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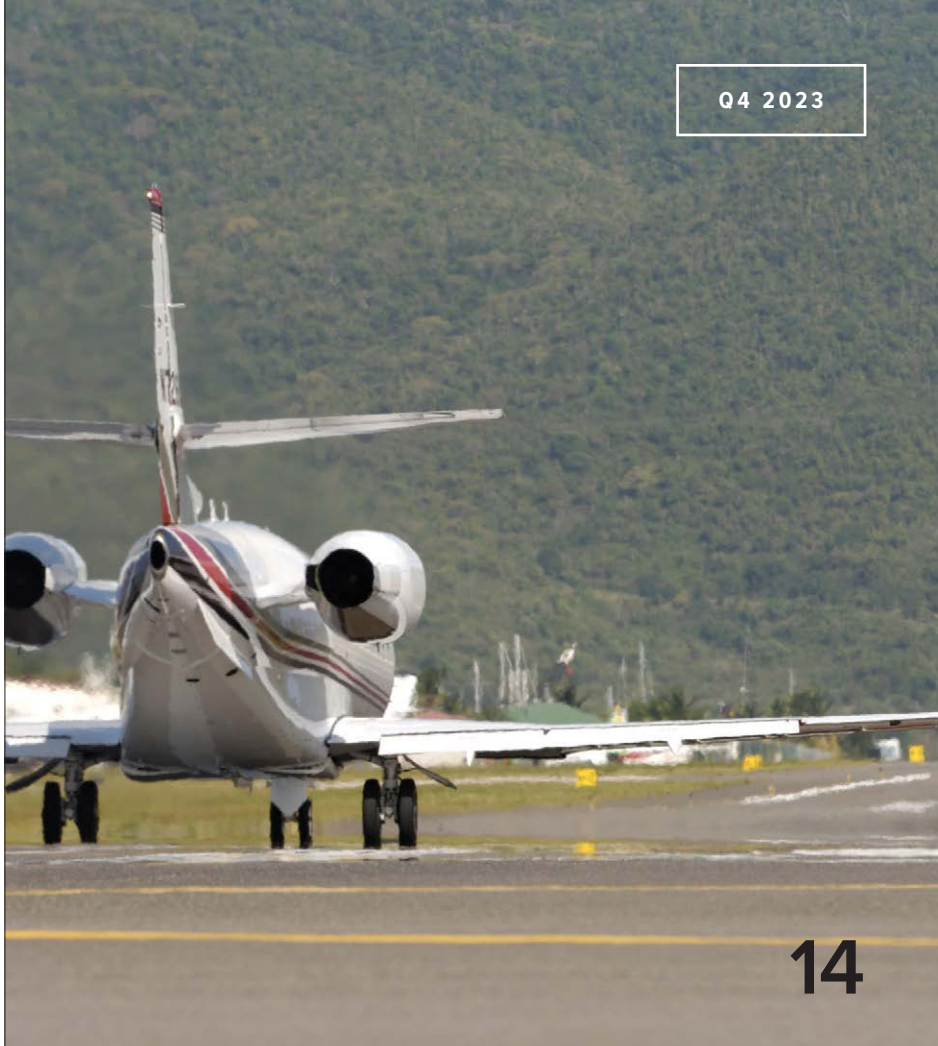
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LEE ANN SHAY
Editor-in-Chief

Sept. 20: Quite the Day

Fractional business jet operations are growing, and with recent announcements, they should continue doing so.

FRACTIONAL BUSINESS JET DEPARTURES are surging this year. WingX calculated that fractional business jet departures are 5.8% higher year-over-year to date, with Cessna Latitude and Embraer Phenom 300 flights each capturing 23% of the flights, followed by Bombardier Challenger 300/350s at 20%. Combined, those mid-size jets represent 66% of the flights so far this year, according to WingX numbers presented at the recent JetNet iQ Summit in September.



TEXTRON AVIATION

NetJets and Flexjet flown hours through August increased 2% and 9%, respectively, year-over-year, while Wheels Up (-13%) and Vista Global (-5%) flight hours decreased.

The WingX presentation points out a big differentiator about these four companies: aircraft utilization. Flexjet (75 hr.) logged the highest monthly average flown hours per aircraft in August, followed by Vista (70 hr.), NetJets (65 hr.) then Wheels Up (35 hr.).

While business aircraft utilization is lower than airline aircraft, the difference between Flexjet and Wheels Up is stark.

Will this change given Wheels Up's new ownership?

Delta Air Lines recently stepped up its investment in Wheels Up. The airline already was the largest shareholder with 20%, but it infused \$15 million in short-term financing on Aug. 8. A week later, Delta announced a deal to rescue the company with other investors—Certaes Management, Knighthead Capital Management and Cox

Enterprise—in exchange for a 95% stake. The deal closed on Sept. 20.

“The partnership will create new opportunities for Wheels Up to drive strategic, operational and financial improvements,” along with leveraging the airline’s “unmatched expertise in premium travel,” Delta CEO Ed Bastian said.

By leveraging Delta, I highly doubt Wheels Up's flight utilization will still average 35 hr. per aircraft this time next year. And given that Delta has been involved with private aviation since 2010 when it launched Air Elite—the first airline that allowed customers to book commercial and private jets in one transaction—it is not new to this side of the business.

And bear in mind Delta invested \$60 million, with the option to increase to \$200 million, in Joby Aviation to seamlessly fly passengers short distances to airports in New York and Los Angeles, so it is indeed thinking about passenger experience in a broader way.

While Delta was closing the Wheels Up agreement Sept. 20, the same day NetJets announced its plan to purchase up to 1,500 additional Cessna Citation business jets over the next 15 years. This enormous deal includes Cessna Citation Ascends, Latitudes and Longitudes—and also makes NetJets the launch customer for the new Citation Ascend. The Ascend, which Textron Aviation announced in May, includes new features such as Garmin G5000 avionics, Pratt & Whitney Canada PW545D engines and a new cabin. Textron expects the Ascend to enter service in 2025.

While neither NetJets nor Textron included a value on this big contract, Jefferies estimates it could be worth \$30 billion to Textron over 15 years.

The mid-size market just got hotter, but note that Flexjet also is in growth mode. It just opened a new \$50 million headquarters and operations center in Cleveland—and a 15-stop tour of its Embraer Praetor 600 super midsize jet, which it just added to its U.S. fleet.

With the NBAA-BACE show coming up mid-October, we could see some interesting announcements.

Best wishes,
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5 QUESTIONS FOR Honda CEO

HIDETO YAMASAKI, who became president and CEO of Honda Aircraft in 2022, talks about the HondaJet 2600 and delivery projections.

1 Honda Aircraft is moving forward with commercialization of the all-new HondaJet 2600 light jet, to be offered alongside its sister, the smaller HondaJet Elite II very light jet. Have you firmed up the interior design and performance specifications?

We are trying to concentrate on the interior. It's going to be a greater concentration of how we're going to express the next generation of what the 2600 will be.

Having all the assets of the total Honda, we do have automobiles, motorcycles and others. We have designers. We have development people who can do those. We are having the automobile guys in Los Angeles drawing the interior sketches (of the 2600) right now. That is now becoming more of an interesting theme. It's going to be changed from—maybe the traditional. We are trying to make some changes and trying to make some kind of a new interior. I cannot say anything that is definite yet. We are still having a trial right now.

In the next NBAA, we will be announcing the naming of the 2600 concept. We have been voting. We will announce the official name that will be in commercialization (of the product).

2 Do you have a launch customer for the HondaJet 2600?

We haven't figured it out yet. We have around 300 letters of interest right now. So, hopefully by NBAA we will try to arrange the kind of pricing so that those customers can actually be more serious. So that we will be able to really see the true, true, true demand. Of course, the 300 is already (an attractive number) that we are looking for. But we will be able to see the more concrete numbers coming in once we start opening some of the features. Most of them came two years ago when we announced (the concept). Maybe about two-thirds of them came in that moment. But the rest of the one-third came after that, including (after) our commitment statement about commercializing it. We are receiving more firm interest.



MOLLY McMILLIN/AW&ST

3 How are you finding the market right now with higher interest rates and other uncertainties?

It's not growing but it's not slipping down. Even with that, the price of the used market is still kind of trending. Given that, demand is very strong. We are not losing any customers. . . . We still have some trouble with enough supply.

4 How many HondaJet Elite II aircraft are you planning to deliver this year?

We are counting right now 28 or around 30. We are producing about that. We don't have any inventory. As much as we can produce, we will be able to deliver. That production is purely based on the supply chain issue that we are facing.

5 What are your delivery projections for 2024?

Next year should be about the same. We are not going to enlarge that much due to the kind of steadiness that we want to do for the business. That is very important right now. We don't want to go up and down, up and down. Steadiness is very much needed for our associates. All the suppliers are very much the same. They want to have the same kind of steadiness.

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WILLIAM GARVEY
Contributing Editor

'Fatcat' Fuel Tax

Grounding business jets won't cleanse the air.

THE FRONT PAGE STORY surely met with smiles or scowls in different Washington offices whose occupants hold contrary views on a matter of increasing sensitivity.

That recent Wall Street Journal article centered on the infrequency that top Boeing executives, and CEO David Calhoun in particular, occupy the company's Arlington, Virginia headquarters. Calhoun, who travels frequently on business and has residences in New Hampshire and South Carolina, ventures into HQ "once or twice a month," according to the Journal. Key facilitators cited were the company's Challenger business jets.

While the information might seem unremarkable to business aviation denizens, it highlights the uneven application of the return-to-office movement and raises questions about corporate aircraft usage. Both considerations help buoy a dubious piece of proposed legislation awkwardly titled the "Fueling Alternative Transportation with a Carbon Aviation Tax" simply to arrive at the acronym, "Fatcat."

Introduced in July by Sen. Edward Markey (D-Mass.) and Rep. Nydia Velazquez (D-N.Y.), the bill calls for increasing the federal tax on business jet fuel from \$0.219/gal to \$1.95/gal. The justification for the 900% hike? Quoting Markey: "Billionaires and the ultra-wealthy are getting a bargain, paying less in taxes each year to fly private and contribute more pollution than millions of drivers combined." And Rep. Velazquez: "It's time for the rich to pay for their pollution."

The crux on their charge is the assertion that with few seats business jets per passenger "pollute up to 14 times more than commercial flights," a calculation attributed to Transport & Environment, a European outfit promoting "zero-emission mobility." The mischaracterization of all "private jet" passengers as "billionaires," "ultra-wealthy" and simply "rich," along with that afore-noted acronym, points to another, less environmentally noble but timeless incentive: Sticking it to the Haves to cheer the Have-Nots.

As with most such proposals, the odds of the bill actually becoming law are long. This one is understandably contested by the National Business Aviation Association (NBAA) that stated, "we oppose efforts to unfairly single out one mode of transportation for punitive tax treatment."

Even if passed, the bill's impact would fall well short of its purported goal of cleansing the environment while helping support public transport, particularly in low income areas. More expensive fuel could curb operations of smaller and older aircraft, but the price of Jet A is much less of a go/no go consideration for operators of expensive, long-range machines. Moreover, The General Aviation Manufacturers Association maintains that the world's business jets are responsible for just 0.04% of global CO₂ emissions, so ground-



BOEING

ing all 22,000 (Source: Aviation Week Network Fleet Discovery) would hardly move the clean-air needle.

And yet, the finger-pointing, name-calling, statistical dueling and airport demonstrations continue unabated. The situation is a matter of continuing and growing concern, an assessment shared by business aviation sages including Dick Van Gemert and Doug Schwartz, among others.

This fight-the-filthy-flyers movement may have taken root in Europe but is growing steadily on the Atlantic's western shores and receiving eager media attention in outlets ranging from The New York Times, CNN and Fox News to the Robb Report, magazines, websites and more. And those in the fore can surprise. Here is businessman and once enthusiastic jet owner Stephen Prince now so upset about his aircraft's emissions, he announced plans to sell it and support the Fatcat legislation. And over there in handcuffs is Abigail Disney (yes, Walt's grandniece and family heiress), under arrest for blocking road access to jets alighting at a Long Island airport favored by sun-seeking swells and others.

The aviation industry has pledged to achieve net-zero emissions primarily through the use of Sustainable Aviation Fuel. Attaining that goal will, hopefully, put an end to the charges of environmental despoilment. However, the self-imposed deadline is a generation off, and I question the acceptance of such a distant target by those accusers. Advancing full compliance by the business jet community would help. A lot.

Meanwhile, at its core, business aviation's purpose is to benefit the many. Consider one stealthy mission in 2009. The assignment of those aboard the company jet touching down one night at a small, remote airstrip was to assess the viability of manufacturing at an international airport 70 mi. distant. Ultimately their findings were so positive that today 7,500 people work at that site to assemble the much-in-demand, fuel-efficient Boeing 787.

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KENT S. JACKSON
Contributing Editor

Interchange Agreements

Trading time for time.

YOUR AIRPLANE IS DOWN for unscheduled maintenance, and the boss needs to fly tomorrow. Your friends at the flight department across the ramp fly virtually identical equipment, and their schedule is clear. Why not just have them fly the boss tomorrow, and you will owe them the favor? If no money changes hands, there should not be any legal problems, right?

With a little pre-planning, there will not be any legal problems with trading time with another flight department, but it would be difficult to get everything done the day before a trip.

Why it's important to understand legal ramifications before swapping flights.



DAVID GOWANS/ALAMY STOCK PHOTO

First, the FAA issues: 14 C.F.R. § 91.501(c)(2) defines an interchange agreement as “an arrangement whereby a person leases his airplane to another person in exchange for equal time, when needed, on the other person’s airplane, and no charge, assessment or fee is made, except that a charge may be made not to exceed the difference between the cost of owning, operating and maintaining the two airplanes.”

If the other flight department is going to fly their aircraft for your company, then they are providing you with a “wet lease,” and you will be wet-leasing your aircraft when you return the favor. “Wet lease” is defined in 14 C.F.R. § 119.3 as “any leasing arrangement whereby a person agrees to provide an entire aircraft and at least one crewmember. A wet lease does not include a code-sharing agreement.”

