AVIATION WEEK NETWORK

BCA
Business & Commercial Aviation

AAM'S RAMP UP

ALSO IN THIS ISSUE

MARK WAGNER/AVIATION WEEK

EDITOR'S NOTE

More Than a Curiosity

The Paris Air Mobility event at the Paris Air Show highlighted the momentum of the AAM industry. A panel on the state of AAM regulatory and certification appears here.

JULIET TREW/AVIATION WEEK

By Lee Ann Shay

Prior to the Paris Air Show, advanced air mobility (AAM) had created a bit of a Superman curiosity: “is it a bird, is it a plane…?”

Just as Superman flies into a scene and makes a big entrance and impact, AAM did the same at the air show—but AAM also demonstrated that it’s not fiction, for anyone who had doubts.

Full-scale mockups and mature prototypes filled Hall 5. Show attendees flooded the area to sit in AAM vehicle cabins and take selfies in front of the futuristic-looking designs.

Archer’s Midnight eVTOL and Volocopter’s VoloCity eVTOL flanked the Paris Air Mobility stage, where three days of comprehensive conference content—covering technology, airspace, regulations and certification, workforce training, operations at the 2024 Paris Olympics and more—was produced by the Paris Air Show organizer and Aviation Week Network. It also clearly showed that AAM vehicles are not intended to replace helicopters, but instead offer a more sustainable travel option in urban and regional areas.
There isn’t space here to fill you in on the entire event, but in case you still have doubts about AAM, let me try to highlight some of the momentum that is building in this sector.

EHang is in the final steps of certifying its autonomous two-seat EH216S vehicle with the Civil Aviation Administration of China and most likely this will be the first AAM vehicle to achieve certification.

To see other hardware updates from the Paris Air Show, check out this gallery.

In addition, several AAM CEOs spoke at Paris Air Mobility. Here’s some of what they had to say.

From an operations standpoint, Volocopter hopes to certify its two-seat VoloCity next year in time for commercial flights at the Paris Summer Olympics. Dirk Hoke, Volocopter CEO, said tests of a conforming aircraft will start in July. Flight testing has been continuing over the last five years and “We’re at the last mile,” he said. Can he guarantee full operations at the Olympics? “No,” but “we’re working like hell.” Here’s a video of VoloCity flying at the airshow.

Paris airports operator Groupe ADP, the French aviation authority DGAC, Skyports, Volocopter and Parisian hospital system AP-HP have established the ecosystem—including routes, airspace integration and infrastructure needed--to support AAM at the Olympics. They selected five routes, four of which use existing vertiports while a fifth will involve landing on a barge on the Seine river.

While part of AAM’s appeal is that unlike helicopters, it can carry people more sustainably from points A to B and doesn’t rely on existing landing

areas, the Paris Olympics ecosystem is largely using existing infrastructure and helicopter routes to show how AAM can integrate into current airspace activity. It will be limited to VFR operations for the Olympics, said Thierry Allain, DGAC's innovation program manager.

From a price standpoint, several manufacturers stated that the fare for an urban AAM flight should be similar to the cost of a car rideshare.

An AP-HP hospital emergency doctor, Matthieu Heidet, says the Paris group is also evaluating how to use AAM to deliver emergency care within the service area. "Each minute [in transit] means 10% less survivability," so an eight-minute delay equates to an 80% chance of losing the patient, he said.

Next year, AP-HP will start demonstration flights to test the feasibility of flying doctors to accident scenes, flying passengers to hospitals and transporting organs. Traffic congestion reduces survivability, especially for cardiac-arrest cases, and "AAM could reduce [response time by] at least 1.5 minutes" compared to ambulances, said Heidet.

There are "major inequalities of access to urgent care" within the Paris region he said, so providing emergency care to people who are farther away from hospitals more quickly increases the reach of emergency medical services and reduces inequalities of access to hospital care.

As our AAM features states, 2024 will be a big year for AAM. Next year and in 2025, expect several vehicles to be certified and start operating.

In related AAM and sustainability news, Daher crossed over to the AAM space at the air show when it announced that it is collaborating with French startup Ascendance Flight Technologies on a hybrid-electric propulsion system. Ascendance is developing the ATEA eVTOL and its Sterna hybrid-electric propulsion system. The partnership will explore hybrid-electric propulsion system architecture, modeling, integration and testing on CS23-category Daher aircraft

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PS: For a roundup of news, videos, photos and podcasts from the Paris Air Show, download Aviation Week's new ShowNews app. Doing so will also give you a head- start because we'll be using this app for coverage of NBAA-BACE. **Just scan the QR code below**.

Lee Ann Shay
Editor In Chief, BCA

AVIATION WEEK NETWORK

FAST FIVE

Fast Five With Bombardier's Chief Pilot

BOMBARDIER

FAST FIVE

Molly McMillin

Etienne Cote joined Bombardier as an instructor and pilot in 2007 and went on to become a customer liaison pilot and a production test pilot. In early 2020, he joined Bombardier's Demonstration Flight Operations team and took over as chief pilot in January 2023.

Cote began his aviation career as a flight attendant for a major carrier. He went on to complete his pilot licenses and aviation degree to begin flying in the business and corporate world. Cote has held positions with a line and ground operation and has been an airport manager, a training captain and manager of training. He also owned a training and consulting company.

What is the size of your team?

The demonstration team varies between 13 and 20 pilots, a number of flight attendants, and we've got maintenance personnel that are dedicated to the aircraft. . . .We do have to supplement as well from outside sources to help us out. The flight department itself . . . is about 40 people that support the demonstration flight operation.

How have things changed since COVID in the demonstration department?

COVID for us was not a stop. For a while we turned into a bit of a corporate shuttle, helping support our company divisions internally, because we had a challenge traveling by airlines. We used our own product line and said, 'Let's do what we promote to our customer base. Let's use them as corporate shuttles a little bit and keep the business going, keep delivering aircraft and keep on making aircraft.'

We also started getting into business as usual. We turned our aircraft into mobile labs. We had the capacity to run tests on the aircraft for the crew so we could meet the different requirements around the globe—the PCR tests within 48 hr. It was definitely a disrupter. But it turned out to be something that forced us to become creative. We had to limit a few things on how we conducted demos in terms of capacity and aircraft, with the spacing and so forth. But in the end, we navigated these interesting challenges.

And now?

In the last year, the floodgates just opened. And we started going back to places we hadn't really visited in three years like Asia-Pacific. But we're there a lot now, and it's posing a whole series of different challenges with regard to crew management, fatigue and things like that. Fatigue management is a big one when you have ultra-long-range aircraft.

We keep on shuttling as much as we can, but we definitely shifted gears back to the sales and support model. We also support customers that are in need because of an aircraft-on-ground situation. That can happen to any aircraft. If they're in a bind and if an asset is available, we try to help the customers that are stranded and keep their missions going. We do our best to make sure that doesn't happen to begin with, but when it does, we try to be there to support for sure.

What is your biggest challenge?

I won't hide the fact that it's when you have ultra-long-range aircraft and everybody wants to see them. We want to promote them; we want to show them, to keep the aircraft rolling whether it's with the maintenance that's required or with the crewing levels that we have. To change a flight from one airport to another, it seems very benign when we're in the U.S. and Canada. But when we're operating across the globe, it involves flight permits. It involves authorities who are not exactly speaking the language. It involves a lot of moving pieces that we don't control. And that's a big challenge. It's also a big challenge to make sure we understand these challenges internally. It's to make sure we support the mission that's given to us while maintaining the safety aspects. We have very high standards at that level. It's also an education to our own people. The collaboration is there; the understanding is there.

What is the climate for hiring pilots? How are you doing in that area?

We're finding the same challenges as the rest of the industry. Everybody's competing for the same good talent. We're no different. We have a twist that makes it a little bit different. On top of that, not only do we need to find people who are qualifiable, but they have to become experts in the product. We are going to tell them to operate it to its design capabilities.

When we talk about short-field landing and somebody wants to demonstrate the capability of the aircraft, we have to be masters at this on the first shot; it's not let's practice three times and then you go. It involves a specific mindset. It also involves people who are socially engaging pilots and flight attendants.

Usually flight attendants have no difficulty in this. But some pilots don't fit the bill because they're not necessarily people who can interact on a continuous basis with our customers. At an airshow, for example, you can spend 14 hr. sometimes standing at an airshow, trying to showcase the aircraft and talking about performance, talking about a number of things. And you're running out of voice before the end of the day. Most of the people who we employ have got a drive for this.

The airshow scene is unique. You need people who are able to do this aspect on top of being really good pilots. It's a little bit more work. We vet our pilots very carefully. We make sure they fit with the philosophy of the OEM but also with the group as a whole.

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*—**Molly McMillin**, a 25-year aviation journalist, is managing editor of business aviation for the Aviation Week Network and editor-in-chief of The Weekly of Business Aviation, an Aviation Week market intelligence report.*

AVIATION WEEK NETWORK

POINT OF LAW

Time-sharing Agreements

Losing money was built into the rule

ADOBE STOCK/ARGUS

POINT OF LAW

Kent S. Jackson

The FAA issues press releases about multi-million-dollar civil penalties on a regular basis. All too often, these cases involve aircraft time-sharing agreements. Although the FAA has allowed time-sharing agreements since 1972, misunderstandings about these agreements still persist. FAA 14 C.F.R.- § 91.501(c) defines a time-sharing agreement as "an arrangement whereby a person leases his airplane with flight crew to another person, and no charge is made for the flights conducted under that arrangement other than those specified in paragraph (d) of this section." Subsection (d) allows the following charges "as expenses of a specific flight" under a time-sharing agreement:

1. Fuel, oil, lubricants, and other additives;
2. Travel expenses of the crew, including food, lodging, and ground transportation;
3. Hangar and tie down costs away from the aircraft's base of operation;
4. Insurance obtained for the specific flight;
5. Landing fees, airport taxes, and similar assessments;
6. Customs, foreign permit, and similar fees directly related to the flight;
7. In flight food and beverages;
8. Passenger ground transportation;

9. Flight planning and weather contract services;
10. An additional charge equal to 100% of the expenses listed in paragraph (d)(1) of this section.

If your company is making good money by time sharing your jet to others, *you are doing it wrong*. For instance, the second item allows travel expenses of the crew, but does not mention salary. According to the comments that the FAA published in the Federal Register when the rule was first published, the FAA allowed time share operators to charge double the fuel cost in order to recover (1) salaries of flight crews, (2) aircraft depreciation, (3) insurance premiums (hull and liability), (4) crew training costs, and (5) maintenance costs. Since all of these items are supposed to be covered by the additional fuel charge, they cannot be charged separately. For example, hourly charges under a maintenance service program may not be charged under a time-sharing agreement. Many operators mistakenly believe that they can charge prorated costs for these items as long as they don't charge a profit. It is a mistaken belief that can result in large civil penalties and the revocation of the airman certificates of the pilots involved.

Who can enter into a time-sharing agreement? The FAA has issued very strict interpretations that are not well known. For instance, 14 C.F.R. 91.501(a) limits the applicability of the rule to large and "turbojet-powered multi-engine civil airplanes of U.S. registry." According to FAA Advisory Circular AC 91-38A, "turbopropeller-powered airplanes are not turbojet powered and [14 C.F.R. § 91.501 is] not applicable unless the turbopropeller-powered airplanes are large." In other words, a King Air B200 cannot be part of a time-sharing agreement, simply because it is a turboprop instead of a turbojet.

There is a simple solution for operators of aircraft that want to time share their aircraft that don't meet the strict applicability of the rule. NBAA has an exemption available to all of its members so that they can take advantage of time-sharing agreements and the other cost recovery methods found in 14 C.F.R. § 91.501. However, it is vital for members to obtain a copy of Exemption 1637 and comply with *each* of its provisions, which include contact with the local FAA Flight Standards District Office. At least one pilot has suffered a 90-day suspension for failing to follow the exact provisions of the exemption.

There are several other restrictions on the applicability of time-sharing arrangements.

The FAA has stated that 14 C.F.R. § 91.501(b)(6) prohibits a time-sharing agreement from being used for the transportation of cargo. Relying on the same provision, the FAA has also stated that only a "company" may provide an aircraft and crew under a time-sharing agreement. An individual may be on the receiving end ("lessee") of the deal but cannot provide the aircraft ("lessor").

Because a time-sharing agreement is a lease, the "Truth-In-Leasing" requirements of 14 C.F.R. § 91.23 apply to these agreements when the aircraft involved are over 12,500 lbs. MGTOW. 14 C.F.R. § 91.23 requires several steps to ensure that the lessee understands the arrangement, and that the FAA can verify that the lessor has complied with the rule. However,

unless the lessee is not a citizen of the U.S., it is the lessee who is responsible for (1) mailing a copy of the lease to the FAA Aircraft Registry, Technical Section, in Oklahoma City, within 24 hours after it is signed, (2) carrying a copy of the lease in the aircraft, and (3) notifying the nearest FAA Flight Standards District office at least 48 hrs. before the first flight of the aircraft registration number, as well as time and location of departure.

According to FAA guidance, when an inspector receives a notification phone call under 14 C.F.R. § 91.23, the inspector must determine whether a ramp inspection is appropriate. Therefore, it would be wise to make sure that the flight crew *and passengers* understand the basic elements of the lease. Specifically, the passengers should be advised that this is *not* a charter flight.

14 C.F.R. § 91.23 also requires specific language at the end of the lease. Among the required elements is a statement of which party has operational control. In a time-sharing agreement, the provider of the aircraft and crew ("lessor") retains operational control. If the lessor were only providing the aircraft, then the arrangement would be referred to as a "dry" lease, and the cost restrictions of 14 C.F.R. § 91.501(d) would not be applicable.

Another required element is a statement identifying the regulations under which the aircraft has been maintained and inspected under for the preceding 12 months, and a statement of which regulations the aircraft will be maintained and inspected under during the term of the agreement. FAA Advisory Circular AC 91-37B gives sample language to comply with 14 C.F.R. § 91.23, and suggests that simply identifying the 14 C.F.R. Part (91, 121 or 135) is sufficient. However, over the years, a number of FAA Flight Standards District Offices have required operators within their realms to state the specific regulation under which the aircraft will be maintained. If the operator intends to use a "current inspection program recommended by the manufacturer," then the proper reference to insert in the lease is "14 C.F.R. 91.409(f)(3)."

Participants in a time-sharing agreement should also be aware that the IRS considers a time-sharing agreement to be subject to the 7.5% federal excise tax (commercial FET); although credit would be given for the fuel FET paid on the time-sharing flights. This means that the lessor will be required to collect the taxes (along with the appropriate segment fees) and remit them to the IRS on a quarterly basis, using IRS FORM 720.

Properly done, time-sharing agreements can be a useful tool for flight departments that have an occasional need to provide the aircraft to executives and receive some reimbursement. The key is to understand and comply with the FAA's strict requirements.

—***Kent Jackson*** *is founder and managing partner of Jetlaw. He has contributed this legal column to BCA since 1998 and is also a type-rated airline transport pilot, flight instructor and repairman.*

SITUATION AWARENESS

General Aviation Aircraft Parts Soar Again By The Thousands

CLINTON MCJENKIN/BAS

SITUATION AWARENESS

William Garvey

While hardly a subject of keen general interest, the broken links in the industrial supply chain are impacting manufacturers, service providers and consumers seemingly universally. All aviation segments are affected.

If Boeing cannot get the widgets it needs to deliver a $200 million transport on time, what chance do owners of broken flivvers have to get the parts needed for slipping the surly bonds once again? One answer may surprise.

I've owned several aircraft, including a 1975 Rockwell Commander 112A. A stylish two-door, four-seat, 130-kt., retractable-gear aircraft, it was fully instrumented and easy to handle. But were it mine still and, say, a distracted tug driver destroyed a landing gear strut, what then? After all, the model is nearly five decades out of production, and its maker is a ghost.

Well, it turns out I could telephone, text, email or go online and, if I was satisfied with what I learned there, a replacement strut could be in my hangar within a day or two for $3,050. That could happen because the part is not a dubious promise on a slowed production schedule but is extant and in stock, having been made years ago and installed on another aircraft that

no longer exists—at least not as a whole.

Welcome to the world of salvage, deconstruction, restoration and resale. There is nothing new about reuse of aircraft parts. The practice began in 1905 when Orville and Wilbur Wright applied elements of their Flyer II to create the Flyer III. There have been a host of aviation recyclers since, notably including the U.S. Air Force.

One small but highly regarded entity among commercial practitioners is BAS Part Sales. The 26-employee company has a global clientele that includes fleet operators, repair shops, individuals and even a movie studio. It services them all from its main 48,000-ft.^{2} warehouse/hangar/office and 10-acre storage yard complex at Greeley-Weld County Airport, 50 mi. north of Denver.

An outgrowth of Beegles Aircraft Service, which began operation at Greeley in 1946, the now-independent, 12-year-old company stocks in excess of 60,000 parts ranging from bolts and yokes to engines, avionics and entire fuselages. Each part is cleaned, photographed, cataloged and listed on its website, along with its price, and comes with free shipping and a 90-day money-back guarantee.

The tech-savvy company previously had focused on light general aviation models, primarily Cessna, Beech, Piper, Mooney and Cirrus airplanes and Robinson Helicopters. But that expanded dramatically in early March with its purchase of White Industries of Bates City, Missouri, some 30 mi. east of Kansas City.

The BAS inventory derives from several sources, including those of former competitors, as well as the 125-150 aircraft it annually purchases from insurance companies and individuals and disassembles. A Piper Malibu, for example, can be transformed into 2,000 parts or more, with just a painted shell remaining.

But the White acquisition represents a seismic shift in the company's stockpile. Based at a privately owned, public-use facility with a single, 4,400-ft. gravel runway, the 67-year-old recycler has 90,000 ft.^{2} of warehouse hangars jam-packed with some 500,000 parts of aircraft ranging from vintage singles to Learjets, Hawkers, Citations, King Airs and even regional airliners. Beyond that, it has 2,000 airframes, some stripped but others nearly complete, spread across 170 airport acres.

In assessing the acquisition, BAS President Jared Boles marveled at "the sheer extent of the inventory we'll have to offer."

Digesting it all likely will take years, but the work has already begun. BAS retained and retrained four White employees, added two more and plans further hires. Beyond that, mechanics recently stripped 101 aircraft at the renamed "BAS Kansas City" facility and trucked the parts to Greeley for processing and resale.

The expansion is likely to further enhance BAS' reputation, one buoyed by nearly 600 five-star Google ratings. Mike Barnett is among the many satisfied customers. An aviation claims adjuster, pilot and mechanic, he is nearly

finished rebuilding his 1961 Beech Travel Air, to which BAS contributed. “They just seemed to have the parts I needed,” he says. Plus one more.

To complete the project, he wanted a rare Travel Air emblem for placement on the fuselage, but the talisman eluded him, a fact he mentioned offhandedly to a BAS associate at a convention both were attending. Two days later, the fellow called with the unexpected and welcome news that he had located three of them—one new and two recycled, naturally. Barnett’s reborn and transformed twin would have its capstone after all.

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*—**Bill Garvey** was Business & Commercial Aviation’s ediror-in-chief from 2000-2020. During his stewardship, the monthly magazine received scores of awards for editorial excellence.*

AVIATION WEEK NETWORK

SMALL FLIGHT DEPARTMENT

Setting Up A Flight Department

Tips, and things to avoid, when establishing a flight department

A hangar waiting for an airplane

DIGITAL STORM/SHUTTERSTOCK

SMALL FLIGHT DEPARTMENT

James Albright

"I bought a new airplane and an old hangar, now I need you to build me a new flight department."

"I can do that."

