr.!

This same trip using a private charter, going from a departure on one’s convenience, to the appropriate destination airport, also of one’s choosing, is always under 90 min. for the entire trip!

Ed Bolen, president of NBAA, has often said: “It takes three days to attend one meeting via commercial airlines, yet, flying private anybody can attend three meetings in one day.”

No wonder that all the presidential candidates fly on chartered jets — except Trump who owns his B757. Even then he has an advantage. Presumably he enjoys the freedoms of Part 91, while his competitors are stuck with the confines of Part 135. One would think that these candidates (of both political parties) understand why, and would agree, that evolution of our aviation system needs a shove to get it solidly into the 21st century.

Yet, as soon as they are elected, they become part of the roadblock, and then they just reinforce the status quo. Hilary won’t even allow the media to photograph her boarding her charter.

Uber is busy bankrupting the legacy taxi services, worldwide. I wonder what will happen when the masses flock to an Uber-AIRbnb to enjoy point-to-point, on-demand, group-and-go, charter flights?

  Peter Green
  Scottsdale, Arizona

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INTELLIGENCE

BOMBARDIER BUSINESS AIRCRAFT DELIVERED ITS 75TH Model 75 Learjet in late February, two years after the first Learjet 75 entered service. The milestone aircraft went to Aurora Jet Partners, a fractional, charter, sales and aircraft management company based in Edmonton, Alberta. Tonya Sudduff, general manager of Learjet programs and of its Wichita, Kansas campus, called the delivery “another achievement in the proud history of our iconic brand.” The Learjet 75, which is now based in Toronto, joins an Aurora fleet that includes Challenger 300, Challenger 604, Challenger 605 and Global 5000 jets. The company has options on two more Lear 75’s this year. The aircraft’s price and performance, as well as Bombardier’s support of its aircraft, makes the Learjet 75 the right addition for the company as it grows, McGoey said. “We’re extremely thrilled to be adding a Lear 75,” he said. The aircraft will be in operation as early as next week. The model, which lists for $13.8 million, seats six to eight passengers and features a Garmin 5000 cockpit, flat cabin floor, and cabin management system with touchscreen monitors. It has a Mach 0.81 cruise and 2,000+ nm range. Meanwhile, Bombardier’s Challenger 650 has been granted full-type certification from the European Aviation Safety Agency (EASA). The manufacturer says demand for the model, which entered service last year, is strong around the world. And now with EASA certification in hand, David Coleal, Bombardier Business Aircraft president, says the company is eager to get it to the continent. With good reason. According to Bombardier, its Challenger 600 series jets are the most delivered aircraft in the medium category in Europe and account for the largest installed base in their segment in the region. The Challenger 650 has a 4,000-nm range and features a redesigned galley, seats and advanced cabin management system that includes high-definition monitors, audio video on demand and Bluetooth integration. It also includes the Bombardier Vision flight deck. All that’s to the good. But the Montreal planemaker’s long and expensive development of the C-Series jetliner, Global 7000/8000, the now cancelled Lear 85, and general market slowdown have taken a heavy toll on its finances and stock value. Accordingly, Standard & Poor’s (S&P) Ratings Service has lowered is revenue and earnings before interest and tax (EBIT) forecast for Bombardier for the next two years, primarily due to pressure in the company’s aerospace business. The forecast includes a higher cash flow deficit due to the reset of its Global 5000 and 6000 production rates, weaker aerospace end-markets and the ramp-up of the C-Series, it said. According to the ratings service, “The company continues to face material risks associated with the C-Series program that are incorporated in the rating, including cost overruns, launch delays and demand that ultimately may be below levels required to support the economics of the aircraft.” It said that even though Bombardier has shored up its liquidity significantly, there is potential for the company to generate weaker than expected profitability. And it views any positive action unlikely in the next 12 months “due to the reduced margins and negative cash flow forecasted under its base-case scenario.”

Jet-A and Avgas Per Gallon Fuel Prices
March 2016

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<th>Region</th>
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The tables above show results of a fuel price survey of U.S. fuel suppliers performed in March 2016. 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 Group/U.S. at (513) 852-5110 or on the Internet at www.aviationresearch.com

For the latest news and information, go to www.bcadigital.com
**Flight Data Services, SKYTRAC Partner**

SKYTRAC has joined with Flight Data Services for enhanced Flight Data Management Services. Under the agreement, the flight data graphing, visualization and analysis features of Flight Data Services’ POLARIS FDM platform will be directly imbedded in SKYTRAC’s SkyWeb online data management portal. SKYTRAC will also be supported by Bly Data Services’ team of flight data analysts. SKYTRAC fixed and rotary wing customers will now have one-stop access to self-serve report and personalized analysis.

**THE FAA LAST MONTH ISSUED** a Notice of Proposed Rulemaking (NPRM) on Part 23 that would overhaul airworthiness standards for small general aviation aircraft. The proposal is based on recommendations from the industry and aims to cut costs and the time it takes to get safety-enhancing technologies those aircraft into the market. The proposed rulemaking addresses the Congressional mandate in the Small Airplane Revitalization Act of 2013, which directs the FAA to streamline the approval of such safety advancements. The NPRM calls for replacing current prescriptive design requirements with performance-based airworthiness standards. It adds new certification standards to address general aviation loss-of-control accidents and inflight icing conditions. “General aviation is vital to the U.S. economy, and this proposal would benefit manufacturers, pilots and the general aviation community as a whole,” said Transportation Secretary Anthony Foxx. And FAA Administrator Michael Huerta added, that his agency’s “collaboration with industry and international partners reflects a performance-based, flexible approach which would accommodate today’s rapidly changing aviation industry and technological advances now and in the future.” The General Aviation Manufacturers Association (GAMA) hailed the proposal. GAMA President and CEO Pete Bunce said the proposal “is the result of nearly a decade of work by the entire aviation community” and “will help improve general aviation safety and bolster the piston, turboprop, and light jet market, as well as remove barriers to certification for new technologies such as electric and hybrid propulsion.”

**PIPER AIRCRAFT RECENTLY RECEIVED AN ORDER FROM ATP FLIGHT** School for 15 additional Archer TX training aircraft. The order is part of a three-year agreement signed in April 2013 for up to 100 aircraft. ATP has been exercising its option for additional Archers as it transitions to a predominately Piper fleet, the company said. At the current rate of increase, Piper will deliver 70 of the 100 aircraft to ATP by year-end. “This follow-on fleet transaction is a display of ATP’s ongoing confidence in Piper Aircraft,” Piper President and CEO Simon Caldecott said. “Our training aircraft continue to impress students and instructors, delivering unmatched performance with countless hours of flight school training around the world.” The Archers are primarily used by ATP’s Airline Career Pilot Program students. This program puts students on an airline-sponsored career track, and moves them from no experience to an airline pilot’s position in two years. After training in the Archers, students then transition to ATP’s multi-engine fleet of more than 100 Piper Seminoles, which are similarly equipped to the Archers.

**THE FAA THIS MONTH BEGINS WEIGHING** recommendations from an aviation rule-making committee (ARC) regarding its handling of light or “micro” unmanned aerial systems (UAS). The committee was tasked with defining a performance-based standard that would allow UAS weighing less than 4.4 lb. to be flown over people not directly involved in its operation. One of the most popular consumer small UAS, and also used widely in commercial operations approved by the FAA, DJI’s Phantom 2 quadcopter weighs in at around 2.2 lb. The Parrot Beebop quadcopter weighs less than 1 lb. The FAA floated the idea of a separate “micro” classification in its small UAS notice of proposed rulemaking published in February 2015, but after reviewing public comments decided not to include the distinction in the final rule expected in June, saying further engagement with industry was needed. The micro-UAS ARC was to consider research into human injury thresholds, hazard assessment methods and acceptable levels of risk for non-participants. In addition the committee was asked to identify how manufacturers would show compliance with the recommended standard.

Bell Begins Biggest Order Deliveries

Bell Helicopter delivered 175 aircraft in 2015, including 99 Model 407s, 52 Model 429s and a dozen each of 412 twins and Long Rangers. And last year, the company also announced the largest helicopter order in its history — 200 Model 407GXPs to Air Methods Corporation. The first of those aircraft was delivered early this year. Meanwhile, development of Model 525 and 505 continues with letters of intent in hand for 80 and 350 units, respectively. And the V-280 Valor program is undergoing systems integration and major assemblies. First flight of that aircraft is anticipated in the second half of 2017.

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OUR SIGHTS ARE SET HIGHER

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Sabreliner Major Milestone in AeroVue Integrated Flight Deck

Sabreliner Aviation, a subsidiary of Innova Aerospace, announced that they have reached a significant milestone with the AeroVue TM integrated flight deck program. With the completion of Critical Design Review (CDR), Sabreliner has now begun cockpit preparation on the initial aircraft. Dave Miner, Sabreliner Aviation, said, “We are excited by our progress, but more that, we are closer to giving Citation operators what they deserve — reliable LCD’s that replace the unreliable and obsolete CRT’s and compliance for the upcoming mandate.”

Meridian Air Charter Adds Falcon 7X to Fleet

Teterboro, New Jersey-based Meridian announced the addition of a Falcon 7X (N221HJ) to its charter fleet of business jets. This ultra-long range aircraft was completed in 2008, and seats up to fourteen passengers. It also has the capacity to sleep up to seven for long-haul trips. It is based at Teterboro Airport and is immediately available for charter.

THE NATIONAL TRANSPORTATION SAFETY BOARD (NTSB) has ruled that the probable cause of the fatal Oct. 30, 2014 crash of a King Air B200 into the FlightSafety International training center in Wichita, Kansas, was the pilot’s “failure to maintain control of the airplane after a reduction in left engine power” and “inappropriate rudder input.” Four people, including pilot Mark Goldstein, a former air traffic controller, died when the aircraft crashed into the training center at Wichita Mid-Continent Airport. Three people inside the building were also killed in the crash, including two FlightSafety employees and a Russian pilot who was in training. Six others inside the building were injured. Seconds after becoming airborne, the 53-year-old pilot radioed the tower that the aircraft had lost its left engine and he was declaring an emergency. The King Air then entered a shallow left turn, continued turning left, and barely cleared the top of a hangar on the west side of the runway before slamming into the FlightSafety building, witnesses told the NTSB. Only 26 seconds passed from the time the aircraft took off until it struck the building. According to the NTSB, “Contributing to the accident was the pilot’s failure to follow the emergency procedures for an engine failure during takeoff. Also contributing to the accident was the left engine power reduction for reasons that could not be determined” but that “a post-accident examination did not reveal any anomalies that would have precluded normal operation.” An analysis revealed that the left engine was likely producing low to moderate power and the right engine was likely producing moderate to high power when the aircraft struck the building. But the NTSB did not rule out the possibility of a sudden left engine power loss. An ATP, Goldstein had more than 3,100 flight hours, including more than 2,800 in multiengine aircraft. Gillesland Aviation, located in Georgetown, Texas, bought the aircraft two days before the accident. The ferry flight was heading to Mena Intermountain Municipal Airport in Mena, Arkansas. According to maintenance records, the King Air had undergone major scheduled maintenance eight days before the accident. The report noted that Goldstein had received Beechcraft King Air 300 series initial training at FlightSafety in Wichita a month before the accident.

HONEYWELL AEROSPACE FORECASTS DEMAND FOR 4,300 TO 4,800 helicopters for civilian use over the next five years. That’s roughly 400 aircraft lower than last year’s five-year forecast. The decrease is due to an environment of slower global economic growth and increased volatility in the oil and gas market, the outlook said. Helicopter fleet utilization generally declined when compared to a year ago. Over the next 12 months, usage rates are expected to improve, but at a reduced rate, the forecast said. “The current global economic situation is causing fleet managers to evaluate new helicopter purchases closely, and that’s why we’re seeing a more cautious five-year demand projection compared with previous years,” said Carey Smith, president of Honeywell’s Defense and Space division. Honeywell’s survey queried more than 1,000 chief pilots and flight department managers of companies that operate a total of 3,070 turbine and 360 piston helicopters. Expected worldwide deliveries of new helicopters over the next five years are 400 aircraft lower than last year’s five-year forecast. The highest demand is expected in deliveries of light single helicopters, with 54% of the shipments over the next five years, followed by 28% medium, 11% light twin and 7% heavy aircraft, the forecast said. Expected demand is highest in North America, with 29% of the deliveries over the five-year period, followed by Latin America at 25%, Europe at 24% and Asia at 13%. Latin America led all global regions in the rate of new aircraft purchase plans, despite the economic slowdown in Brazil. Just under half of the demand in Latin American is expected in light single-engine models. In the Middle East and Africa, 30% of operators who responded said their fleets were slated for turnover with a new helicopter replacement or additions. More than 60% of the planned purchases were for intermediate and medium twin-engine models.
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**GERMANY AIRCRAFT MANUFACTURER REMOS** plans to unveil the next generation of its high-wing composite GX aircraft at the Aero Friedrichshafen 2016 trade show in Friedrichshafen, Germany, April 20-23. The new GXiS is described by REMOS as “a milestone in the development of the aircraft.” The reliable and well-known airframe remains the same, but the airplane has been “completely reinvented” from a technology perspective. A significant technical innovation of the GXiS is integration of the Rotax 912 iS Sport engine from Rotax Aircraft Engines. The electric fuel injection makes the engine more efficient, and potential issues like carburetor icing are no longer an issue. The Neuf orm Composite Propellers fixed-pitch, three-blade propeller is standard. Among options for improved performance is the new hydraulically operated, constant speed propeller from German manufacturer MT-Propeller of DeLand, Florida. The new air intake on the redesigned cowling is part of an optimized cooling system, and the fuel and electric systems have been improved. Safety is augmented with the TRX-1500 collision avoidance system from Air Avionics. It receives ADS-B signals, interfaces with FLARM, and shows surrounding traffic on the moving map display. The installed transponder sends out its own ADS-B signals. And like all REMOS aircraft models, the GXiS is equipped with a ballistic parachute made by U.S. manufacturer BRS Aerospace of South St. Paul, Minnesota. Avionics are by Dynon and Garmin, and the heart of the aircraft is the new avionics suite. With this technology, the GXiS will meet the new European Aviation Safety Agency standard for light sport aircraft with 1,320-lb. maximum takeoff weight, REMOS says.

**CHINA WILL LIKELY OVERTAKE JAPAN THIS YEAR AS THE LARGEST CIVIL HELICOPTER** market in the Asia-Pacific region, even as its rapid growth of the recent past abates to more realistic levels. Mainland China’s rotorcraft fleet was the fastest growing in the Asia-Pacific last year with total civil rotorcraft rising by 118, or 20% to 694 aircraft. It grew even faster in 2014, by 31%. China’s performance contrasts sharply with Japan, currently the largest fleet operator with 762 helicopters. The total shrank 3% last year in Japan for a net decrease of 20 aircraft as older models were replaced with fewer, more capable rotorcraft. The Chinese market is expected to grow at a much more moderate rate from now on, according to an annual survey of Asia-Pacific helicopter markets by Hong Kong-based consultants Asian Sky Group (ASG). Negative factors include a slowing in China’s economy, government austerity measures, airspace taking longer to open up than anticipated, and the decline in oil and gas activity.

But slower growth may only be relative, and China will no doubt remain the land of golden opportunity as helicopter sales deals continue to be made for deliveries over the next few years. On March 1, Bell Helicopter announced the sale of 10 525 Relentless helicopters to a Chinese property developer; the manufacturer already has “numerous” Chinese orders for its 505 Jet Ranger X. Last September, Airbus Helicopter inked a record agreement for 100 light-single H125 and H130s with a Chinese leasing company, and Agusta-Westland claims to have sold more than 130 helicopters to Chinese customers to date, of which, according to ASG data, 41 were in service at the end of last year. ASG’s extensive survey analyses 34 markets in the region, and this year includes Australia, New Zealand (both of which operate significantly larger fleets than Greater China), and India for the first time. The report, released at this week’s Heli-Expo here, can be downloaded at http://www.asianskygroup.com/media-reports. The entire Asia-Pacific operated 6,015 civil helicopters at the end of last year, including 2,094 in Australia, 841 in New Zealand and 304 in India, with net growth in the region of 4.5% over the year.
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Solar Impulse Back in the Air

Solar Impulse 2 (SII2) has completed its first test flight following a battery system upgrade and ahead of restarting its solar-powered round-the-world flight attempt in April from Hawaii. The aircraft has been in storage in the University of Hawaii’s hangar at Kalaeloa Airport since its batteries were damaged by overheating on the record 3,896-nm, 117-hr., 52-min. flight from Nagoya, Japan, to Hawaii in June 2015.

TBM Sales Territory Expanded

Keystone Aviation in Salt Lake City, Utah, has expanded its North American sales territory for the Daher TBM turboprop aircraft. It has added four Canadian provinces and one additional U.S. state, Alaska, to its area of responsibility. The provinces include Manitoba, Saskatchewan, Alberta and British Columbia. That is in addition to its coverage areas of Washington, Idaho, Oregon, Wyoming and Montana. Keystone Aviation has been a TBM dealer since 2006.

DASSAULT AVIATION’S NEW FALCON 5X business jet will not enter service until the first half of 2020 due to difficulties in developing the Silvercrest engine at Safran’s Snecma motors division. The French aircraft manufacturer said Snecma’s difficulty in developing the new powerplant has halted work on the 5X and postponed engine certification from 2015 to 2018. “We have informed our customers of this change,” Dassault Aviation Chairman and CEO Eric Trappier says. “This is obviously a disappointment.” Dassault says it is operating in an increasingly competitive market against Gulfstream in the U.S. and Bombardier of Canada. Economically, the three rivals faced a sharp slowdown in the business jet market in emerging countries, notably China, Brazil and Russia, as well as a drop in oil prices and the recovery of the dollar against the euro. To improve its competitiveness, Dassault plans to lower costs directly impacting sales prices, despite the euro decline. On the bright side, 2015 saw the first flight of the Falcon 8X, with the company asserting that the test program has proceeded in line with expectations, and certification is still planned for mid-2016. The company says interior completion work started on five aircraft late last year, with delivery of the first jet expected in the second half of this year. Dassault plans to boost Falcon sales while supporting entry into service of the Falcon 8X this year. The company has vowed to ensure Snecma’s progress on the Silvercrest engine while improving after-sales service to Falcon customers and preparing the technological building blocks for future Falcon aircraft.

BUSINESS AVIATION DEPARTURES IN EUROPE ROSE 2.3% in February when compared to the same time a year ago, due to a boost from leap year, according to WINGX’s Business Aviation Monitor. Business aviation departures in Europe totaled 52,184 in February, up 1,176 flights from February 2015. Without the extra day for leap year, however, flights would have declined 1% when compared to a year ago, WINGX said. The month saw gains in business jet, turboprop and piston fleet activity, with total flight hours up 4%. Year-to-date for 2016, business jet activity is down 1% over 2015. Departures from France, the U.K. and Switzerland represented 42% of all activity. Each of the countries saw activity rise by at least 200 flights over a year ago. Year-to-date, activity in France is down 2%, Switzerland is flat and departures from the U.K. are up 1.6%. The biggest decline in February came from Germany, where flight activity receded 3%, or the equivalent of 263 flights. Year-over-year activity in Russia and Turkey, meanwhile, fell my nearly 200 flights each.