It is important to understand this definition, because it clears up several misconceptions that are common in the industry. A wet lease has nothing to do with whether fuel is provided as part of the agreement. This rule also shoots down the common belief that it is OK to provide the co-pilot with the plane and state that the lessee has operational control because they provided the pilot in command.

Splitting a crew is not acceptable under the regulation, and experience shows that it may not be safe, either. The 1996 Gulfstream IV accident at Chicago Executive Airport (then called “Palwaukee”) illustrates the importance of pre-planning an airplane swap. The National Transportation Safety Board listed as contributing factors to this fatal accident: “the lack of standardization of the two companies’ operations manuals and interchange agreement.” It is rare for a legal agreement to be listed in the contributing factors to an accident, and it should alert corporate lawyers to the fact that there are worse things in life than a surprise Internal Revenue Service (IRS) audit. This should also alert the flight department to make sure that its insurance carrier approves of and will cover any proposed interchange.

Corporate lawyers will want to know that the IRS considers an interchange 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 interchange flights. This means that each lessor (aircraft provider) 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. Because this is a “barter” arrangement, it is wise to state a value in the interchange agreement for the use of each airplane, so that the accountants know what number to multiply the 7.5% against.

Who can enter into an interchange 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.” Turboprop-powered airplanes are not turbojet-powered, and 14 C.F.R. § 91.501 is not applicable unless the turboprop-powered airplanes are large. In other words, a King Air B200 cannot be part of an interchange agreement, simply because it is a turboprop instead of a turbojet.

There is a simple solution for operators of aircraft who want to interchange platforms that do not meet the strict applicability of the rule. The National Business Aviation Association (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 NBAA members to obtain a copy of Exemption 7897 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 interchange arrangements.

Several FAA Chief Counsel opinions interpreting 14 C.F.R. § 91.501(b)(6)—which is the paragraph authorizing, rather than defining, interchanges—have stated that only a “company” may provide an aircraft and crew under that rule.

Because an interchange 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 lb. maximum gross takeoff weight (MGTOW). Several steps are required under 14 C.F.R. § 91.23 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: a) mailing a copy of the lease to the FAA Aircraft Registry, Technical Section, in Oklahoma City, within 24 hr. of its signing, b) carrying a copy of the lease in the aircraft and c) notifying the nearest FAA Flight Standards District office at least 48 hr. before the first flight of the aircraft registration number, as well as time and location of departure.

According to FAA Order 8900.1, 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.

The same regulation also requires specific language at the end of the lease. Among the requisite elements is a statement of which party has operational control. In an interchange 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.”

Another required element is a statement identifying the 14 C.F.R. Part (91 or 135) under which the aircraft has been maintained and inspected under for the preceding 12 months—as well as a statement of the part under which the aircraft will be maintained and inspected during the term of the agreement. FAA Advisory Circular AC 91-37B gives sample language that can be used to comply with 14 C.F.R. § 91.23, and suggests that simply identifying the 14 C.F.R. Part (91 or 135) is sufficient.

An interchange agreement can be a very useful tool for dealing with the inevitable airplane scheduling problems. But it is vital to deal with the FAA, IRS and insurance requirements prior to the first flight.

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A Delta Air Lines McDonnell Douglas MD-88 aircraft is shown from a front-quarter perspective on a runway. The aircraft is white with red and blue stripes. The background shows a green, hilly landscape under a clear sky.

Runway Conditions

There are many reasons why the actual runway environmental conditions can vary significantly from the reported values.

SNOWY RUNWAYS, LOW CEILINGS and a crosswind landing are threats that a prudent flight crew will take seriously. Now add a runway distance that is barely marginal if the subjective braking action reports are “good,” and the situation turns into one in which every decision and action by the flight crew needs to be spot on.

To further heighten the risk, let’s put a body of water at the boundaries of the marginal-length runway. That was the situation faced by the flight crew of Delta Flight 1086, a McDonnell Douglas MD-88, as it approached New York’s LaGuardia Airport (LGA) on the snowy day of March 5, 2015.

The flight left Atlanta that morning heading for LGA. While enroute, the flight crew continued to monitor the weather conditions at LGA and assessed the factors that could affect stopping performance. They closely examined company policies for landing on contaminated runways and understood that a change in runway conditions from accumulating snowfall could increase the landing distance and that a change in wind could cause the flight to exceed crosswind limits.

The flight crew asked the dispatcher and the Washington


Air Route Traffic Control Center controller for braking action reports, but neither had any reports at the time because LGA operations personnel were conducting snow removal operations, and no aircraft were landing. The four previous automatic terminal information service (ATIS) reports (issued between 07:51 a.m. and 10:24 a.m.) contained outdated and contradictory field-condition information about the status of LGA’s runways. Besides company and ATIS reports, air traffic control (ATC) communications as late as 10:40 a.m. gave the impression to the flight crew that at least some patches of runway surface would be visible upon breaking out of the instrument meteorological conditions (IMC) on the approach.

But upon first seeing the runway in sight at 233 ft. above ground level (AGL), the runway appeared white. This was contrary to their expectations given the recent snow-cleaning operations and the reports of good braking action by two of the four preceding aircraft. Only 13 sec. elapsed between the time the captain called the runway in sight and the 50 ft. automated call-out, during which the flight crew intensely focused on precise control of the aircraft. It would have been difficult for the crew to visually assess the nature and depth of the snow on the runway.

A combination of factors resulted in the MD-88 veering off the runway, coming to rest with the nose of the aircraft over

Reports

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A Gulfstream G200 lined up on the runway ready for takeoff.

the berm above Flushing Bay. There were no fatalities, but 24 people were injured.

While the bulk of the official NTSB accident report focused on a phenomenon called rudder blanking, the accident amply illustrates the consequences when the actual runway environment differs from the reported conditions. Accurately predicting the effects of wind, temperature and runway surface conditions are vital to every takeoff and landing. Standard practice in the aviation industry expects a pilot to dutifully enter the performance charts for these parameters to calculate the aircraft's performance. Yet there are many reasons why the actual runway environmental conditions can vary significantly from the reported values.

The situation is amplified for business aviation aircraft that operate into a wide spectrum of airports, most of which are non-towered and have limited resources for runway snow removal. The runways often do not include features such as crowning, grooves and porous filled concrete to minimize the pooling of water that exists on runways serving scheduled air carriers.

Fixed-base operator (FBO) personnel likely have little training on the accurate assessment of braking action from the perspective of an aircraft's needs. Furthermore, transitory phenomena such as the melting action from daytime

sun on snowbanks adjacent to a runway can result in a liquid that turns into black ice after sunset and will not be readily apparent.

WINDS AT THE THRESHOLD

Some of business aviation's most glamorous locations are surrounded by significant landscapes that can create their own microclimates. Notable U.S. examples are Aspen, Eagle, Telluride, Gunnison, Sun Valley, Truckee and Jackson. European examples include Gstaad, Samedan (St. Moritz) and Courchevel. These are considered some of the most challenging airports in the world because of their difficult topography and winds, as well as high altitude.

The microclimate effects produce rapidly changing localized winds that will not be detected by an airport's automated weather observing system (AWOS). Adverse winds caused by mountain wave, diurnal "canyon" winds or convective activity can create downdrafts of significant strength.

Localized winds just short of the landing threshold can cause negative effects on an aircraft's stability, control and performance. Even minor variations in vertical currents as the aircraft is precariously transitioning into the landing flare can cause the aircraft to balloon or dive markedly from the desired glide path. A sudden loss of headwind from windshear can cause the aircraft to nose down and temporarily lose important airspeed.

These effects can be even more pronounced when a runway's threshold is close to vertical terrain. A classic example would be the cliff adjacent to the threshold of Telluride's Runway 9. As the sun's angle moves across the sky and begins to heat that slanted terrain, the air immediately adjacent to the cliff begins to heat and rises rapidly in a thermal.

For those lacking the benefit of a soaring background, thermals are rising parcels of air that continue to rise as long as the surrounding air is cooler. It is not uncommon for the strength of the cores of these thermals to exceed 2,000 fpm in the western U.S. states. Conversely, the outer portion of these rising bubbles—indeed, imagine the shape of a doughnut, with the middle rising and the outside descending—can be nearly as strong.

WASATCH COUNTY FIRE DISTRICT



Wintry conditions prevailed in the day previous to this Citation CJ4 incident. During landing, the aircraft hit some ice and veered off the runway.

Aircraft control and flight path maintenance can instantly be compromised by these sudden and surprisingly strong vertical air currents. Incidentally, there is a warning for pilots that the Telluride airport sits on a 1,000-ft. mesa, with the precaution of strong vertical turbulence along the mesa's edge.

What is the FAA criteria for the siting of a wind sensor? According to Order JO 6560.20C, "Siting Criteria for Automated Weather Observing Systems," the preferred siting of the wind sensor at an airport with only a visual or non-precision runway is adjacent to the primary runway 1,000 ft. to 3,000 ft. down runway from the threshold.



KIM HENNEMAN

Localized winds just short of the landing threshold can cause negative effects on an aircraft's stability, control and performance. Aircraft flight path maintenance can instantly be compromised by these sudden and surprisingly strong vertical air currents. A potent example of this is the warning for strong vertical turbulence at the edge of the mesa collocated with the threshold of Telluride's Runway 09.

Clearly, these indicators are not able to accurately sense the shifting wind currents in the threshold of a runway such as Telluride's Runway 9.

This type of rapidly changing adverse wind close to the approach end of the runway was a contributing factor in the crash of a Socata TBM 700 on Feb. 15, 2003, at Aspen-Pitkin County Airport, Colorado. The approach was stabilized at 100 kt. with landing gear and flaps in the landing position. The approach was normal until approximately 100 ft. above the runway, at which point the airplane encountered a turbulence condition, causing rapid-roll tendencies right and left.

As the pilot began his landing flare at about 15 ft. above the runway, the left wing dropped rapidly—combined with a sudden high sink rate—and struck the runway. Fortunately, none of the four individuals in the aircraft were injured. Winds

at the time were reported 310 deg. at 6 kt. Records suggest that the winds were variable throughout the day. The NTSB determined the pilots had failed to maintain aircraft control. Contributing factors include the tailwind and the turbulence.

TEMPERATURE AT THE RUNWAY

The heat on the ramp was unbearable while walking out to the aircraft on a hot August afternoon in Lincoln, Nebraska. ATIS was reporting 108F, but it felt much worse than that on the ramp.

Mechanics from Duncan Aviation walked out to the aircraft with their recently acquired infrared temperature detector. Their "temperature shot" from the cement showed a reading of 127F. The blacktop was even worse. It showed 143F.

As per company operating procedures, takeoff performance was calculated using the reported ATIS temperature. Fortunately, we had no passengers and only a modest amount of fuel for the post-maintenance test flight. Normally the takeoff distance would be relatively short at that light weight and low altitude, but the end of the runway seemed unusually close when we rotated for takeoff.

Months later, I was flying with a colleague whose primary passion in life is competitive racing of high-performance automobiles. He informed me that the auto racing industry is cognizant of the difference between the racetrack's temperature and the reported air temperature. In fact, teams will purposely tune-up their engine performance in conditions as close as possible to the track conditions, replicating the time of their race.

Certainly, this same principle applies to aircraft. When the temperature of the air at the height of our engines and wings is significantly hot, we should expect longer takeoff runs, anemic climb rates, higher speeds for takeoff, reduced engine longevity and reduced climb gradients. Excessive temperatures will undoubtedly bake the tires and brakes during ground operations, increasing the risk of high-speed tire failure and overheating wheel and brake assemblies.

According to FAA Order JO 6560.20C, "Siting Criteria for Automated Weather Observing Systems," the temperature sensor must be mounted so that the aspirator intake is 5 plus or minus 1 ft. above ground level or 2 ft. above the average maximum snow depth, whichever is higher. It can be placed at any convenient location on the airport that is protected from radiation from the sun, sky, earth and any other surrounding objects, but at the same time, must be properly aspirated.

The sensors must be installed in such a manner as to ensure that measurements are representative of the free air circulating in the locality and not influenced by artificial conditions such as large buildings, cooling towers and expanses of concrete and tarmac to minimize the effect that the underlying ground itself might have on temperature.

I emphasize those final words with italics in the hopes that you might reach the same question I have. For the record, heat transfer is not within my engineering specialty. Many of you with soaring backgrounds will recognize the drawings in training manuals of the warmer air over heat-soaked ground

to include large expanses of concrete or asphalt becoming more buoyant than air over adjacent grass-covered landscape and eventually rising as a thermal. This further reinforces my curiosity in the micro-scale temperature differences around an airport.

When will this adverse heat problem over the runway be most problematic? The amount of solar radiation absorbed by the ramp depends on various factors, such as the angle of the sun with respect to the ramp—given that the noontime sun directly overhead bombards the ramp with the highest ratio of sunshine. Clear skies and cloudy days can also contribute, as can numerous other factors. Dark surfaces, such as asphalt, absorb more radiation than lighter-colored surfaces, which tend to reflect some of the radiant energy.

It takes a lot of incoming radiation to heat up concrete, but once it does reach a warm temperature, it tends to retain that heat for quite some time.

RUNWAY SURFACE CONDITIONS

For obvious reasons, it is important for a pilot to have an accurate report on the runway surface conditions to properly perform a Landing Performance Assessment. Unfortunately, the flexibility of business and emergency medical services (EMS) aircraft to operate into a wide spectrum of airports creates the distinct disadvantage of uncertainty in the runway surface conditions.

The Flight Safety Foundation's study of fixed-wing EMS accidents found that critical information regarding runway conditions was not transmitted to pilots in 14 of 36 accidents during landing.

One of those accidents occurred on Jan. 31, 1995, as the pilot of a Cessna 421 attempted to land at the remote airstrip in Chinle, Arizona. The airplane was dispatched in day visual meteorological conditions (VMC), and local police reported that the runway was dry, despite a recent snowstorm.