Of course, the next question is: how am I going to do that? My natural reaction is to find a good business jet management company and offload all the things I know I won't have the time or the expertise to accomplish and focus on the job of flying airplanes. The definition of pilot, after all, doesn't include all that pencil pushing. When I got this request, the company's CEO had already had a bad experience with a management company and insisted that I create a new flight department from scratch, and that I would handle all of it. I had never done anything like this, and I must admit, I was intimidated. If you find yourself with the same challenge, I think the process is easier these days. But avoiding my mistakes can speed things along and reinforce the confidence the boss has that you are the right person for the job. As with any large task, it helps to break things into manageable pieces. In this case, into jobs you understand.

You: the dispatcher.

Dispatch team Credit: Fizkes/Shutterstock

Your company is probably anxious to fly, and your first unexpected duty is that of dispatcher. Somebody has to coordinate with the departure and destination Fixed Base Operators (FBOs) to coordinate fueling, catering, and other services. Somebody needs to arrange ground transportation. Somebody must reserve hotel rooms and rental cars. Until (and if) you find someone to handle the job, that somebody is you. My initial solution was to write trip sheets using Microsoft Word and maintain a database of contacts in Excel. I used a simple flight planning program to compute times, and online resources for phone numbers. (Hint: check out www.acukwik.com or www.airnav.com) But my efforts failed because I was often rushed and made mistakes. I finally surrendered to the need for a purpose-built dispatch program when the company complained I wasn't responsive enough to their scheduling needs. Within a year it became clear we needed a dedicated dispatcher and everyone happily gave in.

You: the finance officer.

After we hired a full-time dispatcher my life became instantly better, and I began to focus on the big picture. We had a full-time mechanic who brought his own toolbox from home, some of which were more suited to working on a home toilet than a multi-million-dollar jet engine. The company's finance department signed a contract with the lowest priced training vendor resulting in pilots who could pass check rides but had very little practical knowledge about the aircraft. No matter where I turned, we were not trained or equipped as well as industry best practices dictated because we were operating "on the cheap." There is an old saying among chief pilots: "start rich, stay rich; start cheap, stay cheap." I didn't agree with that and set out to change our start cheap origin.

The mechanic's toolbox, for example, had to go. He would often show up at the aircraft with a hodgepodge of tools and I sometimes found one he left behind. He didn't know he was missing a Snap-On brand 5/8-inch open-end wrench, for example, because he still had another from Craftsman and two others from Mac Tools. The company grudgingly accepted my proposal for a complete toolbox with an automatic inventory system after I brought up a

Credit: Everett Collection/Shutterstock

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few case studies of missing tools interfering with flight controls or shelling out engines. "Say no more." The last time they ever pushed back on a financial decision was when I fired our training vendor and doubled our training costs overnight with the industry-leading vendor. I next explained that even the best pilot is handicapped by poor training, and that their lives were in the hands of these poorly trained pilots.

The more I think about it, the more the "start cheap" adage rings true. If you start cheap, the fix will be harder to achieve. But these kinds of decisions cannot be made the way most corporate decisions are made. I know it sound crass: the price of a bad decision in aviation is often paid in blood. But if the bean counters won't budge, it may be time to be crass

You: the human resources officer.

Twenty years ago, I often thought about a scene from the movie "The Right Stuff" when it comes to hiring pilots. "You mean you don't want our best pilot?" "No, we want the best pilot we can get." Hiring pilots and other aviators was often a matter of competing locally and paying only as much as it took to get the candidate to sign. Once hired, the person was little more than another employee. How much should you pay? It can be as simple as looking at the latest NBAA salary survey and calling around your airport to see what the competition is paying. Most chief pilots are reluctant to talk salaries, but you might get valuable intel by asking, "If I were to pay a new Challenger pilot X dollars, would that be out of line?"

The pilot and mechanic landscape has changed considerably the last few years and we face a new challenge unknown to previous generations of business jet pilots. How do you justify paying more to the two people in the front of the airplane than many (or all) of those sitting in back? The answer is that you don't. The company HR department cannot type cast any of your aviators into existing classifications unless they are in the same business as you. The newest first officer in your flight department possesses a skillset

no software engineer, top lawyer, or even a heart surgeon can hope to appreciate. It is up to you to point out that you cannot expect the level of expertise from your people unless you pay enough to hire them and then to keep them from leaving.

You: the standards officer.

Writing an operations manual can be a daunting task and many flight departments never get around to it. They can find themselves going for years with no rules or regulations at all. Things are left to each individual's discretion and the person in charge ends up with very little control. Having each pilot with their own Standard Operating Procedures (SOPs), or no SOPs at all, is a recipe for an accident. We wrote our first operations manual and passed our first Safety Management System (SMS) certification and got our first Letters of Authorization (LOA) with it. It was a lot of work! Ten years later, another round of SMS and LOAs didn't go as well. Keeping our manuals up-to-date and fully compliant with international and other SMS requirements has become too much for us. There are companies dedicated to doing this well, so we turned our manuals over to www.aviationmanuals.com and have never looked back. Even if you don't have any manuals at all, AviationManuals can get you started.

You: the safety officer.

As with all these positions, it would be in your best interest to delegate the duties but keep "plugged in" to what is going on. And that is especially true

Human resources team Credit: Rawpixel/Shutterstock

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with your safety program. I am fond of saying that we are all safety officers in the business of flying airplanes. But if you can, have one person manage your safety program. It may be tempting to turn your safety officer loose with no formal training. That's how you end up with walls covered with

Rules and Regulations Credit: Wolfilser, Shutterstock

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meaningless safety posters. Is "Safety First" true anywhere? If safety was first, you would never fly. Sending your safety officer to training will motivate him or her to really motivate everyone in your organization to keeping themselves (and you) out of trouble. A good place to start is with the National Business Aviation Association (www.nbaa.org) Safety Manager Certification Program.

You: the director of aviation.

If you are asked to create a new flight department and feel overwhelmed by the task, that is natural. (I certainly was.) You can get to where you want to go by taking it one step at a time, one job at a time, and learning from your mistakes. You might be better off using a management company to relieve you of all this extra work and possibly save money. (Some of these claim that the discounts they will get you in training, fuel, and maintenance costs can completely offset their management fees.) But if that isn't an option, creating a flight department that is completely self-managed is entirely doable. And I think it is one of the most satisfying things I've ever done.

—***James Albright*** *is a retired U.S. Air Force pilot with time in the T-37B, T-38A, KC-135A, EC-135J (Boeing 707), E-4B (Boeing 747) and C-20A/B/C (Gulfstream III). Since turning civilian, he has flown the CL-604, Gulfstream GIV, GV, G450, and now the GVII-G500. He is the webmaster and principal author at Code7700.com*

Hiring and Retention Challenges

Retaining flight department pilots isn't just about pay

PLANNING

James Albright

The business aviation landscape for hiring pilots has certainly changed in the last 10 years. The normal progression from newly minted commercial pilot often meant years building time as a flight instructor, hoping to get lucky enough to find a small turbine aircraft operator and then graduating to a commuter airline before getting to the "big leagues."

We in the business jet world could scavenge the cream of the crop with higher pay than airline probation wages, followed by salaries that dwarfed even what a senior flag carrier captain could make. The old business jet goal of "making six figures" became so commonplace that new goals came in multiples. For some aircraft types, salaries over $300,000 have become the starting point in negotiations. It is no wonder we were able to compete against the better-known airlines. But all of that has changed. We have fallen behind on multiple fronts.

How do flight departments compete against airlines?

High salaries are a prerequisite. As a person doing the hiring and firing over many years, I used to think I could throw money at the problem and keep the front seats on my airplanes filled with highly qualified pilots and our hangars with first rate mechanics. The airlines soon recognized that the business jet world is a great source of talent and have turned us into farm clubs to pillage from at will. If we want to compete, our starting pay numbers must keep up with the competition. This has led to the current crisis in many companies' human resources departments: how can you have the guys flying the airplanes making more money than the passengers they are flying? The answer is to divorce the aviation department's pay scale from the rest of the company. If you want your multimillion-dollar airplane flown safely, the flight department's personnel costs must go up.

Job security may be more important than pay. I've lost more than a few pilots to the airlines and the reason is usually a simple one. Flying for a one-airplane flight department, I cannot guarantee the job will be here tomorrow. An economic downturn may mean my company ceases to exist. Decades ago, the airlines were more apt to suffer from the economy and furloughs were commonplace. These days it is hard to imagine any major airline throwing pilots on the street.

How do we compete? It might be worthwhile to explore hybrid pilot organizations where companies agree to hire only from an agreed upon pool of pilots, making it easier for pilots to recover from one company's demise. At the very least, paying for a pilot's loss of license insurance can help convince a pilot that a job in business aviation can be a lasting one.

Schedule drives quality of life, and quality of life is the bottom line. Having

Together, we're converting opportunities into results in Business Aviation.

Stricter regulations, safety requirements, evolving technology, and the demand for private jet charter service drive the industry at warp speed, and you need to stay ahead. Our comprehensive set of tools and resources is designed to bring help to your fingertips in seconds.

1. **READY**
   We deliver the knowledge and insights to inform how you do business.
2. **SET**
   Our predictive intelligence and customized data solutions ensure you're always ahead of the curve.
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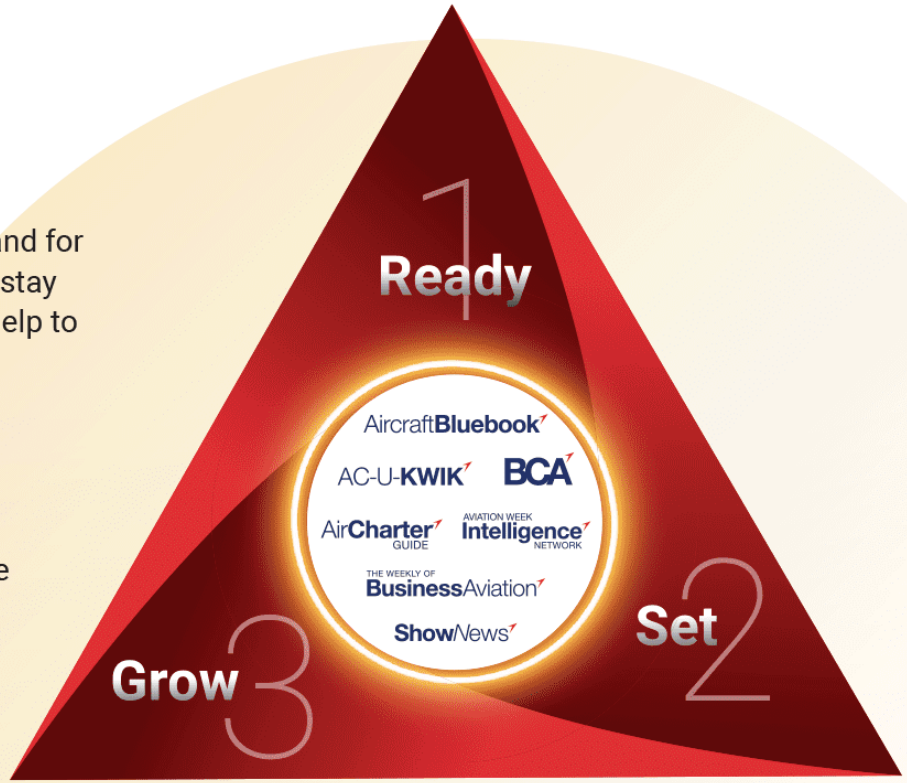

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AVIATION WEEK NETWORK

flown half my professional career in the U.S. Air Force and the other half in business aviation, I accepted that I didn't have a schedule and sometimes a planned vacation would have to wait. I counseled pilots that if they are uncomfortable with uncertainty and need to know what they are doing every day for the next month, they probably aren't cut out for our line of work.

For me, the lure of flying better equipment and being able to see more of the world was enough to make up for everything else. But I must admit that my quality of life was lacking and that my peers at the airlines spent more time at home, missed fewer of their children's school events, and may have been, in a word, happier.

The quality-of-life problem may be the biggest challenge of all for us in business aviation. My flight department is trying to address that by hiring more pilots. We think we can schedule two pilots each day for any no-notice trips, freeing everyone else. The days off must be known well in advance, or they are no better than days spent on standby duty. Once a vacation is scheduled, it becomes set in stone. The next challenge is to convince the company that a schedule cannot be built on a 24-hour notice basis.

Our attempts to solve our manning problems with more money have failed and it is time to look at the problem from a career viewpoint. We need to lure good aviators and then keep them. I think the only way to do that is to understand these three points. First, high salaries are assumed. Second, we need to take steps to remove the idea that the security of our

jobs is only as good as the quarterly reports at the next stockholder's meeting. And finally, we need to recognize that our people have lives beyond the job, and if we don't provide a quality of life comparable to our competition, nothing else matters.

—***James Albright*** *is a retired U.S. Air Force pilot with time in the T-37B, T-38A, KC-135A, EC-135J (Boeing 707), E-4B (Boeing 747) and C-20A/B/C (Gulfstream III). Since turning civilian, he has flown the CL-604, Gulfstream GIV, GV, G450, and now the GVII-G500. He is the webmaster and principal author at Code7700.com*

CONNECTIVITY

ViaSat-3 Americas, the first terabit-class communications satellite, launched aboard a SpaceX Falcon Heavy rocket from Kennedy Space Center on April 30, more than a year later than planned.

VIASAT

Connectivity Upgrades

The promised wave of new inflight connectivity is still gathering

CONNECTIVITY

Bill Carey

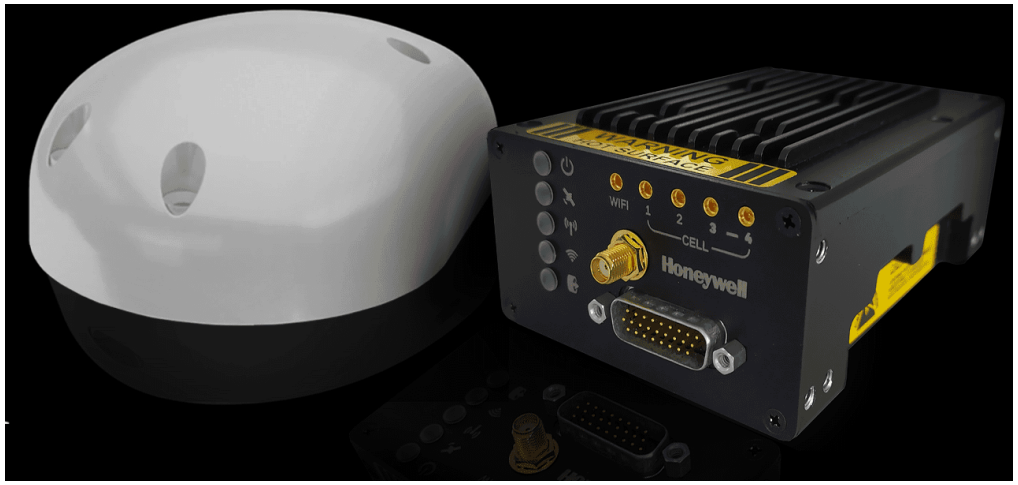
The recent European Business Aviation Convention & Exhibition (EBACE) conference in Geneva presented service providers with a platform to report progress—and for the industry to take stock—of a promised new wave of in-flight connectivity (IFC) that is still gathering.

Still awaiting closure during EBACE was Viasat's $7.3 billion acquisition of London-based Inmarsat, which the companies first announced in November 2021. The marriage of the two major legacy providers of satellite communications was delayed when the UK Competition and Markets Authority (CMA) initially withheld approval over monopoly concerns. U.S.-based Viasat announced the completion of the transaction on May 31.

During the regulatory review period, Viasat had expected to deploy the first of three, new-generation, high-capacity Ka-band satellites in the first quarter of 2022. ViaSat-3 Americas, the first terabit-class communications satellite, finally launched aboard a SpaceX Falcon Heavy rocket from Kennedy Space Center, Florida, on April 30, more than a year later than planned.

After an extended review by an independent panel, the CMA approved the Viasat-Inmarsat merger in early May. "The evidence analyzed by the panel

Gogo's Shuaib Shahid and Mark Sander display the new Gogo Galileo FDX (r) and smaller HDX electronically steered antennas.
Credit: Gogo Business Aviation



Honeywell has unveiled VersaWave, a new satcom and 5G terminal for advanced air mobility and uncrewed aircraft systems.
Credit: Honeywell Aerospace

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shows that, while Viasat and Inmarsat compete closely—specifically in the supply of satellite connectivity for Wifi on flights—the deal does not substantially reduce competition for services provided on flights used by UK customers," the authority stated. "The evidence also shows that the satellite sector is expanding rapidly—a trend that is set to continue for the foreseeable future. This is due to increased demand for satellite connectivity, driven largely by the ever growing use of the internet by business and consumers."

The CMA specifically mentioned OneWeb and SpaceX Starlink, new constellations offering Ku-band service from low Earth orbit (LEO) satellites. The authority noted partnerships OneWeb struck last year with equipment supplier Panasonic Avionics and geostationary (GEO) satellite operator Intelsat, both focused on marketing to airlines, as well as Starlink's launch contract with airBaltic. OneWeb deployed a last batch of 36 satellites via launch provider NewSpace India into space in March, completing construction of its 618-satellite LEO constellation.

New Branding And New Antenna

At EBACE last year, air-to-ground (ATG) network operator Gogo Business Aviation announced partnerships with OneWeb for satellite connectivity and with Hughes Network Systems for a new flat-panel electronically steered antenna (ESA) to track OneWeb's spacecraft. At this year's conference, Gogo christened its launch product in the LEO satcom space as "Gogo Galileo" after the famed Italian astronomer and unveiled a second ESA form factor designed for larger aircraft, manufactured by Hughes.

IFC service and equipment provider Satcom Direct (SD) has also partnered with OneWeb and Germany's QEST to develop a flat-panel ESA antenna. In February, SD announced the entry into service of its mechanically steered, tail-mounted Plane Simple antenna system after two years of development and testing. Twenty-one aircraft participating in evaluations of the Ku-band version of the Plane Simple system, which connects with Intelsat's FlexExec broadband service, were transitioned to customer status. SD is also developing a Plane Simple antenna for

A SmartSky Networks shipset, including (l-r) an aircraft base radio, blade antenna and full-duplex quad antenna, was displayed during the NBAA Maintenance Conference in Hartford. Credit: Bill Carey

Inmarsat's Jet ConneX Ka-band service.

As of this spring, SpaceX had launched more than 4,000 Starlink satellites into orbit. Aircraft connect to Starlink via a top-mounted Aero Terminal ESA antenna. In early May, charter operator JSX announced that it completed installing Starlink terminals across its fleet of 40 Embraer regional jets. SpaceX has said that supplemental type certifications are in development to fit Starlink on Gulfstream, Dassault, Bombardier, Beechcraft, Cessna and Embraer models.

Other Notable Developments

Among other notable, recent developments in the satcom connectivity space:

- Honeywell announced at EBACE that its Aspire 350 satcom hardware has been certified by satellite operator Iridium to transmit and receive the latter's high-speed Certus L-band voice and data service.Honeywell is a value-added manufacturer of Certus terminals.
- Honeywell also recently announced VersaWave, a new satcom and 5G shipset for advanced air mobility and uncrewed aircraft systems The VersaWave terminal connects with Inmarsat's SwiftBroadband L-band system when outside of cellular coverage.
- Bombardier said May 5 that new Challenger 3500s will come with Iridium Certus L-band connectivity as a baseline feature, making the 3500 the first super midsize business jet so equipped. Collins Aerospace will supply its new IRT NX SATCOM system with high-gain antenna for reception.
- Inmarsat named Collins as a distribution partner for its new SwiftJet L-band connectivity service, expanding their existing partnership. A product of Inmarsat's Elera network upgrade that is set to enter service this year, SwiftJet will be six times faster than SwiftBroadband, the company says.
- A third supplier, Israel-based Orbit Communications, will provide next-generation terminals for Inmarsat's Jet ConneX Ka-band service, with Honeywell and Satcom Direct. Orbit has developed the AirTRx series of satcom terminals consisting of two line replaceable units. Jet Connex, launched in 2016 using Honeywell-made JetWave terminals has been activated on 1,400 business jets.