JET AVIATION WILL ACQUIRE AVJET CORPORATION, a Los Angeles-based jet charter and management company, for an undisclosed sum. The acquisition will expand Jet Aviation’s aircraft management and charter services on the West Coast. Closing is subject to governmental approvals, including relevant airport authorities. “Avjet’s 37 years of experience in aircraft management and charter services and impressive fleet of 45 aircraft makes it the perfect complement to Jet Aviation’s operations,” said David Paddock, senior vice president and general manager of Jet Aviation’s U.S. Aircraft Services. “This acquisition will also provide excellent benefits for Avjet’s customers by providing access to Jet Aviation’s global network of service facilities.” Avjet’s chairman and CEO Marc Foulkrod will continue to own and operate Avjet’s sales and brokerage division under the name Avjet Global Sales. “This acquisition meets my plan to continue to expand our global sales, acquisition and brokerage services while allowing Jet Aviation to continue Avjet’s tradition of excellence in aircraft management and charter services,” Foulkrod said.

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All of these names have one name in common.

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Wichita-based True Blue Power, announced that its lithium-ion engine-start battery will power Bell Helicopter’s 505 Jet Ranger X. The helicopter relies on a high-power, low-maintenance battery ideal for rugged environments. The TB17 battery uses proprietary Nanophosphate lithium-ion cell chemistry to provide power, energy, safety and life. Weighing 15.6 lb., the battery offers a 45% weight savings, increased payload and 60% to 90% reduced maintenance costs compared to lead-acid and nickel-cadmium alternatives.

**Gogo Customers to Get Duncan AOG Service**

Duncan Aviation has been selected as the exclusive aircraft-on-ground (AOG) service partner for inflight connectivity specialist Gogo Business Aviation. Duncan will work with Gogo to support its customers 24/7 with serviceable line replaceable units (LRUs) and spare parts strategically placed at Duncan’s network of facilities and avionics satellite locations within the U.S.

**KEY BUSINESS JET MARKET** indicators, measured by a monthly UBS Business Jet Market Index survey, point to a weakening global market and have fallen back to levels tracked in 2008-2009. The UBS Business Jet Market Index, released March 10, tracks changes in market conditions through surveys of domestic and international brokers/dealers, manufacturers, fractional providers, financiers and others. Its latest Business Jet Market Index was 11% lower than the previous survey and reached a new post-crisis low. Large-cabin jets showed the most weakness, followed by midsize jets and small-cabin jets. All index components declined. Inventory fell 21%, willingness to increase inventory declined 19%, 12-month outlook fell 7%, and customer interest declined 4%. Customer interest remained strongest in North America, although it fell 13% from the previous survey and came through “barely positive.” All other regions of the world continue to indicate incrementally weaker conditions, it said. About 65% of survey respondents cited weakness in emerging markets and currency devaluation as having a significant negative impact; 73% highlighted large-cabin jets as being most affected.

**VISTAJET EXPERIENCED DOUBLE-DIGIT** growth in passenger and flight traffic in 2015, the European private jet charter and aircraft management company said. Worldwide flight traffic increased 21% and passenger numbers grew 23% year-over-year when compared to 2014, VistaJet said. At the same time, the number of flights to the U.S. increased by 135%, while the number of flights within the U.S. increased by 165%. Thomas Flohr, VistaJet’s chairman and founder, said that “2015 was a record year for VistaJet. We maintained our position as the leading business aviation company, taking our passengers to the destinations that no one else will, with as little as 24 hours’ notice. We welcomed more passengers onto our jets than ever before.” Flights to Asia grew 62% in 2015 while the number of passengers increased 57% when compared to 2014. Flights to China grew 25%. To keep up with its growth, VistaJet continues to invest in its fleet. By March 10, VistaJet expects to own 60 Bombardier Global and Challenger aircraft. The U.S. has become one of its fastest growing markets, with New York City, Los Angeles, Palm Beach, Florida and Miami leading the growth.

**GE AVIATION HAS CREATED A DIGITAL ORGANIZATION** that brings digital operations from across its aviation businesses into one. The digital operations will be headed by Jim Daily, who has been named president and chief digital officer for engineering and technology for GE. “Over the past two years, we have shown the significant benefit that GE Aviation can provide customers by combining our depth of aviation product knowledge with the rapidly growing technologies around digital and analytics,” said David Joyce, GE Aviation president and CEO. “We have only taken our first steps in this journey, and the GE Aviation Digital organization will be the driving force to achieve aggressive goals for operational value for our customers.” GE Aviation Digital will form its own division within GE Aviation, which will support customers’ operations. It will also enhance the digital capability for the 35,000 engines that GE Aviation monitors daily, the company said. “GE and its customers are working together to unlock new opportunities to grow and deliver more productivity beyond traditional services,” the company said. “GE is creating industry standards for cloud computing and strengthening collaboration with customers to work on solving their toughest challenges.”
BOMBARDIER’S CHALLENGER 650 business jet has been granted full type certification from the European Aviation Safety Agency (EASA). The Challenger 650 entered service last year. EASA-registered customers will begin taking delivery of the aircraft this year. Demand for the Challenger 650 is strong around the world, said David Coleal, Bombardier Business Aircraft president. “With certification now in hand, we are eager for EASA-registered customers to experience this brand new jet.” Challenger 600 Series jets are the most delivered aircraft in the medium category in Europe and account for the largest installed base in their segment in the region, the company said. The Challenger 650 has a 4,000-nm range and features a redesigned galley, seats and advanced cabin management system that includes high-definition monitors, audio video on demand and Bluetooth integration. It also includes the Bombardier Vision flight deck.

BENDIXKING HAS ENHANCED ITS INFLIGHT INTERNET CONNECTIVITY for general aviation aircraft, according to BendixKing. The company is now shipping its next generation of the BendixKing Aero Wave 100 with a new Active Low Gain Antenna and optional Wi-Fi routers that make installation easier and provides voice or data connectivity for passengers and crew. AeroWave also provides connected Honeywell services to general aviation pilots, such as weather services, flight planning tools and communication with flight dispatchers and fixed base operators. Service plans are billed based on hours of use rather than amount of data used, BendixKing said. “Building on our first-generation AeroWave 100, BendixKing is excited to enhance the system with a simpler install process and easier passenger access to inflight internet,” said Justin Ryan, president of BendixKing. “The new antenna and routers reduce the system weight, install and setup time, and component count.” The company is offering a $3,000 promotional rebate to customers who take delivery of the AeroWave 100 system before June 1. The system is available through BendixKing’s dealer network.

PETROLEUM AIR SERVICES has been appointed the first Bell Helicopter Authorized Customer Service Facility in North Africa, the helicopter manufacturer said. Petroleum Air Services provides fixed wing and helicopter transportation to the oil and gas and travel industries in Egypt.

DISABLED AIRCRAFT SERVICES, based in Buffalo, Minnesota, has introduced upgrades to its line of PlaneSkate products designed to move aircraft with a flat tire from a runway, taxiway or ramp. Its 2nd Generation 4K PlaneSkate design is built to accommodate lower profile aircraft wheel struts and ensures the winch strap is properly retracted when recovering aircraft, it said. The design changes increase the product’s capacity by 30% and is designed for aircraft 10,000 lb. gross weight or less, the company said. It reduces runway closure time because of an aircraft flat tire to less than 10 min. The 30K PlaneSkate is also available for corporate and regional jets weighing 75,000 lb. gross weight or less.

EMBRY-RIDDLE AERONAUTICAL University-Prescott Campus and Universal Helicopters have extended a 2010 agreement to exclusively provide helicopter training to Embry-Riddle students. The program is designed to train students from zero time through a Certified Flight Instructor certificate. Since 2010, more than 150 students have received training through Universal Helicopter’s fleet of Robinson R22 and R44 aircraft.

AW&ST Laureates Recognize Textron Aviation in Biz Aviation

The Aviation Week & Space Technology’s 59th annual Laureate Awards for business aviation went to Scott Ernest, president and CEO of Textron Aviation, and Scott Donnelly, chairman, president and CEO of Textron, for saving Hawker Beechcraft, rejuvenating Cessna with aircraft upgrades and new turbine models, expanding its support network and creating a new manufacturing and training division. Runners-up included Flight-Safety International, Gulfstream Aerospace and BBA Signature Support.

Banyan Air Service to Transition Tech Info Library

Banyan Air Service, based in Fort Lauderdale, Florida, has signed an agreement with Aircraft Technical Publishers to transition Banyan’s technical information library from CD-based services to the ATP Aviation Hub, a cloud-based SaaS (Software as a Service) application. The change will allow Banyan staff to access technical and other information on any Internet-enabled device.
In the late 1960s, Detroit native Barents was working on his master’s degree at the University of Michigan, but with growing concern over the escalating Vietnam conflict. Precluding a draft call, he joined the U.S. Air Force, earning his wings and then flying fighters, ranging from F84s to F16s, for the next 34 years. He retired from the Kansas Air National Guard as a brigadier general. Meanwhile, he moved at Mach speed in mufti. Joining Cessna as a salesman in 1976, he rose quickly into the executive ranks, ultimately charged with all sales, marketing, product support and aircraft completions. In 1987 he joined Toyota to help launch the Lexus brand, but returned to aviation two years later to lead Learjet Inc. out of bankruptcy. By 1996 the iconic jet maker was making the greatest profits in its history. Next, Barents co-founded Galaxy Aerospace in 1997, which was acquired by Gulfstream four years later. In 2002, he joined with Dr. Richard Tracy, a master of natural laminar flow, and financier Robert Bass to found Aerion Corp., which is developing the AS2, a $120 million supersonic business jet. Airbus joined in that effort in 2014.

Questions for Brian Barents

1. **What technology needs yet to be created for the Aerion AS2 to proceed?**
   - **Barents:** An engine. We need to adapt a current production engine for efficient supersonic flight while meeting Stage 4 noise requirements. Today’s technology focuses on high-bypass engines for their economy and quiet. Unfortunately, we need a low to medium bypass engine for efficiency at transonic and supersonic speeds, and therein lies our challenge. Securing an engine that makes it all work is our highest priority. It is the pacing item for the program. Without an engine, we don’t have a program.

2. **Are the engine makers interested in providing a solution?**
   - **Barents:** NASA’s recent contract with Lockheed to design a ‘low boom” supersonic flight demonstration aircraft has brought additional positive attention to the market, and yes, the engine manufacturers are very interested. We’re closely evaluating two cores — you can guess whose they may be — and expect to be under contract with an engine maker this summer or fall. Based on the size of those cores, the AS2 will probably be a three-engine aircraft. But if all of a sudden a core emerged that would satisfy a two-engine configuration, we’d certainly look at it.

3. **Will Aerion benefit from NASA’s research?**
   - **Barents:** If the low-boom design is successful, we can certainly incorporate it into other models. But we plan to be flying in 2021 and begin deliveries in 2023, which will be ten years sooner than anything that might result from the NASA work. We have the technology to be first to market.

4. **What is required to lift the ban on supersonic flight over the U.S.?**
   - **Barents:** In discussions with government agencies we’ve been told that when they sought comments from the public on various subjects, the ban never came up, so the regulation remains in place. But the matter wasn’t an issue because no one was building a supersonic aircraft. I believe the ban, which dates back to the early ’70s, was imposed at the urging of the U.S. airlines, which were concerned about Air France and British Airways operating the Concorde. The ban was imposed for competitive reasons. The Concorde was short lived, but the ban is still on the books and it will be very difficult to remove given the current political atmosphere. That’s why we chose the path of least resistance. Our natural laminar flow design provides economies at both supersonic and subsonic speeds.

5. **Next year will be the 70th anniversary of supersonic flight. Are you surprised that people are satisfied with flying slower?**
   - **Barents:** Yes, I am. The Boeing 707 was flying at Mach 0.82 in the 1950s. The latest most expensive projects of Airbus and Boeing, the A380 and B787, respectively, are flying at essentially the same subsonic speeds today. They may fly farther, and are more comfortable, and haul more people, but they’re not going faster. That’s not progress. We believe there’s a market for speed. There’s no question that the industry wants a supersonic airplane.
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Lessons From Bedford, Part 2 True professionals do things the right way

BY JAMES ALBRIGHT james@code7700.com

We are told that on May 31, 2014, the professional pilot world got a wake-up call when two pilots crashed their Gulfstream IV (N121JM) at Hanscom Field (BED), Bedford, Massachusetts, and killed all on board. The NTSB rightfully called their performance an act of “intentional, habitual noncompliance,” but that was being charitable.

As the NTSB detailed, and as BCA Contributor Jim Cannon noted here last month (“Sticking With SOPs,” March 2016, page 52), the pilots failed to disengage the gust lock prior to engine start, failed to perform a flight control check after engine start, failed to reject the takeoff when takeoff thrust wasn’t achieved and failed to check elevator freedom of movement at 60 kt.

The NTSB report further noted that the pilots did not run a single checklist (of four) between engine start and takeoff, and in 98% of their previous 175 takeoffs, they neglected to do a flight control check.

This tragedy was, after all, a classic case of what David Huntzinger, Ph.D. in safety, labeled Procedural Intentional Noncompliance, which he detailed in his award-winning article, “In the PINC,” also published by BCA in January 2006. At last, nearly a decade later, we finally have proof that PINC can be deadly. A wake-up call?

I have my doubts. If you are reading this page you probably get it. You follow your checklists, by the book. You have been doing your flight control checks, prior to every takeoff. You have been on guard against the forces of complacency that overtook this pilot team. You get it. I think about half of us — at most — get it.

The other half? They aren’t reading this page or any professional journals. They might have read the title of Richard Aarons’ Cause & Circumstance, “Gulfstream IV at BED,” in BCA’s June 2015 edition (page 48) but not bothered with the contents. They may have even attended a safety stand-down and heard about the dangers of PINC and complacency, but they weren’t paying attention. They don’t believe they are at risk. Why is that?
I think that we, the half that get it, are partly to blame because we treat these types of behavioral problems in polite, clinical terms. If you suffer from PINC, after all, perhaps it is just a minor malady that can be treated with a week at the simulator or a new gizmo for the cockpit. Your complacency is just a passing phase. You’ll grow out of it. Well, none of that is true.

We need to stop looking the other way and as professional pilots make intentional, habitual noncompliance our business. We either retrain the offenders, or we purge them from our hallowed profession. We can do this by tightening up our own behavior when it comes to checklist compliance; you cannot lead by example if your example is flawed. We need to make line observations a regular practice for all professional pilots; and not the anemic 14 CFR 135.299 checks we all know are little more than square fillers. And finally, we need to become aggressive advocates for professionalism; we need to track down the intentionally, habitually noncompliant and “get in their faces.” So let’s get to work.

**Checklist Philosophy**

There is no doubt that the crash of N121JM could have been prevented had the pilots simply executed their Before Starting Engines checklist, which instructed them to disengage the flight control gust lock, or the After Starting Engines checklist, which called for a complete flight control check. A profound irony of this crash is that nearly seven decades earlier, the use of checklists became institutionalized following another airplane crash resulting from a gust lock that pilots had forgotten to disengage.

In the early days of aviation pilots were required to simply remember to do everything. While there were written procedures, such as the “Hints on Flying” issued with the Curtiss JN-4 Jenny in 1918, the idea of a checklist hadn’t become widespread until after the crash of a Boeing Model 299 in 1935.

In that accident, the airplane’s test pilots forgot to disengage the elevator lock and the airplane crashed attempting to take off. The U.S. Army Air Corps decided the airplane was simply too complicated for any pilot to fly and temporarily canceled the prototype program. There was no other airplane in the same league, however, and the service still wanted it. The fix to the airplane problem was deceptively simple: They developed checklists crews would follow prior to takeoff and before landing. The bomber proved flyable after all and over 12,000 of what became the B-17 Flying Fortress were produced, helping win World War II.

Today, checklists are an accepted part of aviation. And yet many pilots look upon them as optional. They regard them as a crutch for those new to the airplane that can quickly be discarded once the pilot has the “flow” of each procedure memorized. But is this true? No, not according to 14 CFR 91.503(b):

> “Each cockpit checklist must contain the following procedures and shall be used by the flight crewmembers when operating the airplane: (1) Before starting engines. (2) Before takeoff. (3) Cruise. (4) Before landing. (5) After landing. (6) Stopping engines. (7) Emergencies.”

> “Shall be used,” in FAA-speak, is another way of saying, “must be used.” If you choose to operate your airplane without using the checklist, you are in violation of the U.S. Code of Federal Regulations.

PM verifies that it was done correctly. The CDV method is the most accurate way to accomplish a checklist, but many would argue it takes more time than necessary.

A do-verify method is easier in that you just get things done and then come back to the verification step. This is what many call “the flow,” whereby you accomplish the items in a visual pattern that makes memorization easier, and then you verify each step with the checklist. While that procedure may be quicker, it is prone to error because we often see things as they should be, not as they are.

Which method is better? Most pilots will tell you it is strictly personal preference. Having jumped into and out of Gulfstream aircraft five times in the last 25 years, I can say not even the manufacturers are immune to this dilemma. One year the flow is verboten, the next year it is the recommended procedure.

However, FAA Order 8900.1, Volume 3, Chapter 32 is fairly explicit on the subject:

> “In the taxi and pre-takeoff phases, aircraft configuration (such as flaps, trim and speed brakes) and flight guidance items (such as heading, flight director, altitude select panel settings and airspeed bugs) have proven to be critical. All flight crewmembers should confirm these items, and at least two crewmembers should respond to applicable checklist items. On approach, flight guidance checklist items have proven to be critical items. At least two crewmembers should confirm and respond to these items. A response should be required from each pilot when the same setting is required on two separate devices (such as computers, flight instruments or altimeters).”

In fact, Paragraph 3-3404 removes all doubt on the subject of CDV versus DV:

> “All checklists, except the after-takeoff and after-landing checklists, should be accomplished by one crewmember reading the checklist items and a second crewmember confirming and responding to each item. POIs (Principal Operations Inspectors) shall ensure that critical items on the before-takeoff and before-landing checklists are confirmed and responded to by at least two crewmembers.”

It makes sense that a DV approach is needed right after takeoff; after all,
you are pretty busy at that point. But we drill these procedures during training and scrutinize each step of the process. Our eyes need to be outside the cockpit and we work very hard at getting this phase of flight just right. We don’t have that excuse while starting engines, configuring the airplane for takeoff, and taxing to the runway. Then a CDV procedure is the only sensible choice.

It could very well be that you started your professional piloting career with the best of intentions and the promise to do things “by the book, each and every flight.” But over the years you became comfortable, proficient and, well, an expert. You may have dropped your CDV and gravitated to the DV. In the case of N121JM’s pilots, they gravitated even further to just D with no V. How can we ensure that we, those who get it, don’t become they, those who don’t?

**Line Observations**

If you are in a very large flight organization with, say, hundreds or thousands of pilots, you probably have a very robust set of flight examiners, check airman and standards officers who work full time to ensure every pilot is flying as the company intended. These evaluators don’t fly with you on a daily basis and may have never met you before settling into your jump seat for a line check. They don’t have to live with the repercussions of hurting your feelings. They have one goal in mind: keeping you in line with the company’s rulebook.

If you aren’t flying for a major airline or the military, you probably don’t have such a watchdog unit ready to pounce on you unexpectedly. Even a 14 CFR 135 operator is hardly under threat from the mostly harmless 135.299 check ride. I’ve given a few of these and received my fair share as well. The only legal requirement is for the check airman to observe a takeoff, an en route segment and a landing. I once had one of these administered by a check airman who never entered the cockpit during flight. It was hardly a check at all. Even with a diligent check airman, flying an empty leg on a day of your choosing hardly shows how you operate in actual, real-life conditions.