On touchdown, the pilot discovered that the runway felt softer than usual, and shortly afterward encountered a dip in the runway that sent the aircraft slightly airborne—and then off the runway through a barbed-wire fence. The three occupants were uninjured, but the aircraft was substantially damaged. The NTSB report noted that although the runway surface appeared dry, there was dry dirt about 1-2 in. deep, with a soft layer underneath.

A Flight Safety Foundation study of business jet safety reviewed 287 NASA Aviation Safety Reporting System (ASRS) reports in which pilots noted problems with runway conditions. Poor runway conditions were cited in 33% of the 287 reports, and lack of adequate runway condition reports was cited in 18%. It should be no surprise that contaminated runway conditions were present in 71% of the runway overrun accidents and incidents reviewed in the sample.

Unreported or inaccurate weather conditions and braking reports were factors in a landing overrun at Ohio State University Airport (OSU) by the flight crew of a Learjet 23. Light drizzle was reported by ATIS. No braking action

advisories or reports were given. The Learjet touched down in the touchdown zone, and the crew immediately applied thrust reversers and spoilers along with maximum braking. Much to their unwelcome surprise, the braking action was nil. As the jet neared the end of the runway, the crew secured the engines, and the aircraft came to a rest 75 ft. off the end. As the pilots waited for emergency vehicles to respond, they noted that the ground became covered with clear ice due to freezing rain.

What can a pilot do to better prepare for a landing or takeoff given the possibility of uncertainty in the reported runway conditions? In an ASRS report, the Learjet pilot wrote: "If we had more information, we would have acted differently. My recommendation is this: If there is any precipitation at all in the winter months, regardless of the temperature, plan on poor braking action at best, replan your landing distance and divert if necessary" (NASA ASRS Report No. 293469, January 1995).



Small vortices shed from the lip of the helipad at Air Zermatt create a unique, localized airflow. It is necessary to keep a windsock and any other obstructions clear of the Final Approach and Takeoff (FATO) and Touchdown and Liftoff (TLOF) areas of a helipad—thus the windsock is not located to sense these localized air flow structures

Experience can be an unforgiving teacher. The previous examples illustrate the pitfalls of relying on reports about the runway environment. This conundrum also applies during dynamic changes in precipitation and winds during thunderstorms or heavy snowfall events. Runway conditions and wind direction can rapidly change from the conditions used to conduct a thorough Landing Performance Assessment just 20 min. prior.

CONSIDER THE UNCERTAINTIES

Aviation training has failed to introduce pilots to the possibility of uncertainty in these reported values. In contrast, it is standard practice in engineering to include possible errors

Acres of pavement with scant shade turn an airport ramp and runway into its own “heat island.” Single-engine air tankers on standby at this Rock Springs, Wyoming, air tanker base utilize reflective shades in the windows to lessen the radiative heat into the cockpit.



NATIONAL INTERAGENCY FIRE CENTER

such as instrument error, position error and reading error into a formal analysis of the uncertainty. A draft report would be sternly tossed back if an engineering apprentice failed to perform a formal analysis of the uncertainty.

It is also standard practice in engineering to include a safety factor for the unknowns. Our safety factors in aviation can quickly dwindle given the uncertainties and inaccuracies with reported runway environmental conditions. Yes, there are safety margins “sort of” built into the landing performance data for transport aircraft. I purposefully use the caveat “sort of” due to the inherent differences in the techniques used by flight-test crews to establish the landing distances versus the method used by proficient transport crews in normal flight operations.

Thus, as you can see, accurate prediction of the effects of wind, temperature and runway surface conditions on takeoffs and landings can be prone to varying degrees of uncertainty. Furthermore, at uncontrolled airports there can be a lack of credibly measured conditions. This further complicates the task of a flight crew attempting to get the most accurate information possible.

Astute flight crews should scrutinize the possible sources of uncertainty when planning a takeoff or landing, contemplate the possibility that the runway environment could be worse than reported and consider applying prudent safety factors into their decision-making. **BCA**

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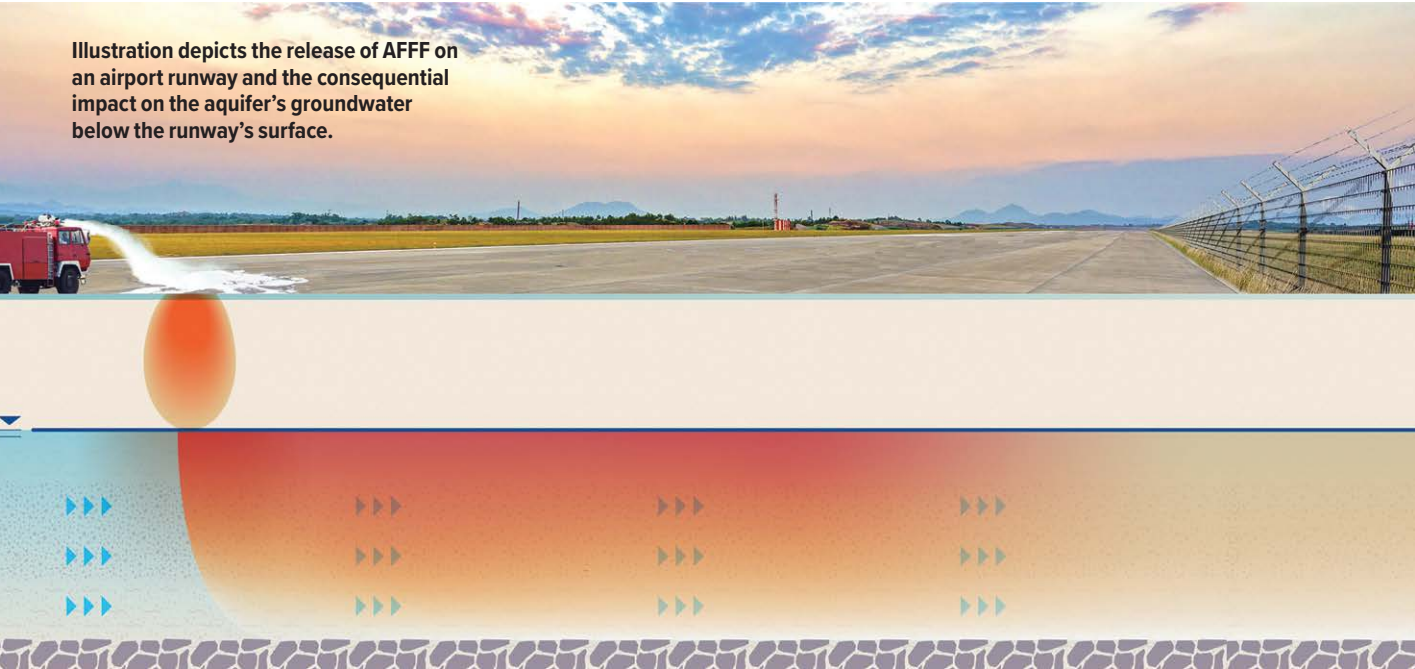
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Illustration depicts the release of AFFF on an airport runway and the consequential impact on the aquifer's groundwater below the runway's surface.



The Looming Legacy

Airports and FBOs eye PFAS cleanup liability, costs.

NOW THAT THE FAA no longer requires airports to maintain foam fire-suppression systems containing PFAS compounds, foam users including FBOs and hangar owners face a legacy of contamination from the so-called “forever chemicals.”

Applied for decades in consumer products including non-stick cookware, food packaging, carpeting and waterproof clothing, Per- and Poly-fluoroalkyl Substances (PFAS) are also inherent in aqueous film-forming foams (AFFF) that are highly effective at fighting jet fuel and other Class B flammable liquid fires. When mixed with water and discharged, the foam forms an aqueous film that cuts off oxygen to a fire, extinguishes the blaze, and prevents it from relighting.

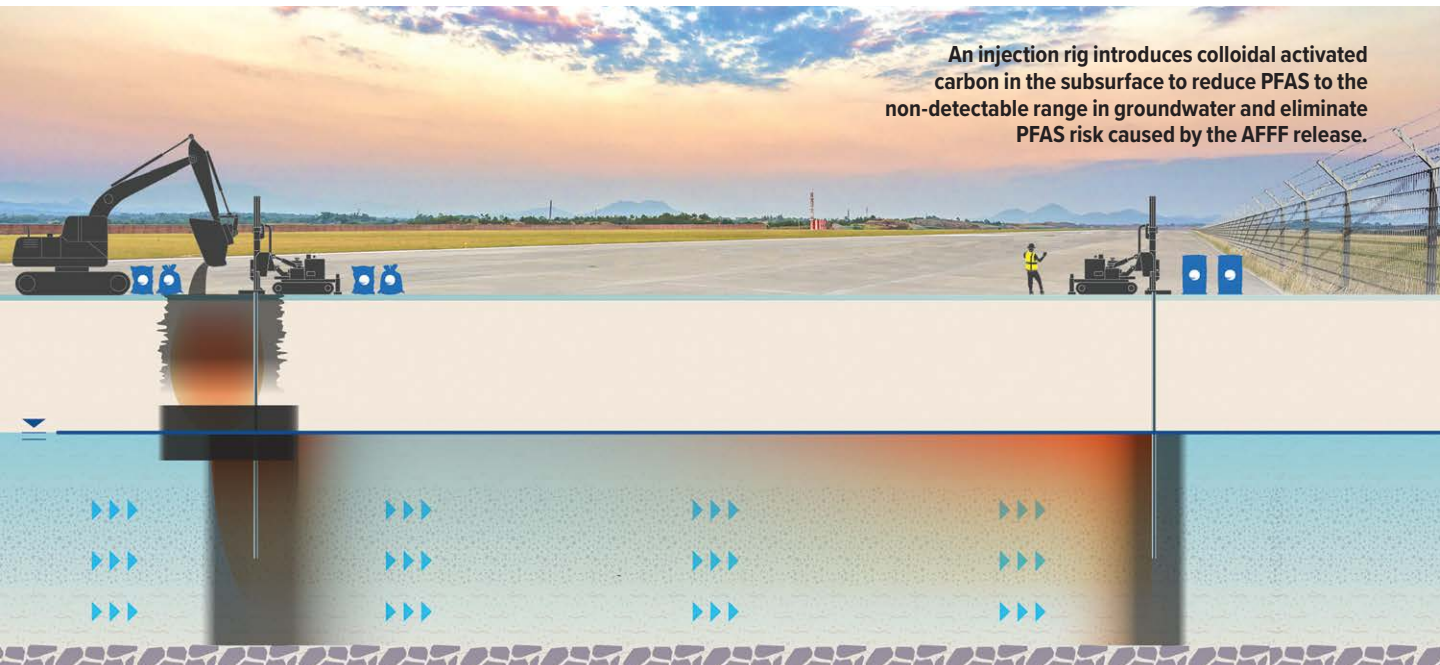
The synthetic chemicals have another characteristic; PFAS have a strong molecular structure based on a carbon-flourine bond that prevents them from breaking down in the environment, enabling them to infiltrate groundwater, soil, wildlife, food, and human bloodstreams. Studies of laboratory animals given large amounts of PFAS indicate the chemicals may have

adverse health effects, but their toxicity for humans based on exposure to low environmental levels of PFAS is “uncertain,” says the U.S. Centers for Disease Control and Prevention.

Also uncertain are the potential liability consequences for airports and associated FBOs and hangars where AFFF has been used for decades in firefighting drills or has leaked or spilled accidentally from hangar fire suppression systems, potentially causing PFAS contamination.

Pending regulatory actions by the U.S. Environmental Protection Agency (EPA) could bring the legacy of PFAS-containing AFFF into clearer focus. In March, the EPA released a proposed National Primary Drinking Water regulation that would establish Maximum Contaminant Levels for six PFAS chemicals in drinking water, including Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic acid (PFOA), two types of PFAS that are found in AFFF. The agency proposes a limit of no more than 4 parts per trillion for each chemical in drinking water, a standard that would be the lowest limit for any chemical the EPA regulates in water, according to the Sierra Club.

The EPA has said that it plans to finalize the regulation by the end of this year. The cost of addressing PFAS and other contaminants in drinking water will be initially covered by federal dollars, including \$10 billion committed for that purpose in the 2021 Bipartisan Infrastructure Law.



An injection rig introduces colloidal activated carbon in the subsurface to reduce PFAS to the non-detectable range in groundwater and eliminate PFAS risk caused by the AFFF release.

REGENESIS CONCEPTS

of PFAS

Also pending is the publication by the EPA of a final rule designating certain PFAS chemicals, including PFOS and PFOA, as hazardous substances under the 1980 Comprehensive Environmental Response Compensation and Liability Act (CERCLA), commonly known as the Superfund. CERCLA establishes liability for current and former owners and operators of facilities where hazardous wastes were released or disposed of, as well as for manufacturers and handlers of such materials. Plans call for the EPA to publish the final rule in February 2024.

“Once it is deemed a Superfund site, all of the owners—anybody who owned the property or contributed to any release of contaminants on that site, whether they’re on the site or it migrated to the site, are potentially responsible parties,” says attorney Brian Gross, a partner with MG+M The Law Firm. “No defense; if you own [property] or you contributed, you owe money. If you are deemed to be a potentially responsible party, you’re on the hook.”

FUTURE FIREFIGHTING FOAMS

The FAA has required that Part 139 commercial airports use AFFF firefighting foam, based on a specification developed by the U.S. Navy, since the 1980s. In 2018 reauthorization legisla-

tion, Congress directed the FAA to no longer require the use of fluorinated chemicals to meet its performance standards for aircraft fire-extinguishing agents—a mandate the agency says accelerated FAA and Defense Department research into unfluorinated, PFAS-free alternative foams.

In a policy directive dated June 20, 2019, the FAA advised Airport Certification Safety Inspectors to no longer require the discharge of AFFF during firefighting drills.