Ground-Based Connectivity

Providers of ATG broadband communications have kept pace with the developments in space. North Carolina-based SmartSky Networks announced in July 2022 that its 4G/5G technology network for business aviation was operational across the continental U.S. The milestone preempted rival Gogo Business Aviation, which completed its own nationwide 5G ground infrastructure in October 2022 and expects to launch service in the fourth quarter. The companies are locked in an ongoing patent-infringement lawsuit that SmartSky filed in February 2022, alleging that Gogo's system draws from some of its inventions.

During an NBAA News Hour webcast in April, SmartSky executives described new ways to share and exploit data via the company's "Skytelligence" platform, which accepts third-party application programming interface connections, and an Aircraft Interface Device (AID)

avionics unit. An AID can connect multiple data sources and gather data from the aircraft's engines and systems.

"Moving data and getting it off the aircraft is where this technology comes into play," said Sean Reilly, SmartSky Networks vice president for air transport and digital solutions. "We can actually route this data directly to the backend, and the company's IT department can manage all the data to and from that aircraft."

"[It's] not just a cabin WiFi experience—it's beyond that," Reilly added. "It's really moving all of this data with our partners, our network, our patented technology, to be able to build a faster path to a differentiated experience."

Responding to a question, Rich Pilock, SmartSky vice president of product management, said the company does not plan to integrate satellite communications as Gogo is doing. "Our position has always been that we're very complementary of satellite service, [and] typically less expensive for the air time," Pilock said. "If you're an operator who is flying 75% of the time domestically and 25% internationally, I think the combination of a satellite system with an air-to-ground system has always made sense."

Once the UK competition authority signed off on Viasat's acquisition of Inmarsat on May 9, approvals by the U.S. Federal Communications Commission and European Commission followed on May 19 and May 25, respectively. The companies are now cleared to build the multi-band, multi-orbit space and terrestrial network they spoke of in 2021.

"You can imagine that on Day 1, we'll be gearing up to innovate and find creative new approaches to bring to customers," Kai Tang, Inmarsat head of business aviation, told *BCA*.

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*—Based in Washington, D.C., **Bill** covers business aviation and advanced air mobility for Aviation Week Network. A former newspaper reporter, he has also covered the airline industry, military aviation, commercial space and unmanned aircraft systems. He is the author of 'Enter The Drones, The FAA and UAVs in America,' published in 2016.*

OUTLOOK

Honda Aircraft's exhibit at EAA AirVenture 2022 in Oshkosh, Wisconsin.

Where's The Market Heading?

Bizav playing supply chain 'Whack-A-Mole'

MOLLY MCMILLIN

OUTLOOK

Molly McMillin

Honda Aircraft's head of sales compares challenges in the business aviation supply chain to a game of Whack-a-Mole.

In the game, players score points by whacking plastic moles that pop up randomly as they appear. The faster the reaction, the higher the points.

"There's always one or two components that are on the top priority list," Peter Kriegler, Honda Aircraft director of sales, said of supply chain challenges. That can vary from week-to-week, month-to-month and from supplier to supplier for various reasons.

"This week it's this one; that week it's that one," Kriegler says of shortages that pop up.

The good news is the situation is improving.

"Everybody's doing the best that they can," he told *BCA*. "Everybody's working well together. We're seeing a lot of things catch up on the production side. So, that's been good."

It's a common issue in the industry, and one that has mitigated manufacturers' ability to boost production in response to near-record demand since the pandemic.

In the past two years, flight activity and pre-owned transactions have been at all-time highs, while inventory has seen all-time lows. First-time business aircraft users have flowed into the market, whether through jet cards, charter, fractional ownership or full ownership.

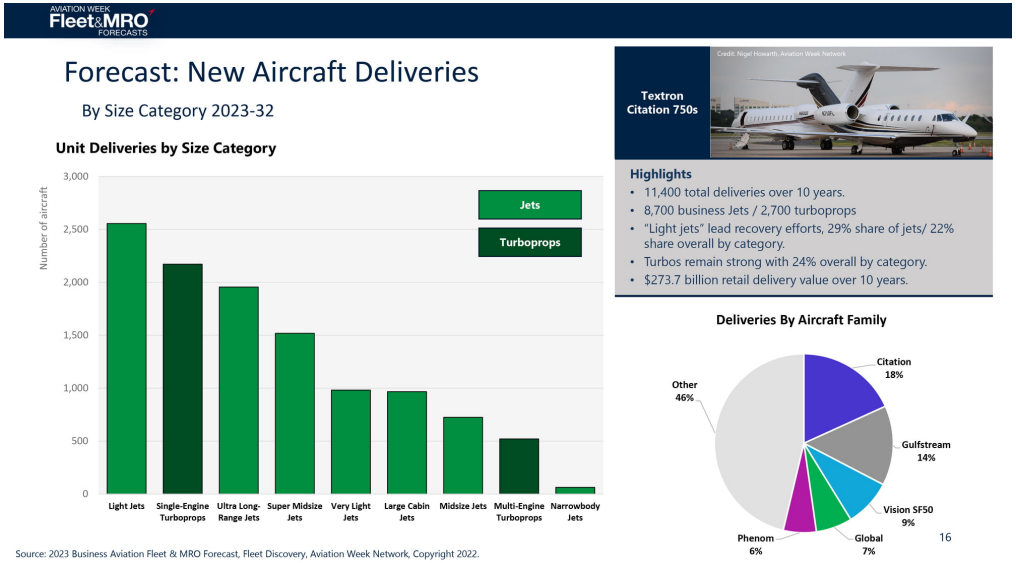
Today, the inability to ramp production to match demand means the industry is well positioned for an uncertain economic future, experts say.

Business aircraft manufacturers and used aircraft dealers say that the market remains busy in 2023, but it is returning to more normal conditions.

Leading industry indicators have been easing over the past six months, although "admittedly against tough comparisons," Robert Stallard with Vertical Research Partners wrote in a recent report to investors.

Business jet activity in 2023 is down 6% compared to a year ago, with a particular weakening in leisure demand, Stallard says.

At the same time, inventory of used aircraft for sale is increasing and pricing has eased. Book-to-bill, or the ratio of new orders compared to deliveries, has declined from 2-to-1 in 2022 to about 1-to-1 in the first quarter of 2023.



"It is tough to fight the tide of a declining book-to-bill ratio," Stallard says.

The number of used business jets for sale in May 2023 totaled 969, according to Jefferies, down from 922 in April and 590 in May 2022. Medium and heavy jet inventories rose 85% in May, compared to a year ago, while light jet inventories rose 42%.

In the first quarter of 2023, dealers closed 239 transactions of used aircraft, down from 288 a year ago but up from 213 in the first quarter of 2021. Of the transactions, 52 experienced lower pricing, compared to six a year ago. Dealers ended the quarter with 197 aircraft under contract, down from 259 a

year ago, according to the International Aircraft Dealers Association (IADA).

"There is evidence that demand and supply forces are rebalancing, with less frenetic activity, more realistic pricing and a slow but steady buildup of available inventory," says Zipporah Marmmor, IADA chair and president of transactions for ACASS in Montreal. "Although specific low-time aircraft with attractive pedigrees continue to attract top-dollar, the overall market has begun to downshift from a peak characterized by accelerating prices and strong residual values."

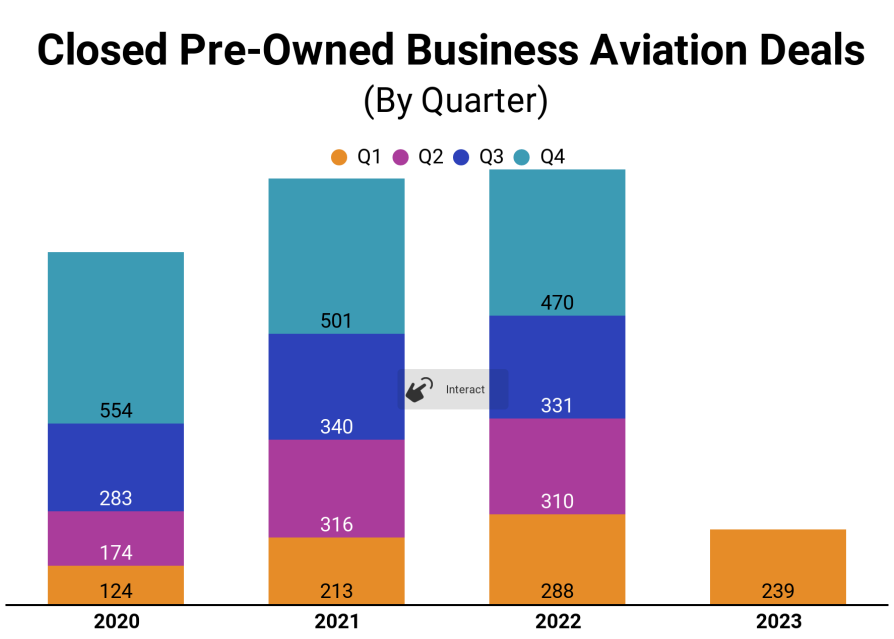
Analysts agree that the industry is in much better shape than it was at the peak of the last upcycle of 2008 and through the subsequent "lost decade." No one is predicting widespread aircraft devaluation or swelling inventories found during the 2008-09 recession.

For one, total production is down. Stallard, for example, projects deliveries of about 650 business jets in 2023, compared to a peak of about 1,100 in 2008 and 680 before the pandemic.

"Unlike in the past, the OEMS have not chased the 2020-22 surge in demand, and have instead built backlog, lead times and pricing," Stallard says. "While no one is immune to a slowing in demand, the bizjet OEMs have much more backlog buffer than they ever had in the past, and so we should not expect significant if any changes to production plans."

During the first quarter, the market for business jets was hurt by news of bank failures, Phebe Novakovic, chairman and CEO of General Dynamics, Gulfstream Aerospace's parent company, told analysts on a call about the company's first quarter financial results.

"The quarter was looking quite good until the two regional bank failures in early March," Novakovic says. "This created a pause in the market for about three weeks. I am pleased to report that normal activity has resumed."



Source: International Aircraft Dealers Association (IADA)

Despite some headwinds in 2023, the business jet market remains resilient, Global Jet Capital officials say. It forecasts steady growth over the next five years.

In 2023, Global Jet Capital projects new deliveries to increase 6.3%, with deliveries over the next five years are expected to grow at a compound annual growth rate of 4.6% with annual dollar volume growth of 6.4%.

The Aviation Week Network forecasts delivery of 8,700 business jets and 2,700 turboprops over the 10 years from 2023 to 2032. It projects the business aircraft in-service fleet to expand 12% to 38,848 aircraft over the period with a compound annual growth rate of 1.3% over the period.

A forecast by Jetcraft projects steady growth to continue in the years ahead, setting new volume and value benchmarks, despite "an inevitable market correction in 2023."

Textron Aviation had a "very nice" first quarter, Ron Draper, president and CEO, told reporters in May. "We delivered 35 jets, 34 turboprops and 46 pistons. We grew backlog in the quarter. So, contrary to a few of the naysayers out there that said the market was going to slow precipitously, that wasn't the case. We grew backlog another $136 million, so we're up to $6.5 billion in backlog. That was a book-to-bill by our calculation of about 1.2 in the quarter."

Despite an uncertain economy, Draper says he sleeps better at night knowing the company has that strong backlog.

"Whether it slows down a bit more or continues where it's at, I think either way, we're in a good position," he says. The company's investment back into its products and the business mean it is in a good position. "We have a nice backlog, so we're ready to see what comes next."

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*—**Molly McMillin**, a 25-year aviation journalist, is managing editor of business aviation for the Aviation Week Network and editor-in-chief of The Weekly of Business Aviation, an Aviation Week market intelligence report.*

AVIATION WEEK
NETWORK

ADVANCED AIR MOBILITY

AAM Industry Prepares For A Pivotal 2024

MARK WAGNER/AVIATION IMAGES

ADVANCED AIR MOBLITY

Graham Warwick & Ben Goldstein

Twenty years ago, the idea of scaling up stable, easy-to-fly multicopter drone technology to enable passenger-carrying air taxis seemed to make sense. Two decades later, technology has moved on.

Most developers of electric vertical-takeoff-and-landing (eVTOL) aircraft are pursuing designs that transition to more efficient wingborne cruise to fly farther and faster on available battery technology.

- Volocopter and Skydrive look to larger vehicles
- AutoFlight debuts Prosperity 1 eVTOL

German startup Volocopter pioneered the human-carrying multicopter in 2011 and is preparing to put its VoloCity eVTOL into commercial service at the Paris Olympics in July 2024. But the 18-rotor aircraft only carries a pilot and one passenger on short urban flights.

With winged eVTOLs in development that will carry four or five passengers over longer ranges, that business model no longer makes sense, even Volocopter admits.

Volocopter plans to certify its VoloCity air taxi in 2024 and transport people in it during the Olympics next year in Paris. Credit: Mark Wagner/ Aviation Week

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So the company is developing a larger, next-generation version of the VoloCity, CEO Dirk Hoke revealed at the Paris Air Show. The vehicle is

distinct from the winged four-passenger VoloRegion regional air mobility vehicle already in development.

Hoke says Volocopter can likely achieve a battery energy density of around 400 Wh/kg by 2025—compared to 250-300 Wh/kg currently—enabling type certification of the new vehicle by late 2026. “Advances in batteries will enable a larger vehicle with higher payload and longer distances,” he said. “We will not reveal all details yet, but we believe it will at least be a four-seater, and it will be available by the last quarter of 2026.”

Japanese eVTOL startup SkyDrive is also moving up in size. The Tokyo-based company unveiled its piloted two-seat SD-05 in September 2022 but at Paris announced that the renamed SkyDrive eVTOL will accommodate a pilot and two passengers. The vehicle’s maximum takeoff weight thus will rise to 1,400 kg (3,100 lb.) from 1,100 kg and operating range will increase to 15 km (9 mi.) from 5-10 km.

SkyDrive also announced a manufacturing partnership with Suzuki, with plans to build its air taxis at a production facility owned by Suzuki in Shizuoka Prefecture, Japan, beginning in the spring of 2024.

The market shifts come as the industry faces a pivotal 2024. Volocopter is still planning to certify the VoloCity by mid-2024 so it can launch the first commercial services at the Summer Olympics. “Paris is not guaranteed, but it is still feasible,” Hoke said.

Archer Aviation and Joby Aviation are both aiming for FAA certification of their eVTOL air taxis by the end of 2024. Joby CEO JoeBen Bevert said the FAA’s release in early June of the proposed Special Federal Aviation Regulation for pilot training and operations of powered-lift eVTOLs keeps the industry on track to launch commercial services in the U.S. in 2025.

There was a large eVTOL presence at Le Bourget, with a dedicated Paris Air Mobility showcase, Volocopter’s 2X prototype flying daily in the display and Chinese startup AutoFlight debuting its lift-plus-cruise vehicle in the static park. The aircraft at the show was AutoFlight’s fourth full-scale proof-of-concept eVTOL, the last before it builds conforming prototypes for certification of its aircraft with the Civil Aviation Administration of China (CAAC).

AutoFlight’s vehicle on display had 10 lift rotors on wing booms for vertical flight and three pusher propellers for cruise flight. The aircraft is fitted with an interior for a pilot and four passengers. AutoFlight has signed a memorandum of understanding with French airport operator Groupe ADP to operate piloted experimental flights with its proof-of-concept eVTOL from Pontoise Vertiport just outside Paris during the Olympics.

The next step is type certification of the uncrewed cargo version of the 2,000-kg-gross-weight (4,400-lb.) aircraft, the Carryall, with the CAAC, expected in 2024, says Mark Henning, AutoFlight Europe managing director.

Certification will allow AutoFlight to begin delivering aircraft to customers in

China and elsewhere in Asia and start gathering operational data for certification of the passenger-carrying Prosperity 1 version with the CAAC, Henning says. The aircraft are essentially identical, and Chinese certification of the Prosperity 1 is expected 2.5-3 years after that of the Carryall, AutoFlight CEO Tian Yu says.

The Carryall is to be certified to a safety level of 10^{-5}, while the passenger-carrying Prosperity 1 is planned to be certified initially by the CAAC at 10^{-7}, the same safety level as current commercial helicopters, Henning says.

After gaining operational experience in Asia with the Prosperity 1, AutoFlight plans to certify the aircraft with the European Union Aviation Safety Agency. This will require a safety level of 10^{-9} under the agency's Special Condition for VTOL and is expected to take another 1-2 years, he says. FAA certification would follow.

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*—**Graham** leads Aviation Week's coverage of technology, focusing on engineering and technology across the aerospace industry, with a special focus on identifying technologies of strategic importance to aviation, aerospace and defense.*

*—Based in Washington, **Ben** covers Congress, regulatory agencies, the Departments of Justice and Transportation and lobby groups.*

AVIATION WEEK NETWORK

SUSTAINABILITY

Unleaded Avgas Paths

An update on the Eliminate Aviation Gasoline Lead Emissions initiative

The Beechcraft Bonanza G36 has a 300-hp Continental IO-550-B piston engine that runs on 100LL avgas.

TEXTRON AVIATION

SUSTAINABILITY

Bill Carey

A year and a half after the debut of the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative, manufacturers of piston-powered aircraft and engines had an opportunity to comment on its progress and their collective message was: it's complicated.

There are four high-octane unleaded fuels being advanced to achieve the EAGLE program goal of eliminating lead emissions from the entirety of the U.S. piston-engine aircraft fleet by 2030. Two fuels are progressing through the Piston Aviation Fuels Initiative (PAFI), an industry-government testing program, and two through the FAA supplemental type certification (STC) process, which is proprietary between the agency and fuel developers.

During an on-line briefing June 5 to update reporters on the status of the EAGLE program and, according to the sponsors, clarify its objectives, engine and aircraft manufacturers said they have not been able to test candidate fuels in sufficient quantities to understand their properties. The discussion also revealed an apparent schism in knowledge between the fuels undergoing the PAFI process and those being approved by STC.

"We're all excited about this and we're optimistic it's going to work, but we

have tested nothing to date," said Textron Aviation President and CEO Ron Draper. "We have been trying to acquire the fuel to test it the fuel and have been unable to do so. We can't endorse or speak good or bad about [a fuel] until we test it and fly the heck out of it."

Draper said Textron's Cessna and Beechcraft brands have built 250,000 aircraft over their histories, the majority of which remain in service. It currently has 20 jets and airplanes in production.

Piper Aircraft has built 140,000 aircraft, of which 80,000 are still flying. "The vast majority of them come from the general aviation heyday, which is well over 20 years ago," said its president and CEO, John Calcagno. "In our case, many flight schools are asking for support from us. We're also getting questions from insurance companies, financial institutions and everybody associated with the purchase of an aircraft."

Calcagno added: "The fuel is very different from a traditional change to our aircraft. A wholesale fuel change is not a typical, incremental product improvement. It's an outside requirement not within our normal span of control through type certificates. Engines are affected, everything where the fuel gets place is affected."