There is an easy way to take out an insurance policy against complacency and it is called a Line Operation Observation (LOO). You simply invite a pilot whom you respect to ride along in the jump seat on one of your operational trips. If you fly business executives, for example, organize your LOO on just such a trip. This pilot doesn’t have to be type rated in your aircraft but needs to be knowledgeable in the type of flying you do. Finding an LOO pilot with previous instructor or flight examiner experience will increase the benefit of this exercise.

A good LOO pilot is also knowledgeable of regulatory requirements and safe operating practices. The pilot should be skilled in observation and patient, and should be motivated by the thought of making everyone safer.

Since an LOO is not a formal check ride and the observed pilots’ licenses are not at risk, this is a low threat event. Nonetheless, the observed pilots will be under self-imposed pressure to do things just right. The observer should do his or her best to just observe and avoid hindering the real job at hand. Once completed and the airplane has been put to bed, the LOO pilot simply reports what he or she saw during the flight. An honest assessment can serve as a wake-up call for good pilots who have lost their edges.

I’ve given many of these over the years and some of the results often surprised the observed pilots. They had no idea that they had stopped visually clearing for traffic after takeoff. They were stunned to hear the amount of time they spend “heads down” in the traffic pattern. They were unaware of recent innovative radio read-back procedures that could have spared them a missed altitude assignment. They realized that while they preached flying stabilized approaches, they weren’t flying them. In all of these cases, a simple observation brought them back “into the fold.” An LOO is a cheap insurance policy against complacency.

Of course the LOO is an insurance policy for those of us who “get it.” What about those pilots who don’t?

**Advocacy**

Articles in magazines and safety journals have no impact on those who refuse to read them. A well-organized safety stand-down and a riveting quarterly safety meeting is wasted on those pilots who refuse to hear their messages. It’s a target audience peopled by pilots who believe themselves above all that. And they are the ones who need the wake-up call. But those of us who get it are partly to blame, and I include myself in this group.

For example, in 2003, I was standing at the counter of one of the FBOs at Washington Dulles Airport (IAD) when two incoming Citation pilots were handing the forms for their jet to a new crew. The incoming crew had brought the airplane in empty and had broad grins on their faces. They reported the airplane was in good shape and that they had managed to fly it 2,000 ft. above its service ceiling because it was so light. All four pilots agreed the Citation is quite an airplane. I just shook my head, decided to mind my own business, and made a mental note to never allow anyone I know to fly with that fractional company.

But that’s not what I should have done because as a professional pilot, it is my business. I should have gotten their names and turned them in. That could have rid our profession of at least two
habitual, intentional noncompliant pilots and would have telegraphed to the other two that we, the professionals, are not amused by those who aren’t. In fact, we are offended by their behavior.

We professionals need to target such noncompliant pilots for extinction. The word needs to get out that ours is a profession only for pilots who take the job seriously. Since the Bedford crash I’ve heard from many contract pilots with vivid examples of flagrant procedural noncompliance in many flight departments. Missing from each story, however, was any negative response on their part.

I fully realize that most contract pilots are reluctant to speak up against the person who signs their paycheck, because doing so might negatively impact their livelihoods, after all. But you per diem pilots are on the leading edge of this fight. You need to telegraph that this behavior is so egregious, you are willing to speak up.

And finally a word to schoolhouse instructors and independent auditors: These habitual, intentionally noncompliant pilots are experts at deception. Having spent much of my career as a flight examiner and auditor I can say that you should be able to tell when the person being examined is doing things by the book just for show. In fact, an essential part of your job is to figure this out and help us bring pilots like these back into the fold.

We all have a role to play. We, the professional pilot class, need to lead by example. We need to shock the habitual, intentional noncompliant pilots into our world. They need to be ostracized and shamed into doing their jobs as professionals or they need to be unceremoniously thrown out. This is our fight and we have to win it.

AUTHOR’S NOTE

If you would like to see an analysis of the crash of N121JM, the NTSB accident report is comprehensive (http://www.ntsb.gov/investigations/AccidentReports/Reports/AAR1503.pdf). I think the report’s coverage of the Gulfstream IV gust lock system is excessive, and any experienced Gulfstream pilot will tell you is a red herring. It diverts your attention from where it needs to be: on the pilots. I’ve analyzed the accident with a focus on pilot actions here: http://code7700.com/mishap_giv_n121jm.html

If you would like to set up your own Line Operation Observation program, I outline the steps and provide an example LOO form here: http://code7700.com/loo.html
Managing Spare Parts
Which parts you **really** need to **keep on hand**

While this may be the age of same-day shipping, computer-controlled inventories, global distribution networks and numerous third-party parts suppliers, chances are good that your airplane will break at the worst possible time and the part that you need will be in a building buried in a blizzard half a continent away. Meanwhile, the boss is packing for an imminent trip to close a “do or die” deal. You may be willing to bet your career on the part showing up in time to launch on that mission, but be sure your resume is up to date, just in case.

A better strategy is to determine the right balance between parts on the shelf and timely delivery by FedEx or UPS. That exercise involves a close assessment of your annual flying hours, scheduled and unscheduled maintenance rates, and a good understanding of the logistics supply chain for your particular aircraft. You’ll need deep knowledge of your aircraft and its systems, as well as its predicted reliability as it ages. For example, if you have an aircraft with a custom avionics suite, or additional features such as ferry tanks, what might their impact be to your spare parts needs? What are the maintenance and parts consequences of extensive hours, cycles or years? Have some parts become unavailable due to suppliers going out of business or models being long discontinued? The answers may require adding inventory in advance.

However, keeping too many parts on the shelf has negative consequences to consider as well. The cost of carrying excess inventory will affect your annual operating budget. Many parts have a fixed shelf life and their utility can expire, the part unused. And periodically parts that sit dormant need to be exercised or sent back for calendar-based maintenance.

Managing a spare parts inventory must be made someone’s assignment, requiring their time and thought and involving accountability. In addition, the parts will need a place to be stored, and some might require a climate-controlled space.

With so many variables to this equation, it is easy to get frustrated and simply place all faith in the deliveryman. But there are other answers.

**Dollars and Sense**

While pilots and passengers assess airplanes on their performance and comfort, maintainers focus on reliability and the cost of continued airworthiness. This expense includes not only the cost of parts and labor, but also the burden incurred when the aircraft is down for service.

Budgeting for spare parts is always a challenge. “A good general rule of thumb for a new aircraft is about 1 to 2% of the cost of the new plane,” said John Bucher, an aviation maintenance consultant based in Castlewood, South Dakota, and former maintenance chief of Honeywell’s corporate flight operations.

Work with your management team to determine the scope and depth of planned maintenance activities. If you are geographically isolated, you will need more capability, as opposed to being based at a major business aviation hub such as Teterboro Airport (TEB) or Dallas Love Field (DAL).
“After discussion with your management for budget approvals, put together a list of spare parts and ground support equipment needed and shop the list with various aftermarket sources,” Bucher advised. “There are many organizations where you can buy certified used equipment at a fraction of the cost of new.”

Other factors that you should consider are joining forces with other operators at your airport or nearby. In many cases you can share access to inventory and help cut costs.

Do not be shy about hunting for bargains, especially when an operator is replacing an aircraft with another model. “Keep your ears and eyes open for another corporate operator shutting down or getting rid of the same kind of aircraft you are buying,” said Bucher. “Many times inventories can be purchased for 20-40% from the new price.”

Aircraft interior parts can often be difficult to find after a period of time, especially if you have a custom interior package with unique finishes. It is a good idea to get two to three or each bulb, latch, hinge and knob (in the plating style in the aircraft). It is also a good idea to have spare service items like coffeemakers, microwave ovens, power plugs and monitors, as these models probably won’t be available in a few years. If they break and you cannot replace them, you are looking at an expensive STC package for your non-essential furnishings.

Links in the Chain

The foundation of your spare parts strategy begins with understanding your Minimum Equipment List (MEL). This will tell you what items are mandatory in order for flight, and which items may have deferred replacement under Time Limited Dispatch (TLD) rules. Items that will keep you on the ground and can quickly be replaced should be a priority on your spares list. Stocking big-dollar items makes for a tough decision, but typically items that take at least a day to install and get ops checked should be left to the OEM or aftermarket supply chain. While having a spare engine or landing gear in the back of the hangar might be convenient, it’s an unrealistic and impossibly expensive luxury for the vast majority of operators.

Many new aircraft come with the manufacturer’s maintenance cost control program, and there are third-party programs as well. Most involve a detailed breakdown of your aircraft’s planned parts needs and a pretty good estimate of frequently replaced items. As good as these programs are for cost management, you still need to manage some amount of inventory. Often the greatest hurdle for this task is your own leadership team.

“Spare parts stock has always been a tough sell to management,” said John Gibson, president of Latitude 45 Aviation Consulting Services and an experienced business aviation maintenance manager, in Brush Prairie, Washington. “They don’t like to see money tied up in inventory, sitting on shelves, yet they want 100% dispatch in the aircraft.”

OEMs have steadily improved the parts availability for their customers, and their capabilities, inventories and locations have expanded over the years. Most have recommended spares lists, but these are often very expensive to fulfill and tend to include some items whose practicality is questionable. It all comes down to you and your decision-making process.

“In later years, I found the manufacturer’s computer listings of high failure items invaluable when it came time to make a list of desired parts to be kept,” Gibson noted. “This list, coupled with experience and a study of the Minimum Equipment List really helped generate a minimal but effective spares inventory.”

According to Gibson, determining which spares to stock is part science and part intuition, and in many ways the operator rumor network is as valid a resource as any OEM’s spreadsheet.

“Over the years, I developed a list of items we had to have: brakes, wheels, boost pumps, light bulbs, beacons, relays, O-rings and whatever other items had a reasonably high failure rate, were difficult to come by, or the plane could not depart without,” Gibson continued. “One can always make a case for the fact that no matter how large your spares inventory, the part that fails will either not be in it, or will be out for repair.”

Even if your budget and storage space can accommodate, you do not want to have too many items on hand since, among the negatives already mentioned, that inventory can have tax implications as well. You want to keep spares low without impacting dispatch reliability. In many cases, if your aircraft breaks while on the road, you are better off having the part shipped directly there from someone else’s inventory, especially if it has to go overseas. It’s a delicate balance.

While the promise of overnight delivery is very enticing, it is far from a guarantee. Having the part on hand brings peace of mind. You don’t need a lot of parts, just the right ones. The key to making parts management work is knowing your aircraft, your operation and the logistics chain. Stay informed about your aircraft through operator groups and message boards. Find out who has your parts and how to get them. Develop a backup plan if your primary source goes dry.

The logistics involved in supporting your aircraft is a key element in your overall operation and your success depends in part on mastering it.

Hunting for Parts?

With so many options available for locating parts, keeping track of all the possible contacts can be quite an undertaking. One company that helps narrow your search is Inventory Locator Service. In operation since 1979, the company has a global online marketplace to enable those in the aviation, marine and defense industries to buy and sell parts, equipment and services. The subscription-based service has plans suitable for most operations. To learn more, visit: http://www.ilsmart.com

GULFSTREAM
Cockpit Cognitive Biases

They can cause pilots to ignore or dismiss real trouble

BY FRED GEORGE fred.george@penton.com

They are those convenient intellectual shortcuts we use to streamline our decision-making processes. Cognitive biases help us process information expeditiously when we're under pressure.

There are 100, or more, cognitive biases that are well known to psychologists. They influence or control ranges of behaviors, including eating and drinking, along with social, economic, religious and political actions. A few help us make good decisions with virtually no conscious thought. Most are relatively benign as long as you stay on the ground and steer clear of heated discussions. But there are about a dozen such biases that can kill you in an aircraft.

Such biases are formed through formal learning, personal experiences and hereditary factors. We use them to conserve our limited memory processing time and capacity.

How finite is human memory? While the human brain is capable of 10 quadrillion processes per second, far more than any computer yet designed, our accessible memory actually is far less capable. So, we tend to make choices within “bounded rationality” ... “within the limits imposed by given conditions and constraints,” according to Nobel Laureate and cognitive psychologist Herbert A. Simon. The limits include the time available to make the decision, cognitive limitations and available information, among other variables.

Bounded rationality can lead to “satisficing,” another term coined by Simon. In essence, that means a problem-solving shortcut that’s “good enough for government work.” As such, “satisficing” can hamper us from making the most rational, logical and optimal decisions based upon all available information and resources. Bounded rationality is just plain intuitive. In severe instances, “satisficing” can lead to grave mistakes and fatal errors as pilots fail to recognize and take action regarding overt and latent threats.

Analytical, logical decision-making — in contrast, is based upon conscious deliberation using rule-based thinking. But humans operate with both analytical and intuitive process models. Under time pressures, humans’ cognitive processes often fall back on shift intuitive cognition, as we unconsciously retreat from analytical decision-making. Our decision-making becomes prone to cognitive biases.

The first step in eliminating or mitigating cognitive biases is to identify them and determine how they can deter us from making the best decisions. For pilots, the key is to focus on the cognitive biases mostly likely to have impact on aeronautical decision-making.

Shem Malmquist, a senior MD11 captain for a major U.S. freight carrier and a Fellow of the Royal Aeronautical Society, has identified several cognitive biases that he believes are most likely to affect safety of flight.

Let’s look at how a dozen such biases, named by Malmquist, can impact safety.

Ambiguity Effect

The old saw “Better the devil you know than the devil you don’t” may help explain this bias. It’s when “a person is more likely to select something that has an intuitively clear risk as opposed to one that seems relatively less certain,” writes Malmquist in his April 2014 blog post.

Ambiguity effect is reinforced by structured experiences, such as flying between regular origin and destination points. Crews become comfortable and accustomed to landing at a destination airport. There’s seemingly never a need to divert to an alternate.

Anchoring Bias

Also known as focalism, this cognitive bias causes pilots to rely excessively on the first piece or set of information provided to them, forming an anchor for making decisions. They may use an adjustment bias to make minor changes to the base assumption of the anchor, but there is a reluctance to deviate sufficiently from the anchor to assure adequate safety margins.

If a computer-generated flight plan, for instance, predicts a certain required fuel burn based upon predicted winds, weather and temperatures, plus assumed reserves, that can create an anchor bias that can hamper the crew
from making dynamic, logical decisions about fuel planning as conditions change. Intuitively, they’re willing to accept minor changes to the original plan. But large-scale changes require a more difficult, analytical approach.

### Attentional Bias

“Once bitten, twice shy,” goes the saying. Attentional bias can result from a previous “thermal scarring,” causing us to focus or fixate on that earlier perceived threat or scare while overlooking other threats that should be considered in the decision-making process. If, for instance, a pilot has had previous anxious experiences flying through rough weather, a subsequent encounter with a weather threat might cause that pilot to pay close attention to that threat while overlooking or ignoring threats related to low fuel quantity, systems malfunctions or navigation errors. Intuitive fixation can blind us to the big picture.

#### Attentional Tunneling

Also known as “tunnel vision,” “attentional fixation” and “cognitive tunneling,” this bias is related to Attentional Bias but doesn’t necessarily result from memories of a previous threat encounter. Rather, it occurs when the crew focuses excessive attention or time on one task or threat to the detriment of being aware of other threats. It’s the “one track mind” mentality, when pilots become blind to what’s going on outside of a narrow channel of attention.

Attentional tunneling is a leading cause of controlled flight into terrain (CFIT) accidents. “Consider, for example, a crew that becomes so fixated on troubleshooting a burned-out warning light that they fail to monitor their altimeter and end up flying into the ground,” says FAA Aerospace Medicine Technical Report, DOT/FAA/AM-03/4.

That’s precisely what happened aboard Eastern Airlines Flight 401, a Lockheed L1011 that crashed into the Florida Everglades in December 1972 while the flight crew became preoccupied with troubleshooting a burned-out landing gear annunciator bulb, says Malmquist.

#### Automaticity

“Going through the motions,” is an apt descriptor for this tendency. This is not a cognitive bias, but it describes the ability to perform tasks by rote without much mental concentration, without paying close enough attention to detect problems. While automaticity can streamline task management when following checklists, during aircraft preflight inspection or programming cockpit automation, it also puts crews at risk for going through the motions without being alert for indications of anomalies or abnormalities. In an aircraft, what you don’t know (or inadvertently overlook) indeed can hurt or even kill you.

Preflight inspections often fail prey to Automaticity. Eyes and hands gloss over every part of the airplane. But, intuitively, pilots may fail to look actively for anomalies, including under-inflated tires, worn brakes, missing or damaged static wicks and open latches.

### Availability Cascade

Repeated exposure to information (or misinformation) can cause people to accept these perceptions as facts. Call this aviation folklore. It’s a self-reinforcing process that can form a stronger cognitive bias the more a particular perception is discussed publicly, the more it becomes accepted as fact.

“A lie told often enough becomes the truth,” noted no less an authority than Vladimir Lenin. In “Availability Cascades and Risk Regulation,” a 2007 research paper by Timur Kuran and Cass Sunstein, the authors note that an Availability Heuristic can morph into an Availability Cascade as a result of the spread of exorbitant rumors. They cite the prolonged public hysteria surrounding the 1986 explosion and crash of TWA Flight 800 as an example. Even though an extensive investigation found no evidence of terrorist involvement or foul play, the public outcry over the event led to the White House’s proposing “extensive additional safeguards against terrorism” within 45 days of the crash.

The cost of the new safeguards ran to billions of dollars, even though the likely culprit of the accident was the ignition of fuel vapors in a warm, nearly empty center wing fuel tank.

Hangar flying can be a prime source of unscientific aviation folklore that reinforces misinformation. If a particular fiction gets repeated enough during hangar flying sessions, it can become accepted as fact.

### Base Rate Bias (or Base Rate Fallacy)

A little knowledge is dangerous. A lack of big data can cause an intuitive inability to see large-scale statistical trends. Here’s an example. Let’s assume that a wheel brake anti-skid system activates 5% of the time when the wheels have not lost traction. Let’s also assume that it activates 100% of the time when the wheels actually have lost traction. And let’s further assume that one landing in 1,000 will result in the wheels skidding.

If the anti-skid system activates on a particular landing, what’s the probability that it’s functioning as intended? Some people might conclude that it’s as high as 95% of the time. But the correct probability is only 2% of the time.

Big data relies on Bayes’ theorem to arrive at the 2% probability. The anti-skid system is 100% reliable when the
CONFIRMATION BIAS

Many people arrive at their political beliefs in the absence of information. The same holds true for pilots in airplanes. Once they’ve established a particular mental model, they intuitively become blind to clear and convincing evidence to the contrary. They only look for additional information that confirms their original model.

Critical thinking and a willingness to search for information that is contrary to one’s mental model can be lifesaving. It’s all too easy to slip into a comfort zone in which small, but vital, bits of information are ignored.

Confirmation bias is suspected as a contributing factor in several loss of control accidents and incidents during which pitot/static system malfunctions have occurred. When pilots earn their instrument ratings, they’re taught to believe the instruments rather than their own perceptions. The instruments don’t often lie, but when they do, it’s often difficult for pilots to accept that they’re reading erroneous indications because of confirmation bias.