On Jan. 6, 2023, the Defense Department published a fluorine-free foam (F3) military specification (Mil-PRF-32725) to comply with requirements of the fiscal 2020 National Defense Authorization Act. Defense authorization legislation also directs the Pentagon, which has identified 700 sites of its own to assess for PFAS contamination, to start qualifying new foam products by October 2023 and to phase out its use of AFFF at military installations by October 2024. Once the department certifies that a manufacturer’s foam meets the new specification, it will be added to the Pentagon’s Qualified Product List.

The FAA issued CertAlert 23-01 on Jan. 12, 2023, stating that it will accept the use of F3 foams qualified to Mil-PRF-32725 by Aircraft Rescue and Firefighting departments at Part 139 airports, but not require that they transition to the new foam.

A REGULATORY DISTINCTION

Responding to another congressional directive, the FAA in May released an 18-page “Aircraft Firefighting Foam Transition Plan.” In the plan, the agency says it will provide guidance to airport operators on mil-spec F3 issues falling within

its regulatory purview; for issues outside of its authority, it will identify best practices when they become available.

State environmental regulations and fire-suppression systems at airport hangars are outside of its authority, the FAA says, underscoring a distinction between airports and hangar owners.

The PFAS Annihilator system separates PFAS compounds from landfill leachate. Ultimately, water is sent to a treatment facility and returned to the water system.

“Although airport hangars are outside FAA’s regulatory jurisdiction, airports should consider hangar fire suppression systems as significant sources of PFAS-containing AFFF and include such systems, as appropriate, in transition planning and execution,” the agency says in a footnote.

To date, mainly state agencies have brought enforcement actions against Part 139 airports, compelling them to test for the presence of PFAS or to remediate contamination, Gross says.

Hangar owners install fixed foam fire-suppression sys-



BATTELLE/REVIVE ENVIRONMENTAL

Stemming PFAS Flow at Martha’s Vineyard Airport

The application of a pilot test barrier of colloidal activated carbon has rapidly reduced groundwater PFAS concentrations detected “downgradient,” or downstream, of a fire-training area at Martha’s Vineyard Airport (MVY), according to the developer of the “Plume-Stop” technology.

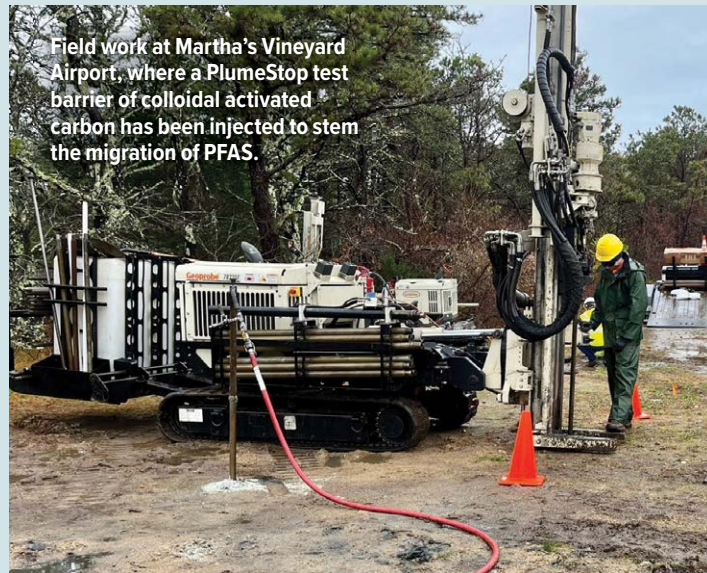
Four months after PlumeStop was injected into the ground to create a 60-ft.-long permeable reactive barrier (PRB), monitoring samples showed that PFAS concentrations were reduced by 99.8% at a distance of 5 ft. downgradient of the fire-training area, by 78% at 25 ft., and by 57% at 75 ft., reports environmental remediation company Regenesis.

MVY is a county-owned, FAA Part 139 commercial airport located on Martha’s Vineyard, an island off the coast of Massachusetts. It is served by American Airlines, Delta, and JetBlue regional jets on a seasonal basis and by Cessna 402 operator Cape Air year-round.

After confirming the presence of PFAS compounds in groundwater at MVY in 2018, Tetra Tech, the airport’s environmental consulting firm, contracted Regenesis to conduct a pilot test of PlumeStop to prevent further PFAS movement away from the site. The installation of a PRB to filter PFAS out of the groundwater, considered an “in situ” remediation approach, was chosen over a more costly “pump-and-treat” solution.

Tetra Tech determined that the best place for the pilot test was immediately downgradient of the area where Aqueous Film Forming Foam (AFFF) had been discharged during recurrent firefighting drills, leaching over time into the underlying groundwater. The goal of the test was to immobilize PFAS at the core of the contaminant plume for 15 years or longer and minimize the plume’s migration away from the site. Another strategy that Regenesis employs is to cut off PFAS migration at the boundary of a property to keep it from moving off-site.

Regenesis performed the PlumeStop application at MVY in



Field work at Martha’s Vineyard Airport, where a PlumeStop test barrier of colloidal activated carbon has been injected to stem the migration of PFAS.

December 2022. “Instead of pulling PFAS out of the ground and generating waste, we inject PlumeStop, which is small particles of colloidal activated carbon—1-to-2-micron-size activated carbon particles—that are suspended in a polymer,” says Maureen Dooley, Regenesis director of strategic projects.

“PlumeStop is going to coat the soil, so in essence we’re creating a ‘Brita’ filter underground,” Dooley explains. “As groundwater flows through this PlumeStop zone, the PFAS compounds are removed from the groundwater and sorbed onto the colloidal activated carbon, or the PlumeStop, and stabilized. Ultimately, it’s stabilized and stays in place and clean groundwater moves through the zone.”

Colloidal activated carbon barriers are designed to be a permanent

tems as specified by the National Fire Protection Association (NFPA) 409 Standard on Aircraft Hangars, a standard applied by local fire marshals. The International Building Code and the International Fire Code—among “I-Codes” developed by the International Code Council and adopted by local jurisdictions—also reference the NFPA standard and take precedence.

NFPA 409 was revised in 2022 to exempt Group II hangars typical of FBOs and general aviation bases from requiring foam-water fire-suppression systems unless “hazardous operations” are performed within the hangar. (Such operations include fuel transfer, welding, torch cutting, torch soldering, doping, spray painting, oxygen service, composite repairs, fuel tank maintenance, wiring changes and electrical system testing.) The exemption was irrespective of whether aircraft are fueled or not. A Group II hangar as classified by NFPA 409 has a door height of 28 ft. or less and a hangar bay less than 40,000 ft².

Current I-Codes still reference the 2016 edition of NFPA 409, however, which requires Group II hangars to have foam

fire-suppression systems unless the facility meets certain conditions; for example, the hangar is only used for housing transient aircraft.

Industry anticipates NFPA 409 and the building and fire codes will be reconciled in the next edition of the I-Codes in 2027. But until then, enforcement of the requirement for foam fire suppression has been uneven, depending on the interpretation of the local fire marshal and allowance for the use of the 2022 edition of NFPA 409, says Megan Eisenstein, National Air Transportation Association (NATA) managing director of industry affairs and innovation.

“We are in this hard position where it’s not the federal government telling us we have to have these foams in hangars, it’s other local statutes and regulations such as NFPA 409,” Eisenstein says.

NATA advocates exempting from potential litigation all federally funded airports, hangar owners, aviation businesses and airport leaseholders that have been required by authorities having jurisdiction to maintain foam fire-suppression systems containing PFAS, with a focus on its member FBOs



solution and do not require later excavation of contaminated soil, Dooley says. “There is no requirement to excavate PFAS-impacted soils since it is the water phase that is the medium of concern,” she says. “In the remediation industry, it is common that soil contaminants are left in place if there is no risk to downgradient receptors...In the rare case where PFAS levels may exceed regulatory limits, the barrier can be reinforced if needed.”

Regenesis, based in San Clemente, California, has conducted 30 PlumeStop field applications for PFAS remediation since 2016, including nine at airports in the U.S., Canada, and the UK. Airports in the U.S. include Fairbanks International

in Alaska and Grayling Army Airfield near Grayling, Michigan, where AFFF foam was used and stored.

PFAS remediation efforts at aviation sites have been more recent, says Dooley, who expects demand will increase as facility owners investigate contamination. PFAS contamination by FBOs and hangar owners would likely be the result of leaks or spillages of foam rather than repeated firefighting drills, she says.

“It has come up around some hangars that they may have some small hot spots, but I wouldn’t anticipate it to be as extensive an individual problem as you might find in a fire-training location because of the multiple applications over time” at those locations, Dooley says.

ALTERNATIVE ‘DESTRUCTION’ SYSTEM

An alternative to the PlumeStop in situ approach to stemming PFAS migration is offered by nonprofit research and development organization Battelle, which has installed a “PFAS Annihilator” system at a wastewater treatment facility operated by Heritage-Crystal Clean in Wyoming, Michigan.

Described as a closed-loop, on-site destruction solution, PFAS Annihilator separates PFAS compounds from landfill leachate—water that has percolated through a landfill and accumulated contaminants—then uses supercritical water oxidation to break the carbon-fluorine bond. The resulting output, Battelle says, is carbon dioxide and hydrofluoric acid, which is neutralized with sodium hydroxide that turns it into inert salts. Ultimately, the water is sent to the treatment facility and returned to the water system.

In January, Battelle launched a spin-off company, Revive Environmental, at its Columbus, Ohio, campus to provide contaminant mitigation services using PFAS Annihilator and other technologies.

“While there is still uncertainty around the regulatory landscape and liabilities associated with PFAS, it is clear that commercial airports will be required to switch from PFAS-containing AFFF to fluorine-free alternatives approved by the FAA,” said Revive CEO David Trueba, in response to an inquiry. “In this transition, airports will have stockpiles of AFFF concentrate, AFFF-containing rinsewaters from changing out their foam systems, and potentially PFAS-contaminated groundwater from sites where AFFF was used.”

Trueba added: “Revive Environmental’s first PFAS Annihilator unit is commercially operating in Michigan and has already been destroying PFAS in different AFFF-contaminated waste streams. With more PFAS Annihilator units on the way this year, Revive is in conversations with airports and other industry partners to provide full life-cycle solutions that provide regulatory compliance and eliminate liability via PFAS destruction.”

and Part 135 operators that own or operate hangars on airport grounds.

In May, U.S. Sen. Cynthia Lummis (R-Wyo.) introduced the Airports PFAS Liability Protection Act (S. 1433) and related bills that would create Cercla liability protections for PFAS releases associated with certain industries and municipalities. Seven other Republican senators co-sponsored the suite of legislation.

ACCIDENTAL DISCHARGES

Another evident distinction between airports and hangars is that aircraft rescue and firefighting services at Part 139 airports have deployed foam mainly during recurrent training exercises, while foam releases in hangars are typically inadvertent.

A NATA-sponsored study of foam system discharges in aircraft hangars by the University of Maryland (UMD) Department of Fire Protection Engineering, dated November 2019, gathered data from seven insurance companies, two FBOs and media outlets. Of 174 reported incidents from 2004-19, 37 were foam discharges in response to a fire and 137 were accidental discharges. None of the 37 discharges in response to a fire involved a fuel spill.

“Requirements for foam fire-suppression systems in NFPA 409 were initially justified to provide protection from fires involving fuel spills,” the study authors stated. “However, the occurrence of a fuel spill in a hangar in the U.S. is rare and fires involving such spills even less common. While some fires do occur in aircraft hangars, they involve ordinary combustibles or occur in spaces adjacent to the hangar bay.”

A February 2021 UMD study analyzed hangar foam-system discharges experienced by commercial airlines and Defense Department facilities dating to the 1960s, but mainly from 2004-20. Of 217 reported incidents with known causes, 214 were accidental discharges with no fire present and three, all at military facilities, were discharges in response to a fire.

The prevalence of accidental foam discharges in hangars introduces another complexity to the liability equation if PFAS contamination is discovered.

“A lot of the utilization of (AFFF) is accidental,” Gross notes. “The question is, were there any safeguards in place to collect (the foam) so it didn’t run off? If not, hangar owners are potentially responsible for that. If it’s an accidental discharge, they’re certainly going to have a claim against the manufacturer of the system, assuming it was a malfunction of the system that created the discharge and not some human error. If it’s human error, if it’s somebody who is not employed by the hangar owner, perhaps they would have a claim against whoever discharged the fire-protection system.”

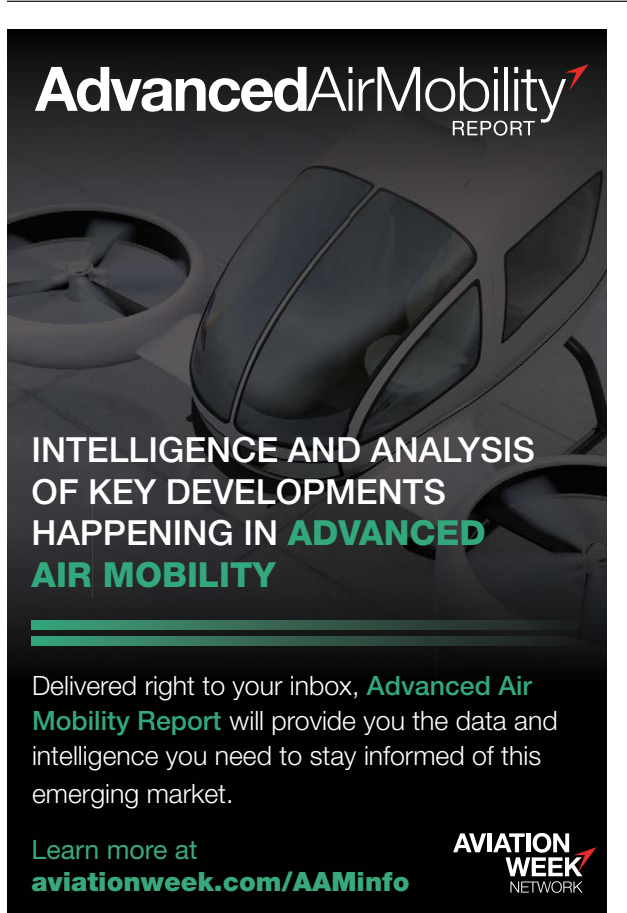
Gross has served as counsel for several entities facing enforcement actions related to PFAS and other contaminants. “If you’re found liable, the first thing you do is look to spread the wealth, you look to see who else might be responsible,” he says.