Lycoming Engines Senior Vice President Shannon Massey said her company, a Textron subsidiary, holds type certificates for 650 engine models. There are more than 100,000 Lycoming type certificate engines still in the GA aircraft fleet, of which more than half require a higher-octane fuel,

as well as Lycoming-powered experimental aircraft that also require high-octane fuel.

"Those are also most of the aircraft in the fleet that are workhorses—they are ferrying supplies to remote locations, they're patrolling borders, they're supporting military operations," Massey said. "The loss of the ability of these airframes to service society would definitely be impactful."

Octane rating is just one measure to consider in a fuel; other factors include materials compatibility, stability, density, flow rate, vaporization and producibility, Massey said. "We want to ensure [an engine] with whichever fuel is being used, is within the safety margins that we've tested and

Piston airplanes parked at Reid-Hillview Airport in San Jose, California, which stopped supplying 100LL in January 2022. The airport now supplies Swift Fuels' UL94 unleaded avgas. Credit: Bill Carey

certified," she explained. "We need to ensure, whether it's through the PAFI authorization process or via the STC process, that we have a good understanding and knowledge of what specific tests and which models of engines are evaluated so we can stand behind that portion of it."

EPA Endangerment Finding

General aviation trade associations and the FAA unveiled the EAGLE initiative in February 2022, although the program was conceived in late 2021, sponsors say. Looming in the background, the U.S. Environmental Protection Agency (EPA) announced a draft finding in October 2022 and expects to issue a final determination this year that lead emissions from piston-engine aircraft that operate on leaded fuel endanger public health. Once that happens, the EPA will formulate a new regulation governing lead emissions from aircraft.

GA trade associations are also defending against a trend of local communities pressuring small airports to ultimately close for various reasons. In late 2021, supervisors in Santa Clara County, California, moved to ban the supply of 100 Low Lead (100LL) at two county-owned airports after a study revealed elevated blood-lead levels in children living near Reid-Hillview Airport in San Jose.

The most common type of avgas, blue-dyed 100LL contains the fuel additive tetra-ethyl-lead, which is used to boost its octane rating, or ability to resist detonation or "knocking," in high-compression piston engines.

"EAGLE has a clear goal and a mandate to eliminate lead in aviation fuel no later than 2030 and hopefully sooner," said Aircraft Owners and Pilots Association (AOPA) President and CEO Mark Baker, who co-chairs the initiative. "It's important that this unleaded transition be safe and smart [and that] local airports and airport sponsors provide a supply of 100LL during the transition for those aircraft that need higher-octane fuel to safely fly. We're pushing back on those airports and communities that are prematurely banning 100 Low Lead before a replacement of unleaded fuel is widely available."

Last September, the FAA granted broad approved model list STC authorization to one of the two STC pathway fuels—General Aviation Modification Inc.'s (GAMI) G100UL—allowing its use in nearly all piston aircraft as a drop-in replacement for 100LL avgas. The agency expects to authorize a second unleaded fuel through the STC process—Swift Fuels' 100R—later this year for a limited set of aircraft.

Owners can apply to GAMI for STCs to use G100UL for their specific aircraft and engine. GAMI co-founder George Braly tells *BCA* that he has arranged with a blending company in Houston to produce the high-octane unleaded fuel and approached avgas suppliers Avfuel, Epic, Titan and World Fuel Services to send rail cars there to load it. Cirrus Aircraft and Robinson Helicopter are testing the GAMI unleaded fuel and engine manufacturers have been offered supplies if they sign non-disclosure agreements.

GAMI started work on G100UL in 2009 and opted not to participate in the PAFI program when the latter effort formed in 2013-14. Had it joined the industry-government collaboration, GAMI would have been required to start over with its certification process, Braly has said.

The company's maverick status and the STC fuel pathway more generally appear to have complicated the industry's transition roadmap for high-octane unleaded fuel, which draws on specifications developed by standards organization ASTM.

"We've been at this a long time," Pete Bunce, General Aviation Manufacturers

A refueler containing Swift Fuels UL94 unleaded avgas is parked near the runway at Reid-Hillview Airport in San Jose. Credit: Bill Carey

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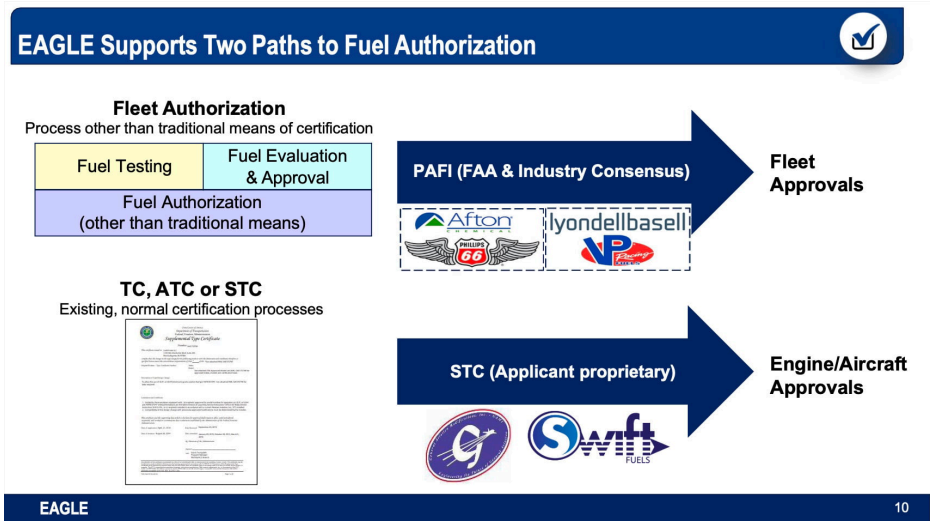
Association president and CEO, told the press briefing. "When we formed PAFI back in the last decade, we set the parameters to be able to look at the corner cases and to have fuels come in and go against the testing criteria that all the associations developed, whether it's for rotorcraft or fixed-wing aircraft, to be safe."

The "transparency" of fuel attributes has been key for manufacturers, Bunce said. "For a century now, we've been designing, then testing, then certifying



EAGLE program graphic illustrates the two pathways to developing high-octane unleaded avgas. Credit: FAA

aircraft and engines," he related.

"The paramount rule in this is that they are safe and we have to prove that to the FAA. The way we have done this is we have had known fuels…[that] we have been able to certify and test against this standard and that standard has been given to us by ASTM. It's been a fuel standard that has been out there and developed and everyone has had confidence because there is a consensus process to provide that fuel. We're into new territory now."

Rob Hackman, Experimental Aircraft Association vice president for government affairs, said more information has been disseminated to engine and aircraft original equipment manufacturers (OEM) through the PAFI program. "The two [developers] that are in the PAFI program have supplied significant amounts of fuel to be tested in that program," he said. "A lot of that testing was either done by the FAA at the Tech Center or by the OEMs through in-kind agreements. Those OEMs that are participating in the program have had insight into those fuels."

Hackman added: "The challenge of not being able to see or have visibility into the fuels comes a little bit more from the STC side, where the STC program, by its nature, is proprietary between the FAA and the applicant. Both the components in the fuel are proprietary but also the certification program that's used to [achieve] the STC."

The PAFI Pathway

The partnerships of Afton Chemical-Phillips 66 and LyondellBasell-VP Racing are advancing candidate fuels through the PAFI program. Testing procedures and results are shared with the companies participating in PAFI, said Lirio Lui, executive director of the FAA Aircraft Certification Service. When a fuel successfully completes the testing regime, the FAA will issue a fleetwide authorization, allowing its use in aircraft.

"Both teams have completed extensive testing," said Lui, who co-chairs the EAGLE program with AOPA's Baker. "They have fine-tuned their fuel formulations based on some feedback and they are in the final initial phase

of testing, with the LyondellBasell fuel at the [FAA] Tech Center. Testing for the Afton-Phillips 66 fuel will begin shortly at one of our engine manufacturing facilities. Things are really moving along under the PAFI umbrella."

The FAA plans to authorize the use of low-octane UL91 unleaded fuel later this year through the fleet authorization process. The release of UL91, which should work across 68% of the piston-engine aircraft fleet, "will facilitate broader-use experience with the transition" to a higher-octane unleaded fuel, Lui said.

The agency allows for two types of standards in certifying fuels—ASTM's as well an independent standard, Lui said. "Historically, aviation fuel has been sold kind of as a commodity that is produced by various stakeholders to the industry standards," she advised. "In recognizing that some fuel developers choose to control the production of the fuel that they develop, an independent specification provides a similar path while keeping the information concerning the fuel under the control of the developer."

In response to a *BCA* inquiry, LyondellBasell, a Netherlands-based chemical company with U.S. operations in Houston, said its team continues to work with the FAA, manufacturers and other industry parties through the PAFI program to develop a drop-in replacement unleaded fuel for 100LL. In parallel, it is conducting ASTM testing to develop an industry fuel quality and performance specification.

"We have developed several fuels with the required detonation resistance for most GA aircraft engines and are continuing to fine-tune these products to ensure the final fuel selection meets all quality and performance requirements for a safe, reliable and cost-effective deployment," LyondellBasell said.

"The FAA has resumed engine testing on our fuel, and we expect full-scale testing will begin sometime in the second half of 2023," the company said. "The PAFI testing program will be completed well in advance of the anticipated phase-out of leaded avgas, which is likely years away."

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*—Based in Washington, D.C., **Bill** covers business aviation and advanced air mobility for Aviation Week Network. A former newspaper reporter, he has also covered the airline industry, military aviation, commercial space and unmanned aircraft systems. He is the author of 'Enter The Drones, The FAA and UAVs in America,' published in 2016.*

AVIATION WEEK NETWORK

OPERATIONS PLANNING GUIDE

How to Use the 2023 Operations Planning Guide

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OPERATIONS PLANNING GUIDE

Paul Lafata

Paul Lafata is the owner of AirPower Software Group, which provides products and services, including Aircraft Budget Analyzer, to inform aircraft purchase decisions.

This year's Operations Planning Guide covers turbine-powered, in-production aircraft. For out-of-production aircraft data consult the Aircraft Budget Analyzer. Aircraft operating costs are presented in a format that separates information into six areas: Direct Mission Costs, Fixed Annual Costs, Variable Costs, Annual Cockpit Subscription Services Costs, Annual Cabin Subscription Services Costs and Annual Trip Support Costs.

Aircraft Category

Aircraft are grouped into six categories reflecting similarity of aircraft size, mission and operations. Category 1 aircraft are turboprops weighing less than 12,500 lb. and very light jets weighing less than 10,000 lb.; Category 2, multi-engine turboprops weighing 12,500 lb. or more and light jets weighing 10,000-19,999 lb.; Category 3, jets weighing 20,000-29,999 lb.; Category 4,

jets weighing 30,000-40,999 lb.; Category 5, jets weighing 41,000 lb. and up; and Category 6, ultra-long-range jets with NBAA IFR ranges above 6,000 nm.

Certain data are common to all aircraft in a category for purposes of calculating mission cost by listed range, including airframe systems parts and labor, engine reserves, APU reserves and propeller reserves for turboprop aircraft. Fixed costs, annual cockpit subscription services costs, annual cabin services costs and annual trip support cost figures are provided for reference only and are not included in the Direct Operating Cost (DOC) figure for each of the Mission Ranges (300 nm, 600 nm, 1,000 nm, 3,000 nm, and 6,000 nm).

BCA Equipped Price

This number is taken from the second-quarter, 2023 Purchase Planning Handbook, and reflects BCA-equipped, completed aircraft. The listed price is based on the latest model produced.

Direct Mission Costs

Mission Costs are calculated based on the business aircraft missions shown in *BCA*'s second-quarter 2023 Purchase Planning Handbook. Three missions are shown for each aircraft: 300 nm, 600 nm and 1,000 nm. Ultra-long-range aircraft (Category 6) missions are 1,000 nm, 3,000 nm and 6,000 nm. The fuel expense for each mission is based on the fuel-burn figure for the mission, provided by the OEM, and calculated under conditions shown in the Handbook.

Missions are calculated utilizing manufacturer's recommended cruise setting; therefore, cruise settings may vary from aircraft to aircraft, (i.e., max cruise versus long-range). Where the aircraft cannot cover the mission distance with an 800-lb. (four-passenger) payload, *BCA* shows a reduction in payload or a reduction in mission length at the Editor's option.

Direct Mission Costs include a bundling of mission fuel consumed from *BCA*'s Purchase Planning Handbook (LINK), maintenance labor, parts, and reserve costs from the Variable Costs section of this guide, apportioned to the actual flight time for the listed nautical mile mission length. Fuel price used is based on a nationwide average price of $6.07 per gallon for Jet-A at press time.

Fuel consumption calculations account for taxi, takeoff, climb, cruise, descent, and landing for the applicable mission as appropriate for the aircraft category. (Note: Longer missions will lower average hourly fuel burns due to more time in cruise; conversely, shorter missions will increase average hourly fuel-burn figures since proportionally more time is spent in the takeoff and climb phase rather than cruise.)

Fixed Costs (Annual)

This area of expense includes those costs that must be borne by the flight department irrespective of the level of aircraft utilization. The years 2021-23 have been a transitional period, particularly for flight department salaries and the impact of COVID-19 economic shutdown followed by renewed emphasis on private aviation over the last 24 months. Airline demand for

qualified pilots is robust, as passenger loads exceed pre-COVID-19 levels. Salary surveys published last year quickly became obsolete as flight department staffing plans regain momentum. The year 2023 is shaping up as a combination of somewhat softer economic news and higher inflation as demand and supply shifts towards hiring of qualified flight crew in the airline and corporate segments. Most corporate operators are facing tough competition for qualified crews. Compensation adjustments, including longer-term incentives, continue escalating to discourage private aviation pilots from migrating to airlines or other opportunities.

Salaries

Included are salaries for Flight Crew, Cabin Crew and Director of Maintenance where appropriate. For this year, Sheryl Barden, CEO at Aviation Personnel International said, "we continue to see robust flight operations with a one-two punch of additional emphasis on hiring typed and current flight crew members to meet increased mission needs and increasing staffing levels to even out crew workloads."

The "aircraft management company sector and flight crew training companies are facing the same pressures on hiring and crew salaries," said Barden. Fractional and Charter Operators are also in the hiring mode as demand for their services has increased over the last 12 months, with some notable demand softening in the charter segment. Airlines are "actively hiring, using creative means to fill positions," she said. Barden further stated that "airlines are recruiting and negotiating higher salaries, which is attracting pilots out of the business aviation market. "

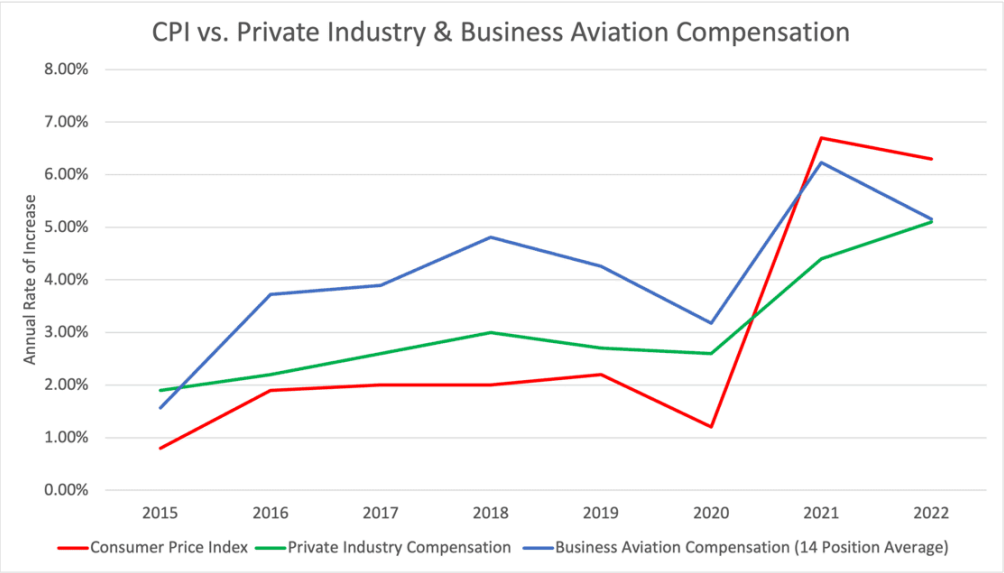
Barden discussed additional shifts in the crew-hiring landscape as follows: "Hiring tactically instead of strategically has resulted in hiring people who can be brought up to the corporate flight department standards is becoming more predominant in the flight crew landscape." The pilot shortage remains significant, said Barden. Additionally, "the contract crew market is very lucrative, she added."

Barden further stated that "Business aviation flight departments are staffing at higher numbers to accommodate more frequent flying and improved work-life balance. COVID-19 concerns are significantly diminished." Barden also noted: "Corporate flight department crew retention remains key as the economy continues to open up. Salary adjustments for 2023 resumed their upward trajectory this year, in anticipation of having to make significant operational adjustments in the next year or two.

Salary increases for flight departments in 2023 have not yet normalized as predicted last year. Overall, business flying has been impacted by qualified crew supply and increased hiring competition. There is no one-size-fits-all formula that can be applied to define current conditions."

Barden emphasized that retention strategies including "bonuses, restricted stock, retention bonuses, work-life balance adjustments, and general working conditions in flight departments, large or small, play key roles in mitigating personnel churn and attracting talent when needed."

Maintenance professionals also are in short supply with "retirement



becoming a factor to consider with salaries rising to retain and attract new talent. Directors of maintenance play a crucial role and can have a direct impact on airframe resale value by ensuring a high degree of aircraft maintenance and repair status along and associated documentation." Barden added that Cabin Crew salaries have also risen more than previous years as emphasis on qualified talent is in high demand."

Christopher M. Broyhill, CEO at AirComp Calculator, reviewed data from multiple surveys across 14 positions and concluded "an average increase in compensation of 5.15% from 2021-22 (the most current data available at this printing). This figure corresponds to data from the U.S. Bureau of Labor Statistics that shows growth in private industry compensation at 5.1% over the same period. But a review of the figure above shows that the current compensation market is very dynamic. Cost of labor (Private Industry Compensation) and business aviation compensation lags the cost of living (Consumer Price Index) and while the rate of increase for wages in the general economy are rising, the rate of increase for wages in business aviation fell by one percent in the last 12 months. "

In addition, he said pilot salaries for long-range jets such as the Gulfstream G550 and Dassault Falcon 7X can be in the $300,000 range, which is higher than in previous years. "That, combined that with the new airline contracts, specifically at Delta Air Lines, which includes a 34% increase over previous levels of pilot compensation, creates a dynamic compensation environment indeed. And it is obvious that the current compensation data is lagging the market," said Broyhill.

"While paying at the 50th percentile or using a lead-lag modality centered on the 50th percentile used to be an accepted strategy, business aviation operators are now regularly targeting the 75th percentile to ensure they stay ahead of the market," he said. Operators still targeting the 50th percentile face retention risks, he said.

Flight Crew Training

Crew training is a substantial constraint as the available supply of qualified

employees remains very tight, as pilot slots can now extend out two years. This is putting extreme pressure on flight departments to find already-qualified flight crew members. Expenses shown are based on average transaction costs for representative aircraft models. Actual expenses can vary due to market capacity fluctuations, changes in training locations, and other factors such as training volume and length of commitment.

The training expenses shown are based on average transaction costs for representative aircraft models, or OEM contracted rates. Actual expenses can vary due to market capacity fluctuations, changes in training locations, and other factors such as training volume and length of commitment.

Cabin Crew Training
These expenses are provided as budgetary planning numbers only.

Maintenance Training
This estimated cost is per technician and includes initial maintenance training on an aircraft model. Data reflected here was initially compiled by ARGUS.