Pitot tube icing, for instance, will cause a decrease in airspeed indication. But as the aircraft climbs, the decrease in static pressure will cause an erroneous increase in the airspeed indication because of the blocked pitot pressure.

In contrast, a static port blockage will cause an airspeed indication to increase with decreasing altitude if the pitot system is properly functioning.

Confirmation bias can cause pilots to believe erroneous instruments are providing correct indications, thus leading to incorrect power and pitch inputs that can cause the aircraft to exceed stalling angle of attack or maximum airspeed limits.

Pilots can be prone to flying with rose-colored glasses, becoming unrealistically optimistic about the probable successful outcome of challenges.

OPTIMISM BIAS

Pilots can be prone to flying with rose-colored glasses, becoming unrealistically optimistic about the probable successful outcome of challenges. They become accustomed to working through difficult situations to reach successful outcomes so many times, that they begin to believe they can successfully work through any abnormality or emergency to a successful conclusion. Such an Optimism Bias (also known as Comparative Bias) makes them believe they’re less prone to risk than other pilots.

“It can’t happen to me” becomes a prevailing attitude. This can lead to bending or breaking SOPs, such as failure to stabilize a landing approach at or before the aircraft reaches standardized continue or go-around decision points.

Optimism Bias is closely related to three types of Overconfidence Bias: (1) overestimation of one’s own piloting abilities and aeronautical decision-making expertise, (2) overplacement of one’s abilities compared to those of other pilots and (3) over-precision, which is the unfounded certainty of the validity of one’s abilities and judgment.

Such bravado can make a pilot believe that nothing can happen that she or he can’t handle. They become fearless of the consequences of Optimism Bias.

PLAN CONTINUATION BIAS

This is the strong unconscious tendency to forge ahead with the original plan in spite of changing conditions. This bias grows stronger near the end of the mission as the crew anticipates landing the aircraft and completing the flight. Plan Continuation Bias “may have the effect of obscuring subtle cues which indicate that original conditions and assumptions have changed,” according to Eurocontrol’s Skybrary online aeronautical reference system. Skybrary cites several airline incidents and accidents in which Plan Continuation Bias has been a factor.

Aboard business aircraft, crews also may be biased toward continuing missions because of external factors, notably their passengers’ expectations. Such biases can be especially risky on positioning flights with no passengers aboard, as evidenced by the December 2005 crash of a Learjet 35A attempting to land at Truckee-Tahoe Airport in low-visibility conditions and the November 2004 crash of a Gulfstream GIII during an instrument approach to Houston-Hobby Airport, among several others.

PROSPECTIVE MEMORY

This is a form of memory that enables people to remember to do something or pay attention to something at a future point in time, such as mentally noting a maintenance snag during a flight and later remembering to record it in the discrepancy log after landing.

Prospective Memory is susceptible to being interrupted by distractions, such as the immediate need to deal with an abnormality or emergency, or even fly a challenging instrument approach in low-visibility conditions. Preoccupation with an immediate problem can result in forgetting high priority tasks later in the flight, including forgetting to extend the landing gear on approach or initiating the final landing checklist.

SELECTIVE PERCEPTION

One’s frame of reference very much influences the kinds of information we are willing to accept as valid. We may not notice and readily forget information that is in conflict with our belief systems, stimuli that cause emotional discomfort or stress. This filtering process is known as Selective Perception and it prejudices and perverts our objective fact-finding and decision-making
processes. Closely related are Selective Attention, the bias that causes us to choose to pay attention to certain information and ignore other stimuli, and Selective Retention, the bias that causes people to remember information that is more closely aligned with their belief systems.

Selective Perception may result from an Availability Cascade of misinformation as noted earlier, causing us to discount or discard information relevant to objective decision-making. Our belief systems become tainted. We’re not aware of such bias, but we’re acutely sensitive to the Selective Perceptions of others who do not share our belief systems.

**Countering Cognitive Biases**

The first step in countering cognitive biases is to identify them. Accident reports provide plenty of events that can be analyzed. Malmquist notes that one or more cognitive biases are primary or secondary factors in most aircraft accidents. Typical flight crew errors in flight include Anchoring Bias, Attentional Tunneling, Confirmation Bias and Plan Continuation Bias.

Startle effect compounds the adverse effects of cognitive biases. The initial emotional shock resulting from an unexpected anomaly can cause crews to fall back on old habits and perceptions as noted by France’s Bureau d’Enquêtes et d’Analyses (BEA) in its investigation of the Air France Flight 447 loss of control crash off the coast of Brazil in June 2009. Some 44 sec. after the aircraft’s pitot tubes iced up, causing the autopilot and autothrottles to disconnect, the pilot flying increased pitch to 11 deg. nose up in 10 sec. Then, when the aircraft initially entered the stall, the flight crew didn’t recognize that the aircraft had exceeded critical angle of attack. Less than 4 min. later, the aircraft hit the Atlantic Ocean with a vertical descent speed of nearly 11,000 fpm.

The BEA report notes that prior to the accident, the aircraft captain “appeared very unresponsive” to the concerns expressed by the pilot flying (PF) regarding weather hazards in the intertropical convergence zone. The PF noted that the OAT was considerably warmer than standard day, thus limiting available reserve thrust to climb higher than 35,000 ft. to top the weather.

The captain said he’d flown the route between South America and Paris several times and he preferred to wait and respond to turbulence if it were encountered. Could his decision have been influenced by Anchoring Bias, Plan Continuation Bias and/or Optimism Bias?

When all the pitot tubes became jammed with tiny ice crystals causing the autopilot and autothrottles to disconnect, was the pilot flying’s decision-making influenced by Attentional Tunneling, Confirmation Bias and/or Selective Perception?

Dozens of other turbine aircraft accidents provide ample fodder for discussion of cognitive biases as causal factors in these mishaps. Once the relevant cognitive biases have been identified in such accidents, then training scenarios can be developed that include anomalies designed to trigger such intuitive decision-making.

Classroom instruction about cognitive biases in the cockpit helps pilots acquire essential knowledge about their risks. Comprehensive line-oriented flight training (LOFT) simulator sessions help pilots acquire the skills to suppress intuitive cognition, develop immunities to cognitive biases and replace them with logical, analytical cognition processes.

Incorporating startle factors when they’re least expected in LOFT sim sessions is essential. Without such “wild cards” in the sim to trigger cognitive biases, the training leaves pilots vulnerable to unexpected events, especially when they involve subtle clues.

The struggle between intuitive and analytical cognitive processes is ongoing. Learning how to recognize and suppress cognitive biases in order to gain the complete mental image of what is occurring and take full advantage of all the data can be critical to safety of flight.

A problem-solving shortcut decision-making that’s “good enough for government work” may be easy and comfortable. But pilots need full-range analytical cognition, based upon the depth and breadth of available information, to ensure everyone aboard arrives safely back on the ground. BCA
The DC-9 captain told the NTSB investigators that there had been thunderstorms all around the airport and the crew used the aircraft’s weather radar to scan the area while taxiing to Runway 19. He said the largest echo was east-north-east, that the cell contoured when he switched to that mode, and the gradient was very steep.

He testified that during takeoff roll the aircraft encountered heavy rain and wind shear about halfway down the runway, significantly reducing visibility. At that point the jetliner began drifting to the right and continued to do so even after left rudder was applied. Rather than reject the takeoff or drift off the pavement, the captain said he began to rotate prior to \( V_1 \), lifted off and called for landing gear retraction even as the stick shaker activated briefly.

The first officer reported that the airspeed fluctuated between 100 KIAS and 110 KIAS during the takeoff roll, and that \( V_1 \) and \( V_t \) were 132 KIAS and \( V_2 \) was 140 KIAS, but the captain rotated at 121 KIAS. However, he said as the airplane passed over the end of the runway, the airspeed went through \( V_1 \), \( V_2 \) and 160 KIAS almost simultaneously.

That extreme wind came from a microburst impacting the ground just to the left rear of the departing DC-9. Six minutes later, a Pam Am Boeing 727 crashed in that same microburst while departing New Orleans International Airport that July afternoon in 1982, killing all 145 people on board and eight others on the ground.

Note that the “forward-looking wind shear” systems currently mandated by the FAA on all airliners would not have alerted those pilots three decades earlier had their aircraft been so equipped. Not to say those systems are useless, it’s just that they address only a small fraction of the directions from which a microburst might strike. Besides, very few corporate or business aircraft have it. The DC-9 captain had the right idea, use onboard radar to survey the surrounding skies before taking the runway for departure, but he hadn’t been trained in what key things to note while looking around.

Vicious, killer winds may come from any direction and business jets are vulnerable, as has been demonstrated time and again:

- The wind was from the south on June 21, 2010, so the pilot of a Cessna 525 elected to land on Storm Lake, Iowa, Municipal Airport’s Runway 17. Storms were all about; one seemed a comfortable distance north. The runway was wet. Just at touchdown the wind suddenly whipped around to the north. With brakes locked, the Cessna overran the 5,002-ft.-long runway and rolled 325 ft. into the rough, ripping off the nose gear.

A vicious line of outflow storms has developed 90 mi. east of a dissipating line northwest of Dallas/Fort Worth International Airport (DFW). Gusts of 50 kt. or greater are possible at each airport in that 90-mi.-long corridor from primary to outflow lines of storms. The magnitude of the gusts will tend to decrease as the wave moves eastward. This situation is easily seen on NEXRAD — but in about 10-min. hindsight, remember. Try to confirm the situation with airborne radar for instant information.

What if the shear is behind you?

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With thunderstorms in all quadrants, but just a breeze from 330 deg., the Hawker 800 charter captain elected to land on Minnesota’s Owatonna Degner Regional Airport’s (OWA) Runway 30 on the morning of July 31, 2008. Just at touchdown on the wet runway, the wind reversed. Touchdown was with 4,300 ft. remaining. Following confusion about deployment of the lift/dump system, the captain decided to go around. Too late. Impact was just off the end of the runway. Both pilots and all six passengers were killed.

Although “professionals,” the Cessna 560 pilots didn’t understand convective storms and were totally ignorant about how to use airborne radar. The pilots allowed themselves to get boxed in by thunderstorms all around and attempted a panic landing to the north at Ellen Church Field (CJJ) in Cresco, Iowa, despite the fact that the single runway was wet and just 2,949 ft. long. At touchdown, a gust hit from the south. Two passengers survived the July 19, 2006, crash; the crew did not.

Upon touching down at Clark Regional Airport (JFY) in Sellersburg, Indiana, late on Jan. 17, 2012, a Falcon 10 was struck by a wind from the right so severe it caused the jet to become airborne again. The aircraft touched down a second time in a grassy area alongside the runway. There were no injuries to the pilots or sole passenger, but the Falcon suffered major damage.

The captain of a Learjet landing to the east on a Florida airport had noted a vicious storm several miles to the southwest of the airport. He judged it no factor. Just after touchdown his aircraft was hit by a terrific gust, again from the right. With full aileron and fast footwork on the rudder and brakes the captain kept his aircraft on the runway. Safely on the ramp, he discovered a right wingtip in tatters and right aileron dangling from a single hinge point.

This sad litany could go on and on.

NTSB data contains dozens upon dozens of such incidents. It’s difficult for many pilots to believe the outflow from a microburst can be so strong and travel as far as it does. This fact might help with understanding the forces at work. Richard Doviak and Dusan Zrnic, brilliant scientists at the National Severe Storms Laboratory, have calculated that a Level 5 “Extreme” thunderstorm will have lifted some 3 million tons of water and ice to levels of 35,000 or even 45,000 ft.

When all that weight comes crashing down, outflow winds of 40, 70, even up to 100 kt., are generated. And then those winds rush outward for 30, 60 and even 90 mi. They often push up more moisture as they go, building into outflow fronts with lines of thunderstorms to 40, 60, 100 mi. out in front of the mother line. The storms that caused a Delta L-1011 to crash while approaching Dallas/Fort Worth International Airport (DFW) on Aug. 2, 1985, were a secondary line from decaying storms more than 30 mi. to the northeast. The crash killed 136 passengers and crew aboard the TriStar, as well as the driver of a car struck by the aircraft.

Note that the outflow is omnidirectional, which is to say you can be smashed by one no matter what your position is in relation to it. Meanwhile, a forward-looking wind-shear system leaves some 350 deg. unmonitored. And it doesn’t alert you — if you even have one — until a horizontal shear is generated within that “forward-looking” characteristic.

Five stages in the life of a microburst. The technique suggested for seeing one on airborne radar should reveal a small red echo at T-5 or just after. Note that the life span is about 15 min. from first evidence to end. That suggests when a microburst is suspected, a delay of 15 min. will see it cleared on either departures or arrivals. The cross-country wave of turbulence begins at about T+5.

International Airport (DFW) on Aug. 2, 1985, were a secondary line from decaying storms more than 30 mi. to the northeast. The crash killed 136 passengers and crew aboard the TriStar, as well as the driver of a car struck by the aircraft.

GOES image of DFW area at the time of the Delta L-1011 accident, Aug. 2, 1985. The supercell storm that caused it was actually an outflow storm from the major storm about 30 mi. north.
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window. Best that you check the atmosphere with your common, everyday onboard radar rather than trust the mandates.

The Departure

Fortunately, there is a simple way to prevent getting smashed by a microburst, assuming you have onboard weather radar. On departures from airports with known or suspected thunderstorms within a radius of 25 mi., first, depart the ramp and after checking your radar for proper function, select the 20-mi. displayed range or next highest, TILT to +10 deg., and reduce CAL (misnamed “GAIN”) half down from normal detent. As you taxi, which is typically downwind, observe the radar for any signs of red echoes. If you see any within a 3-mi. range of the airport, you’d be wise to delay the departure until the situation clears. If you must go, a maximum performance departure would be a wise choice.

If there are any echoes displaying red within 20 mi. on your radar, be super alert for a failure of your airspeed to increase as expected during the takeoff roll. The hesitation may be caused by a gust from the rear. Also, as you turn to take the runway, stop for a couple of sweeps at the 90-deg. position and check for any sign of a red echo in that direction. Time permitting, as you taxi out, reduce the displayed range on your radar down to the shortest available for a sweep or two. You may discover there was a red echo hiding in that blanked-out area at the base of many displays. Also, there may be tiny, intense red rain or hail shafts within 10 mi. of your nose, too small to be resolved on the longer displayed range.

Finally, line up, check for red echoes in the direction of your departure, switch that CAL/GAIN control back to CAL and go . . . unless there’s a no-go something ahead.

Many modern onboard radars will provide you with a full 360-deg. sweep of the area. On other systems there will be a 60- to 90-deg. gap left or right. If you’re nervous about that, you should arrange for a 360-deg. turn on the ramp or run-up pad. Safety always trumps embarrassment caused by appearing too cautious.

If before departure you see a red echo with tilt +10 deg. and CAL/GAIN down halfway, there is an “Extreme” thunderstorm just waiting to dump 3 million tons or more of rain on the runway. If it’s you who gets dumped on, the runway will be flooded, visibility will drop to nothing, and the wind may suddenly snap 90 deg. or more and go from near calm to 60 kt. or better. And all of that will occur precisely at the go/no-go decision time in your departure. While that scenario is not a sure thing, those red echoes are strong clues. They reveal what we once called a VIP 5 “Intense” thunderstorm.

Wind event at New Orleans that caused the Pan Am Flight 759 crash, created by Dr. Theodore Fujita for the NTSB.

The Arrival

At 8 or 10 min. prior to expected arrival time, select the 40- or 50-mi. displayed range on your radar and +5 deg. on tilt. CAL/GAIN half down to MIN. As you approach, survey the area out to 25 or 30 mi. from the airport in all directions for any red echoes. If you see any . . . remember, 3 million tons.

If the red is within 3 mi. of the airport, a hold outside until it moves away would be prudent. If you must chance it for some reason, prepare to lose total forward visibility just over the numbers, then float off the end of the runway aided by a wind switch from calm to a 60-kt. tailwind.

As the approach continues, select shorter displayed ranges to open up that blanked area at the base of your display and to reveal the tiniest little spears of rain and hail shafts.

All this may seem like a lot of knob turning and button pushing just when you’ve got other worries and tasks. But note that after selection of displayed range, plus TILT and CAL/GAIN, the radar requires nothing further on during departure or arrival except a quick look several times, plus a change or two in the displayed range. And during departure there’s a last-second switch back to normal CAL when taking the runway.

Maintaining radar rigor when weather threatens is one of the many routine things professional pilots do to ensure the safety of all on board.

The frustrating thing about safety devices and safety advice is you never know for certain whether either was effective. Microburst accidents have decreased since forward-looking wind shear was mandated for airliners, which suggests that technology works well. In the case of the above advice on avoiding wind-shear incidents and accidents that come from other than straight ahead, we may never know whether they’ve been effective or not. But better to follow the advice and never know than to ignore it and wish you hadn’t.

Be Wary

For those airline types flying the Collins 700 series radars, chances are your CAL/GAIN cannot be reduced, only increased. In that event, before takeoff and landing survey the airport area with MAP selected, CAL selected on GAIN. If you see any red echoes, be wary. Being overly cautious trumps not being cautious enough.

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A Cessna Citation 500 (N610ED) owned by Dufresne Ministries, Murrieta, California, departed Wichita Mid-Continent Airport (ICT) at 1007 on Oct. 18, 2013, with a 49-year-old commercial pilot at the controls. The sole passenger aboard was Dr. Ed Dufresne, a faith-healing evangelist who had been in Wichita on ministry business.

The two men were on their way to New Braunfels Regional Airport (BAZ) in New Braunfels, Texas. The pilot had filed an IFR flight plan after spending the previous day in Wichita tracking down a replacement attitude indicator for the copilot’s panel and seeing to its installation.

Weather in the Wichita area was basically VFR on the ground — 10 mi. visibility in light rain with a broken ceiling at 4,400 ft. AGL and an overcast at 6,500 ft. AGL. Generally, the light rain was spreading and ceilings were lowering. Weather aloft was layered with plenty of icing conditions.

All seemed normal as the airplane departed ITC to the north from Runway 1R and the pilot had routine radio contacts with the departure controller.

At 1014:49, N610ED reported to the controller that he was “. . . leveling at one five thousand” The controller cleared the Citation at 1014:54 to “climb and maintain flight level two three zero. Cleared direct Millsap.” (A direct course to the Millsap VORTAC was about 184 deg. at a distance of about 295 nm.) The pilot responded, “Millsap direct, uh, Zero Echo Delta.

Meantime, about 10 mi. southwest of ITC, a Mulvane, Kansas, woman and her husband were traveling east on 95th Street South between Derby and Mulvane. Later, she would recount this experience to air safety investigators with the NTSB.

“The sky was slightly overcast, but visibility was at that time. We had just passed Woodlawn Street and crested a hill when I noticed a black trail of smoke and a small jet falling from the sky to the east and slightly north of our location.

“At first I thought it was a jet practicing maneuvers, but it didn’t pull up. I then realized it was a small jet that appeared to be traveling at a high rate of speed with black smoke trailing it and what appeared to be fire. The jet appeared to be spiraling nose-first straight down.

“I said to my husband, ‘Is that a jet crashing?’ He looked up and saw the jet also. A second or so later it impacted the ground with a black cloud of smoke coming from the site, and I called 911 on my cellphone. The log on my phone said the call was initiated at 1017.