But one potential downside for FBOs and hangar owners is that an airport facing an enforcement action may look to them to determine if any of the contamination originated from their facilities. “If you’re talking about a private hangar, at least those that are on Part 139 airports, they are potentially going to be one of several (facilities) that are responsible,” Gross says. “[At] smaller airports, they could be the only one responsible.”

Water sampling of private wells around Gustavus Airport, Alaska, in 2018 found PFAS concentrations above Alaska Department of Environmental Conservation (DEC) action levels in 19 wells. “Of these, one well serves the Alaska Airlines and Alaska Seaplanes terminals, six wells are used for airplane washing or other non-drinking-water uses, and 12 are private or business wells used for drinking water,” says the state’s Department of Transportation and Public Utilities. “One of these well results is due to city firefighting foam use.”

In November 2022, the Alaska DEC and state agencies in Illinois, Michigan, Minnesota, Nebraska and Wisconsin wrote to then-acting FAA Administrator Billy Nolen seeking a commitment from the agency to secure federal funding to help commercial airports investigate the extent of PFAS contamination and put in place controls to address risks associated with the chemicals.

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A large white and black private jet is parked inside a spacious hangar. The hangar has a high ceiling with a complex steel truss structure and large windows on the right side. A red lift basket is visible in the upper left. The aircraft is the central focus, with its tail and wings clearly visible.

General aviation hangar space often involves a long wait list.

Hangar Headache

EXTREME PHOTOGRAPHER

The waitlist of hangar space is growing.

FOR YEARS, PILOTS across the country have felt the strain of limited hangar availability. Recently, that strain has increased in breadth and severity, leaving many asking the same questions—why has the supply of hangar space not kept up with demand?

A survey conducted by the Aircraft Owners and Pilots Association (AOPA) Airport Support Network found that 71% of general aviation airports are experiencing a shortage of individual general aviation hangars. At the same time, 55% of airport managers surveyed report having land available to develop them, but they lack the funding to do so.

“I can’t tell you with any statistical data how long it’s been going on but ask any pilot if there’s been a hangar shortage and he’ll say yes. How long? He’ll say as long as I’ve been flying,” says Mike Ginter, AOPA vice president of airports and state advocacy. “It’s worse now, but I would tell you that I’m aware of a hangar shortage because there’s been waiting lists

at airports for as long as I can remember, and I’ve been flying for almost four and a half decades.”

General aviation airports are feeling the pressure. According to the AOPA, hangars are responsible for approximately 45% of an airport’s gross revenue, which makes the shortage an ongoing concern in terms of financial sustainability.

For airports, the answer is not always as simple as building more hangars. A combination of several factors, such as inflation, labor shortages, demand and pandemic-related economic stressors has steadily increased the cost of construction.

The aviation industry has especially felt the sharp rise in construction costs, as Curt Castagna, president and CEO of the National Air Transportation Association (NATA) explains.

“The cost of new hangar development today is more than double what it was 20 years ago, and during the pandemic, we were watching construction costs rise 3% or more monthly almost, or quarterly,” Castagna says.

Besides the need for additional hangars, many existing ones also need to be replaced.

“Airports provide leases to FBOs or developers or businesses that are building hangars, and they give them a term commensurate with the investment that’s being made, and that could be 20, 30, 40 years,” Castagna says.

The last surge of development in the U.S. was during the 1980s and 1990s, with many of those leases now coming up for termination. In addition, many of the hangars built before the 1980s have now served their functional lives, he says.

For small, GA airports, covering the cost to replace or add units can prove to be difficult.

“Regardless of the cost, the available funding has never been there to fund GA hangars,” Ginter says. “Now, to be fair, the Airport Improvement Program (AIP) funding does allow hangars to be built. [But] every airport manager we’ve talked to said it’s impossible to get higher funding.”

LOW-PRIORITY FUNDING

The FAA’s Airport Improvement Program (AIP) provides grants to public and private entities seeking to increase the development of public-use airports included in the National Plan of Integrated Airport Systems (NPIAS).

For smaller GA airports, the AIP generally covers at least 90% of development costs—the rest of which is typically

split between the airport sponsor and the local and/or state government.

While a handful of airports have received the FAA’s AIP funding, the number remains extremely low, Ginter says.

“Since the amount of airport grant money requested is always greater than what the FAA has available, the FAA sets priorities by project type,” he says. “They decided hangars are a very low priority. In fact, according to the latest FAA order 5090.5 “Formulation of the NPIAS and ACIP” dated Sept. 3, 2019, hangars ranked 31 out of 32 eligible airport funding projects. This is why a federal funding stream is so important to improve the financial self-sustainability of community airports.”

With funding difficult to obtain, airports are left to their own devices to be innovative, Ginter says.

According to Ginter, those innovative options could include USDA Rural Development Loans or similar grants designed for local development.

At the same time, a little help may be coming.

The U.S. House of Representatives recently passed the Securing Growth and Robust Leadership in American Aviation Act, otherwise known as the FAA Reauthorization Bill, which included an increase in funding for airport infrastructure—and prioritizing funds for smaller GA airports,

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which could help offset some of the scarcity of available hangars.

“Typically, the reauthorization bill has included sections, little, tiny snippets that include things that improve GA, whether it’s funding or workforce development or whatever. This one has an entire section that you just call the GA title, so that’s incredible,” Ginter says.

AIP funds would also be increased, per the House’s version of the bill.

“It’s not a giant sledgehammer fix; it’s a scalpel fix,” Ginter says. “If the numbers work out the way we’ve calculated them, it might mean 20 or 22 airports might be able to get an 11-unit T-hangar complex at 5% or 10% of the total cost. The funding will be a game changer for small community airports that are federally funded. It’ll be eligible at the federally funded eligible airports.”

Until governmental assistance becomes more of a reality, the efforts can often only move at the speed of Congress. Until then, there are still opportunities for individuals across the industry to help alleviate the shortage.

“We believe that while the public sector, through AIP, grants and other programs, can provide funding to airports,” says Castagna, “there’s opportunity with the private sector to come into an airport, invest private money in exchange for a ground lease, and do a development build—whether it be an FBO or just a hangar facility or a small general aviation terminal and self-service facility. Private equity is interested in helping airports in exchange for ground leases and those ground leases provide the term to amortize the investment.”

Ginter echoed the support for federal funding access for private entities.

“We believe that the private sector developers should have the same access to those funds that the public airport sponsors do,” he says.

At the individual level, Castagna suggests that aviators could jointly invest in available airport land to build new hangars at their local GA airport, but should ask themselves the following questions:

“Are they [local residents] supportive of the airport or is there anti-airport sentiment in that community?” Castagna says. “Does the airport have a business strategy where they’re providing development, where they’re bringing infrastructure, electrical, sewer and water up to the land, to the airport, so that development connections can be made? Is the rental rate around the airport healthy, where it’s been kept up to market so that when I’m finished doing new development, I’m not competing with existing airport facilities?”

“These are all some of the variables that a developer should look at as they’re talking with their airport to study it, and we encourage airports to study it, because, if you just go build some hangars and the market’s not healthy or sustainable, then you’re going to have empty hangars and bankrupt facilities. And that just doesn’t work either,” Castagna says.

While the shortage has remained a consistent force for



CURT CASTAGNA



MIKE GINTER

several years, Ginter believes there is still much to be learned about the scope of the situation.

WAITLISTS

“About three years ago, as the VP of airports for AOPA, I started looking around the industry for the literature,” Ginter says. “Where’s the data? Who’s looked at this? And I could find nothing. There’s nothing on the other alphabet websites. There’s nothing in the FAA’s archives. Nothing in the ACRP literature that talks about the hangar shortage. The hangar shortage is an evolving, deepening knowledge base. So, we’re going to continue quantifying the problem.”

When considering years-long waiting lists, Ginter offers the following advice to airport managers to help ease waitlist woes.

“If you have a hangar waiting list, please validate it. Check it out,” he says. “Call everybody on the list, make sure it’s current. See how interested the next person is to get a hangar and make sure that when a hangar does become

available, you know you have a good list. The second thing we tell our airport managers is if you have a waiting list that’s valid and long, like 2-5 years or longer in some cases, then your master plan should be updated and your airport layout plan should be updated to reflect T-hangars to help you alleviate the shortage.”

Occasionally, aircraft owners on hangar waiting lists may not be ready to use the hangar for a multitude of reasons, even if one becomes available.

“If you’re on the waiting list, call again and make sure they have the correct information that you’re still on the waiting list and that you verified your readiness to move,” Ginter says. “One of the things we’ve learned in the last three years is not all waiting lists are created equal.”

Additionally, Ginter suggests that airport managers be vigilant in monitoring the use of their existing hangars.

“We also ask our airport managers to basically do their existing job, which is to, on occasion, check for compliance with the non-aeronautical use of hangars,” he says. “We’re not trying to bring airport managers down on our members, that would be stupid. But we are in favor of airworthy airplanes being in hangars to help buy gas, need maintenance and increase the financial self-sustainability reports.”

While the shortage has been in place for several years, Ginter believes there is still much to be learned about the scope of the situation.

“About three years ago, as the VP of airports for AOPA, I started looking around the industry for the literature. Where’s the data? Who’s looked at this? And I could find nothing. There’s nothing on the other alphabet websites. There’s nothing in the FAA’s archives. Nothing in the ACRP literature that talks about the hangar shortage,” he says. “The hangar shortage is an evolving, deepening knowledge base. So, we’re going to continue quantifying the problem.”

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Helping Maui

Business aviation helps Maui after wildfires.

IN ONE OF THE MOST BRUTAL WILDFIRES in recent U.S. history, the people of Maui, Hawaii, lost a great deal.

As of Aug. 11, more than 2,000 buildings were destroyed, totaling approximately \$5.5 billion in damages, according to the Pacific Disaster Center (PDC). Thousands of residents were displaced—losing their homes, businesses and schools.

Early estimates suggested more than a thousand people were missing as a result of the fires, but that number has since dropped below 50, according to Hawaii Governor Josh Green. As of Sept. 16, the death toll remains at 97.

“Tragedy that hits one of us is felt by all of us,” said Maui County Mayor Richard Bissen in a public message. “These past few days, the resolve of our families, businesses and visitors have been tested like never before in our lifetime.”

In the hours during the fire’s creep across the community, powered by hurricane-force winds, nearby emergency services, residents and businesses sprang into action. Business aviation was no exception.

Operators such as Atlantic Aviation and Signature Aviation utilized their FBOs to shelter residents escaping the carnage, while also helping coordinate flights off the island. According to the Hawaii Transportation Department, Maui’s Kahului Airport operations were not largely impeded, allowing for Hawaiian Airlines to add flights from Kahului to Honolulu.

Roam Maui, a local private airline, began transporting supplies and donations from Boeing Field in Seattle directly to Maui. Donations came flooding in after Dianne Leppa, who works for Roam Maui, took to social media to gather aid for the affected residents.

“Blessed to have a company that has jets at our disposal, so we have empty cargo space, some empty cargo space that we have been able to load some donations on,” Leppa told King 5 Seattle.

Leppa’s call did not go unanswered. Planet 9, a California-based private aviation company, spearheaded donation efforts using an Amazon wish list to gather supplies for Maui residents. According to Planet 9, nearly 3,000 lb. of sustainable

aviation fuel (SAF) was given to help deliver the donations, supported by Avfuel and Castle & Cooke Aviation.

One of the more unique donations was made by Black Widow Helicopters, a California-based company, in the form of two specially modified Sikorsky UH-60L Black Hawk helicopters to support rebuilding efforts on the island.

“What we do is we take those Black Hawks, we bid them on auction, we win them, we demilitarize them and then our modernization programs revolve around a robust aircraft as a standard airframe and engine cycles, performing live with contemporary ones,” Renne Simoes, Black Widow Helicopters’ director of brand development, says.

“So, the modification that we make does bring these retired Black Hawks from the U.S. military into private use so that it can go into firefighting, search-and-rescue and utility missions. So, through these strategic modifications, the operator, the owner, can extend the lifetime of this aircraft for decades while minimizing costs in comparison to any other new aircraft.”

The helicopters—capable of carrying external loads of up to 9,000 lb.—may serve as an invaluable resource in local rebuilding efforts. According to the PDC, more than 3,000 acres of land were caught in the fire—large portions of which contained residential buildings that will need to be cleared.

“We’re going to do what we can to house the 7,415 people that are currently in hotel rooms and move them into long-term rentals,” Governor Green said in a Sept. 15 update. “We want everyone to get housing for a long time as we rebuild. Mahalo for understanding, and mahalo for your generosity.”

In the following weeks, emergency services will continue to clear West Maui of debris and hazardous materials. It remains ambiguous how long it will be until residents will be able to return to their homes, but the people of Hawaii, despite the circumstances, are remaining strong.

Those looking to support efforts in Maui can visit maui-niustrong.org to find more information on donations and volunteer opportunities.

Creative Measures

Business aviation makes changes to help address workforce challenges.



Textron Aviation's 2023 interns.

AS THE BUSINESS AVIATION industry grapples with workforce shortages, manufacturers are taking a variety of steps to attract and retain employees—including increasing pay, benefits and a number of perks.

They also are working with a variety of trade schools and colleges, as well as increasing the number of internships.

On July 26, for example, Piper Aircraft opened a health care center at its Vero Beach, Florida, headquarters offering no-cost preventative care, remedial care, chronic condition management, health coaching and lab services to employees and their families.