Hull and Liability Insurance
Aircraft hull and liability (and all aviation insurance in general) premiums remain in the crosshairs since last year's Operations Planning Guide publication, particularly for single- pilot, owner-flown, high-asset-value aircraft. Annual premium increases have slowed from the 35%+ seen two to three years ago, to a more sustainable single-digit and low double-digit upward pace as noted by Tom Hauge, national sales director at Wings Aviation Insurance. However, the hot button topic noted by Hauge remains "escalating airframe values over the last year, and low inventory availability for sale. Naturally, aircraft owners and buyers alike are adjusting to upward pressure on airframe valuations, changes in insured values, and the attendant impact on premiums."

Hauge and the aircraft insurance industry are closely watching war risk and confiscation of commercial aircraft related to the Ukraine/Russia conflict, with the potential to impact aviation insurers as one of the largest loss events in aviation insurance history. Hauge said "Airliner confiscation could be a driving factor, and the future impact on insurers is to be determined as insurance companies are in a wait-and- see mode to see how this issue works out." Hauge points out that "the aviation insurance industry is one massive risk and financial pool. Everyone paying aircraft insurance premiums will be impacted if the pool is drained by war-risk coverage losses due to confiscated aircraft."

Therefore, market forces will continue to impact premiums, including global catastrophic property/casualty loss events, aviation losses in the sector (aircraft hull and liability claims), cost of repairs and loss of underwriting facilities over the last several years, and limited competition and reduced capacity. All these factors have made the smaller market space restrictive on high hull and liability limit aircraft, along with continuing to drive tighter requirements on pilot qualifications.

There is, however, some additional capacity in the U.S. aviation insurance market, with two "new" carriers entering the hull and liability space as of fourth-quarter 2022--with a third targeting to start underwriting later in 2023. This additional market capacity should help soften the sub-$5 million hull value aircraft premiums (owner-flown and professionally flown). However, the underwriting space in the U.S. remains at only 7-8 insurance carriers for mid-size and large-cabin aircraft.

Hull and liability rates reflected in the guide are established based on key experience and type-specific training as noted below. Actual premiums can vary significantly from those noted in 2022 and beyond. Hauge shared additional guidance for this year's guide. "My job as an insurance broker is akin to that of a salesman. I work to position the buyer in the best possible light to the underwriter. The level of thoroughness and detail on a particular risk achieved through interviews with my clients can directly correlate to the quality of the market results. Come prepared to give your broker all the information needed to put you in front of an underwriter." Your broker will specifically ask about your:

- Pilot experience (the more detail provided, the better). Pilots without prior make/model experience, adequate turbine time as PIC, and prior overall experience can dramatically impact the overall total annual premiums. Premium variation can be 100% higher or more from previous years depending on the experience metrics noted.
- Planned utilization for the aircraft, including estimated annual flight hours, territory you plan to operate in and how you will use the aircraft.
- Detailed training plan (if you are transitioning to a higher-performance aircraft or turbine transition, this area is particularly important to define).

Your broker will also dig into your aircraft use case, including:

- Where you fly and how often.
- 'Owner'-flown versus professionally crewed aircraft--there is a significant difference in risk between the two designations.
- Size of the aircraft make/model pool and overall safety record--i.e., an experimental turbine aircraft with limited numbers in service will have a vastly different insurance market acceptance versus a legacy OEM production aircraft with 100s or 1000s of the models insured worldwide.
- How many times a year do you utilize the aircraft/flight hours estimated per annum?
- Expectations on liability coverages / any third-party passenger exposure (how many and how frequent?).
- Where the aircraft is based and how it is secured when not flying (tied outside versus hangered).
- Number of underwriting companies willing to write coverage for a specific aircraft type and planned crew operation.

Hauge advises: "When you get down to the last step of selecting one insurance policy over another, choose the proper policy for broadness of coverage, liability limit needs, checkout or transition pilot requirements, and finally pricing." Other considerations include: "Do you plan to dry-lease time in the aircraft to a third party? Does the policy cover this use? Can dry

leasing be added to the policy / if so, at what additional cost? We have seen several insurers prohibit third-party dry leasing – others that may permit dry leasing to third parties typically cap the number of leases that may be added to the policy and will surcharge the leases at a flat, fully earned premium per lease.

What minimum experience requirements do your pilots need to have to be approved by the policy underwriting company or what might be the requirements/minimum experience threshold to add additional pilots? Do all of your pilots currently hold these qualifications and experience, and if not, what will be required to have them approved by the insurance underwriting company?" Also, as of recently, some insurers will mandate simulator-based training for the pilots, some allow training to be completed in-aircraft, so this topic should be addressed with your broker when reviewing insurance quotes from various underwriting carriers.

These are just examples to consider, said Hauge. "When you review your policy choices, make sure all your missions/usage, pilots, etc. are covered. Without this knowledge, you could find yourself in an uncovered situation, responsible for a multitude of damages. With the right broker by your side, and the proper information, timing, and knowledge about your policy, you can smoothly navigate the aviation insurance purchasing process and gain a policy that best fits your needs." Insurance estimates are based on the aircraft flown by professional, simulator-trained flight crews or well-qualified pilots with sufficient PIC (pilot-in-command) time in type particularly for the owner-flown, single-pilot-class platforms. In other words, the best- case scenario as opposed to minimum qualification scenarios."

Hull Insurance per $100

This is the factor used as a multiplier to arrive at the total annual cost of hull insurance for a particular aircraft. It is derived from actual aviation insurers' quotes. Insurance quotes can vary depending upon if the aircraft is covered under a fleet policy or a standalone policy. The first number reported is the estimated annual cost of hull insurance for a particular aircraft based on its *BCA*-equipped price as reported in *BCA*'s second-quarter Purchase Planning Handbook. The cost is computed by multiplying the cost per $100 of hull insurance factor by the *BCA* equipped aircraft price. The figure includes war-risk coverage, which constitutes on average $0.03 to $0.05 per $100 of hull insurance (this figure is increasing in 2023--war risk--as noted earlier).

Liability Insurance

This figure represents the total annual cost for liability insurance for an aircraft model. Aircraft in Categories 1 and 2 are assumed to carry $5 million in liability insurance; Category 3 aircraft carry $100 million; and Categories 4-6 carry $200-500 million in liability insurance coverage, depending on make and model. The annual cost is computed by multiplying the amount of liability coverage in millions by a per $ million factor supplied by a leading provider of this type of insurance coverage.

Maintenance Software

The figure shown for maintenance software programs represents the average annual cost for a software program to track maintenance activities,

intervals and expenses. This number represents an average cost and should be utilized as a budgetary planning estimate.

Hangar/Office Facilities
Expenses shown here are based on national average annual costs reported by flight departments in 2017 and escalated for 2023 based on the annual rate of expected inflation. The figures shown in each cost area are broken down by the six aircraft categories and will generally be the same for all aircraft included in the same category. This figure is an annual cost per aircraft and includes hangar and office rent as well as additional facilities costs such as utilities, ground upkeep, snow removal, janitorial service and insurance (other than aircraft insurance).

For more than one aircraft, it is valid to multiply the figure by the number of aircraft to arrive at a total flight department cost. Actual rental costs will vary widely from one geographical area to another.

Variable Costs (Per Flight Hour)
These expenses are directly related to the operation of the aircraft and are represented as an hourly cost figure. Included are maintenance labor expense, parts expense, plus engine, APU, avionics and propeller reserve expenses as appropriate. For in-production aircraft it is assumed the aircraft is covered by the manufacturer's warranty. The figures shown are based on aircraft OEM direct estimates with warranty effect incorporated unless otherwise noted by an (*). For OEMs that did not participate this year, an inflation escalation was added to the most current available data.

Service center maintenance labor expense is computed by multiplying the maintenance man-hours per flight hour ratio by the nationwide average service center hourly maintenance labor cost (Category 1: $126/hr.; Category 2: $126/hr.; Category 3: @131/hr.; Category 4: $137/hr.; Category 5: $147/hr.; Category 6: $147/hr.). Labor expenses for each category noted here were used in the preparation of in-production aircraft maintenance labor costs per flight hour.

Airframe Systems Parts and Labor
This figure is a model-specific hourly expense with warranty considered. It should be noted that warranty periods and coverage vary from OEM to OEM and are not specifically defined in this description. Contact the OEM for policies related to new aircraft warranty and pre-owned aircraft within the warranty period for transfers related to the airframe, engines, APUs and avionics. The following descriptions define how maintenance man-hours and parts expense were calculated into mission costs:

Maintenance Labor Hours/Flight Hour (in-production aircraft)
An aircraft manufacturer-supplied ratio of maintenance man-hours per flight hour. The number reflects an average for the first five years of operation while under warranty, including scheduled maintenance and unscheduled maintenance events. Maintenance man-hours per flight hour are multiplied by corresponding labor rate, by aircraft category and incorporated into the airframe systems parts and labor variable cost figure line item.

Parts Expense (In-production aircraft)

This hourly expense is derived from model-specific manufacturer's quotes and included parts expense for airframe systems. In-production aircraft parts expense provided by the OEM have the warranty taken into consideration. It should be noted some warranty periods covered timeframes of less than 5 years but are not specifically mentioned in the guide. Airframe systems parts calculations assume unscheduled maintenance events would be covered by warranty and does not include reserves for engine or APU overhauls, hot sections, long-range maintenance events, or propeller reserves. Those items are listed separately in the variable cost section. Avionics repair costs during the warranty period would also be covered by the OEM warranty and therefore no reserve costs are shown for Categories 1-6 platforms. Regulatory mandates should be separately budgeted for when evaluating operating costs for each aircraft.

Engine Reserves and APU Reserves (where applicable)
These expenses are based on OEM input for in-production aircraft where provided. Engine and APU OEMs and third- party service providers offer programs designed to fix or cover operator's scheduled and unscheduled maintenance requirements on a per-hour, fee-paid basis. Engine and/or APU loaners may not be covered by these programs for unscheduled events, resulting in significant out-of-service time for the aircraft. Consult policy terms and conditions or the service provider for specifics.

Avionics Reserves
For in-production aircraft, avionics reserves for categories 1-6 are assumed not to be applicable due to OEM warranty coverage during the first 5 years of operation following entry into service. Additionally, upgrades to cover regulatory mandates are not factored into hourly operating costs.

Propeller Reserves (where applicable)
These expenses are based on OEM input for in-production turboprop aircraft.

Annual Cockpit Subscription Costs
These are expenses related to cockpit navigation equipment database updates, safety services associated with flight planning, and other services associated with flight operations. These services are typically purchased through the OEM in the case of FMS and GPS navigators or ground-proximity system databases, and service providers for data link, flight planning, charts and graphs and digital weather-related products. Information in this section is dependent on the cockpit avionics configuration and pricing offered at the time of aircraft delivery, or as contracted with a cockpit services provider. Procurement of subscription services from a provider that offers training support on use of products as well as troubleshooting, system configurations on-wing and satellite communication link setup for service delivery where needed are highly desirable support elements. Typical subscription costs, which vary depending on mission needs, are reflected in this section. However, annual aircraft utilization and bundling of other services may reduce these expenses.

Navigation and EGPWS/TAWS Databases

Annual subscription prices are derived from OEM data sources or estimated where OEMs do not publish publicly available pricing, and therefore should be viewed as directionally correct for budgetary planning purposes. Navigation database prices do not include optional bundled or enhanced feature pricing unless specifically noted. For example, navigation database, plus terrain, traffic or other charts and maps can be covered in a one-time renewal, or annual subscription price depending on the avionics manufacturer. The aircraft or database supplier should be consulted for price quotes. Expenses shown vary depending on cockpit avionics equipment configurations and are approximated averages for in-production aircraft.

Annual Cabin Services Costs

Cabin services costs assume the aircraft is optioned with appropriate equipment at time of delivery from the factory. Aircraft Budget Analyzer provided budgetary planning numbers for Swift Broadband (SBB), KA/KU, SatTV, and Cabin Iridium services. Estimated air to ground service costs are derived from published pricing, where available. Cabin services except for air-to-ground and cabin / Iridium phone are applicable to aircraft categories 4-6 due to suitable empennage and or vertical stabilizer antenna / radome solutions and suitable space for installation. Cabin services costs are for activation, on-wing field labor support, aircraft crew training expense, or ongoing technical support associated with troubleshooting complex satellite communications equipment and networks that is not included. Many service providers offer a continuum of support services and should be contacted directly for information related to ongoing support and service activation.

Annual Trip Support Costs

Annual trip support expenses are similar for all aircraft in a particular category, reflecting comparable aircraft capabilities and mission utilization. Trip expenses includes catering service, flight crew travel, international trip support, concierge service, ground handling and landing/parking fees. Fees reflected are annual numbers assigned to specific aircraft categories. For aircraft in categories 5-6, 400 annual flight-hour utilization rates were used to arrive at budgetary planning estimates. For categories 1-4, 250 annual flight-hour utilization rates were used. Mission durations vary, which resulted in a change in the way these costs were calculated for the 2023 Operations Planning Guide. Many operators elect to use a service provider in the case of concierge and international trip support due to complexities associated with overflight and landing permitting and other logistical arrangements. International trip support and concierge was not factored in for aircraft in categories 1 – 4 unless otherwise noted, or if the aircraft had sufficient NBAA IFR range to justify a budgetary planning estimate.

Operations Planning (Aircraft Acquisition)

Selecting a new or replacement airplane can be a complex, daunting task, particularly for first-time buyers and those upgrading to a new platform. Acquisition planning involves a thorough operational needs review to ensure the right aircraft for your unique mission needs is purchased.

Due Diligence

Don’t skimp on due diligence to close an aircraft purchase. “Confirm the physical condition and title of the aircraft,” cautions Michelle Wade,

managing partner at Jetstream Aviation Law. “Perform due diligence on other parties in the transaction to confirm you are not buying an aircraft from a sanctioned party or an entity whose ultimate beneficial owner is a sanctioned party and to confirm to whom payments are being made. With the U.S. government’s recent focus to ensure that general aviation aircraft are following export processes, due diligence also includes confirming the export/import status of the aircraft.”

Team Planning

Wade shared essential advice: “Assemble a team of subject-matter experts, including technical, operations, tax, legal, staffing and general consulting expertise in addition to the owner’s in-house business team. Using a robust team to create a complete acquisition plan that considers mission needs, utilization plans, business goals, tax laws, and FAA regulations can avoid future problems.” Wade emphasized allowing sufficient time to accomplish all tasks associated with the acquisition, and to “start your planning early, allowing sufficient time to research questions arising from unique business needs.”

When asked for additional clarification, Wade advised: “Well-defined utilization information narrows the list of aircraft to consider, narrows the list of significant tax issues to address, and helps identify how FAA regulations will affect ownership and operation of new aircraft.” The answers to these questions will help clarify the intended utilization of the aircraft:

- Will flights be primarily for business use, with limited personal flights?
- Will flights be predominately personal flights?
- Does the owner expect anyone to pay for their flights on the aircraft?
- Will a professional aircraft management company be hired?
- Will the aircraft be leased to a charter company to provide charter flights to the owner, friends or third parties?

Tax Goals

Wade emphasized that missteps with taxes, including federal and state, can be costly. Consider whether to take a tax deduction for bonus depreciation. “Bonus depreciation may allow the owner to deduct a significant percentage of the purchase price on the owner’s tax return in the year of purchase; however, it is important to understand the impact of IRS bonus depreciation regulations on the planned flight operations,” she said.

Wade further stated that: “Significant flight hours for personal use, or business flights that also carry passengers traveling for non-business purposes, may negatively affect an anticipated bonus depreciation deduction. Planning with the entire team to address how to best satisfy tax goals and business goals while complying with FAA regulations can avoid unpleasant eleventh-hour surprises. State sales and use tax, state property tax and the availability of any exemptions should be considered” because they will affect ownership planning and aircraft operations. “Each aircraft owner has a unique business structure, unique tax goals and unique business goals. There is no ‘one-size-fits-all’ tax plan when buying a new aircraft. Early discussion of the planned operations and desired tax benefits will allow the team to identify and address any potential conflicts between

business plans, tax laws and the FAA regulations," she said.

Financing

Begin seeking lenders and getting quotes "at least several months before funds are needed. It takes time to provide the required due diligence to the selected lender, obtain loan approval, review the loan documentation and negotiate important business points into the loan documents while ensuring a smooth closing," advised Wade.

Home Base Logistics

Depending on where the aircraft will be geographically based, this planning element is critical to ensure an expensive asset is not parked on the ramp, unprotected. Wade further advised: "The aircraft acquisition team should also identify the resources needed to support the new aircraft.

- Where will the aircraft be hangered? This decision is affected by identifying a convenient departure airport for most flights, hangar space availability and state tax laws.
- How will the aircraft be staffed?
- How many pilots will the owner employ? Will any contract crew be utilized?
- Will a maintenance technician or a flight attendant be employed?
- What maintenance/service programs will be utilized?
- What insurance coverages will be obtained?"

Purchase Agreement

For new aircraft purchases, manufacturers will provide the sales agreement. Some terms are not negotiable, but Wade advises some can be revised.

Consider:

- Consider the pre-purchase inspection and delivery process to ensure that it meets the buyer's expectations.
- Consider addressing what closing documentation the buyer will receive from the manufacturer at delivery time.
- Consider addressing the closing procedure in more detail.
- Do you have any specific delivery conditions to include for your aircraft?

"Planning for the delivery when negotiating the purchase agreement can create an easier closing experience," she said.

General

Abbreviations and annotations are used throughout the tables: "NA" means not available or Not Applicable to a particular aircraft model. An asterisk in brackets (*) in the Model Column indicates data was not available from the OEM or other sources, and operating costs were estimated. Single-Pilot (SP) certified aircraft will not include a salary for the Captain or Copilot in the Guide Tables, and assumes the aircraft is owner-flown unless otherwise noted due to insurance requirements or typical mission usage; "NP" signifies that the specific performance is not possible; "OC" means On Condition; and "INCL" indicates a particular cost item is combined with another specifically noted item.

Cirrus Aircraft offers an all-inclusive operating cost per flight-hour product that includes recurrent training, all scheduled and unscheduled maintenance, all subscriptions and more. Variable costs are broken out only for the purposes of calculating direct mission costs for each of the predefined ranges.

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OPERATIONS PLANNING GUIDE

2023 Operations Planning Guide Charts

ADOBE STOCK/MATTHEW

2023 Operations Planning Guide

Production Aircraft — Category 1 — Turboprops <12,500 lb. – Jets <10,000 lb.

	Manufacturer	Textron Aviation	Textron Aviation	Piper Aircraft	Daher
	Aircraft Model	Cessna Caravan*	Grand Caravan EX*	M500**	Kodiak 100***
	Category (1-6)	1	1	1	1
	BCA Equipped Price	$2,320,000	$2,610,000	$2,650,000	$2,953,653
DIRECT COSTS	300 nm	$774	$1,075	$664	$850
	600 nm	$1,901	$2,106	$1,190	$1,663
	1,000 nm	NP	NP	$1,899	$2,752
	3,000 nm	—	—	—	—
	6,000 nm	—	—	—	—
COSTS	Captain Salary	$103,589	$103,589	SP	SP
	First Officer Salary	SP	NA	SP	SP
	Cabin Crew Salary	NA	NA	NA	NA
	Director of Maintenance Salary	NA	NA	NA	NA
	Flight Crew Recurrent Training	$4,500	$4,500	$4,500	$4,500
	Cabin Crew Recurrent Training	NA	NA	NA	NA

AIRCRAFT

A Piaggio Avanti II arrived in Geneva for the EBACE conference in May.