“We continued east on 95th Street South toward the crash site, informing the 911 operator that the crash site was in a field northeast of the Hill Crest Cemetery . . . and flames were visible. Before we reached the cemetery, I saw a small piece of white debris — maybe 2 ft. by 2 ft. — falling slightly north and west of the cemetery.”

The crash site was 13 mi. southeast of ICT. Neighbors who heard the crash and explosion rushed to the scene — a soybean field — and found only a crater 30 ft. across and 15 ft. deep.

The Investigation

There wasn’t much to see initially at the scene. Ground scars and other evidence showed the airplane struck the earth in a near vertical nose-down attitude. The wreckage was extensively fragmented. Portions of the terrain and some wreckage components on the surface showed evidence of a post-impact fire. The accident was not survivable.

Investigators excavated most of the airplane, including the landing gear, engines and the other heavier portions of the wreckage, from the crater. Dirt was ejected from the crater mostly toward the southeast with the centerline...
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February 23 — About 1145 PST, a Robinson R66 (N266RH) was damaged following a precautionary autorotation at Zamperini Field airport (TOA), Torrance, California. The pilot was not injured. The R66 was registered to, and operated by, Robinson Helicopter Company as a FAR Part 91 personal flight. It was VFR and no flight plan was filed for the flight that originated from TOA at 1145. The pilot reported that he was executing a simulated max performance takeoff. About 200 ft. AGL, the pilot felt vibrations and performed an autorotation to an open area. The helicopter hit the ground and the main rotor blades contacted the tailboom.

▶ February 22 — At 1334 PST, a Mooney M20J (N201KY) experienced a loss of engine power after takeoff and made a forced landing onto a city street near Whiteman Airport (WHP), Pacoima, California. The airplane was operated by the pilot who was not injured. The airplane was severely damaged during the accident sequence. The local personal flight departed Pacoima about 1330. It was VFR. The pilot reported that after takeoff the engine started to run rough, and as he was attempting to return to the airport, it lost power. The pilot was able to land on a city street during which time the airplane struck a moving car and numerous parked vehicles; substantially damaging both wings and the fuselage. The accident site was documented by the Los Angeles Police Department. Inspectors from the FAA Flight Standards District office responded to the site and assisted in coordinating the recovery of the airplane. The wreckage was secured for further examination.

▶ February 18 — About 1020 Hawaiian standard time, a Bell 206B (N80918) was heavily damaged when it crashed into water during an emergency landing near Honolulu, Hawaii. The helicopter was registered to a private individual and operated by Genesis Helicopters Part 91 as a local air tour flight. The commercial pilot and two passengers sustained serious injuries, one passenger sustained minor injuries, and one passenger was killed. It was VFR and a company flight plan was filed for the flight that originated from the Honolulu International Airport (HNL), Honolulu, about 0935. The pilot reported...
While work went on at the scene, other investigators looked at the radar track records that showed N610ED continued its right turn after departure from ITC to a course of about 240 deg. and climbed to 15,200 ft. It then entered a left turn to a course of about 170 deg. and began a meandering descent to 14,600 ft., followed by a climb to 15,200 ft.

At 1016:19, radar showed the Citation was at 15,200 ft. when it began a descending left turn to a course of about 080 deg. At 1016:51, the last radar contact showed N610ED was at an altitude of 10,100 ft. The airplane was not equipped with a data or voice recorder. It seemed likely that icing had been a factor. AIRMETs Sierra and Zulu issued at 0945, and valid at the time of the accident, forecasted IFR conditions for the accident site with ceilings below 1,000 ft. and visibilities below 3 mi. with precipitation and mist, and moderate icing conditions between the freezing level and FL 180.

Current Icing Potential (CIP) is produced by the National Weather Service’s (NWS) Aviation Weather Center and is intended to be supplemental to other icing advisories (e.g. AIRMETs and SIGMETs). The CIP indicated a 40% to 80% probability of icing at the Citation’s altitude around the time of the accident. The high likelihood of icing indicated by CIP matched the weather environment described in the upper air sounding, weather radar and pilot report (PIREP) sections.

In addition to the CIP showing that icing was likely at 13,000, 14,000 and 15,000 ft. at 1000 hours, it characterized the icing as moderate to heavy in the area of the accident site. Similar icing probabilities and severity were also indicated by CIP above 10,000 ft. MSL near the accident site around the accident time.

PIREPs indicated a large area of light to moderate icing conditions throughout the atmosphere around the accident site. One report of moderate icing came from a Boeing KC-135E as it was taking off from McConnell AFB, and this report, along with the ice pellet and snow reports, indicated that more severe icing was possible at the flight altitude of the accident flight.

The closest NWS WSR-88D with dual-polarization weather radar data was at ICT. That radar showed it was likely that the precipitation in and around the accident site at the time of the accident was a mix between ice crystals, dry snow and supercooled liquid water. The freezing level was located at 7,231 ft. MSL.

There was no record that the pilot received a weather briefing.

to the NTSB investigator-in-charge, that while in cruise flight over Ford Island, he felt a vibration followed by a grinding noise. Shortly after, the pilot heard a loud bang, scanned the instrument panel and saw that the engine instruments indicated the engine was still running, however, rotor rpm decreasing. The pilot initiated an autorotation to a grassy area near Contemplation Circle at the World War II Valor in the Pacific National Monument. As the pilot neared his intended landing area, he observed multiple people within the area. The pilot stated he initiated a left pedal turn, attempting to land close to the shoreline. Subsequently, the helicopter descended rapidly into the water, about 20 ft. from the shoreline in about 40 ft. of water.

February 18 — About 1910 EST, a Beech A36 (N61WB) made a forced landing after a total loss of engine power near Marshville, North Carolina. The airline transport rated pilot was fatally injured. The airplane’s wings and firewall were heavily damaged. The airplane was registered to and operated by Indigo Air LLC business flight. VFR conditions existed near the accident site at the time of the accident and the flight was operated on IFR flight plan. The flight originated at Daytona Beach International Airport (DAB), Daytona Beach, Florida, about 1554, and was destined for the Davidson County Airport (EXX), Lexington, North Carolina. According to a representative of the operator, the pilot flew part-time for Indigo Air LLC and was scheduled fly the owner of the company and another passenger from the Piedmont-Triad International Airport, Greensboro (GSO), North Carolina, to DAB. The flight originated earlier that day from EXX, where the airplane was based, and departed with full fuel (81 gal. total, 74 usable). The pilot flew to GSO, picked up the owner and passenger then flew direct to DAB. No fuel was purchased in GSO. In DAB, the pilot parked at a fixed-base operator (FBO). According to the owner, the pilot told him he was “going to put 15 [gal. of fuel] in a side.” The owner went inside the FBO, paid for the fuel, and left because he “was in a rush.” According to the FBO’s fueling records, 30 gal. of 100LL fuel were purchased with 15 gal. going in each tank. The pilot then departed for EXX. About 3 hr. into the flight, he reported a loss of engine power to air traffic control and made a forced landing about 10.5 miles east-north east of Charlotte Executive Airport (EQY), Monroe, North Carolina. Examination of the airplane’s fuel system revealed the fuel selector handle was set to the right tank. A visual inspection inside each fuel tank revealed there was a small amount of fuel in each bladder. When power was

The Pilot and Airplane

The pilot held a commercial certificate with ratings for airplane single-engine and multiengine land, and instrument. On Feb. 6, 2006, he was issued a restricted type rating for the CE-500 with a limitation of “SIC privileges only.” On Dec. 13, 2008, he earned an unrestricted type rating for the CE-500. The pilot also held an FAA second-class medical certificate, issued on July 3, 2012, with a restriction of “must have available glasses for near vision.”

Investigators reviewed the pilot’s logbooks and determined his total pilot experience was about 2,605 hr., with about 2,566 hr. in multiengine airplanes, and a total of 239 hr. of instrument flying experience. He had logged a total of 1,172 hr. in Cessna 500 and 550 airplanes, which included 658 hr. of second-in-command experience.

He completed a satisfactory CE-500 pilot proficiency check on Oct. 4, 2012. And on Nov. 10, 2012, he completed a satisfactory proficiency check for a single-pilot exemption in CE-500 airplanes. Pilot logbook entries showed that since Nov. 17, 2012, he had flown about 206 hr. in CE-500 airplanes with all of that experience logged as a “single pilot,” and without another pilot crewmember in the cockpit.
The accident pilot had the appropriate exemption, but apparently the airplane’s required gear was not fully operational.

The Citation, s.n. 500-0241, was originally issued a standard airworthiness certificate on June 12, 1975. It was powered by two Pratt & Whitney Canada JT-15D-1A turbofan engines each capable of producing 2,200 lb./thrust. At the time of the accident the airplane was maintained on an approved aircraft inspection program (AAIP) and its most recent airframe inspection had been completed on Sept. 24, 2012, at an airplane total time of 7,560.9 hr. On that date the left and right engines had then accumulated a total of 7,212.8 hr. and 10,435.2 hr., respectively.

FAA registry documents show that the airplane was purchased by DuFresne on March 14, 2005. The airplane’s type-certificate data sheet (TCDS) showed a maximum takeoff weight limitation of 11,500 lb. and a requirement that it be operated by a minimum of two pilots, or one pilot with a single-pilot exemption.

More to the point, that exemption for single-pilot operation also stated that all required equipment must be operational, including a fully functioning autopilot, flight director and gyroscopic flight instruments. The accident pilot had the appropriate exemption, but apparently the airplane’s required gear was not fully operational.

An aviation maintenance person in another state reported to investigators that the pilot had telephoned him on the day before the accident to say that on his inbound flight he had several failure flags on the horizontal situation indicator (HSI) and artificial horizon (AH) and that the right-side (copilot side) AH gyro was “sideways.” The pilot also stated that several times on the same inbound flight to ICT he had uncommanded drops in N1, N2,

Accidents in Brief

applied to the airplane, the left and right fuel gauges indicated about 1/8th full.

► February 16 — At 1130 CST, a Cessna P210N (N732FU) collided with trees and the terrain during a forced landing in Bryan, Texas, following a loss of engine power. The private pilot received minor injuries. One passenger received serious injuries and a second passenger was not injured. The airplane sustained heavy damage. The airplane was registered to BIA Air LLC, and was being operated by a private individual as a personal flight. VFR conditions prevailed for the flight which operated on a VFR flight plan. The flight originated from the Arlington Municipal Airport (GKY), Arlington, Texas, about 1100.

► February 13 — About 0830 PST, an Aerostar International Inc. RX-8 hot air balloon (N3647A) hit a fence during an approach to a field in Petaluma, California. The balloon was owned and operated by the pilot as a VFR, revenue sightseeing flight FAR Part 91 when the accident occurred. The pilot and two passengers were uninjured, one child passenger received serious injuries. In a telephone conversation with the NTSB investigator-in-charge, the pilot stated that he was making an approach to a field for landing at the end of the sightseeing flight. During the approach, he misjudged the wind, and the balloon was blown near a pipe fence, striking the fence with the basket. A child passenger, who was sitting down in the basket, received serious injuries during the event. After striking the fence, the balloon landed safely on an adjacent road. The balloon sustained minor damage.

► February 12 — About 1850 CST, a Piper PA-28-181 (N2209W) was destroyed when it crashed into the Gulf of Mexico while maneuvering to land at Destin Executive Airport (DTS), Destin, Florida. The private pilot and a passenger were killed. The flight departed Pearland Regional Airport (LVI), Pearland, Texas, about 1715. It was VFR and not flight plan filed for the personal flight. According to preliminary radar data from the FAA, as well as witness accounts, the airplane approached DTS from the west, and transitioned along the shore on the south side of the airport for landing on Runway 32. Witnesses reported the pilot announced a go-around on the airport’s common traffic advisory frequency (CTAF), and the radar track depicted the airplane crossing the approach end of Runway 32, then turning upwind on the east side of the runway. The airplane continued in a left-hand circuit around the airport and its altitude varied between 500-700 ft. MSL. The radar depicted a left turn in a location consistent with a left base turn for landing on Runway 32. Instead of continuing to an approximate heading of 050 deg., for the base leg of the traffic pattern, the airplane rolled out on an approximate heading of 090 deg., and flew through the final approach course, west to east, as it tracked parallel to the coast. The airplane then turned 90 degrees to the south and

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and ITT readings on one engine and those repeated changes in the engine power setting required re-trimming the aircraft.

Maintenance records and interviews with maintenance personnel at ICT showed the pilot got their assistance to replace the copilot’s AH. However, the pilot did not mention to them the problems with the malfunctioning autopilot, the malfunctioning pilot’s flight instruments, or the malfunctioning engine. No evidence could be found that the pilot ever attempted to fix those problems.

**Safety Board Analysis**

In its analysis, the Safety Board presented this scenario:

After climbing to and leveling at 15,000 ft., the airplane departed controlled flight, descended rapidly in a nose-down vertical dive and impacted terrain; an explosion and post-accident fire occurred. Evidence at the accident site revealed that most of the wreckage was located in or near a single impact crater; however, the outer portion of the left wing impacted the ground about half a mile from the main wreckage.

Following the previous flight, the pilot reported to a maintenance person in another state that he had several malfunctioning flight instruments, including the autopilot, the horizontal situation indicator, and the artificial horizon gyro. The pilot, who was not a mechanic, had maintenance personnel replace the right-side artificial horizon gyro but did not have any other maintenance performed at that time.

The pilot was approved under an FAA exemption to operate the airplane as a single pilot; however, the exemption required that all aircraft equipment be operational, including a fully functioning autopilot, flight director and gyroscopic flight instruments. Despite the malfunctioning instruments, the pilot chose to take off and fly in instrument meteorological conditions (IMC).

At the time of the loss of control, the airplane had just entered an area with supercooled large water droplets and severe icing, which would have affected the airplane’s flying characteristics. At the same time, the air traffic controller provided the pilot with a radio frequency change, a change in assigned altitude and a slight routing change.

It is likely that these instructions increased the pilot’s workload as the airplane began to accumulate structural icing rapidly. Because of the malfunctioning instruments, it is likely that the pilot became disoriented while attempting to maneuver and maintain control of the airplane as the ice accumulated, which led to a loss of control.

The probable cause, said the Safety Board, was “the airplane’s encounter with severe icing conditions, which resulted in structural icing, and the pilot’s increased workload and subsequent disorientation while maneuvering in instrument flight rules conditions with malfunctioning flight instruments, which led to the subsequent loss of airplane control. Contributing to the accident was the pilot’s decision to take off in IMC conditions and fly a single-pilot operation without a functioning autopilot and with malfunctioning flight instruments.”

**February 9 — About 0800 CST, a Cessna 560 Encore (N774SB)** experienced a flight control malfunction during the takeoff from Dallas Love Field Airport (KDAL), Dallas, Texas. The two flight crewmembers and three passengers on-board were not injured. The airplane was registered to Bridgeway Enterprises, Inc. and operated by SevenBar Aviation under Part 135 as an on-demand air taxi. It was VFR and an IFR flight plan had been filed. The flight was destined for McCurtain County Regional Airport (404), Idabel, Oklahoma. During takeoff rotation, the first officer stated he had difficulty maintaining runway heading and the airplane experience a tendency to roll right. As speed was increased, the pressure required on the control yoke to maintain level attitude increased. The first office transferred control to the captain who experienced the same flight control difficulty. The captain attempted to adjust the aileron trim however the trim control knob would not move, the trim indicator appeared centered. The flight crew requested to return to KDAL from air traffic control and declared an emergency.

When the airspeed was decreased during approach the right roll control pressure decreased and the flight crew was able to free the aileron trim control. The flight crew landed the airplane at KDAL without further incident.

**February 5 — About 1157 MST, a North American F-51D (N551JP)** sustained substantial damage when it crashed about 6 mi. southwest of Maricopa, Arizona. The airplane was registered to and operated by the pilot. The commercial pilot and a passenger, who was an airline transport pilot, were fatally injured. VMC prevailed, and no flight plan had been filed. The local personal flight departed Stellar Airpark (P19), Chandler, Arizona earlier that morning, at an unknown time. A witness located about 1 mi. from the accident site reported observing the airplane in a nose down spiral about 1,500-2,000 ft. AGL, until it hit the ground. Another witness located near the accident site stated that the airplane was in a dive and that he did not observe the airplane pull out of the descent.
Icing Review Homework From the NTSB

The NTSB, after finding icing as a probable cause of the loss of Citation 500 N610ED, urged pilots to review icing basics — specifically those in the FAA Instrument Flying Handbook and the Aeronautical Information Manual.

The Safety Board emphasized these excerpts:
FAA Instrument Flying Handbook FAA-H-8083-15B; Chapter 10, 10-24: “The very nature of flight in instrument meteorological conditions (IMC) means operating in visible moisture such as clouds. At the right temperatures, this moisture can freeze on the aircraft, causing increased weight, degraded performance and unpredictable aerodynamic characteristics. Understanding avoidance and early recognition followed by prompt action are the keys to avoiding this potentially hazardous situation, . . . Structural icing is a condition that can only get worse. Therefore, during an inadvertent icing encounter, it is important the pilot act to prevent additional ice accumulation. Regardless of the level of anti-ice or deice protection offered by the aircraft, the first course of action should be to leave the area of visible moisture. This might mean descending to an altitude below the cloud bases, climbing to an altitude that is above the cloud tops or turning to a different course. If this is not possible, then the pilot must move to an altitude where the temperature is above freezing. Pilots should report icing conditions to ATC and request new routing or altitude if icing will be a hazard.”

Chapter 11, Inadvertent Icing Encounter: “Because icing is unpredictable in nature, pilots may find themselves in icing conditions even though they have done everything practicable to avoid it. . . . The effects of ice on aircraft are cumulative — thrust is reduced, drag increases, lift lessens and weight increases. The results are an increase in stall speed and a deterioration of aircraft performance. In extreme cases, 2 to 3 in. of ice can form on the leading edge of the airfoil in less than 5 min. It takes only one-half inch of ice to reduce the lifting power of some aircraft by 50% and increase the frictional drag by an equal percentage. A pilot can expect icing when flying in visible precipitation, such as rain or cloud droplets, and the temperature is between +2C and -10C. When icing is detected, a pilot should . . . leave the area of precipitation or go to an altitude where the temperature is above freezing. . . . Proper preflight action includes obtaining (weather) information.”

Chapter 5: “An autopilot is a mechanical means to control an aircraft using electrical, hydraulic or digital systems (and) can control three axes of the aircraft: roll, pitch and yaw. . . . The autopilot should be utilized to reduce workload, which affords the pilot more time to monitor the flight (and) decreases the chances of entry into an unusual attitude.”

Chapter 7: “When operating in IMC and in a partial panel configuration, the pilot should avoid abrupt changes to the control yoke. Reacting abruptly to altitude changes can lead to large pitch changes and thus a larger divergence from the initial altitude. . . . overcontrolling causes the pilot to move from a nose-high attitude to a nose-low attitude and . . . small changes to pitch are required to insure prompt corrective actions are taken to return the aircraft to its original altitude with less confusion . . . during instrument flight with limited instrumentation, it is imperative that only small and precise control inputs are made. Once a needle movement is indicated denoting a deviation in altitude, the pilot needs to make small control inputs to stop the deviation. Rapid control movements only compound the deviation by causing an oscillation effect. This type of oscillation can quickly cause the pilot to become disoriented and begin to fixate on the altitude. Fixation on the altimeter can lead to a loss of directional control as well as airspeed control.”