Textron Aviation also has opened an on-site employee wellness clinic and a pharmacy at its Wichita headquarters, as well as on-site cafes and a learning center designed for skill development and training. This summer it took on 350 college and 150 high school interns who worked with mentors and were assigned to a cross-section of business functions across the company.

“This will help us address that and differentiate us in the marketplace,” Michele Gifford, Textron Aviation human resources director, said recently. Textron plans to hire 2,000 employees in 2023 to allow for growth and attrition, with job openings across manufacturing and maintenance positions.

THE NUMBERS

Boeing's latest forecast predicts global demand for 649,000 pilots over the next 20 years—and that does not count pilots required by the business aviation industry. Boeing also forecasts demand for 690,000 maintenance technicians and 938,000 cabin crewmembers. Over the next 10 years, more than 30% of U.S. aviation technicians and more than 25% of commercial pilots in the commercial aviation workforce will be at or near retirement, it predicts.

Staffing challenges have been most acute over the past 24-36 months, says Todd Simmons, Cirrus Aircraft president of customer experience. Cirrus employs more than 2,500 people, with the majority of its workforce located in Duluth, Minnesota, where Cirrus aircraft are manufactured.



TEXTOR AVIATION

“We know there have been compensation changes [in the industry,] and Cirrus has made those changes,” Simmons says, in everything from direct labor to its pilots. It has enhanced employee benefits, such as health care and 401(K) plans.

Cirrus has also been creative in adding a variety of options for pilots and experiences they can have within the company.

“That’s not to say there are not pilots that are trying to build toward an airline career,” Simmons says. “There are, and there will always be.” But now, the company offers a variety of pathways for pilots. For example, pilots have become product specialists, production flight-test and experimental flight-test pilots and leaders in sales and marketing. In addition, pilots train and teach customers using Cirrus aircraft.

The company has been investing in training and is spending more time in the recruitment process.

“Our investment has been intensified on the front end,” Simmons says, with more dedicated resources for human resources and training. It is spending more time in the recruitment process to find staff with the skills to do the job.

“I think these are the hallmarks of what Cirrus has done,” he says. “We are beginning to see more stability in the employee population, especially in the past six months, because of that.”

TECHNOLOGY ATTRACTION

Honda Aircraft, based in Greensboro, North Carolina, held a job fair during EAA AirVenture in Oshkosh, Wisconsin, in July, where it was well-received, officials say. Recruiters there met with students and professionals.

The company has immediate openings for more than 100 new hires, including engineers, pilots, mechanics, supply chain professionals and others. With Honda Aircraft’s new HondaJet 2600 model, an 11-seat longer-range version of its current HondaJet HA-420, the company will eventually need to add 300 employees to its staff.

Honda Aircraft is studying the market, the supply of and demand for workers and whether it needs to make changes in its salary structure.

“We are very much carefully monitoring that,” says Hideto Yamasaki, Honda Aircraft president and CEO.

At the same time, the new HondaJet 2600 is generating excitement for applicants and its workforce, Yamasaki says.

Honda Aircraft is recruiting from “everywhere,” both inside and outside the U.S., “wherever there is an industry,” he says.

Meanwhile, Tokyo-based Honda Motor Co., Honda Aircraft’s parent company, has released plans to develop a new electric vertical-takeoff-and-landing (eVTOL) aircraft, as part of a series of next-generation technology under research and development by the company.

“We don’t have a clear connection, but we have started to do some kind of collaborations,” Yamasaki says. “They are coming over to Greensboro [the company’s U.S. headquarters in Greensboro, North Carolina] to have some research for their new development.”

Engineers joining Honda Aircraft will be able to work on exciting projects such as these, he says.

A SHORTAGE BENEFIT

Like others in the industry, Piper Aircraft is competing for top-quality employees. That’s one reason the manufacturer decided to add a family health center to its campus in a partnership with Marathon Health.

While a workforce shortage, along with supply chain issues, are a challenge, they also present advantages, says Ron Gunnarson, Piper Aircraft vice president of sales, marketing and customer support.

“Those constraints can be both a curse and a blessing,” Gunnarson says. “We are an industry that follows the market like no other industry with the ups and the downs.”

When times are good, the industry has a tendency to over-produce aircraft.

“You are going full tilt, full throttle all the time, and you get yourself out onto a ledge,” Gunnarson says. “No one can over-build like general aviation OEMS.”

Overbuilding presents difficulties in times of a downturn.

Today’s supply chain and labor shortages difficulties are “keeping us in the real world,” he says, with a healthy order backlog of aircraft.

“It’s a very good and special place to be,” Gunnarson says.

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A Phenom at SaxonAir.

New Normal for Charter

Operators and brokers balance pains and gains.

BUSINESS AVIATION BOOMED during the COVID-19 pandemic, but as vaccines enabled much of the world to return to something close to business as usual, the private air charter world has had to adapt to a new set of operational norms. This has brought challenges for many in the sector, as attendees of the Air Charter Expo, organized by the Air Charter Association and held at Biggin Hill Airport in London—heard Sept. 12.

“I think we all breathed a bit of a sigh of relief,” said Claudia Watt, business development director at the UK division of Air Partner, during the event’s opening panel discussion. “On the passenger side, we definitely saw fewer entrants into the marketplace. The market has suffered a little bit—we maybe had to work a little bit harder to bring new business in.”

Operators as well as brokers can see both the upsides and the challenges in a return to lower overall levels of demand.

“Compared to 2022, when it was like a seller’s market for aircraft owners, we have suffered with capacity issues,” said Yannick Monreal, Zurich-based sales director at Jet Aviation. The higher prices charter customers were willing to pay during 2022 have dropped, leaving some owners less inclined to make their aircraft available to the sector. However, this is starting to be balanced by those owners who are using their aircraft less because their own travel requirements have reduced as travel restrictions eased.

“Now our owners and aircraft that were private before are looking to bring the aircraft onto commercial AOCs [air

operator certificates], increasing the capacity again,” he added. “The capacity right now for us is quite good, and we have aircraft to finally offer again.”

In the private cargo sector, the picture is similar.

“Capacity has massively increased again,” Daniel Carriett, global cargo director of specialist broker Chartersync, told a panel on cargo charter. “Not just from those passenger airlines that are flying again, providing that extra capacity, but also the additional freighter aircraft and main-deck freighter capacity that we’ve seen in the last two or three years that’s grown out of the pandemic. That’s caused the demand to drop.”

Much of the extra business that cargo charter operators saw during the pandemic was related to the medical emergency. As that work has disappeared, traditional jobs—which had fallen away during COVID restrictions—have returned, and with them, some familiar challenges are also coming back into focus.

“In 2021, we were really busy [with] medical flights,” said Karl Kimber, commercial planning manager at operator RVL Aviation. “That’s now dropped away as testing has stopped, and we are now back to automotive, oil and gas, which is very much more on demand and hard to predict.”

Helicopter charter, however, appears to be bucking the trend. Levels of operation that increased during the pandemic are—at least so far—being sustained.

HELICOPTER DEMAND DIFFERENT

“[Helicopters] were silly after COVID, but this year again, they just kept going, and I think it’s caught a lot of us off guard,” said Jordan Smith, head of ground operations for operator SaxonAir, based at Norwich Airport, England. “We’ve upstaffed for it, but it was almost too late because

none of us really expected after last year that we could possibly peak again, which we did.”

There also has been a return to pre-pandemic seasonality, with demand very high in the European summer, particularly when the flights are associated with leisure travel—high-net-worth individuals taking their families on holiday, or businesses entertaining corporate clients by flying them in helicopters to major sporting events or summer music festivals. This is a challenge even for operators who own their own aircraft.

“We’ve got one owner, so he very much understands the seasonality and understands the importance that we have to make money,” says Alex Harrington, commercial director of charter airline Titan Airways. “[But] we’ve still got crews to pay for during the winter. They might be operating 80 or 100 hr. a week if we can squeeze that out of them during the peak months, [but] we’ve still got to pay them pretty much the same even when they’re operating maybe 10 hr. a month in the winter. You try and manage that best you can with seasonal contracts wherever possible, and then when it comes down to engineering and maintenance, you try and have every day available in the summer and you push as many of the big checks and maintenance into the winter.”

One way companies across the private charter sector can

help themselves to manage these demand spikes is to work with customers to explain the challenges.

“I generally think it’s about managing the expectations of the client,” said Charlie Cole, founder and CEO of brokerage Charter Consultants. “Maybe three, four, five years ago, I feel as though there was a lot more availability and you could dictate more. Whereas now, I find that it’s more the operators are dictating to me what they can do, and then it’s just about me managing my client’s expectation to make sure that they are satisfied with the service.”

“The harder piece is actually educating the clients over why there’s such a discrepancy—and it can be huge in commercial—between the price in November and the same trip in August,” Harrington said. “It comes down to supply and demand. Some people get it, some people don’t. Some people, I suspect, do get it, but decide they don’t want to.”

“What sets you apart then is your product,” he adds. “It’s easier to have a pricing conversation when your product level is good. And it’s simple things: a clean aircraft turning up; a reliable service; something that’s not going to break down; you turn up on time; you do the job; [and] your crew are briefed. Certainly, in our market, we like to think that sets us apart a bit—and starts to maybe justify the price you’re charging.”

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Aircraft Trainer Market

Flight schools around the world are signing deals.

THE MARKET FOR TRAINING AIRCRAFT from flight schools is booming, as evidenced at EAA AirVenture in July, where manufacturers announced hundreds of orders for new trainers.

A global pilot shortage and the promise of high-paying jobs means high demand for flight training programs.

The latest pilot compensation survey by the National Business Aviation Association shows salaries up 12% from 2022 to 2023 for senior captain, captain and first officer positions in the business aviation industry. Survey results were released on Sept. 5. At the same time, business aviation positions grew by 7.22%.

“We’re still in this pilot shortage and the training institutions are trying to grow as fast as they can,” says Chris Crow, Textron Aviation vice president of piston sales. “The market is good.”

Textron Aviation is delivering a “good portion” of its single-engine aircraft to small and large flight schools and universities, with the majority of the deliveries going to the large flight schools.

“Most are buying multiple aircraft for their business,” Crow says.

There is a shortage of single-engine aircraft available, says Mike Tonklin, Elixer Aircraft business development director for North America, with more aircraft going to the scrapyard per day than new aircraft coming into service.

Elixer Aircraft, based in La Rochelle, France, announced an order at AirVenture for 100 new Elixer trainers from Sierra Charlie Aviation, based in Scottsdale, Arizona, with deliveries set to begin in early 2025. The aircraft has received European Union Aviation Safety Agency CS-23

certification, with FAA Part E23 certification expected soon.

Tecnam Aircraft launched the P-Mentor two-seat trainer at AirVenture and announced orders for 30 aircraft from Kilo Charlie Aviation near Kansas City, an order for 15 from Epic Sky Aviation in Des Moines, Iowa; and an order for three from the Vermont Flight Academy in Burlington, Vermont. It also announced an initial order for 15 from Stephen F. Austin State University in Nacogdoches, Texas, with an option for Tecnam 2006T twin-engine aircraft.

FAA certification of the P-Mentor is expected soon, the company says.

Piper Aircraft, based in Vero Beach, Florida, announced orders at AirVenture for nearly 100 Piper Archer DX and TX aircraft valued at \$50 million from four flight schools, including three based in India.

“For Piper, India is one of the fastest-growing commercial aviation markets and is expected to remain so for the foreseeable future,” says Ron Gunnarson, Piper vice president of sales, marketing and customer support.

Most recently, Air India signed deals with Airbus and Boeing at the Paris Air Show in June for 470 commercial airliners valued at \$70 billion based on list prices, with an option for 70 additional aircraft.

This expansion has fueled trainer aircraft purchases. Sky-nex Aero in New Delhi ordered 27 Archer DX diesel-powered aircraft for delivery in 2024 and 2025; Dunes Aviation Academy based in Bhavnagar, Gujarat, placed an order for 10 aircraft for delivery in 2024, while Vman Aero Services based



Market Is Hot

in Mumbai, has 10 aircraft on order for delivery in 2024.

Sierra Charlie Aviation, meanwhile, has ordered 50 Archer TX trainers as it plans to expand from two locations to four within the year. Deliveries are scheduled to begin in 2026 and conclude in 2030.

In March, Piper signed a purchase agreement with Blue Line Aviation in North Carolina, for an initial firm commitment for 55 trainers and an option for 60 more, with deliveries to begin later in 2023.

Embry-Riddle Aeronautical University is replenishing its training fleet with 172 Skyhawks on order. In July, it announced an order with Diamond Aircraft for 12 new DA42-VI multi-engine aircraft for flight training at its Daytona Beach, Florida, campus, for delivery in 2024.

Its fleet at the Florida campus includes 87 Cessna 172s and 11 Diamond DA42s, while its Prescott, Arizona, campus operates a fleet of 75 aircraft. Embry-Riddle also trains students on more than 260 flight simulators housed at both campuses.

In June, ATP Flight School placed an order for 40 Cessna 172 Skyhawks for delivery in 2025. The aircraft adds to its fleet of nearly 200 Skyhawks positioned across 82 training centers. It is the flight school's second fleet purchase in a year for its Airline Career Pilot Program.

The school plans to train 20,000 airline pilots by 2030. As of June, ATP had 95 Skyhawks on order. **BCA**



Textron Aviation's Cessna 172 Skyhawk upgraded with a number of interior enhancements



Luke Ormsby, program director with Sierra Charlie Aviation, with the flight school's Piper Seminole. Ormsby was at AirVenture as Piper announced the school's large order with Piper for training aircraft



Tecnam launched the new P-Mentor trainer during EAA AirVenture in July and announced orders for more than 60 at the show.



Textron Aviation vice president of piston sales, with a Cessna 172 Skyhawk upgraded with a number of interior enhancements.

Surf's

HAVING FINALIZED AN EXCLUSIVE deal with Textron and acquired commuter airline Southern Airways, U.S. startup Surf Air Mobility believes the pieces are in place to accelerate its bid to electrify a substantial portion of the existing global fleet of Cessna Caravans.