20/Twenty: The Unique And Elegant Avanti

Interest in acquiring manufacturer Piaggio Aerospace suggests its ongoing viability

MARK WAGNER/AVIATION IMAGES

AIRCRAFT

Bill Carey

Italian government-appointed commissioners received 18 expressions of interest in acquiring Piaggio Aerospace as of a June 19 deadline, suggesting that the manufacturer of the iconic P.180 twin turboprop will remain a viable concern.

Piaggio Aerospace, consisting of subsidiaries Piaggio Aero Industries and Piaggio Aviation, has been in extraordinary receivership since December 2018, when Abu Dhabi-owned Mubadala Development Co. withdrew its 100% share in the company. The 18 expressions of interest (EOI), including half from businesses with headquarters in Italy, came during a fourth attempt to sell Piaggio.

"The market is sending us encouraging signals," the commissioners stated. Most of the EOIs were submitted by prominent business parties. "This acknowledges once again the attention for a national strategic company with a significant potential, especially considering the latest developments on sustainable mobility."

Based in Villanova D'Albenga, near Genoa, Piaggio didn't skip a beat after Mubadala withdrew its investment. "The company has been operating

The Avanti was designed to match the speed of a jet with the fuel efficiency of a turboprop. Credit: Nigel Prevett/Aviation Week

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continuously, without a break, despite the [Covid 19] pandemic," Davide Rossetti, one of the three commissioners, told BCA's Angus Batey during the EBACE conference in May. "The order portfolio has increased during this time, and there's been no negative impact on jobs—no temporary layoffs."

At the time, the manufacturer had an order backlog of 17 P.180 Avanti EVOs, from both Italian government institutions and private customers. Its order book was valued at €550 million ($593 million).

A Unique Design

With its fixed forward wing, curving low-drag fuselage and twin pusher engines, the P.180 Avanti has been likened in appearance to a catfish or a hammerhead shark—the latter being inspiration for the uncrewed P.1HH HammerHead military reconnaissance derivative of the P.180. The type's three lifting surfaces of the forward wing, main wing and horizontal stabilizer work together for aerodynamic efficiency.

Designed by a team of engineers headed by Alessandro Mazzoni to match the speed of a jet with the fuel efficiency of a turboprop, the P.180 first flew in 1986 and was certified in 1990. Powered by 850-shp Pratt & Whitney PT6A-66 turboprop engines, the Avanti seated up to nine occupants and came with a sticker price of $4.1 million.

Piaggio certified the Avanti II in 2006; it featured a new Collins Pro Line 21 avionics suite, upgraded PT6-66B engines and increased maximum takeoff weight to 12,050 lb. In December 2014, the manufacturer announced European Union Aviation Safety Agency certification of the third-generation Avanti EVO.

The EVO improved the aircraft's noise signature by fitting the PT6s with patented exhaust stacks and Hartzell low rpm, counter-rotating 5-blade scimitar propellers. Winglets on the main wing and new front-wing wingtips improved max cruise range to 1,770 nm and climb speed to 35,000 ft. by 10%. Max speed of the EVO is 402 KTAS. The more efficient wing combination increased its service ceiling to 41,000 ft.

Aviation Week's Fleet Discovery Database counted a world in-service fleet of 205 P.180 Avantis in June, consisting of 117 Avanti IIs, 57 original P.180s, 17 military P.180AMs and 14 EVOs. There were five aircraft in the possession of a third party.

The 2022 factory-new list price of a P.180 Avanti EVO was $7.7 million; the average retail price was $7.2 million, according to the Aircraft Bluebook.

There were 17 P.180s listed for sale in June, including Avanti IIs and Avanti EVOs, said Bryon Mobley, president and managing partner of Wetzel Aviation, of Englewood, Colorado. Of these, about half had been advertised for a year or longer, he said. "This isn't an indication of a slow market, rather you are seeing the same high-time, 'maintenance challenged' and relatively inaccessible aircraft that just don't move," Mobley explained.

Earlier P.180s sell in the ballpark of $1.5 million to $2 million; Avanti IIs for $2 million-$3.5 million; and EVOs for $5 million-$8 million, depending on how new they are, Mobley said. There are a lot of variables in pricing, he added, such as for engine time remaining, landing gear overhaul status or airframes that have had Garmin's GTN 750 avionics interface installed.

Which other types compete for sales with the P.180 Avanti? "This is interesting, because I think most [prospective buyers] that approach us for pre-owned or new aircraft aren't really considering anything else," Mobley said. "They just want a Piaggio.

During EBACE, Piaggio introduced a quick-change shuttle configuration of the Avanti with high density seating for seven passengers.
Credit: Piaggio Aerospace

"If I had to suggest general competition for the aircraft, I'd say probably the Cessna CJ2/3/4 series rather than any other turboprop," he said. "Simply because the P.180 can provide a much nicer cabin experience for less fuel. There is a speed difference for sure, but depending on the trip, it may not be massively significant."

Reconfigurable Cabin

The Avanti EVO cabin is pressurized and measures 5.74 ft. high, 6.07 ft. wide and 14.92 ft. long. Its external baggage compartment holds up to 350 lb. There are several different cabin configurations available—the typical executive layout is for six passengers and one pilot—and include galley space and an enclosed lavatory with a belted seat aft. At the European Business Aviation Conference & Exhibition in May in Geneva, Piaggio introduced a quick-change shuttle configuration with high density seating for seven passengers that can be reconfigured for cargo or medevac operations.

Basic hourly maintenance intervals for the Avanti start at 200 hr., followed by a B check at 600 hr., C check at 1,800 hr. and D check at 3,600 hr. "The landing gear overhaul is very expensive and a heavily discussed item but is only due at either 12-year intervals or 6,000 landings, whichever occurs first," Mobley said. Engine intervals are the same as other similar PT6s, with hot section inspection at 1,800 hr. and overhaul at 3,600 hr.

"Factory support is always discussed with potential buyers," Mobley said. "Sometimes it can be problematic, and sometimes operators must rely on used or 'as removed' parts, but Piaggio does work actively to support the aircraft.

"But they aren't a massive corporation with thousands of aircraft in operation, so they don't have the economies of scale that Textron might, so parts can be expensive, and things don't always move quickly," he added. "It

is probably also worth noting that from what we've heard in other markets, there are still a lot of supply chain issues right now industrywide."

BCA welcomes comment and insight from aircraft dealers and brokers for its monthly 20/Twenty pre-owned aircraft market feature. The focus aircraft for July 2023 is the Piper M600 and for August 2023 the Pilatus PC-12. To participate, contact bill.carey@aviationweek.com.

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*—Based in Washington, D.C., **Bill** covers business aviation and advanced air mobility for Aviation Week Network. A former newspaper reporter, he has also covered the airline industry, military aviation, commercial space and unmanned aircraft systems. He is the author of 'Enter The Drones, The FAA and UAVs in America,' published in 2016.*

IMPACT

The Crash of Asiana 214– 10 Years Later

There's a saying that a good landing starts with a good approach. The pilots of Asiana flight 214 didn't manage their approach well and crashed into a seawall.

NTSB

IMPACT

Robert L Sumwalt

When Asiana flight 214 crashed at San Francisco International Airport (SFO) on July 6, 2013, many in the aviation community were incredulous. There were cries of “How could an airline crew with three pilots on the flight deck crash a perfectly good airplane on visual approach on a perfectly clear day with light winds?” Like many crashes that I dealt with while at NTSB, the causation of this accident was complex and involved the interaction of several elements of the system. Those elements collided on this day, just as Asiana 214 collided with the seawall surrounding the airport.

The Boeing 777 was approaching SFO runway 28L when it careened onto the airport at the completion of a 10 ½ hour flight from South Korea. The captain was completing his initial operating experience to wrap-up his PIC qualifications on the 777. His total flying time was around 9,700 hours, including 45 in the 777. He was transitioning from the Airbus 320 where he had been a check airman. With 12,000 total hours, including over 3,200 in the 777, the check pilot occupied the right seat. This was his first trip as an instructor. The third pilot was the relief first officer who was sitting on the jumpseat.

Setting the stage for the crash were fatigued pilots, which NTSB found likely degraded their performance. The two pilots were new in their respective roles. Combine these factors with an airline culture that didn't promote manual flying and widespread misunderstandings of the limitations of the Boeing 777's Automatic Flight Control System (AFCS), and you have a formula for disaster. Central to this crash was the notion of *expectancy*; the captain *expected* the airplane to do something it wasn't designed to do. Specifically, he expected the autothrottle system to provide speed control for him, but unbeknownst to him, the system would not do so while in a certain autothrottle mode. Not only did this captain not understand this part of the autothrottle system – other, more experienced 777 pilots referred to this as the "FLCH Trap."

The 777 AFCS controls the autopilot and autothrottle. As with most highly automated autoflight systems, there are several modes and sub modes. "FLCH" is an abbreviation for the AFCS Flight Level Change mode. It is used for two things: To climb to a preselected altitude above you with climb thrust, and to descend to a preselected altitude below you with idle thrust. In the decent mode, once the throttles reach the idle stop for two seconds, they transition into HOLD mode. In this mode, the throttles are disengaged from the autothrottle servos and will not move until commanded by the AFCS or the pilot.

If engaged, the autothrottles will not allow speed to drop below the commanded speed. The autothrottle logic also has a nice speed protection feature: If the autothrottles are disconnected with the autothrottle

disconnect switch on the side of the throttles, they will reengage ("wake up") and apply thrust to protect speed if airspeed gets too slow. This autothrottle wake up feature was demonstrated to the captain during simulator training. Impressed with this protection system, the captain told investigators that he was "astonished" that the airplane would do this.

FLCH can be used several times during flight, which presents a paradox: If the AT are completely disconnected, they will wake up and apply thrust if airspeed gets slow. However, if they are still connected, but in the HOLD mode as a result of FLCH, or as a result of being manually overridden by the pilot, the autothrottles will not wake up if speed gets slow. Oddly, neither Asiana's training nor Boeing's manuals mentioned this situation, a

This shows how HOLD would be annunciated on the Flight Mode Annunciator. Credit: NTSB

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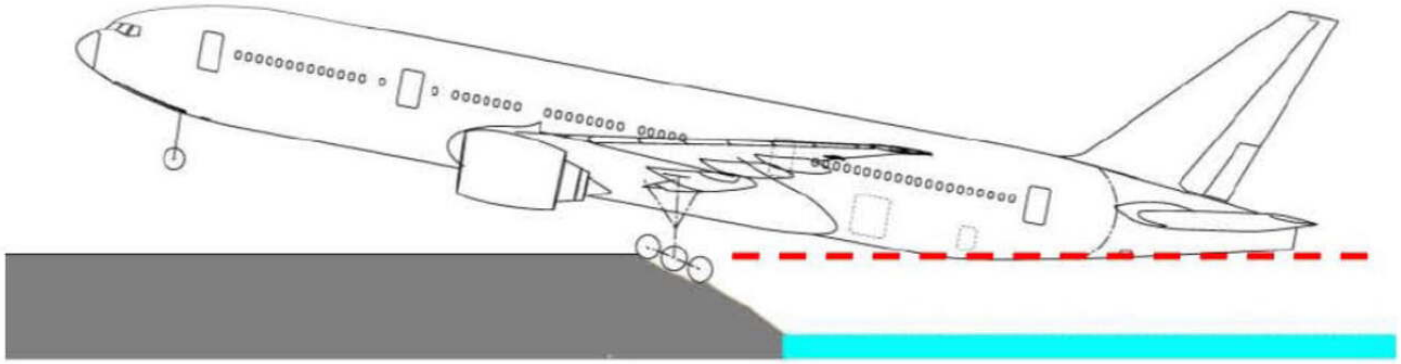
factor NTSB found contributed to the crash. In fact, even the ground instructor who taught the captain's class did not understand this nuance. Before the board meeting where we wrapped up this investigation, I asked the head of 777 training for a large US airline how well this autothrottle "failure to wake-up while in HOLD mode" was understood prior to this accident. He replied that it was not well understood at all. Shockingly, four years after this crash, where the FLCH trap became even widely discussed, I found myself on the jumpseat of a 777 of a United Air Lines flight. I asked the captain if the autothrottles would wake up if thrust was idle and in a HOLD mode. He got the answer wrong.

Put bluntly, the captain of Asiana 214 mismanaged the approach. He started out high and through a series of manipulations of the AFCS, he placed the system in FLCH. However, because the altitude set in the altitude window of mode control panel was above them, the autothrottles advanced to climb thrust – not idle as he expected. Not understanding this action, he manually pulled the throttles to idle and held them long enough for them to placed in HOLD. Now descending at idle thrust, the aircraft was passing through 500 feet with a descent rate of 1,200 fpm. The aircraft was also descending through PAPI glade path. (The glideslope was out of service). At this point, he did what would have worked on the Airbus, the aircraft that he was just transitioning from, and would have worked on the 777 had he not unintentionally placed the throttles in a HOLD mode - he pulled back on the control column to get back on the proper glidepath. Because the throttles were in HOLD, they would not increase thrust as the captain expected.

In concentrating on the below glidepath situation, believing the autothrottles would take care of speed, NTSB concluded that the captain focused on getting the aircraft back on a proper glidepath and discontinued monitoring airspeed. NTSB analysis was that the captain did not monitor airspeed for at least 24 seconds, and the check pilot didn't monitor speed for at least 17



Estimated aircraft position at impact with seawall. Credit: NTSB

seconds. According to NTSB: "Human factors research has demonstrated that system operators often become complacent about monitoring highly reliable automated systems when they develop a high degree of trust in those systems and when manual tasks compete with automated tasks for operator attention." The captain had developed trust that the autothrottle would take care of speed, so as he focused exclusively on getting back on the proper glidepath he dropped his scan of airspeed. "Thus, the flight crew's inadequate monitoring of airspeed and thrust indications appears to fit this pattern involving automation reliance," stated NTSB.

As the captain pulled back on the control column to recapture the glide path, airspeed continued to drop. Vref for this approach was 132 kts. Including a 5 kt additive, the approach was to be flown at 137 kts. Airspeed remained below approach target speed for 28 seconds, ultimately reaching 110 kts before the check pilot reacted. At 90 feet agl the check pilot yelled "speed," added full thrust and pulled the control column full aft. Unfortunately, it was too little, too late. The aircraft careened into the seawall and cartwheeled across the runway and burst into flames. Of the three fatalities, NTSB found that two of those were not wearing seat belts and likely would have survived the crash had seat belts been worn. Remarkably, of the 303 occupants, 255 received either no or minor injuries.

One of NTSB findings was "If the autothrottle automatic engagement function ('wakeup'), or a system with similar functionality, had been available during the final approach, it would likely have activated and increased power about 20 seconds before impact, which may have prevented the accident."

Despite that finding, I was outvoted in a 3-1 vote for a safety recommendation for Boeing to redesign the autothrottle wake up logic. I'm pleased to say that a few years after the Asiana crash, Boeing did just what I pushed for – they modified the 777 autothrottle logic so they now will wake up even if autothrottles are in HOLD.

The investigation found that Asiana had a culture that promoted heavy use of flight path automation with little emphasis on manual flying. An Asiana contract simulator instructor told investigators that manual flying was a "big scare for everybody," and he believed that pilots avoided flying manually because of concern that they might do something wrong. The chief pilot told NTSB that turning off the autopilot at eight miles from the airport at 2,800 ft would not be recommended. Asiana provided NTSB with data that showed that nearly 20 percent of Asiana's 777 landings were auto-lands. I compare this to my airline days where the only time we did an Autoland was on Cat 2 and 3 landings.

NTSB stated concluded that "by encouraging flight crews to manually fly the airplane before the last 1,000 ft of the approach, Asiana Airlines would improve its pilots' abilities to cope with maneuvering changes commonly experienced at major airports and would allow them to be more proficient in establishing stabilized approaches under demanding conditions…" The ensuing NTSB recommendation to Asiana was sensible and to the point: "Modify your automation policy to provide for more manual flight, both in training and in line operations, to improve pilot proficiency."

As you think about this crash, ask yourself how well do you know the hidden corners of your aircraft flight path automation system? Do you have an overreliance on automation? How effectively are you at flight path monitoring? Are your fatigue mitigation strategies effective?

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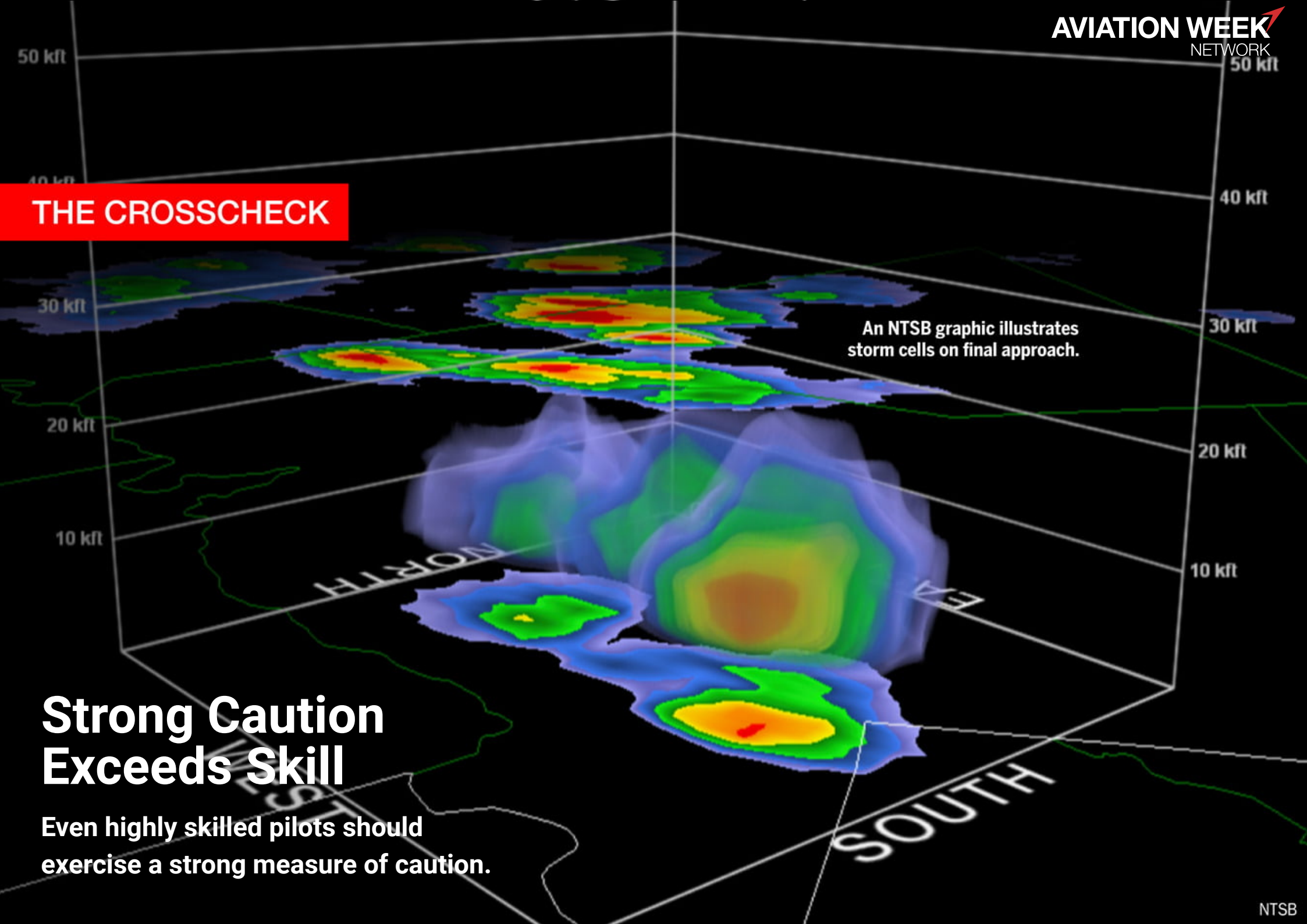
*—**Robert Sumwalt** is executive director for the Boeing Center for Aviation and Aerospace Safety at Embry-Riddle Aeronautical University. He was a member of the NTSB from 2006-21, including being chairman from 2017-21. Before that he managed a corporate flight department for a Fortune 500 company, and previously was a pilot for US Airways and Piedmont Airlines.*

THE CROSSCHECK



An NTSB graphic illustrates storm cells on final approach.