Aeronautical Information Manual; Section 8-1-5, Illusions Leading to Spatial Disorientation: “Various complex motions and forces and certain visual scenes encountered in flight can create illusions of motion and position. Spatial disorientation from these illusions can be prevented only by visual reference to reliable, fixed points on the ground or to flight instruments. . . . A rapid acceleration . . . can create the illusion of being in a nose-up attitude. The disoriented pilot will push the aircraft into a nose-low, or dive attitude. A rapid deceleration by a quick reduction of the throttles can have the opposite effect, with the disoriented pilot pulling the aircraft into a nose-up, or stall attitude. . . . An abrupt change from climb to straight and level flight can create the illusion of tumbling backward. The disoriented pilot will push the aircraft abruptly into a nose-low attitude, possibly intensifying this illusion.” BCA
The SpeedNews 21st Annual Business & General Aviation Industry Suppliers Conference is designed for equipment manufacturers, material suppliers, MRO and IT suppliers, aviation marketing and business development professionals and analysts wanting to learn about the latest industry programs. You will hear from experts from both business and general aircraft and engine manufacturers on industry advancements and achievements. If you are interested in having a better understanding of current programs, market forecasts and deliveries, this is the Conference you won’t want to miss.

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More than 260 Falcon 7X trijets have entered service since mid-2007 and the fleet has logged more than 440,000 flight hours, according to Dassault Falcon Jet officials. BCA is conducting a second 7X Operators Survey now that the aircraft has had time to mature and dozens of product improvements have been made. Consistent with our findings in our March 2011 Operators Survey, Falcon 7X operators contacted for this follow-up report say the aircraft provides substantially more speed, range and cabin comfort compared to midsize and large-cabin aircraft they previously flew. Most of them moved up from Falcon 2000- and Falcon 900-series aircraft, so they are loyal to the brand.

Not surprisingly, Falcon 7X operators cited the aircraft’s best-in-class fuel efficiency, three-engine redundancy, EASy flight deck and runway performance as favorite features, much the same as they did during the last survey. But this time they also said they’re pleased with their aircraft’s dispatch reliability and Dassault product support. Five years ago, those were two areas with opportunities for improvement.

Back in 2011, we also heard grumblings about the shortcomings of the EASy cockpit. Many operators said Dassault fell short on delivering several of its promised capabilities. We learned that most of those deficiencies have since been rectified with the optional EASy II/II+ hardware and operating system upgrades.

Wes Gustafson, aviation manager at Valkyrie 7X LLC at Seattle’s Boeing Field/King County International Airport (BFI), is just as enthusiastic about the airplane as he was in 2011. “It’s a STOL machine. It’s got great aerodynamics, fly-by-wire and safety features. It’s easy to fly and very efficient.”

The aircraft has the highest cabin pressurization of any Falcon jet in production, affording passengers 4,000-ft. to 5,000-ft. cabin altitudes at typical cruise altitudes. Dassault offers a cabin air humidifier as an option. Operators also say the aft baggage compartment is considerably larger than that of older Falcon models, providing ample storage room for 12 to 13 passengers when all seats are occupied.

Several operators praised the hot-and-high takeoff performance of the airplane, saying that its three-engine redundancy makes it one of the few business aircraft that can achieve required climb gradients associated with some instrument departures at Rocky Mountain airports.

Most also say range performance is adequate for nonstop trips between most North American and European city pairs. Going between North America and Asia, they make the stops in Anchorage to top the tanks before continuing on to destination airports. But some say they are comfortable flying nonstop from Japan to the U.S. West Coast because of prevailing tailwinds.

In the current political environment in which business aircraft are frequent class warfare targets, operators are sensitive to ramp presence. They appreciate that the Falcon 7X has a relatively low profile compared to other large-cabin, long-range aircraft. Long-time Falcon 900 operators say that the 7X looks a lot like the older trijet but with a longer wingspan and fuselage.

Some also said they admired...
Dassault’s ability to build an aircraft with such a robust structure and yet such a light empty weight.

**Operator Demographics and Mission Profiles**

Of the aircraft in service, 117 are based in Europe, or about 45% of the world fleet, according to Dassault. These include 18 in Switzerland, 13 in France, eight in Luxembourg, seven each in Belgium, Denmark, Germany and Portugal, six in Russia, four in Ukraine and smatterings in other nations on the Continent.

Among corporate operators in Europe, Flying Service in Antwerp operates five aircraft. Shell Oil has four based in Rotterdam and Dassault Falcon Service at Paris-Le Bourget (LGB) manages four others. Long-time Falcon Jet operator Volkswagen AG in Wolfsburg has increased its Falcon 7X fleet to four aircraft. Palmali Shipping Group in Istanbul also operates two. The French Air Force operates two aircraft as VIP transports.

Formula One Management in London has operated serial number 008 since 2008. Premium watchmaker Patek Philippe in Geneva has operated a single 7X since 2009. But neighbor Rolex Montre sold its Falcon 7X and replaced it with a Bombardier Global 6000 in 2012. That Falcon 7X found a new home in the U.S. Charter operators such as TAG Aviation and NetJets Europe, plus high-net-worth individuals account for most of the others.

North America accounts for the second largest block of operators, with one in five aircraft on the continent. More than 50 Falcon 7X aircraft are based in the U.S., double the number recorded in our last survey. Half a dozen are based in Canada and five are in Mexico.

U.S. corporations Archer Daniels Midland (ADM) and AT&T, along with Honeywell, Emerson Electric and Lowe’s Companies, plus Liberty Global and Liberty Media, McKesson, United Technologies and Whiteco Industries operate the 7X. High-net-worth individuals who made their fortunes at Microsoft, in the Silicon Valley, in the Napa Valley vineyards and in the hotel industry also fly the Falcon trijet. Texas Pacific Group now operates two, affirming the owner’s satisfaction with the model and brand. Cisco Systems replaced its 7X with a Global 5000 in 2014. Nextel no longer operates its 7X and ADM has its 7X up for sale due to a downsizing of its flight department. Still, ADM pilots remain enthusiastic about the aircraft’s capabilities.

The next largest block of operators is based in the Asia-Pacific region, with 14 in Hong Kong, 11 in China and one each in Malaysia, the Philippines and Singapore.

All operators we contacted have opted for the no-cost 70,200-lb. increased ramp weight and 70,000-lb. MTOW, which are 1,000-lb. increases over the original specification. The boost was necessary as the typically equipped BOW climbed from Short field performance is a strong suit. The Falcon 7X can depart London City Airport and fly to anywhere in the United States.
34,300 lb. to 36,600 lb. The increase allows operators to carry eight passengers with full fuel.

The downside is an increase in standard day takeoff distance from 5,555 ft. to 5,700 ft.

Dassault reports that the average mission duration for the fleet is just under 2.5 hr., or about 17% longer than five years ago. That results in a stage length of about 1,080 nm. Assuming standard-day conditions, the Falcon 7X can use 2,750-ft. runways for such missions, which is a better TOFL performance than that of many light jets.

Dassault reports that the Falcon 7X can fly eight passengers 5,600+ nm while cruising at Mach 0.80 and land with NBAA IFR reserves. That data is consistent with the BOWs reported by operators.

But most operators aren’t comfortable landing with 2,380-lb. NBAA IFR fuel reserves. Most say they want 3,000 lb. to 4,000 lb. remaining on touchdown. On international flights with no close-in alternate airport, some want 5,000 lb. of fuel remaining at touchdown.

The fatter reserves allow for contingencies, such as early descents from cruise altitudes, amendments to ATC clearances, holding delays and lengthy diversions to alternates. In light of these increased fuel reserves, operators say they can fly the aircraft 11.5 to 12.0 hr. and land with 3,000 lb. of fuel. Each additional 1,000 lb. of reserve fuel reduces flight endurance by about 25 min.

Most operators, though, report they seldom stretch the aircraft’s maximum range performance. As a result, on most missions they initially typically climb into the high thirties and cruise at Mach 0.85. First-hour fuel flows range from 3,000 pph to 3,500 pph. During the second hour, fuel flow drops to 2,700 to 2,800 pph. Near the end of the mission, fuel flows decrease to 2,500 pph or less. They also say there’s little loss of fuel efficiency when cruising at Mach 0.83 rather than the Mach 0.80 long-range cruise speed.

On shorter missions, such as U.S. coast-to-coast sprints, they can climb their aircraft directly into the low forties and liberally plan for 3,000-pph fuel flows. That usually leaves plush reserves in the tanks upon touchdown.

Operators proportionately decrease cruise speed down to Mach 0.80 long-range cruise. At heavy takeoff weights, the aircraft will climb to FL 370 to FL 390, depending upon outside air temperature. First-hour fuel burn ranges between 3,500 lb. and 4,500 lb., depending upon departure delays, ATC climb and speed restrictions.

Second-hour fuel flow drops to 3,000 pph or less. As fuel burn decreases aircraft weight and with a series of step-climbs, fuel flow drops to about 2,200 pph near the top of descent. Most operators say that actual aircraft performance is spot-on with Dassault’s book predictions. But the factory altitude, range, speed and fuel flow numbers must be adjusted for heavier-than-brochure BOWs, warmer-than-standard OATs and higher-than-NBAA fuel reserves.

The relatively low number of maximum range missions flown by operators also means that most U.S.-based operators haven’t configured their aircraft with full-berth crew rest areas.

There is a wide variation in 7X cabin configurations, reflecting the preferences and needs of different operators. The most common layout has a forward crew area with a lav and main galley on the right side and an aux galley on the left. In those aircraft, the main cabin is divided into three seating areas with a four-seat club section in front, a center four-seat conference grouping on the left flanked by a credenza on the right side, and an aft section with one three-seat divan and one or two individual chairs. The main passenger lav is at the rear of the aircraft and there is an in-flight accessible baggage compartment at the rear.

Some aircraft, though, have full, layout bunks up front and others use berthing seats in the main cabin for crew rest. Aircraft with full-sized crew rest compartments up front on the right side have left-side galley ais of the entry door. A few aircraft have an extended crew rest and galley area up front, resulting in the loss of the two aft-facing club chairs in the forward cabin.

Most of those configurations will seat 12 to 16 passengers in various combinations of individual or conference chairs plus divans. However, the average passenger load of the operators we contacted was 3.5 people. Large corporations that have fleets of aircraft tend to have higher load factors than high-net-worth individuals who operate the aircraft.
Five Best and Worst Features

The last time we surveyed Falcon 7X operators, they weren’t hesitant to express their enthusiasm about the aircraft. This time, they were even more positive in their praise, perhaps because of improved dispatch reliability and better product support.

Range, speed and fuel efficiency again ranked close to the top of their five favorite features. The aircraft can fly nonstop from Beijing to Geneva, Buenos Aires to St. Louis or Budapest to Seattle. They also like the near 30-kt. increase in long-range cruise speed compared to the Falcon 900EX and 2000LXS. The Falcon 7X’s larger, more swept and redesigned wing is 30% more efficient at Mach 0.80.

Operators said it has virtually the same fuel burn at Mach 0.80 as the 900LX. “Our passengers just love this airplane. It’s fast, it’s quiet and it’s easy to operate,” commented the aviation manager of a large corporation. Another chief pilot said, “What’s not to like about this aircraft?”

Fuel efficiency was an important consideration in operators’ competitive analyses of the Falcon 7X versus other long-range aircraft built by Bombardier and Gulfstream. Operators said that the Falcon 7X burns as much as one-third less fuel than some purpose-built, large-cabin, long-range competitors.

Passenger comfort and cabin quiet also ranked near the top of operators’ lists of favorite features. The Falcon 7X has the same fuselage diameter as the Falcon 900 series, but the interior is almost 6 ft. longer and its 28 cabin windows are larger and more numerous. Pressurization has been increased from the 900EX’s 9.3 psid to 10.2 psid on the 7X, resulting in lower cabin altitudes at typical cruise altitudes. At FL 450, for instance, cabin altitude is less than 5,000 ft. The lower cabin altitude reduces both crew and passenger fatigue on long missions.

Low cabin noise levels also reduce fatigue. One operator said his airplane has 48 dBA sound level in the aft cabin during cruise.

The aircraft’s advanced technology features, including its digital fly-by-wire (FBW) flight control system and EASy cockpit, also were ranked highly by operators. At the time of purchase, Falcon 7X operators believed their aircraft offered more advanced technology than its Bombardier or Gulfstream competitors. Then, it was the only purpose-built business aircraft to offer digital FBW flight controls.

Now, Bombardier, Em-
set speed during landing approach, particularly in gusting wind conditions. Many say they disconnect it and handle the thrust levers themselves when maneuvering.

Missing from the list of complaints were all the remarks we heard five years ago about computer problems, such as nuisance or spurious CAS messages, error codes experienced during boot-up and FBW test faults. Such snags no longer delay departures or result in AOG dispatch cancellations.

Rigorously following step-by-step checklists, though, is a must with the 7X. Many checks must be completed with the parking brake set, including starting the APU and the FBW built-in-test procedure after engine start. Operators said they have to run through a complete set of FBW system built-in tests every time they shut down and restart an engine. The computers forcefully drive the primary flight control surfaces to full travel during those checks.

“The whole airplane looks like a wet dog shaking itself off,” said one operator. Another chief pilot countered that his passengers now have become accustomed to the quirk.

Notably, we know of no other transport category airplane with FBW flight controls that requires such palpable and audible BIT checks.

Crosswind yaw control authority was an issue for many operators during our last survey. But a series of flight control software Service Bulletins now has corrected the problem, operators say.

Operators also say there’s more usable room in the cockpit because the sidestick replaces the control yoke and stalk. In addition, the sidestick makes crew seat access easy. The pilots also like the foldout tables.

Dassault furnishes a telescoping tow bar with the aircraft, but it’s limited to 49,000 lb. An optional Service Bulletin provides a more robust tow bar capable of handling weights up to 70,200 lb.

**On Balance**

The Falcon 7X provides reliable, fast, fuel-efficient, long-range business transportation. But it’s not inexpensive to operate.

Most operators we contacted said they’ve enrolled their aircraft in FalconCare, a maintenance parts and service program that covers virtually all airframe maintenance, including 600-hr./9 month A checks, 2,400 hr. B checks and 96-month C checks. The average cost is about $22,500 per month, $575 per flight hour and $575 per landing cycle.

Engine maintenance is covered by Pratt & Whitney Canada’s Eagle Service Plan (ESP), priced at about $260 per engine. Honeywell MSP for the APU runs close to $47 per operating hour.

Dispatch reliability now tops 99.6%. GoTeams based in North America, Europe, Brazil and Asia can be dispatched to support AOG aircraft in the field. In addition, Dassault now offers FalconResponse, an enhanced AOG support service that uses two Falcon 900 aircraft to rush small parts, hand tools and technicians to repair disabled aircraft. Larger parts and shop tools are shipped via truck or commercial air freight.

If a customer’s aircraft cannot be returned to service in short order, the Falcon 800 response aircraft are available to provide supplemental lift to transport stranded passengers to their destinations.

Parts support is much improved. Dassault now claims that parts arrive at customers’ facilities on or before the required date 98% of the time. Parts warehouses in New York, Paris, Africa, the Middle East and Asia have shortened the transit times. Few operators now complain about ready parts availability for scheduled inspections or AOGs awaiting parts arrival.

On balance, Falcon 7X operators are quite pleased with their aircraft. That bodes well for the introduction of the Falcon 8X in the second half of this year. A large portion of Falcon 8X customers is moving up from the Falcon 7X. The new model is an iterative design, so development risks have been minimal and it should have few teething problems compared to the Falcon 7X in its youth.

Brand loyalty among operators of new Falcon 7X aircraft appears to be stronger than at any time in recent history. Tip-to-tail FalconCare airframe maintenance support, Pratt & Whitney Canada ESP and Honeywell MSP have enabled operators to predict operating costs precisely, to submit rock-solid annual operating budgets to top management.

Falconists always have been engineered with passion. Falcon 7X operators say that passion now is matched with everyday practicality as well.

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**Spacious forward galley serves the needs of up 13 passengers. But, if the aircraft is configured with a full-size forward crew rest compartment, the galley is considerably more compact.**

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**The Falcon 7X comfortably operates out of small general aviation airports. Departing off a 3,000-ft. runway, the aircraft can fly more than 1,500 nm.**
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am a gear head — a mechanical guy; a dying breed. From age 15 I did all of my own tune-ups. And then one day I bought a car that had no distributor. My precious timing light and dwell meter were instantly buggy whips in a horseless world. And I was technically back to square one. I felt helpless as my slow downward drift into cyberbewilderment began.

Throughout my piloting career, I flew airplanes with mechanical connections from the flight deck to the systems and control surfaces, my bike had cables to the brakes and gear shifter, and my somewhat battered 1976 911S had mechanical fuel injection commanded by a cable. I liked it that way.

So, cyberspace feels so intangible to me — a free fall through a place with no firm handles. Like a guy 30 min. late to a movie — what the heck is going on...? It takes a while to get caught up when you tune into the middle of a story.

Today, I ride a Harley in which I have installed a digital auto tuning system that constantly reads ambient atmospheres and adjusts the air/fuel ratios for density altitude and humidity in real time. The bike runs the same every day, at every altitude. My current car does the same thing. And the aircraft we fly today are a wonderment of precision and digital control. Beautiful works of engineering art. Pinnacle achievements.

There is wonderment in the mystery of the digital, virtual and intangible. Yet with them amazing things are possible. Fighter jets with no structural aerodynamic stability, when controlled by a computer, can fly almost like sci-fi saucers. Sophisticated drones fly missions halfway around the world autonomously. We can control our homes, security systems and appliances from our smartphones — instantly from anywhere.

We can watch live TV, send and receive email, stream movies and make video phone calls, all while tooling along at 500 kt. and 45,000 ft. And I can change my Hog’s baseline fuel mixture, torque curves and timing with a laptop connected by a USB cable. Wow. Eight or nine years ago these capabilities were very rare; today they are expected.

Every new technology brings with it unintended consequences that can be good, but often not, and which can be quite dark. And problems that grow in menace — sometimes from mindful and nefarious manipulations, sometimes from unforeseen "bugs" in the system — emerge as the technology becomes more and more complex, convenient and indispensable to our daily lives.

Which brings us to the matter of cybersecurity as it pertains to business, a matter of growing concern to many including crews, maintainers, passengers and managers, along with company legal, IT and security departments, among others.

This article is intended to heighten a general awareness of the issues and identify resources to help find solutions that work for your particular flight department. Those solutions can be complex, and keeping your aircraft and those within secure from digital intrusion and disruption — hacking — is going to take a team approach.

A business aircraft is no longer “just” a mode of transportation; now it can serve as a hacker’s gateway into the

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corporate database, potentially resulting in extreme business and financial duress.

But how vulnerable is your aircraft to hacking? Is connecting to company email while airborne more or less risky than it is from company headquarters? Is the company jet a highway for hackers?

And what about (GULP!) a hacker taking over some or all of your aircraft’s flight controls — either from an onboard hack or through the in-flight uplinks from the ground or from another aircraft shadowing yours? Possible? Yes. Unlikely? Probably. Stoppable? Depends. Depends on how you manage data access and what that means.

After consulting industry experts the message is clear: Be vigilant. The dangers of complacency in the cockpit or on the hangar floor just got another bullet point; that is, know what you are downloading, who’s doing it and its source.