The flurry of recent activity has centered around a direct listing on the New York Stock Exchange in late July. Going public was a pre-condition to finalizing the exclusive agreement with Textron—a partnership that will see the OEM promote and market the modified Caravans as an official product line, leveraging extensive customer relationships and a global network of service and support centers.

While the transaction did not directly generate additional capital for Surf Air, it did allow the company to begin accessing a \$400 million financing facility from alternative investment group Global Emerging Markets—which, like the Textron deal, was contingent on Surf Air going public—as well as financing from Jetstream Aviation Capital for a fleet order for up to 150 Caravans that was announced alongside the transaction.

“All those things came together to ensure that we would basically have everything that we needed for our business plan, on the condition of us going public,” says Sudhin Shahani, CEO of Surf Air. “We considered going public through an SPAC, but when we looked at the market environment, we concluded that a direct listing would provide the most expedient path to market.”

The company is developing both electric and hybrid-electric powertrains for the Caravan. The all-electric variant will come with a range of 115 mi. (100 nm), while the hybrid system—built around a combustion engine and turbogenerator—will get up to 345 mi. (300 nm). The company plans to place charging stations on each end of routes operated by its electric caravans, while the hybrid variant will not require new infrastructure.

Shahani observes that around 30% of existing Caravan missions would fall within the 115-mi. range of the electric variant, which reduces operating costs up to 50% compared to the conventional Pratt & Whitney PT6-powered Caravan. The hybrid variant, by contrast, could handle most existing



Caravan missions, but only has half the operating cost savings of the electric version.

Selling Caravan operators on the retrofits should be easy, Shahani says, pointing to the similar price point between electrification and a routine engine overhaul. “All the 3,000 Caravans out there today should be eligible when they come up for an engine overhaul to instead replace that combustion motor with a hybrid or a fully electric variant,” he says.

“Another key part of the Textron agreement is that they’re not just installing our powertrains in new Caravans—they’re going to market it as an upgrade across their network of service centers globally,” he adds. “Given the option to upgrade and reduce operating costs for the same cost of an engine overhaul, it’s going to be a commercially logical decision for operators to make.”

Surf Air’s acquisition of commuter airline Southern Airways was completed a day prior to its direct listing. In addition to providing scheduled and on-demand services, the airline will function as an R&D platform to prove out and generate interest in the electrified Caravans. The carrier’s sister airline, Hawaiian carrier Mokulele Airlines, also flies short-hop, inter-island missions that will be perfect to demonstrate the capabilities of the electric variant, according to Southern Airways CEO Stan Little.

“We have this very large platform with which to debut the motor and increase that adoption curve because people can see it put into commercial use,” Little says. “We think it’s the perfect combination of having that R&D element, the

Up

Surf Air leverages Textron to electrify Caravan fleet.



Surf Air Mobility offers commuter service with Pilatus PC-12 turboprops for a monthly subscription.

SURF AIR PC-12

on-demand element and North America's largest fleet of passenger Caravans."

In addition to operating scheduled and on-demand services, Surf Air plans to continue and expand its existing regional air mobility marketplace platform, in which it connects paying customers with third-party charter operators on short-haul turboprop flights using its integrated software and app. The company expects the platform to serve as a "pipeline" to help onboard other Caravan operators to its electric and hybrid powertrains.

"The parallel path of scheduled service and then on-demand using other operating partners will be what fuels our growth," Little says.

Surf Air is targeting early 2026 to obtain its Supplemental Type Certificate for the electric variant, with the hybrid variant expected somewhat afterward, according to Shahani.

Looking ahead, Shahani says he hopes to use the powertrains developed for the Caravan to power other turboprops powered by the PT6.



Surf Air Mobility's powertrain for the Cessna Caravan comes in electric and hybrid-electric variants.

SURF AIR MOBILITY

"That PT6 lives in a number of different aircraft, so the fact that the technology we're developing will have applications beyond the Caravan is well understood," he says. "Of course, that PT6 lives at different power levels in different aircraft, and as batteries get better, more and more aircraft will become addressable to our powertrains."

BCA



A technician at StandardAero's Houston facility working on a TFE 731 engine.

STANDARD AERO

Legacy Engine Parts

Plan ahead for high-demand legacy engine components.

OPERATORS OF OLDER BUSINESS AIRCRAFT are facing ongoing supply chain issues and materials shortages, particularly for the legacy engines powering them. Little if any relief is in site.

“Legacy engines are more impacted by non-availability of parts from the OEMs,” says Stacy Hollis, Duncan Aviation’s engine service sales. Honeywell TFE 731 engines represent the majority of the legacy engines serviced by the MRO provider, followed by the Pratt & Whitney-Canada PW 300 series.

Hollis reports that the shortages for legacy engines encompasses any and all parts—not just major components. However, turbine blades have been the most impacted by availability issues.

“Turbine blades from Honeywell and Pratt & Whitney-Canada have had significant delays in the last couple of years and

it doesn't seem to be getting any better,” he remarks. “Some turbine blade sets may arrive in a few weeks once ordered, while other orders may take a few months to arrive.” Although these are parts for older engines, Hollis says that the engines continue to power aircraft with high monthly utilization rates.

Asked about sourcing used serviceable material (USM) as an alternative to new parts for legacy engines, Hollis stresses that they are almost non-existent. “In recent years, that market has been exhausted, so the best option I can offer are new parts directly from the OEM,” he says. “This has become the new normal in our industry.”

USED SERVICEABLE MATERIAL

There is a continuing industry struggle for both new and used parts. “Used serviceable material is in high demand for MROs and OEMs, so we are constantly looking for options there,” says Brian Campbell, StandardAero Business Aviation vice president, global sales and marketing. “Another

option is to provide our customers with exchange engines. However, due to the high demand for rental engines, availability is difficult and rental pools are frequently depleted.”

StandardAero is OEM authorized to provide heavy engine MRO services for legacy engines such as the Honeywell CFE738, HTF7000, TFE731, Pratt & Whitney PW300, PW500, Rolls-Royce Spey and Tay, out of primary MRO facilities in Van Nuys, California; Dallas; Houston; Augusta, Georgia; and the UK—as well as regional service centers in the U.S., UK, Brazil, South Africa and Singapore.

“OEM constrained parts are in high demand, driven by the strength of the industry’s recovery and continued, lingering pandemic impacts on the aerospace industry’s supply chain,” says Campbell. “Unfortunately, availability of a single part can cause a significant impact to turnaround times, especially if the part is sole-sourced.”

As Campbell explains, StandardAero’s in-house parts repair capabilities sometimes can enable the company to avoid new-parts roadblocks.

While the MRO works closely with OEMs to develop component repairs, “on many occasions, we are completely reliant on the external supply chain for OEM sole source parts,” he says. “To help address that, we work hard to educate operators regarding these industry dynamics and encouraging them to become more proactive about planning ahead and establishing longer lead times to work through the supply chain issues. Proper coordination and scheduling their maintenance and service needs, in advance, is key.”

As with other MRO executives, Campbell is not optimistic that things will change soon. “Due to current industry and economic conditions, we don’t envision any significant near-term improvements,” he cautions.

START EARLY

“Start the conversation early,” when it comes to legacy engine support, suggests Phil Stearns, Stevens Aerospace & Defense Systems’ director, sales and marketing. He specifically points to the Pratt & Whitney Canada JT15D, which he reports is the most prominent legacy engine serviced by the Greenville, South Carolina-based MRO.

In the business jet world, the JT15D is among the most prolific. According to statistics from Jetnet, there are 4,102 in service, powering a total of 2,051 aircraft. Of that group, the Cessna Citation II—produced between 1978 and 1994—represents the largest user at 450. Other older, no longer produced Citations, along with the Beechjet 400/400A, Hawker 400XP, and Mitsubishi Diamond 1A also use this engine.

For operators that do not want to overhaul JT15D engines, many “are looking at sourcing used mid-time engines—1,500-2,000 hrs. remaining” to buy time at a lower cost, Stearns explains. “Although a viable option, a couple of issues to consider are the unknown and possibly risky condition of mid-time engines and the immediate timing needed to buy them once they are found. These are hot commodities. With no zero-time JT15Ds available, the mid-time sets are usually sold immediately once on the market. A set may be

available today and the next set may not become available for months—it’s very unpredictable.”

Stearns adds that Stevens spends considerable time locating mid-time JT15Ds, which could take anywhere from a few days to a few months. Most JT15D engines come off retired aircraft.

With regard to USM, Stearns cautions that this could be very helpful in combating certain material shortages, but the availability and quality of USM varies widely. “Good quality, life limited parts (LLPs) are less likely to be available as USM,” he says. “For example, hot-section parts can represent a bottleneck, as high quality hot-section used serviceable parts are rarely available.”

Stearns advises JT15D customers to allocate up to one year in to acquire a mid-time JT15D, “even if it sits on the shelf for months. The important thing is that you can get an engine you can fly for the next several years,” he notes. “Just don’t wait until the last minute, or your airplane will be sitting on the ground.”

Kyle Ballantyne, Honeywell Aerospace’s legacy turbofan product line director, reports that supply chain health has been improving throughout the year, and expectations are that will continue into 2024. Honeywell supports about 9,000 TFE 731 turbofan engines, and in excess of 10,000 TPE 331 turboprop units.

“Honeywell has been driving supply chain capacity improvements in collaboration with the supply base,” says Ballantine. “We established new supplier readiness and supplier development organizations, and have focused on rapid improvement, capacity expansion and establishing dual sources. In fact, we have generated double-digit volume supply year over year, yet demand has continued to grow at a faster rate.”

Specifically, Honeywell and its authorized service center network have collaborated to increase the USM supply through repair development and sourcing surplus engines to part out, in lieu of manufacturing new parts. “We have utilized our rental bank and USM across the Honeywell network to keep the fleets operating,” he says.

BCA





JAMES ALBRIGHT
Contributing Editor

Buying an Early-Build G500

Was buying one of the first G500s, with a 0.925 maximum operating Mach number, the right decision?

WE OFTEN LOOK at our aircraft purchase decisions using 20/20 hindsight afforded by the experience of a few years. Did the aircraft live up to our expectations? Were the manufacturer's promises kept? Would we make the same decision all over again? I led the acquisition team for our company's purchase of one of the first Gulfstream GVII's ever produced, a G500 that rolled off the assembly line during the first year of the type's production. It has been a great airplane for us, but I'm not sure buying an airplane before it achieves certification and system maturity is the right choice for a single-aircraft flight department. Please allow me to explain.

First, the good. We upgraded from the Gulfstream GIV to a G450 when that airplane was a few years into its produc-

tion run, and the G450 became the workhorse the GIV had always been. We decided to take a risk on a brand-new type, the GVII, which promised to be revolutionary, because the promises were just so good. I can sum up the promises with our most popular oceanic trip: Boston to Paris.



MATT BIRCH

tion run, and the G450 became the workhorse the GIV had always been. We decided to take a risk on a brand-new type, the GVII, which promised to be revolutionary, because the promises were just so good. I can sum up the promises with our most popular oceanic trip: Boston to Paris.

The G500 was the first of the GVII series to be certified and promised to get us to Paris Le Bourget at least 30 min. faster, climbing higher more quickly, with a lower cabin altitude, and doing all of that using less fuel. All of those things have panned out in real life. We can climb immediately to 43,000 ft., sometimes 45,000 ft., immediately cruise at Mach 0.90, hold that speed for the duration, have a cabin altitude of

under 4,000 ft., and burn less than 2,800 lb. of fuel per hour. As I promised our company, "We can get you to Paris faster, with less gas, and you will feel better when you get there."

How does the aircraft perform all this magic? The primary reason is the fly-by-wire (FBW) flight control system that has two major impacts on the aircraft's design. First, the FBW eliminated the need for heavy cables, pulleys, and other hardware between the cockpit and the flight controls themselves. A lighter airplane burns less fuel, it's that simple. Second, the FBW computers know how to maximize performance better than we flesh-and-blood pilots. Third, the aircraft design affords other weight savings, and the engines are extremely efficient.

Now the bad news. Each of the problems I am about to list has been fixed. But I will list them as an illustration of what can go wrong with a brand-new type, especially one that is quite revolutionary in design and yet to be "broken-in" by real-life experience. This is exactly what we went through.

Our initial delivery slipped by half a year because a division of the engine nacelle manufacturer, Nordam Group, went bankrupt, leaving Gulfstream with airframes and engines but no engine nacelles. In September 2018, Gulfstream bought out Nordam's G500/G600 nacelle manufacturing line and made things right, but it set us back as they rushed to catch up.

Just before we took our delayed delivery, the FAA decided the G500 would have to comply with recently adopted guidance for the use of Type II, III and IV deicing/anti-icing fluids on airplanes. This guidance, found in FAA Policy Statement PS-ANM-25-10, meant I would be taking delivery of an airplane in December 2019 that could not use anything but Type I deicing fluid. Since we are based in New England, this was a non-starter and we refused delivery, delaying us a further three months.

We finally took delivery in the spring of 2020 and discovered the airplane was a joy to fly--the best-flying airplane I've ever flown, and I've flown a lot of airplanes--and certainly delivered on performance. But there were a lot of growing pains, which I suppose are better termed "learning pains."

Our first flight home, for example, was especially vexing. The initial software had a bug that wouldn't accept a high-altitude flight plan following one or two local pattern flights. We had a Gulfstream test pilot onboard and he called the lead design pilot who called every program engineer he could think of. The only solution they had for us was to reboot the airplane. (This problem has since been fixed with a software update.)

Another issue was that the manufacturer and our training vendor didn't understand how the autothrottles engaged with the engines. Most Gulfstreams use Rolls-Royce engines that measure engine performance using Engine Pressure Ratio (ERP) where a minimum ERP is needed prior to autothrottle engagement. The G500's Pratt & Whitney PW814GA engines don't use ERP at all and the autothrottles rely on Throttle Lever Angle as a precursor to engagement. This wasn't taught by our training vendor, and it was up to operators to figure this out. There were a host of other learning challenges, but most of these are now resolved.