Strong Caution Exceeds Skill

Even highly skilled pilots should exercise a strong measure of caution.

NTSB

Roger Cox

One of the most enjoyable parts of flying professionally is you get to meet and fly with pilots from all different backgrounds. Many have had colorful experiences and have some good stories to tell. A pilot I'll call Will had a story that was most memorable for me.

Sometime in the 1990s I flew a trip with Will and I thought he was a terrific pilot. I don't remember many of my copilots unless I see them again or fly with them a few times, but Will stood out. I just remembered how professional he was doing checklists, following SOPs and flying precisely when it was his turn to fly.

Will was not a big talker or a braggart. He and I had the usual cockpit conversations at cruise, and somewhere along the line I asked him what he flew in the Air Force. He said the F-111, and that led to more conversation. I knew some pilots who flew that famous airplane, and I wanted to know a little more about it. Eventually, he mentioned that he flew the raid on Libya in 1986. In fact, the way he put it, he was the one who "put a bomb through Gaddafi's window."

Will went on to talk about having to fly a circuitous route from England

through the Gates of Gibraltar for diplomatic reasons and having to hit the tanker multiple times to get to Libya and back. I remembered the raid and the terrorism accusations against Gaddafi and President Reagan deciding enough was enough. When Will talked about it, he was very matter-of-fact, and everything he said rang true. His story and his skills matched.

Tail Strike In Charlotte

Some years later, I retired and took a job doing accident investigations with the NTSB. In 2015, my division chief dropped by my office and assigned me to work on an American Airlines accident in Charlotte. I got busy and called the head of the safety department at American to get the names and background information about the pilots involved. When he told me Will was the captain, I immediately remembered him and what a good job he had done when we flew together.

The NTSB is very concerned about improprieties. The board avoids having even the appearance of bias during an investigation. I walked into my chief's office and told him that I'd be glad to proceed with the investigation, but he should be aware of the appearance of partiality. He reassigned the case to one of my colleagues, who did his usual fine job.

The Airbus A321 that Will was flying had a tail strike while he was attempting to land on runway 36L at Charlotte, causing damage to the airplane and the runway. The A321 is 146 ft. in length. It is a stretched version of the standard A320, which is 123 ft., 3 in. long. Stretched airplanes have less tail clearance than standard airplanes when they land, and thus

are more prone to tail strikes. In addition, Will was dealing with a deceptive wind condition which he misjudged.

When you parse out the details of what happened in the last few moments of the approach, you can understand how Will and his copilot were working with conflicting information about the wind. On the one hand, Charlotte was landing to the north despite a prevailing 6 kt. tailwind. That was within the airplane's approved limitations. There was a wind shear advisory in effect, but that is not unusual. Pilots land in convective conditions all the time.

On the other hand, they flew through a rain shower that temporarily obscured their view of the runway, and they observed another rain cell right

Damage from a tail strike is evident to the underside of this fuselage.
Credit: NTSB

over the runway end. The tower advised them of a wind shear alert with a 20-kt. loss of airspeed on one mile final and advised that another aircraft had reported 8-15 kt. airspeed gains at 300 ft.

Finally, Will chose to land with flaps full instead of flaps 3. Flaps full creates more drag and makes it easier to stop on a slippery runway. The runway was wet from recent rain. Flaps 3 is recommended for landing in windy conditions. It makes a go-around easier. He had to weigh the conflicting guidance and decide. He made the wrong call.

At 2.8 sec. before the airplane impacted the runway, a "Windshear, Windshear, Windshear," aural alert sounded. Will applied maximum thrust, but the airplane struck the runway hard as the crew commenced the go-around. They made another circuit of the field and landed safely. There were no injuries to the 159 persons aboard.

Analysis of the flight data recorder (FDR) showed the airplane entered a small microburst on short final about 7 sec. prior to the landing attempt. The wind shifted from a headwind of 15 kt. to a tailwind of 15 kt., then back to a headwind. The vertical acceleration at landing was 2.6 Gs.

The NTSB's probable cause was "an encounter with a small microburst on short final at low altitude that resulted in a loss of lift and a tail strike during the go-around. Contributing to the accident was the captain's decision to continue the approach without applying appropriate windshear precautions in accordance with published guidance."

In retrospect, Will used poor judgment in continuing the approach. However, every one of us who has flown in and out of the big airports has had to pick our way through windy, rainy conditions while trying to decide which of the many information sources we are seeing and hearing are the most believable. The choices aren't always obvious.

Highly skillful pilots can be overconfident. Even if you know you can handle adverse winds, last-moment wind shear accelerations can't be stopped. Skill can't save you. That's when a strong measure of caution exceeds a high level of skill in importance.

—A former military, corporate and airline pilot, ***Roger Cox*** *was also a senior investigator at the NTSB. He writes about aviation safety issues.*

CAUSE & CIRCUMSTANCE

Ice-Induced Hard Landings

An EMB-500 hard landing in Paris and related incidents.

Phenom ice-protection panel.

CAUSE & CIRCUMSTANCE

Roger Cox

A charter crew approached Paris Le Bourget Airport in their Embraer EMB-500 Phenom 100 on the morning of Feb. 8, 2021. The wing and stabilizer de-icing system was not turned on when they passed through a layer of freezing clouds on final approach, and at 50 ft. above the runway, the airplane stalled. It descended rapidly and the recorders, FDR and CVR stopped when the airplane struck the runway. That happens when the G-load exceeds 5gs.

The crew did not forget to turn on the "Wingstab" de-icing system; they made a conscious decision to leave it off. Other Phenom pilots before them had made the same decision in similar circumstances, with the same results. One such accident took place in Germany in 2013 and another took place in the U.S. in 2014.

After those accidents, both the German BFU and the American NTSB made recommendations to prevent such accidents, but they weren't entirely successful. The French Bureau d'Enquetes et d'Analyses (BEA) analyzed the Paris accident and came up with an additional insight that might be more helpful.

9H-FAM accident site. Credit BEA France

The accident flight departed Venice, Italy, at 0917 Paris local time and climbed to FL 340. The charter flight carried a two-pilot crew and one passenger. The co-pilot was the pilot flying. While enroute, the crew discussed the possibility of snow and a contaminated runway at Le Bourget and they tested the anti-icing system to ensure it was working. About 45 min. before landing, and before listening to the terminal information broadcast (ATIS), they briefed the normal clean-wing approach speeds. Those speeds were 97 kt. Vref, 102 kt. VAC (approach climb speed), and 121 kt. for VFS (final segment speed).

When they listened to the ATIS, it reported that the temperature was -1C (30F) and the dew point -3C and that there was severe icing between 3,000 ft. and 5,000 ft. The captain discounted this information, saying there was no snow and that icing was common near Le Bourget. The crew briefed the ILS approach to runway 27, planning to use full flaps and autopilot engaged. They did not consider any changes to the approach speeds.

Ten minutes before landing, the crew turned on the engine anti-icing and windshield demist/de-icing systems. As they intercepted the localizer, the crew activated the Wingstab de-icing system. Only 21 sec. later, after observing ice breaking off the wings, they turned that system off. They intercepted the glide slope, switched to the tower and were cleared to land on runway 27. They ran the before-landing checklist, and the captain turned off the engine anti-icing system.

The captain later stated that the cloud layer began just below 5,000 ft. and ended at 2,000 ft., and there was another thin layer at 1,500 ft. He did not see ice forming on the wing after he turned off the de-icing system.

At 300 ft. above the approach end of the runway, the airplane was stabilized at 100 kt. IAS and the autopilot was disengaged. Then the airplane began slowing and sinking, with the airspeed falling to 90 kt. and the angle-of-attack (AOA) increasing to 28 deg. The wings began to rock and the sink rate increased to 960 fpm. The captain, saying the airplane was too high on the glide slope, took control. The “STALL STALL” aural warning sounded and the captain attempted to advance power for a go-around. The airplane stalled in a 10-deg. right bank and landed hard.

The airplane came down only 33 ft. past the runway 27 displaced threshold and slid 3,445 ft. before veering off the left side of the runway and pivoting around to a heading of 160 deg. The nose gear broke off and the right main landing gear penetrated the right wing and the right fuel tank. A fire broke out near the wing root, but the occupants were able to safely evacuate the burning airplane. Aircraft Rescue and Fire Fighting Service (ARFF) responded and doused the fire.

Le Bourget I (LFPB) has a tangle of runways, with the shortest being runway 27, at 6,060 ft. The airport is historic. It opened in 1919 and was the landing site for Charles Lindbergh after he first crossed the Atlantic Ocean solo in 1927. Coincidentally, it is also the home of the BEA. Investigators had only a short walk across the field to begin their examination of the wreckage of the Phenom. Upon their arrival, BEA investigators immediately noticed a build-up of ice along the leading edges of the wings and stabilizer.

After the initial visit to the accident site, the BEA organized the investigation according ICAO Annex 13. They brought in representatives from Brazil as the state of manufacture and Malta as the state of the operator. Brazil, in turn, brought in technical advisors from Embraer and Malta brought in advisors from Luxwing, the operator.

The investigation began with a focus on the design and operation of the airplane's de-icing and anti-icing systems, the stall warning system (SWPS) and the airplane's performance in icing conditions. The Phenom has three de-icing/anti-icing systems - thermal, for the engine intakes, electric, for the

Phenom ice-protection panel. Credit BFU Germany

probes and windshield, and pneumatic, for the wing and stabilizer leading edges. The pneumatic system inflates and deflates leading-edge boots--four on the wings and two on the stabilizer. Some Phenoms are also equipped with an ice detector, but the accident airplane, 9H-FAM, was not.

The Embraer Phenom flight manual says that the Wingstab de-icing system

must be turned on as soon as the total outside air temperature is less than 5C in the presence of visible moisture, even when there are no signs of ice accretion. A warning in the manual says “The ice protection system must be kept on until the crew is certain all ice has been removed.” When the de-icing system is switched on, the stall warning system and the low-speed awareness tape in the airspeed indicators adjust upward. The difference is significant.

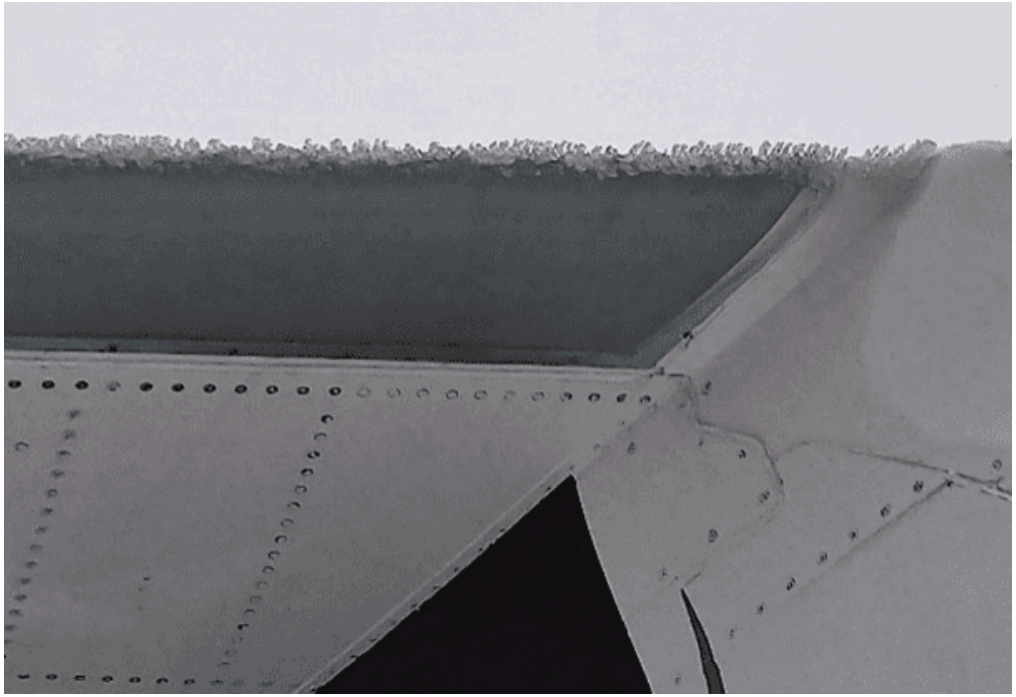
For the conditions of the accident flight, the Vref speed without the de-icing system on was calculated to be 96 kt., but with the Wingstab and engine anti-icing system on, the calculated Vref was 119 kt.

The calculated landing distance for the accident flight was only 4,252 ft., flying at the lower Vref speed and leaving the anti-icing and de-icing systems off. With the equipment on, the calculated landing distance was 7,549 ft., which exceeded the length of runway 27. In addition, the one-engine-inoperative climb gradient was negative, meaning the airplane could not conduct a missed approach with the de-icing system on.

A review of the FDR showed that 3.8 nm from the airport at 1,380 ft, the flight was maintaining 135 kt. It had slowed to 100 kt. by the time it was at 468 ft. An Embraer simulation showed that the stall warning came very close to activating three times during the approach before it activated at the end of the flight.

The BEA interviewed the pilot of a Piaggio P180 who flew an approach to the airport about 10 min. before the Phenom. He said his visual ice-accretion probe accumulated so much ice that he took a photo of it. He provided that photo to the investigation, and it does indeed show a massive ice buildup on the probe.

The 40-year-old Phenom captain had logged 3,625 total flight hours,



9H-FAM ice on stabilizer. Credit BEA

including 2,961 on the EMB-500. He had worked at the charter company for 8 years. The co-pilot, age 25, had logged 625 flight hours, including 425 in the EMB-500. His commercial license and EMB-500 type rating were less than a year old at the time of the accident. Both pilots had completed training on de-icing/anti-icing procedures and systems in the last year.

The captain said in a statement that he knew that the aircraft's landing performance would not permit landing at Le Bourget Airport if the icing conditions on approach required the continuous use of the de-icing systems until landing. He said that after coming out of the cloud layer at 2,000 ft. he saw no more ice on the wings, so he deactivated the de-icing and anti-icing. He also said he knew he would have to divert if he left the de-icing system on.

The captain's statement prompted the BEA to talk to other Phenom pilots and to review online Phenom pilot forums. One Phenom pilot said he had been unofficially taught that he could deactivate the de-icing systems after 1,000 ft. if the leading edges of the wings were not contaminated by ice. Another pilot, speaking anonymously on a forum, said "Frequently, in the Northeast, accompanied by bad weather and icing. Phenom book Vref increases when hots re on. For some reason Cessna does not have the same requirements. Spoke with one pilot who did a lot of 100 flying in cold wx. Said that as soon as he cleared the clouds on approach, would turn off the hots so that he could approach and land at normal speeds. Seems reasonable, as long as you remember to turn them back on if you need to go missed."

The flight's operator, Luxwing, had a fleet of 21 business jets, including 7 Phenom 100's. Its flight operations department was supposed to check that the landing performance of its airplanes was adequate for the forecast conditions at the destination airports. Apparently, they did not do that for the Paris flight.

Recommendations from Previous Accidents

In February of 2013, a Phenom pilot lost control of the airplane in the flare while attempting to land at Berlin-Schönefeld airport in Germany. The German safety investigation agency, the BFU, found that the crew flew the approach in known icing conditions and did not activate the wing and horizontal stabilizer de-icing system. A build-up of ice on the wings and the horizontal stabilizer and the flight's slow approach speed caused the airplane to stall.

The agency thought the crew did not understand the connection between the de-icing system and the stall warning system and recommended additional training for pilots receiving EMB-500 type rating training.

In December 2014, another Phenom 100 crashed while on approach to Gaithersburg airport (GAI) in Maryland. The three people on board and three other people on the ground were fatally injured. The NTSB said the probable cause of the accident was "the pilot carrying out an approach at a landing speed below that recommended in the manufacturer's normal procedures in icing conditions and the non-activation of the wing and horizontal stabilizer de-ice system. The combination of these two factors led to a stall at an

altitude which made recovery impossible."

The pilot was flying at the appropriate speed for non-icing conditions. He was probably very concerned about stopping on GAI's 4,202 ft long runway 14. He had a previous runway excursion at that airport in another type of airplane and would have been very aware of the landing distances required. If he had attempted to land with the de-icing system on, even if he performed a flawless approach and touchdown, he would have only had about 100 ft. margin to be able to stop. With the de-icing system off, he had about a 1,700 ft stopping margin. In addition, with the de-icing system on, he did not have a sufficient rate of climb on one engine to conduct the approach.

As with the BFU, the NTSB recommended better training. They asked the National Business Aviation Association, manufacturers and training providers to develop better pilot training for winter weather. They also recommended that FAA and the General Aviation Manufacturers Association develop automatic icing alert systems.

A problem with the training recommendations is that the pilots in both the Berlin accident and the Gaithersburg accident probably knew that they were operating in violation of Embraer's flight manual warning. Lack of adherence to a warning or standard operating procedure (SOP) is not a training issue, it's a compliance issue.

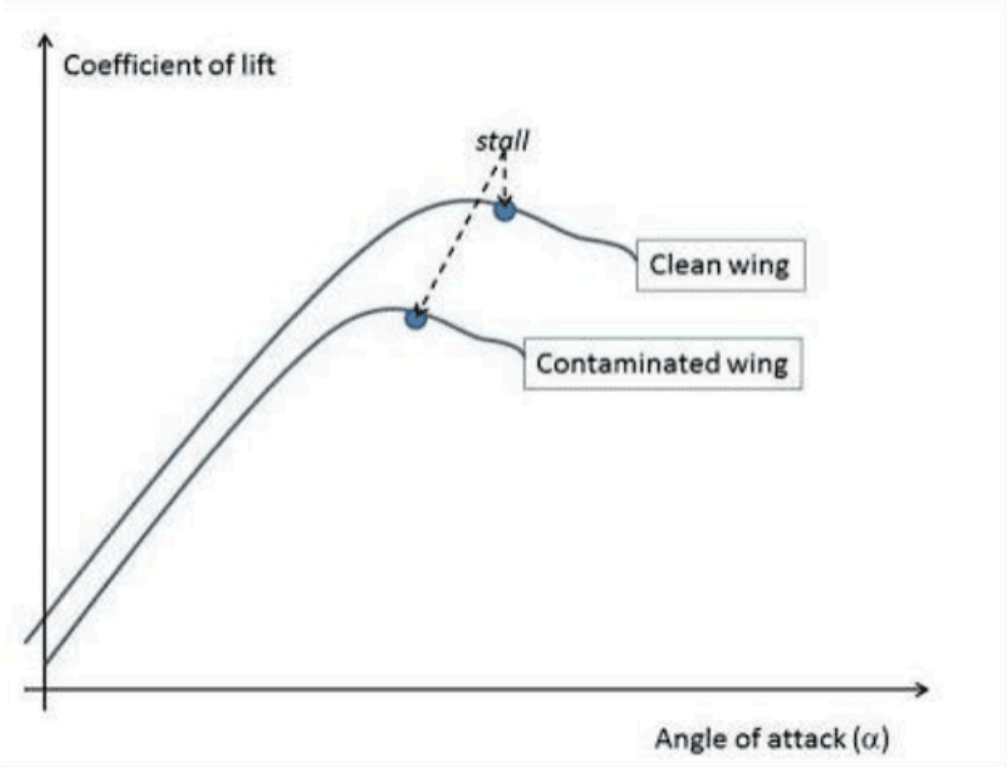
The automatic icing alert system recommendation seems like a better idea. The NTSB's recommendation was directed at turbofan airplanes that require a type rating, are certified for single-pilot operation and flight in icing conditions. The concern is that solo pilots flying turbine-powered airplanes in bad weather are so busy that they may not notice when the temperature and moisture require de-icing equipment to be turned on, and an icing light would be a helpful reminder.