To better understand the problem, it’s helpful to study “Information Technology Security Threats to Modern e-Enabled Aircraft: A Cautionary Note,” an article presented at the German IT Security Congress in 2013. The article identified five groups that are highly motivated and capable of creating havoc.

(1) Military forces can and have developed, and in some cases demonstrated, that they can intrude on aircraft communications using equipment on site.

(2) Intelligence services gather confidential or classified information, “including personal, business, military or political developments.” Their methods may include exploitation of systematic security weaknesses, organizational, or back-end security vulnerabilities or monitoring airspace (e.g. via globally unique ICAO aircraft identifiers).

(3) Terrorists usually “sabotage a particular aircraft or aircraft control systems for politically motivated extortion or intimidation.” Terrorists typically use commercial off the shelf (COTS) equipment.

(4) Business competitors can intrude on aircraft IT systems developed or used by a particular company for industrial espionage.

(5) Hackers, ranging from individuals with little specialist knowledge to powerful underground groups such as Anonymous, may try to attack the security or privacy of aircraft IT systems for fun, fame, politics, revenge or profit.

A complementary listing in the “Cautionary Note,” details the unwelcome activities possible once an aircraft’s digital systems are breached:

(1) Interception of communications from airborne equipment. As reported by the Wall Street Journal in 2009, militants in Iraq and Afghanistan intercepted live video streams of U.S. Predator drones using COTS equipment valued at less than $100. The U.S. military knew there was a way in but thought the enemy was not sophisticated enough to find it. The video streams could have been any confidential data — your flight plan, your passenger manifest or business confidential email traffic.

(2) Spoofing GPS navigation of a U.S. military drone has occurred several times (that we know of) and was the alleged cause of a U.S. drone landing in Iranian territory in 2011.

(3) Spoofing GPS signals of civilian drones “has been publicly proved and the integrity of civil GPS navigation is easily violated.”

(4) Spoofing aircraft with fake ADS-B messages. This is possible because, according to the report, “Current ADS-B specifications are without any authenticity or integrity protection against malicious manipulations of spoofing.”

(5) Business Aircraft Registration Request (BARR) aircraft vulnerability to unauthorized eavesdropping or tracking through ADS-B. In a demonstration cited in the report, the authors note, “ADS-B messages (or even speech contents) are always sent out unprotected (i.e. without encryption or signature) and this enables eavesdropping and tracking of any aircraft equipped with ADS-B transponders.”

(6) Attacking the FMS has been demonstrated, according to the authors, but experts say doing so in a normal flight

Figure 1

![Diagram of aircraft systems and cybersecurity]

COURTESY OF ESKOFF EMBEDDED SECURITY, GERMANY
through wireless external interfaces. This has reportedly been demonstrated with the virus spreading from one drone to another wirelessly.

(10) Corrupted data/malware delivered from a secure server to the aircraft (the inside job).

By identifying the “components” or “domains” of a typical aircraft’s connectivity architecture, an operator can then parse out areas in which to take effective action supporting or augmenting the extensive security work your connectivity hardware and system suppliers already have achieved.

The “domains” of the system — like railroad cars in a train — are all connected one way or another to pull the load. In the connectivity scenario sometimes they are connected in a linear way, sometimes not.

Figure 1 on page 57 illustrates the general “domains” on a typical “connected” aircraft: digital flight deck, company aircraft data links and passenger IFE system with streaming capabilities.

A break in the black lines illustrates a potential gateway for hackers to burrow deeper into the aircraft (gray shaded area) and steal data, deliver malware, or even wrest control of systems, displays or flight controls.

Across the top are the wireless pathways into the aircraft “domains” of the flight deck, operating systems, cabin systems and passenger IFE and communications systems. Across the bottom are typically ground-based “plug-in” pathways for aircraft operating systems and avionics maintenance updates, cabin control system maintenance and, finally, passenger IFE and communications systems. Today, many of these updates can be done wirelessly. Do you have a plan to manage that?

In September 2015, the FAA issued Advisory Circular AC-119-1, “Airworthiness and Operational Authorization of Aircraft Network Security Program (ANSP).” It cites, among other things, the value of recent technological developments like Internet Protocol (IP) connectivity to increase speed of data transfer while saving weight, and the ability to move data to and from the aircraft without the use of standard storage media (thumb drives, DVDs). The types of data transmitted can range from customer profiles and IFE content to navigation and aircraft health monitoring.

But the AC also cites potential hazards, stating, “As with other advanced connectivity, a real threat exists, that may be intentional or unintentional, with a detrimental effect on systems performance. These effects may range from reduced performance, denial of service, or criminal activity.” It continued, “The transmission of critical data affecting airworthiness to and from the aircraft necessitates the need for an ANSP. A comprehensive ANSP mitigates risk to network security onboard the aircraft, the off-airport supporting infrastructure (corporate offices, and everything in between, to include wired and wireless connectivity.”

This new AC underscores the importance of setting policies and procedures in place at your flight department to control and monitor access to data entry ports and to establish accountability and traceability.

With one exception, the main defenses against threats seeking to penetrate the aircraft or capture data through the wireless pathways are essentially out of the operator’s control. But then, too, is the structural integrity of the aircraft; rather, that was determined during design and confirmed during certification.

It’s important to understand the general design of the onboard data distribution network and the pathways...
Recognizing this, the FAA established an Aircraft Systems Information Security Protection working group in February 2015 to “provide recommendations regarding Aircraft Systems Information Security Protection (ASISP) rulemaking, policy and guidance on best practices for airplanes and rotorcraft, including both certification and continued airworthiness.”

The directive pointed to a lack of standards, citing, “The issue is that without updates to regulations, policy and guidance to address ASISP, aircraft vulnerabilities may not be identified and mitigated, thus increasing exposure times to security threats.”

The ASISP recommendations are due to be submitted to the FAA in August of this year and are expected to be released in the September/October timeframe.

These recommendations will address connectivity systems Continued Airworthiness standards for systems installed by the OEM under an aircraft’s Type Certificate and by third-party STCs. Keep an eye out for it.

The good news in all of this is that U.S. technical expertise is at work on the project, whose goal is to establish a leak-proof connected aircraft.

Recognizing ways to mitigate a threat so intangible as cyber espionage and sabotage is difficult. But there are effective actions you can take — tangible countermeasures against an intangible foe. Above all, vigilance is key.

Oh, one more thing. While I have FADEC on my Harley and car and a digital TV, my wrist sports a Hamilton KAK1 automatic self-winding mechanical watch — complete with a clear crystal back that displays all those beautiful springs, gears and counterweights. Just because. BCA

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THE IN AND OUT

Industrial grade anti-virus software that verifies data and application integrity at every boot is the hallmark of a top-notch systems supplier. One example is Astronautics Corporation of America. Since its founding in 1959 it has been at the forefront of securing connected environments used in military, space and civilian applications. Focusing on aircraft networks and “firewalls” that separate flight decks from passenger connectivity systems, its architecture relies on onboard servers. These integrate with EFBs that have special software and hardware provisions to shield them from suspect consumer devices since those leave and reenter the aircraft. Such devices need to be “filtered.”

Brian Keery, the Milwaukee company’s product strategy manager, describes its hardware philosophy thusly: “A secure server and protected gateway means safe on-aircraft connectivity that is architecturally designed to be very hard to hack, maintains an access list of approved users and will announce if someone is trying to break into the system. Our systems are designed to be customizable depending on the customer’s operational and cyber-threat profile.”

The other half of the connectivity equation is the delivery system, a specialty for Satcom Direct.

John Zban, the Indian Harbor Beach, Florida, company’s chief information officer, explains, “We have designed, built and we protect our system so it is as secure for the end user in the airplane as it is in their office. Every week we have a security trial on our system, where a third-party contractor continuously tries to hack our system, probing for weakness, and each week we get a report from them on what ifs and any soft spots they find.”

Satcom Direct is unequivocal in its stewardship of the data stream coming and going from the aircraft. Data is encrypted up to the satellite and relayed to a Satcom Direct receiver on the ground via VPN link directly to the client’s corporate server. It doesn’t get any tighter than that.

And both suppliers have dedicated professionals to carry out security audits of your connectivity system. BCA
Cybersecuring Your Aircraft
Avionics makers step up their cyber game

BY JOHN CROFT john.croft@penton.com

When a hacker last year claimed to have tapped into an airliner’s entertainment system and then wormed his way into the flight control system, the major avionics companies were quick to internally debunk the claim, but they were less outspoken in public. That’s because the burgeoning number of federated boxes that are increasingly common in connected cockpits are outside their direct control.

“No one wants to comment,” says Scott Zogg, Rockwell Collins’ newly appointed chief security officer. “We can say the probability is very low but can’t say it’s impossible. We could test a particular configuration of an aircraft with our equipment, and it could never happen. But with a different configuration?”

The seeds of doubt have governments and the aviation industry scrambling to find and fix any cybersecurity holes and hacking vulnerabilities within the ever more digital fleets of commercial and business aircraft.

While digital safety guidance has been built into new aircraft through “special conditions,” the industry is developing more comprehensive safety nets to more broadly protect the increasing number of data transactions taking place on aircraft in flight and on the ground. These interactions include database updates and maintenance downloads.

A key junction for data — and hence a prime focus for cybersecurity — is the routers, or system servers, that connect various data buses and enable wireless communications with tablets.

“The ‘special conditions’ worry about any security threat that affects flight safety,” says Dan Johnson, an engineering fellow and cybersecurity expert at Honeywell Aerospace. “We within Honeywell are also worried about business considerations, dispatch, maintenance, economic and privacy concerns.” Companies are also integrating what previously tended to be dispersed pockets of cyber expertise into enterprise-wide operations.

Johnson and representatives from government and other avionics companies over the past few years have developed, largely through the Radio Technical Commission for Aeronautics (RTCA), standards and information security processes and certification guidance for airframers, operators and maintainers. Honeywell is now “making sure we integrate that guidance into all of our own integral processes,” says Johnson. “Pretty much all of our new avionics products are going to include security considerations that come from that guidance.”

The FAA by next year will likely codify the special conditions and cybersecurity best practices in a new rule, based in part on recommendations from an aviation rule-making committee, called Aircraft Systems Information Security and Protection (ASISP), that it launched last year. The ASISP is expected to issue a final report later this year, identifying needed cybersecurity measures.

Honeywell set up a cybersecurity lab about three years ago, says Johnson, staffed by approximately a dozen engineers who “borrow resources” from “a few hundred” engineers working in the company’s industrial side where cyber threats exist on a much larger scale. “These are guys who are looking at how people are trying to hack, for example, into thermostat systems,” he says. “They have a lot more incident reporting than we do, as they’re currently exposed to a level that we are not. We’re using them to sort of prepare ourselves.”

Meanwhile, Thales Avionics has significant cyber experience through its financial arm, which manages 80% of financial transactions worldwide. The company says it has more than 1,500 cyber experts working in 50 countries in both the civil and military markets.
“We’re already a key partner of aircraft manufacturers and regulatory authorities, helping them to assure that system safety and security requirements are being implemented,” says Bruno Nouzille, the company’s technical director. “Cybersecurity protections are already built into our critical systems.” Along with an information technology (IT) security evaluation manager running Rockwell Collins’ cyber lab.

Astronautics Corporation of America is considering setting up what officials say would be a first of its kind facility: a combined flight simulation and cybersecurity research lab at its Milwaukee headquarters. “We’re starting to look at scenarios, architectures and the ability to hack,” says Chad Cundiff, Astronautics president. “Hacker-type stuff.”

Cybersecure design has three key principles, called the three Ds: Deter, Defend and Detect.

**“Deter”** can mean making a system architecturally difficult to hack. Cundiff says typical avionics data buses are somewhat protected because there is no physical port to plug into. However, there are federated boxes built by various companies typically tied to a bus that might provide a way into the system.

**“Defend”** can mean restricting access to “trusted people” or requiring a certain proximity to the operation. Rockwell Collins last year was testing a method of wirelessly connecting an iPad to a cockpit avionics suite. In it, the pilot first connected the iPad to a secure wireless network because there is no physical port to plug into. However, there are federated boxes built by various companies typically tied to a bus that might provide a way into the system.

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Astronautics is in the process of certifying a new device called Patio (Personal electronic device and tablet input/output), positioned between portable electronics and Astronautics’ newest server, the Nexis flight intelligence system. “A tablet almost by definition is a corrupted device,” says Cundiff. “If you want to authenticate it, then you want an extra layer of security to make sure that tablet can’t get through and access the aircraft systems.” Patio is a secondary processor (the server is the primary) that validates the device trying to gain entry.

**The last of the three Ds, “Detect,”** is key since hackers believe that with enough time and money, there’s nothing that can’t be hacked. Cundiff says one tool for detection is to monitor data going across the bus. “It’s like watching a river,” he explains. “You can see when a river changes course and then you say — that’s unusual, maybe I’ve been hacked. If you can detect it, then maybe you can alert and shut things down, but you can also find the vulnerability to intercept.”

As such, a critical element of cybersecure avionics is data logging of potential intrusions. The action is called for in FAA special conditions and will ultimately be included in the cyber rule expected next year. Johnson says Honeywell, along with others, is researching ways to improve intrusion monitors.

So, certain defenses against digital system intrusion are already in place, and reinforcements are on the way to strengthen aircraft against hackers. “Architecturally it’s hard to hack” today’s aircraft, says Astronautics’ Cundiff. But he quickly adds, “Is it impossible? Heck no.”
News of promotions, appointments and honors involving professionals within the business aviation community

▶ Advent Aerospace, Largo, Florida, announced the Brian Barber has joined the company as vice president of Sales and Marketing responsible for expanding its offerings beyond VIP completions.

▶ Aircraft Technical Publishers (ATP), San Francisco, California, announced the CEO Charles Picasso has selected Mark Culpepper as chief product officer responsible for leading product development process, including implementing the company’s new product vision and strategy.

▶ AJW Aviation, London, recruited international finance expert, Thomas van de Wiel, to the role of chief financial officer to lead financial and legal function and support affiliates and subsidiaries of the AJW Group.

▶ Aura Aviation, London Biggin Hill Airport, Kent, U.K., appointed Stephen Mitchell sales director for the company’s new rotary division that operates under the JetBrokers name.

▶ Baltic Air Charter Association (BACA), London, United Kingdom, announced the Richard Mumford, head of aviation at law firm Stevens and Bolton, has been appointed as the new chairman of the BACA. He succeeds Tony Coe who served for three years.

▶ FAL Aviation, Nürnberg, Germany, appointed Russian business aviation expert Victor Rudnov to the newly created position of director of Business Development, Russian Federation and CIS. He will be based in Moscow.


▶ Greenpoint Technologies, Kirkland, Washington, promoted Bret Neely to executive vice president of. He most recently was vice president of sales. Neely will oversee information technology and finance in addition to sales and design.

▶ Gulfstream Aerospace, Savannah, Georgia, appointed Leda Chong senior vice president of government programs and sales.

▶ JetSmarter, New York, New York, announced that former governor of Pennsylvania, and former Secretary of Homeland Security, Tom Ridge will serve on the company’s board of directors.

▶ Luxivair, San Bernadino, California, appointed Wendy Bechtel as FBO manager for Luxivair SBD. She comes to the company after an 11-year stint at Encore Jet Center.

▶ Rectrix, Concord, Massachusetts, named Paul Foley Chief Executive Officer responsible for overseeing the aviation division and launching its scheduled airline service. Chris Shewokis was named general manager of the Rectrix Aerodrome Center at Hanscom Field (KBED).

▶ SKYTRAC Systems, Kelowna, British Columbia, Canada, appointed Jan van der Heul as vice president Sales reporting to the CEO. Van der Heul most recently was at CHC Helicopter, where he led a global team of account managers responsible for a helicopter oil and gas portfolio.

▶ Turbomeca, Bordes, France, announced that Serge Maille has been appointed vice president of strategy and development. Maille succeeds Philippe Couteaux, who has taken another position within the Safran group. Maille joined Turbomeca in 1983.  

BCA
Nextant 400XTi
New Life for Hawker 400A/400XP

THE BUYERS’ MARKET FOR LIGHT JETS IS STRONGER THAN AT any time in decades, with upward of 200 aircraft available. Well hidden among all that inventory are a scant few Nextant 400XT and 400XTi aircraft that are true bargains, priced at less than $3 million for the first 2011 models and up to $4.7 million for 2015 units. The newer XTi aircraft have more space-efficient interiors, super-sound-proofing and plusher passenger seats, among other upgrades.

Most of these aircraft originated as Flight Options Beechjet 400A/Hawker 400XP aircraft that were “remanufactured” by Nextant Aerospace with reconditioned airframes, overhauled rotable components, new primary wiring harnesses and Rockwell Collins Pro Line 21 avionics. Most notably, Nextant installs new 3,052-lb.-thrust Williams FJ44-3AP turbofan engines that boost climb performance, burn one-third less fuel in cruise and have considerably higher TBOs compared to the original Pratt & Whitney Canada JT15D-5 powerplants. Fill the tanks and this aircraft comfortably can fly 1,700 to 1,800 nm at Mach 0.70.

Similar to Bombardier Learjet 45-series aircraft, the Nextant 400 XT has a flat floor and a non-circular fuselage cross-section that provides more head and shoulder room. Nextant guts the interiors and installs new acoustical insulation, a more volumetrically efficient interior shell and LED lighting. One of the most popular cabin layouts involves a right-side three-place forward divan and redesigned left-side galley, four new club chairs aft of the door and an upgraded lavatory with optional belted potty seat. The result is one of the quietest, most comfortable and space-efficient cabins in the light jet class.

All of the cabin luxury kit offsets the weight savings associated with the FJ44 engine upgrade, so typical BOWs are close to 11,000 lb. That yields a meager 600-lb. tanks-full payload. But most operators seldom carry more than three or four passengers. Each additional passenger costs about 100 nm of range.

While the 400XTi’s runway performance is not best in class, it’s improved over the Beechjet 400A/Hawker 400XP, being most apparent when departing hot-and-high airports. Taking off from BCA’s 5,000-ft. elevation, ISA+20C airport, the 400XTi can depart at MTOW, a 470-lb. improvement over the original aircraft.

The aircraft can climb directly to FL 430 in 30 min., but most operators initially level off at FL 410 until burning down 2,000 lb. of fuel. Then, they’ll climb as high as FL 450. Assuming long-range cruise, first-hour fuel burn is about 1,200 lb., second hour is 900 lb., third and fourth hours are 800 lb. and fifth hour is 700 lb. Normal cruise speed is Mach 0.73, but many operators push up the throttles to cruise at Mach 0.76 to Mach 0.78 redline on shorter range missions. Long-range cruise is Mach 0.69 to Mach 0.71, depending upon aircraft weight.

The semi-super-critical airfoil has 20 deg. of sweep and only 241 sq. ft. of area. That yields a hefty 67.6 lb./sq. ft. wing loading for a comfortable ride in turbulence. Nearly full span Fowler flaps enable the aircraft to have respectfully low V speeds. Manually actuated spoilers provide roll control and heavy roll control forces at high speeds. But operators also say the aircraft could use more roll control authority at low speeds in gusting wind conditions.

The wing’s drag divergence Mach number is a respectable Mach 0.84 and transonic pitching moments are moderate, according to BCA’s September 1982 report. The aircraft can cruise as fast as Mach 0.78, making it quite competitive with the fastest current production light jets.