Unfortunately, the accident record shows that ice detectors are not foolproof. A case in the NTSB's database illustrates the point.

Ice Detectors Not Foolproof

In February 2014, 10 months before the Gaithersburg crash, an Embraer EMB-145 regional airliner had a hard landing in icing conditions at Memphis, Tennessee. There were no injuries to the 44 passengers on board. While the first officer was applying control inputs to adjust for a crosswind, there was a rapid roll to the right, a wing strike and substantial damage to the airplane. The airplane was examined about 40 min. after parking at the gate, and there was an accretion of ice on the leading edge of both wings.

The airplane was equipped with two ice-detector units, with sensors located on both sides of the nose. The airplane's ice-protection system uses either bleed air or electrical power and is fully automatic. When either of the ice detectors detect ice, an advisory message "ICE CONDITION" is shown on the EICAS display, and a signal is sent to the anti-icing system valves to activate them to open, and a signal is sent to the full authority digital engine control (FADEC) to activate the automated engine icing thrust setting. The ice



Effects of contamination on lift. Credit BEA

detectors are self-monitored and activate a caution message when a detector fails.

The last ATIS broadcast before the accident reported tower visibility of 1/2 mile, ceiling overcast at 400 ft. agl, temperature 1C, and dew point temperature -1C. An NTSB aircraft performance study showed that the airplane was in icing conditions for at least 20 min. before the accident. However, the ice-detection system never activated.

The study concluded that the right roll happened due to ice buildup, but the airplane did not experience a full stall. There was enough ice to create flow separation on one wing in the flare but not enough to affect control of the aircraft during the approach.

The ice-detection and anti-icing systems were tested, both on the airplane and at the manufacturer's facility, and no faults were found.

The company's airplane operating manual and SOPs said the crew was responsible for monitoring icing conditions and manually operating the ice-protection system if necessary. However, the company's flight standards manager said manual operation of the anti-icing/de-icing systems was not emphasized in training.

The NTSB could not determine why the automatic ice-detection and protection system did not work. They concluded that the crew failed to adequately monitor the system.

The Memphis accident proved that while an ice detector can be useful, it is easy to over-rely on the system and that there is no substitute for the crew to actively monitor ice conditions and the status of protection systems.

9H-FAM. Credit BEA and jetphotos.com

Conclusions and Comments

In the Paris case, the BEA did not provide a succinct probable cause statement, but provided a concluding discussion. They said the ice on the leading edge of 9H-FAM did not fully break off when the de-icing system was used, and it reformed. The stall warning system (SWPS) was not configured to alert the crew that they were flying close to stall speed. The pilots either didn't see the ice buildup or ignored it.

They then said that the aircraft's landing performance penalties in icing conditions frequently caused crews to make risky approaches. "Commercial pressures associated with this type of operation may encourage crews not to comply with the proper procedures for the approach and landing in icing conditions by deactivating the de-ice systems as soon as they visually observe that the leading edges of the wings are free of ice," wrote the BEA. In addition, "The crews who have to fly in icing conditions are then faced with difficult choices: either refuse to carry out the flight, or accept a very high probability of diversion, or lastly accept a deviation from procedures and take the risk of landing with a contaminated aircraft."

As with the NTSB, the BEA recommended ice detectors on all EMB-500 Phenom 100 aircraft. The Phenoms equipped with a Garmin G3000 avionics suite already have ice detectors, and Embraer issued a service bulletin in October 2019 that permitted installation of an ice detector on the other Phenom's that have the older G1000 suite. As of November 2021, 39 out of 376 Phenom 100's had ice detectors installed.

They also recommended that operators pay more attention to the performance limitations of the aircraft when choosing the type of aircraft for each mission, and that the European Union Aviation Safety Agency (EASA) revise certification criteria to include icing performance issues that are hard for crews to manage.

From my perspective, it appears that the Paris crew was put in the position of choosing between having to land without using their de-icing equipment or failing to deliver their passenger to his intended destination. Furthermore, this has been a common dilemma for crews.

Better training, ice detectors, and more conservative and safety-oriented flight planning should all help to prevent this type of accident. I would add the following simple rules:

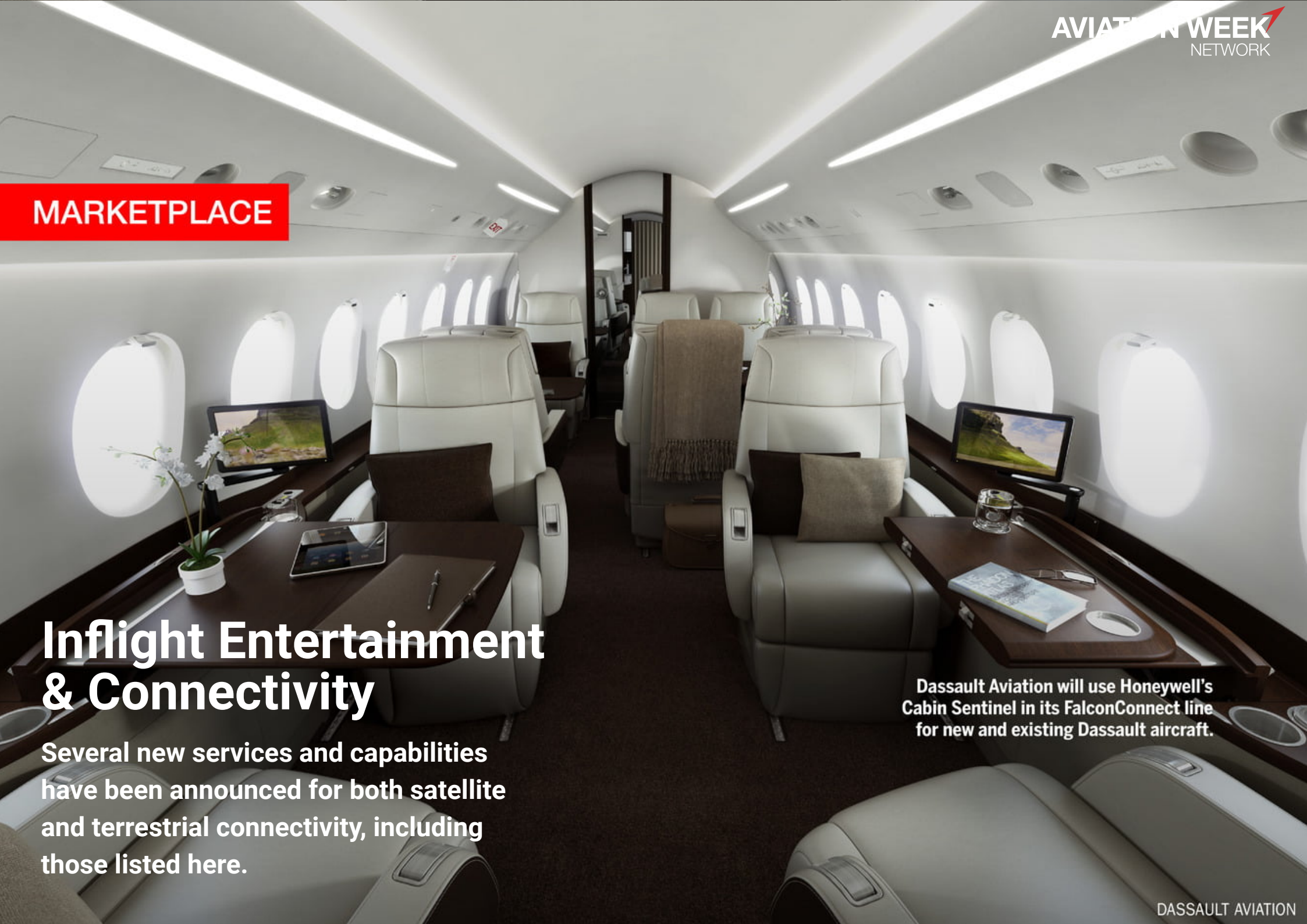
- There is no substitute for disciplined adherence to flight operations manual limitations, procedures and warnings.
- It is always necessary to monitor ambient temperatures and moisture.
- It is dangerous to dispatch a flight to a destination with forecast icing conditions when you know the airplane cannot land with the de-icing equipment on.

—A former military, corporate and airline pilot, ***Roger Cox*** *was also a senior investigator at the NTSB. He writes about aviation safety issues.*

MARKETPLACE

Inflight Entertainment & Connectivity

Several new services and capabilities have been announced for both satellite and terrestrial connectivity, including those listed here.



Dassault Aviation will use Honeywell's Cabin Sentinel in its FalconConnect line for new and existing Dassault aircraft.

DASSAULT AVIATION

MARKETPLACE

Jeremy Kariuki

Improved Data Management
Company: Honeywell Aerospace
Product: Connectivity Software Suite

Honeywell's new cabin connectivity monitoring and support software suite, branded Cabin Sentinel, is designed to give customers more control over inflight data usage to help reduce monthly connectivity costs. The suite allows customers to manage data, including content blocking, media prioritization, and notifications for data usage limits and coverage area updates.

Cabin Sentinel offers customer support via Microsoft Teams. According to Honeywell, the company's GoDirect Router provides enhanced security features, including on-wing intrusion detection, alerting suspicious activities up to 50% earlier. Honeywell recently announced Cabin Sentinel's inclusion in Dassault Aviation's FalconConnect line for new and existing Dassault aircraft.

https://marketplace.aviationweek.com/company/honeywell-aerospace-0

L-Band Speed Upgrade
Company: Inmarsat
Product: SwiftJet
Prior to the closing of its acquisition by Viasat on May 31, Inmarsat announced that its newest commercial service, SwiftJet, will provide L-band connectivity at 2.6 Mbps—six times faster than current

Credit: Inmarsat

SwiftBroadband (SBB) service. SwiftJet is designed to provide stable inflight connectivity, including social media and video applications, that have previously been unavailable in the smaller jet market, Inmarsat said.

For existing SBB customers, upgrades to the new service will not require a new externally mounted antenna. The new service also shares the same installation process as other Inmarsat L-band terminals. Viasat's acquisition of Inmarsat portends increased coverage and capabilities once the companies are fully integrated.

https://marketplace.aviationweek.com/company/viasat-inc

Credit: Orbit Communications Systems

Small But Mighty

Company: Orbit Communication Systems

Product: Satcom Terminal

Orbit Communication's next-

generation series of satellite communications terminals, AirTRx, offers broadband Ka-band connectivity in a 12-in. form factor. Designed for mid-size to large business jets, the AirTrx-30Ka features the lowest weight on tail and lowest power consumption of any similarly sized terminal available.

The Orbit terminal provides maximum speeds of 130 Mbps based on two line replaceable units and is compatible with LEO, MEO, HEO and GEO satellite networks, the company says.

https://marketplace.aviationweek.com/company/orbit-communication-systems-ltd

Narrowband Is Broad

Company: Iridium

Product: Certus

Iridium's Certus 700 service offers some of the highest L-band data speeds available, at up to 704 Kbps,

Credit: Iridium Communications

the satellite operator says. Certus is capable of supporting three simultaneous, high-quality voice lines, high-speed streaming and secondary data flows.

Certus is supported by the Iridium Next constellation of 66 cross-linked satellites in low Earth orbit. The Iridium constellation was upgraded from a legacy network of first-generation spacecraft to Iridium Next satellites in 2019.

Iridium has earlier selected Collins Aerospace, Gogo, Cobham, L3 and Thales as value added manufacturers for the design and

production of Certus terminals. It named Collins, Honeywell, Skytrac, Avitek, Navicom Aviation and Gogo as service providers.

https://marketplace.aviationweek.com/company/iridium-satellite-communications

Credit: Bill Carey

Plane And Simple
Company: Satcom Direct
Product: Plane Simple
Satcom Direct's (SD) Plane Simple antenna system features a unique dual dissimilar platform that allows customers to access two separate networks—Intelsat's FlexExec Ku-band network and Inmarsat's JX Ka-band network. The Plane Simple shipset consists of two LRUs, allowing for a cost-effective upgrade path.

SD is developing a new flat-panel, electronically steered satcom antenna for small to mid-sized jets.

https://marketplace.aviationweek.com/company/satcom-direct

A New LEO Contender
Company: Starlink Aviation
Product: Ku-Band Connectivity
Starting this year, SpaceX's Starlink service will begin delivering Ku-band connectivity for business aviation through its network of low Earth orbit satellites (LEO). Starlink Aviation promises data speeds up to 350 Mbps to each aircraft with a low latency of 20 ms.

Aircraft connect to the new LEO service via Starlink's Aero Terminal, a low profile electronically steered phased-array antenna. Starlink offers unlimited data for each plan, with no long-term contracts.

https://marketplace.aviationweek.com/company/starlink-aviation

One Size Fits All
Company: OneWeb
Product: Built for all aircraft types, OneWeb offers inflight connectivity through its constellation of 648 low Earth orbit satellites. The Ku-band constellation delivers latency under 70 ms in every region, the company says. OneWeb's terminals consist of four LRUs and can be replaced in under 30 min.

With the recent completion of OneWeb's satellite constellation, it now meets the threshold for global broadband coverage, making it the second largest satellite constellation in the world.

https://marketplace.aviationweek.com/company/oneweb

Connections To-Go
Company: Gogo Business Aviation
Product: Avance
Gogo's Avance platform is an all-in-one inflight connectivity ecosystem, offering a wide variety of controls for flight data and inflight WiFi, the company says. Avance comes packed with Iridium's L-band voice service, engine trend monitoring and satellite broadband internet.

The Avance platform provides access to Gogo's 3G, 4G and 5G

terrestrial networks with support for third-party routers. Each service is made available through the Gogo Avance app, consolidating all information and control through a single point for the customer.

https://marketplace.aviationweek.com/company/gogo-llc

Air-To-Ground Connection
Company: SmartSky Networks
Product: SmartSky LITE
Combining 5G and 4G LTE features, SmartSky LITE is an air-to-ground (ATG) connectivity solution designed specifically for smaller business aviation aircraft. The system utilizes the same Aircraft Base Radio (ABR) and FDQ Antenna as SmartSky's flagship service.

Aircraft connect to the SmartSky system via a lightweight belly-mount antenna for small jets. As an option, customers can add Honeywell Forge analytics software to help reduce an aircraft's carbon footprint and improve fuel efficiency.

SmartSky LITE has received supplemental type certifications (STC) for several business aircraft types, including the Bombardier Learjet 60. STCs for the Pilatus PC-12 and the Embraer Phenom 100 were in progress.

https://marketplace.aviationweek.com/company/smartsky-networks

AVIATION WEEK NETWORK

VIEWPOINT

The Need To Standardize Aircraft Charter Agreements

KEVIN DIETSCH/GETTY IMAGES

VIEWPOINT

Catherine ‘Cat’ Buchanan

The yachting industry has successfully implemented standardized contracts. So, why haven't standardized charter agreements emerged in business aviation?

The comparison to yachting is perhaps not as precise as it may seem. Yachting is heavily regulated with high barriers to entry, causing many to compare it to a cartel. In contrast, business aviation has few barriers to entry--it is comparatively easy to launch an aircraft charter brokerage, which makes it considerably more difficult to implement standardized documentation across the industry.

Logistically, the two industries are different. Clients must travel to wherever a yacht is moored and empty legs are rare, whereas business aviation fleets often “float” around the world, creating numerous empty legs. This imbalance presents different operational and revenue liabilities between the two industries.

Barriers To Standardization

What has prevented standardization of agreements in business aviation? Business aircraft operators are likely to point to obstacles including cancellation terms, fuel surcharges, AOG (aircraft on ground) contingencies and the inclusion of services, such as catering, Wi-Fi and other amenities.

There also are significant disparities in fleet size, service provision and aircraft ownership among operators. Furthermore, operators typically tailor services to their home market, further compounding disparities in services worldwide.

Benefits To Brokers And Clients

Standardization of terms would, in principle, address issues, such as cancellations and AOG contingencies. If such variables were clearly addressed, negotiations between operators and brokers could potentially be greatly simplified.

Charter clients are also likely to benefit from greater transparency. However, as many operators and brokers will tell you, clients seldom read the fine print in their contracts.

So, could the industry--at least--standardize cancellation terms?

Cancellation terms are often set by aircraft owners and intended to guarantee a minimum revenue stream. But different owners have different priorities. Hence, cancellation terms vary as much as human personalities. However, it would seem logical that standardized cancellation terms would benefit all involved by bringing a greater degree of transparency and

consistency to the business.

Operators of owned fleets would certainly seem to have a vested interest in standardizing cancellation terms, but their motivations may be more influenced by fleet size, the likelihood of reselling a cancelled trip and other factors.

Standardization of cancellation terms may be a mixed blessing for charter brokers because it would reduce haggling, but it could also eliminate a margin.

Aircraft On Ground Situations

When an aircraft is grounded, everyone loses-- time, money or both. But that does not make standardization of terms any easier.

AOGs are difficult to standardize because reactions are functions of individual operators. For example, does an operator have enough aircraft in its fleet to manage its own recovery? Or will it be necessary to sub-charter an aircraft from a third party? The financial implications of each scenario are different.

When it comes to AOG recoveries, brokers sometime complain that liability is unfair. For example, if an aircraft is grounded, an operator can back out of a contract without penalty but if a client cancels, they are subject to a cancellation fee. The alignment of liabilities would seem another benefit of standardization, but movement in this direction has been slow.

Standardization Across Markets

Different regions, cultures and regulators apply different provisions. In the U.S., for example, catering is not usually included in the charter price but domestic Wi-Fi is included. By contrast, in Europe, catering is typically included in the charter price but Wi-Fi is billed based on usage.

To drive standardization, the world's air charter associations, such as the National Business Aviation Association, The Aircraft Charter Association, European Business Aviation Association and others would need to work together to synergize these service provisions. Worldwide standardization of charter agreements would seem to benefit to all concerned.

Will Technology Provoke Change?

Greater standardization across national and regulatory boundaries will facilitate the automation of flight bookings using the latest technologies. As more operators and brokers embrace technology, including automated business operations systems, customer-facing portals and platforms such as Avinode and VOO, the requirement to standardize contracts may increase over time.

Ultimately, technological advancement will benefit the individual client/passenger who will enjoy unprecedented transparency and the ability to book flights with ease.

Conclusions

Despite numerous compelling reasons, it has been difficult to standardize

aircraft charter agreements largely because the business aviation market is so fragmented. Aircraft operators have different requirements and different liabilities, which result in widely disparate agreement terms.

Furthermore, contracts are often a product of hindsight. For example, operators and brokers tend to add contractual clauses in response to coverage shortcomings. Denying operators and brokers the ability to protect themselves with evolving contractual terms would be difficult. Perhaps synergizing key contractual areas would be more acceptable to the industry.

To truly be impactful, the standardization of agreement terms must be based on a coordinated international effort--representing all stakeholders--and will require significant compromise on all sides.

Author's Note: This column was inspired by a panel moderated by Cat Buchanan at EBACE 2023.

—***Catherine 'Cat' Buchanan*** *is director of business development at STACK.aero, a developer of business operations systems for aviation.*

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