Wheel brake life never was one of the aircraft’s assets. But operators say they fly at lighter weights because they need less reserve fuel. Also, the FJ44 turbofans produce much less idle thrust on the ground than did the JT15D-5s, so pilots don’t have to ride the brakes during taxi to control speed. The result is up to 500 landings between brake changes.

Refueling the aircraft is not easy. Each wing has a fuel port, plus there’s a third port, high in the right, aft side of the fuselage, that is used to refill the five fuselage tanks. However, fuel transfer from the fuselage tanks to the main wing tanks is automatic.

Aircraft without vapor cycle air-conditioners are uncomfortable during ground operations in hot climates. If the aircraft you’re considering only has the standard air cycle machine, consider retrofitting it with vapor cycle air-conditioning, operators advise. Auxiliary electric heating is popular among folks who operate at cold weather airports.

Aftermarket services from Constant Aviation, the sister company to Nextant Aerospace that provides product support, is excellent, according to operators. Williams’ TAP Blue power-by-the-hour program costs about $160 per engine. Aircraft enrolled in TAP are eligible for 5,000-hr. TBOs.

Principal competitors for the Nextant 400XTi are the Cessna Citation CJ3, which has comparable range and better runway performance but a smaller cabin cross-section; the Embraer Phenom 300, which has a larger cabin and better runway performance but slower cruise speeds; and the Bombardier Learjet 40/70XR with its larger cabin, higher cruise speeds, better runway performance and more range.

The choice depends upon your budget. If you’re in the market for a commodious cabin, rock-solid reliability and 400+ kt. block speeds, but you can afford to give up a little runway performance, it’s tough to beat the value of the Nextant 400XTi.
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700 NM farther
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ST190 - 95 GALLONS EACH TANK
ST120 - 60 GALLONS EACH TANK
ST72  - 36 GALLONS EACH TANK

3 SADDLE TANK MODELS AVAILABLE
ST190 - 95 GALLONS EACH TANK
ST120 - 60 GALLONS EACH TANK
ST72  - 36 GALLONS EACH TANK

STORAGE VOLUME
ST120 - 36” X 28” X 12”
ST72  - 55” X 28” X 12”
The Aircraft Bluebook has been the industry choice for complete and reliable aircraft valuation data for more than 60 years. Online and in print we provide in-depth information unmatched by any other valuation guide.
1. Universal Aviation Mexico FBO Complete

Universal Aviation Mexico, a joint venture between Avemex and Universal Weather and Aviation, Inc., has completed the multi-million renovation of their 16,384-sq.-ft. co-branded FBO at Toluca International Airport. The facility also has three direct ramp access points from taxiway, 135,000 sq. ft. of ramp space and a private parking lot. There are conference rooms, private and open lounges, along with an executive dining room, crew lounges and associated crew amenities.

Universal Weather and Aviation, Inc.
www.universalaviation.aero/mexico
Avemex
http://avemex.com.mx

2. Astronautics Launches Roadrunner EFI for Helicopters

Astronautics Corporation of America announced RoadRunner, an electronic flight instrument for helicopters. It’s a form-fit-function upgrade that increases reliability and offers operators the choice of moving from electromechanical instruments and legacy EFIs to a digital displays. RoadRunner expands flight safety capability with its internal Helicopter Terrain Awareness and Warning System (HTAWS) and Synthetic Vision System (SVS), which provides a real-time, 3-D rendering of the terrain. The company expects to receive its STC by year-end and begin deliveries shortly thereafter in order to fully comply with the HEMS mandate deadline of April 2017.

Astronautics Corporation of America
Milwaukee, Wisconsin
www.astronautics.com

3. FSI Offers EC145 Training in Shreveport

FlightSafety International will offer training for the Airbus Helicopters EC145 using a new Level D qualified simulator located at the Helicopter Flight Training Center, a Metro Aviation company, in Shreveport, Louisiana. This is the first simulator of its kind in North America and was developed with Metro Aviation. The FS1000 simulator is equipped with the company’s VITAL 1100 visual systems, CrewView collimated glass mirror display and 60-in. electric motion base. Initial and recurrent training will be provided by FSI under its Part 142 single certificate and will begin later this year.

FlightSafety International
www.flightSafety.com
4. AW139 Sliding Door from Mecaer Aviation

Mecaer Aviation Group (MAG) has initiated the development and certification of their proprietary SILENS technology for the sliding door AW139. SILENS technology is a noise canceling system that reduces cabin decibel levels to where normal conversations can be conducted without the use of headsets. The company uses a combination of interior panel design, sound dampening materials and specific connecting point to the airframe to achieve low Db levels. The new SILENS will be certified with EASA and the FAA.

Mecaer Aviation Group, Inc.
Irving, Texas
(972) 717-2900
www.mecaer.com

5. BLR to Certify FastFin for H125 Helicopters

BLR Aerospace is working with Airbus Helicopters to certify the FastFin Tail Rotor Enhancement and Stability System on an H125 helicopter. BLR is nearing the end of its certification flight test program and is on track for Federal Aviation Administration (FAA) certification of its new H125 system later this year. Approvals from the European Aviation Safety Agency (EASA) and Agência Nacional de Aviação Civil (ANAC) are expected to follow. The system will be offered to the aftermarket and as an option on new H125s. Detailed performance data will be available once certification occurs, according to Dave Marone, vice president of Sales and Marketing. The FastFin system includes patented airflow modifiers at strategic locations on the tailboom, optimizing airflow around the tailboom to create an advantageous pressure differential between the left and right sides of the tailboom, dramatically improving tail rotor authority.

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- ALI’s LEDs are compact, ideal for placement in difficult-to-reach places
- ALI’s LEDs contain no dangerous chemicals such as mercury
- ALI’s LEDs are DMX (color)-controllable with simple Bluetooth controller system
- ALI’s LEDs come in customizable lengths and curves
6. Hartzell STC for Five-Blade Meridian and M500 Prop
Hartzell Propeller has received an STC for a five-blade composite propeller for the Piper Meridian and the new M500. The prop design increases performance and value for the two aircraft and boosts climb rate while decreasing noise and giving the aircraft a stylish look on the ramp, says Hartzell President Joe Brown. They are certified for unlimited life and are five to 10 time stronger than wood core blades. They feature a stainless steel shank, nickel cobalt leading edge, and mesh erosion screen for FOD protection.
Hartzell Propeller, Inc.
Piqua, Ohio
www.hartzellprop.com

7. Bell Improves Performance with Bell 412SP Upgrade
Bell Helicopter has introduced a newly available kit that allows customers to upgrade their current Bell 412SP to the 412HP configuration – increasing aircraft performance and reducing customers’ cost. The new 412HP upgrade kit provides an additional 165 hp available at the main rotor, allowing out-of-ground-effect hover performance to increase to 11,900 lb. at 5,200 ft. — up from 11,500 lb. at sea level. Major features of the kit include a new main rotor transmission, mast torque measurement system, dual engine trim, all new tail rotor drive shafts, and upgraded intermediate and tail rotor gearboxes. Bell Helicopter installed the first production article of this kit with Agrarflug Heilift GmbH & Co. KG in Ahlen, Germany. The 412SP to 412HP upgrade kit further saves direct maintenance costs by reducing the number of greased couplings in the drive system and increasing the overhaul intervals of multiple components.
Bell Helicopter
Fort Worth, Texas
www.bellhelicopter.com

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In keeping abreast of soaring growth, this April 1966 Planning & Purchasing Handbook has evolved into our biggest issue since BCA’s inception as an independent publication in 1958. We know no other source comparable to it in business aviation, and we hope you will agree.

Light twins continue to account for 80% of the business twin market as more and more pilots seek multiengine reliability, increased performance and capacity. Piston engine medium twins have suffered in sales recently because of turbines.

Model 23 Learjet will be produced along with transport-category-certified Model 24 as long as there is demand.

The Fan Jet Falcon is first, and definitely not last, turbofan-powered business jet. The airplane is flying with seven U.S. firms.

Altitude Computer made by Intercontinental Dynamics Corp. To conform with soon to be released FAA TSO (C-10c), altimeters must be accurate within 125 ft. above 25,000 ft.

Bright indicator for RCA AVQ-20 on Beech Queen Air can be seen by both pilots in daylight without a hood.

The Piaggio-Douglas PD808 will be marketed in the U.S. via World Jet Aircraft, a new subsidiary of Pacific Western Aviation in Van Nuys. The Viper-powered twin jet carries 7 to 10 passengers and grosses out at 18,000 lb.

The Lockheed Model 286, high-speed, rigid-rotor helicopter will be certified in 1966. A demo tour will sample operator interest in the easy-to-fly, fast, high-cost helicopter.

Industry historians tell us that United States Steel started the whole thing. Some 11 years ago, this barometer of the nation’s economy bought its three Viscounts new from Vickers in England and, thereby, opened up the turbine era in business aviation. BCA

The MU-2 is one of the most tested new planes ever to be introduced to general aviation, according to Mooney’s latest advertisement for the airplane.
Current JetBed Availability

**Bombardier**
C300, C600 Series, Conference Group, Learjet 40 Series, Learjet 60, Global Express (5000, 6000, 7000, 8000)

**Cessna**
CJ, CJ1, CJ1+, CJ2, CJ2+, CJ3, CJ4, XL, XLS & XLS+, Ultra, Encore, Encore+, Citation X, Citation Sovereign, Citation Mustang

**Dassault**
F2000, F9000, F7X, Falcon 50, Conference Group

**Gulfstream**
G200, Galaxy, GIV, G450, GV, G550, G650, G650 Conference Group, GV Crew Rest, G550 Crew Rest, Conference Group

**Hawker**
XP Series

**Embraer**
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Legacy 600 Series

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“I have been chartering jets for well over a decade now and last night was the first time that I was able to sleep all the way home from Minneapolis to Los Angeles. The JetBed is simply amazing. Why all charter jets don’t have these is beyond me.”

*Bill Engvall - Actor/Comedian*
To step inside Dassault’s new flagship is to experience the ultimate expression of comfort and cabin chic. With 30 spacious configurations to choose from and exquisite, handcrafted finishings, no detail is overlooked. With its 6,450 nm/11,950 km range, the 8X not only flies farther than any previous Falcon, it is able to fly into airports other long-range jets have to fly over. Falcon 8X. Arriving in 2016.
Interiors Showcase for Business Aviation

5 Tips to Upgrade Your Interior the Right Way

RCO Aerospace Products LLC, p. 3
Duncan Aviation, p. 4
Constant Aviation, p. 6
Flying Colours Corp., p. 7
Pentastar Aviation, p. 8
Five Tips for Upgrading Your Interior

Aircraft interior completions and modification centers and component suppliers know the ins and outs of interiors. They offer these tips to aircraft operators upgrading the cabin.

1. **Fly the aircraft first.** If your flight department acquires an older aircraft, “get it in the air” before you get it into the refurbishment center, Gordon Ross, director of interiors for Pentastar Aviation, says. All aircraft have quirks. Put the plane to use to find the bugs in the interior that you will want to change at the next opportunity. This initial period will give you a better chance to take care of all the interior issues all at once.

2. **Mind the mission.** Eric Gillespie, executive vice president at Flying Colours Corp., recommends considering the mission of the aircraft when shopping for a new interior. Knowing whether the aircraft is used for personal travel, charter flights or business travel and who will use the aircraft can help designers and operators find the right aesthetics and wearability needs.

3. **Consider comfort.** In large long-range aircraft, seats may be used as office chairs, for dining or for relaxing, Norm Starr, general manager at RCO Aerospace Products, says. RCO has developed the CloudRocker Collection of seats to give passengers more flexibility to assume different postures for work, meals and rest in the same seat. Armrests, footrests and fabric choices, and even lighting and the sheen of woodwork, can affect comfort on longer flights, too.

4. **Meet in person.** While reconfiguring an aircraft, Constant Aviation toured the aircraft owner’s New York loft to understand the feel the owner wanted in the airplane, president and CEO Stephen Maiden says. In-person visits allow designers to replicate personal tastes or business culture in the aircraft. Also consider visiting your vendor’s design center. At Constant Aviation (shown above), for example, designers can show you renderings on screen, photos of previous work and fabric samples, Maiden says.

5. **Plan ahead.** Save time by scheduling interior work when your aircraft is going to be down for a mandated avionics upgrade, other maintenance or an inspection. Operators aim to maximize the time they can keep the aircraft in the sky, Suzanne Hawes, completions and modifications sales representative for Duncan Aviation, says. She often schedules paint and interior work to coincide with work done by other shops. Plus, planning many months in advance allows more truly customized options, which might not be significantly more expensive than more standard options, Constant Aviation’s Maiden says.

— Justin Marciniak
New Approaches to Aerospace Design and Comfort

RCO Aerospace Products LLC is uniquely positioned as a supplier who can take your ideas from concept all the way through production. Our 430,000 sq. ft. campus in southeastern Michigan includes the following services:

- Design and engineering
- Upholstery
- Cushion foam – poured and skived
- Metal stamping and fabrication
- Composite parts
- Complete seat systems

RCO provides aircraft manufacturers with an alternative to traditional aerospace design and product development approaches. Bringing over 40 years of automotive technology, processes, quality and repeatability to the aircraft industry, RCO is changing the way aircraft seats and interiors are designed, built and installed. We believe comfort is one of the most important aspects of a seat. Our expertise and proprietary process enable you to achieve the customized comfort profile you desire.

Many of our projects are joint development programs where we design and produce a product unique to each customer’s requirements. When the world’s premier business jet manufacturer was looking for a premium seat supplier for its next generation aircraft, it came to RCO. Since that time, follow-on programs have also been awarded, demonstrating the excellent partnerships we create with our customers.

Innovation is at the core of how RCO operates. Currently we’re pioneering the application of carbon fiber structural parts to replace aluminum and high-strength steel assemblies for cost and weight savings. This has changed our approach to structure component and assembly design, enabling our engineers to explore new shapes and executions of complex load path designs.

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For more than 35 years, Duncan Aviation has developed creative and innovative interior solutions that meet the needs of business aircraft operators around the world. Customers come to Duncan Aviation with their ideas, and the company makes them happen.

These interior solutions include things like one-piece PSU overlays, pop-up mid-cabin dividers, special storage requests and unique interior configurations. They can also include cabin entertainment and business productivity solutions like Wi-Fi access, the latest cabin management systems and mobile charging stations.

These unique solutions sometimes require the use of unique materials. For example, Duncan Aviation recently installed an innovative F/LIST stone floor in the entry of a Falcon 2000. With its lightweight panel substructure, this new stone floor is as durable as it is attractive. It meets certification requirements for flame- and slip-resistance and is extremely easy to clean.

In addition to unique solutions, Duncan Aviation interior projects mean excellent quality and longevity. This quality is delivered by an in-house design team focused on ergonomics and aesthetics, dedicated interior craftsmen who provide unmatched attention to detail and experts who listen to customer needs and develop creative solutions for their aircraft. These technicians know the aircraft models they work on inside and out and understand the way aircraft interiors are used. When they work to design an interior, their goal is to enhance the overall cabin aesthetics as well as the on-board experience for passengers. This includes passenger comfort, convenience and overall flight enjoyment.

Duncan Aviation technicians hand-craft nearly every aspect of an aircraft interior, from eye-popping custom cabinetry inlays to perfectly stitched seats. Duncan Aviation’s interior and paint designers have won awards for their unique solutions, and their winning
interiors have earned the admiration and respect of operators and organizations around the world. Duncan Aviation’s unique interior upgrades include the following:

- New seat designs and interior shell kits
- One-piece PSU overlay and window panels
- Stone flooring
- Custom pop-up mid-cabin dividers
- Custom interchangeable cabinets
- Custom thermal and acoustic insulation packages
- 16G dynamic seat reupholstery

And customers consistently rave about the extra services that come with a project completed at Duncan Aviation. These include the following:

- Professional designer dedicated to assist in selecting the interior materials, designing the paint scheme and adding a personal touch to overall aesthetic design
- Daily project manager and designer oversight of every project
- Access to myDuncan.aero, an online project monitoring and approval process that aids communication and helps ensure on-time delivery
- All aspects of the interior project are completed in-house
- Dedicated in-house engineering and certification services are available if needed
- Extensive experience, expertise and the technical knowledge to complete the project to the customers’ exact specifications
- Three-year interior warranty

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Turning Dreams into Reality

Our 30,000 sq. ft. interior facility is home to extremely talented interior specialists. It also boasts a state-of-the-art design center where our interior design team can walk customers through a variety of materials and show them a mockup of their new interior.

Our interior design team travels to the customers to understand their vision for what the interior should look like. From there, the design team provides sample boards showing multiple options for all materials including carpet, leather, soft goods, veneer and plating.

Once the materials are chosen, our in-house engineering professionals are involved to ensure any necessary engineering drawings are complete for the upgrade. The team will then provide customers with 3-D renderings of the interior allowing them to see what it will look like upon completion. The goal with any interior refurbishment is to truly turn our customers’ dreams into reality.

Our capabilities range from small cosmetic upgrades to full refurbishments to complete interior reconfigurations. One add-on service we offer our maintenance customers at any of our facilities is for our interior team to inspect the full aircraft and provide suggestions to the customers for interior upgrades that could be completed during the maintenance downtime.

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Making the Impossible Possible

Flying Colours Corp. has built an international reputation for providing a service led by the core philosophies of technical innovation, business integrity and service flexibility. The company specializes in green interior completions, interior refurbishment and modification, and avionics installations for rotary- and fixed-wing aircraft.

Clients have access to the full capabilities of an in-house production and design team that uses advanced 3-D software to provide state-of-the-art structural and graphic renderings of aircraft interior components. These showcase the final look and feel of the cabin. With over 25 years of experience, the Flying Colours team has the extensive knowledge required to guide clients through the process of refurbishing their interior from design to manufacturing, all within the same facility.

The internal design team also maximizes the opportunities to push the limits. Recent projects included the interior refurbishment of a stunning Bombardier Challenger 850, which featured predominantly carbon fiber monuments and a customized cabin reconfiguration. The red, white and black interior became a game changer in completions design. A striking interior for a privately owned Sikorsky S-92 helicopter inspired by the client’s request for lapis blue elegance quickly followed.

“Clients have a strong vision of what they want, and we are always excited to help them realize it. Sometimes the seemingly impossible becomes doable thanks to the ingenuity of our design engineers and talented craftsmen and women,” says Kate Ahrens, VP design. The company specializes in mid- to large jets from the leading OEMs and is an Authorized Service Facility for Bombardier and a Bombardier Preferred Completion Centre.

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Ingenuity and Artistry to Bring Your Aircraft Cabin Vision to Life

Pentastar Aviation® Interior Services offers you a world of style, sophistication and distinctive design. Whether you use your aircraft for business or leisure, the innovative minds at Pentastar combine ingenuity and artistry to bring your aircraft cabin vision to life.

The newly opened aircraft Interior Design Studio features a talented team with more than 130 years’ combined experience on aircraft large and small.

There is nothing the designers and master craftsmen at Pentastar cannot accomplish. From cabin reconfigurations for professional sports teams to custom leather seats that replicate the design elements of your favorite luxury automobile, the Pentastar Aviation design team’s attention to detail is unsurpassed.

Available services include design and engineering, custom cabinetry, custom upholstery, custom/tailored carpets, cabin management systems, LED lighting, cabin entertainment systems, cabin reconfiguration, sound deadening and insulation.

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