After a year of great flying, two G500s were involved in hard-landing incidents where the pilots used inappropriate control inputs in the flare, causing the FBW to limit the Angle of Attack available to the pilots. (Long story short: don't

repeatedly "pump the stick" in the flare.) The FAA moved in swiftly and until the software was updated, we were saddled with several operating limitations. The worst of these limited us to a 5-kt. gust for landing, which is almost calm winds for many New England airports. This severely reduced our operations for half a year. Gulfstream gave us a maintenance credit and performed the eventual software update for free, but since we are a single-airplane operator, this severely impacted our company's business.

This wasn't my first new airplane operation, but it was easily the most frustrating. It also gave the lie to the claim of the manufacturer's claim of a 99%-plus reliability rate. None of our lost trips due to the inability to use Type IV anti-ice fluid or predicted winds with more than a 5-kt. gust counted against the aircraft's reliability statistics.

So, the bottom line here is this: If I had to do it all over again, back in 2018, would I have bought the proposed Gulfstream GVII-G500? No, I would have waited three years for the manufacturer to work out all of the bugs with the help of all the "beta test" operators. But, on the other hand, would I buy a Gulfstream GVII-G500 as the best available aircraft to suit my company's needs today? Absolutely. **BCA**

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What Are You Looking At?

The critical role of flightpath monitoring.

LAST DECEMBER, a United Airlines Boeing 777 departed Maui on a stormy afternoon. About 60 sec. after liftoff, the crew allowed the airplane pitch attitude to decrease from 12½ deg. nose up to 16 deg. nose down over the next 23 sec. The airplane descended from 2,100 ft. above ground level (AGL), reaching a maximum descent rate of 8,500 ft. per minute and a height of just 748 ft. above the water. With the enhanced ground proximity warning system (E-GPWS) blaring “Sink Rate! Pull Up! Too Low! Terrain!” the captain initiated the controlled flight into terrain (CFIT) escape maneuver. Disaster was averted by mere seconds.

This widely publicized event caught the attention of NTSB, which found the probable cause to be “the flight crew’s failure to manage the airplane’s vertical flightpath, airspeed and pitch attitude following a miscommunication about the captain’s desired flap setting during the initial climb.”

The NTSB report and the associated background material does not provide much more detail about what was going on within that flight deck. However, one thing is for sure: The crew, at least momentarily during a critically important regime of flight, was not monitoring the flightpath of the 777.

The notion of pilots not adequately monitoring flightpath is not new. Almost 50 years to the day before this United incident, Eastern Airlines Flight 401 crashed into the Florida Everglades. The crew apparently became absorbed with attempting to replace a faulty landing gear indicator light. Because of their preoccupation, the crew did not realize the autopilot was no longer maintaining the set altitude. The

Lockheed 1011 descended into the dark, featureless terrain of the Everglades. Ninety-nine lives were lost.

In the 50 years between these two events, there have been scores of other accidents, along with countless events such as altitude deviations, runway incursions and speed deviations that have resulted from pilots not paying attention to where the aircraft was headed. I started researching flightpath monitoring in 1997 as a research consultant for NASA’s Aviation Safety Reporting System, and I even wrote my Master’s thesis on this subject.

In 2002, I convinced the FAA to change the term “pilot not flying” to “pilot monitoring” to draw attention to the critical task of flightpath monitoring. The idea was simple: It is important to describe the pilot’s title by what he or she *should* be doing instead of what he or she is *not* doing. The FAA agreed and revised two advisory circulars to reflect this change. Aircraft manufacturers soon followed, as did many airlines and business aviation operators.

Last year, the FAA published advisory circular AC-120-123, “Flightpath Management.” According to that document, flightpath refers to the “trajectory (lateral, longitudinal and vertical) and energy state of the aircraft.” The term also includes ground path when the airplane is moving on the ground. “Ensuring that the aircraft is on a safe and correct flightpath is the highest priority of all pilots on the flight crew,” states the document. “Ensuring the airplane is on the correct flightpath includes the actions necessary to check/verify that the flightpath is correct and to intervene as necessary if it is not correct.”

In truth, research in several disciplines has shown that humans are not great at monitoring highly automated, highly reliable systems for extended periods of time. Yet, that’s precisely what pilots are expected to do. Like other aspects of aviation, however, monitoring is a skill that can be taught and perfected. Following a Cessna 560 crash in Pueblo, CO, while serving as vice chairman of the NTSB, I pushed the



agency to issue a safety recommendation for FAA to require that pilot training programs teach and emphasize monitoring skills and workload management. In 2013, FAA published a rule that requires pilot monitoring training for Part 121 operators. Although I approved closing the recommendation once FAA made this regulatory change, as I sit here today, I see an irony: That NTSB recommendation, A-07-13, was issued at a result of a business aviation crash. However, the FAA's response only covers Part 121 operators.

Research has shown that most flightpath monitoring errors are manifested when the aircraft is in a dynamic state, such as changes in altitude, speed or course. Therefore, strategies can be built around enhancing flightpath monitoring during these phases. "A Practical Guide For Improving Flight Path Monitoring," published by the Flight Safety Foundation, refers to these phases as "areas of vulnerability" (AOV). These are flight regimes where "either the potentially increased likelihood of a flight path [sic] deviation or the increased severity of potential consequences if such a deviation occurs," the publication says.

Knowing that you are more likely to have a flightpath deviation in these AOVs is significant. You should use enhanced monitoring during the AOVs and plan your workload to avoid doing non-monitoring tasks during these flight regimes. Think of it as making sure you are not doing the right things at the wrong time. For example, briefing the approach is something that we must do. When should it be done? It is best to perform this task prior to leaving cruise altitude—when possible—to increase flightpath monitoring capability. This allows greater attention to be devoted to properly monitoring the descent because the crew is not having to divide attention between reviewing the approach and monitoring the descent.

Many altitude deviations occur because pilots are not properly monitoring the level-off. After a few altitude deviations early in my career, I employed the technique of suspending

"In 2002, I convinced the FAA to change the term 'pilot not flying' to 'pilot monitoring' to draw attention to the critical task of flightpath monitoring."

non-monitoring tasks during the last 1,000 ft. of altitude change. That allowed my focus to make sure the airplane leveled at the proper altitude.

Lastly, remember that one pilot must always be monitoring the flight path—no matter what. When a distraction or malfunction occurs, the tendency is to focus on that issue. Resist that urge, and first make sure that one pilot is designated to monitor the flight instruments. One attention trap is the flight management system (FMS). I have noticed that when one pilot goes heads-down to program the box, the tendency is for the other pilot to watch. I once heard the late Earl Wiener, who conducted early research on automated aircraft, compare the FMS to a vacuum cleaner. "It sucks attention, fingers and eyeballs right into it," he quipped.

Ask yourself: How are you doing with flightpath monitoring? Take a look through the Flight Safety Foundation monitoring guide and AC-120-123. Weigh up those words of wisdom against how you conduct your operations. **BCA**

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 serving as chairman from 2017-21. Prior to that, he managed a corporate flight department for a Fortune 500 company, and previously was an airline pilot for 24 years.



ROGER COX
Contributing Editor

Stepped On

Why hasn't anti-blocking circuit technology been implemented?

THERE'S A LOT OF CONCERN about runway incursions at the FAA and in the media right now. The FAA cited six serious incursions that have recently occurred when it issued a SAFO (Safety Alert for Operators), number 23002, in March. Both the FAA and the NTSB picked up the megaphone to emphasize the increased peril using Calls to Action, Safety Summits and Roundtable Discussions.

While these efforts are expected and well-intended, I suspect that such calls for more care from pilots and controllers

The VHF radio frequencies commonly used in air traffic control don't allow simultaneous transmissions. When a pilot or a controller presses his transmit button at the same time as another pilot or controller is already transmitting, one blocks the other. Sometimes there's a squeal, sometimes garbling, sometimes one transmission overpowers the other, but generally the outcome is that the transmitted messages don't get through. Pilots call this "stepping on" another's radio call. Blocked transmissions have been around since

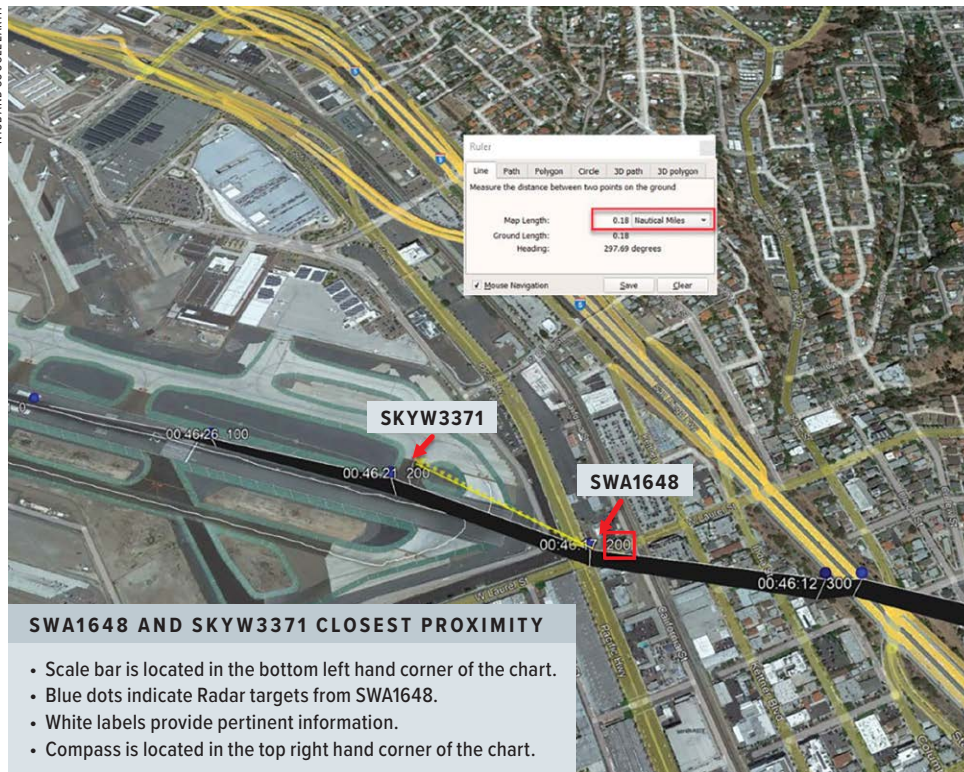
the piston age, but nobody has been able to stop them.

Blocked radio transmissions have caused accidents, near-accidents, and runway incursions many times. A blocked transmission was causal in the famous accident on Tenerife in the Canary Islands between two Boeing 747s in 1977.

The latest runway incursion caused by a blocked transmission took place at San Diego International Airport (SAN) on June 10, 2021. A tower controller left a Skywest Embraer 170 flight sitting on the departure end of runway 27 while an inbound Southwest Boeing 737 approached that runway. Realizing the developing conflict, she ordered the Skywest to exit the runway and the Southwest to go around.

The FAA ATC audio captured the pilot of SWA1648 stating, "Ah," followed by

the tower controller stating, "Southwest sixteen forty-eight go around." Immediately after the controller unkeyed the transmission, the Southwest pilot stated, "Southwest sixteen forty-eight". On another recording made by a commercial source, the pilot of the Southwest flight was heard saying, "Ah, is that an airplane on the runway, for Southwest sixteen forty-eight." The pilot's question blocked the controller's go-around command.



miss the mark with their intended audience. Pilots and controllers are already some of the most conscientious professionals in the world. What the folks in the cockpits and the towers would really like to see is concrete improvements in their tools, staffing and work environment.

One tool that would help to reduce runway incursions and improve other ATC-pilot communications in general is the anti-blocking circuit in ATC and aircraft radios.

The Southwest flight was 0.84 nm from the end of runway 27 when the controller and the pilot blocked each other on the frequency. Because the Southwest crew did not hear the go-around order, they continued to the runway and landed. The closest proximity between the two airplanes was 0.18 miles laterally and 200 ft. vertically.

The idea for an anti-blocking circuit in aviation radios has been around for a long time. Testifying before the House Aviation Subcommittee in 2001, retired American Airlines Captain John Rutty said "An anti-blocking circuit can prevent a pilot from stepping on an ongoing voice transmission, allowing the other transmission to be completed, uninterrupted. The valid signal in the receiver is sensed and the switch or transfer from receive to transmit is inhibited. The pilot hears an audible beep, which tells him he is not transmitting and, by remaining in the receiver mode, the pilot for sure hears the incoming message, which otherwise would have been blocked."

Captain Rutty went on to suggest starting with just controllers' radios. An alerting beep on the controller's radio would let him or her know the information was not being received by at least one aircraft on the same frequency. "This is suggested only for the controllers' radios as a step that can be done immediately since there would be no rule change required," Rutty said.

Even though it had some congressional support and the president of the Air Line Pilots Association was behind the anti-blocking circuit technology, it wasn't implemented.

In considering why such a simple safety tool has been overlooked for so long, I recalled some simple verities about aviation I heard long ago. "There are two kinds of people, ground and air. The ground crowd design, construct, dispatch, maintain and otherwise control and regulate flying. They wield the clout because they control the money and write the rules." These words were spoken by Captain Len Morgan, a Braniff captain I had the pleasure of flying with in the late 70's.

Len went on to explain that each person on the ground has their own goals and pressures. Few are able to grasp the total picture as seen from the air. It's up to us, he said, to better communicate what we know is wrong with the system.

Too many people on the ground seem to have myopia on the subject of anti-blocking circuits. Nobody wants to be the first to make the small investment that could prevent a catastrophic collision. It's too easy to blame the few pilots and controllers that err and just urge us all to be more vigilant.

Instead of "calls to action," I'd like to see some real action. Get anti-blocking circuits installed in ATC facilities and airplanes, and we won't have to say "stepped on" again. **BCA**

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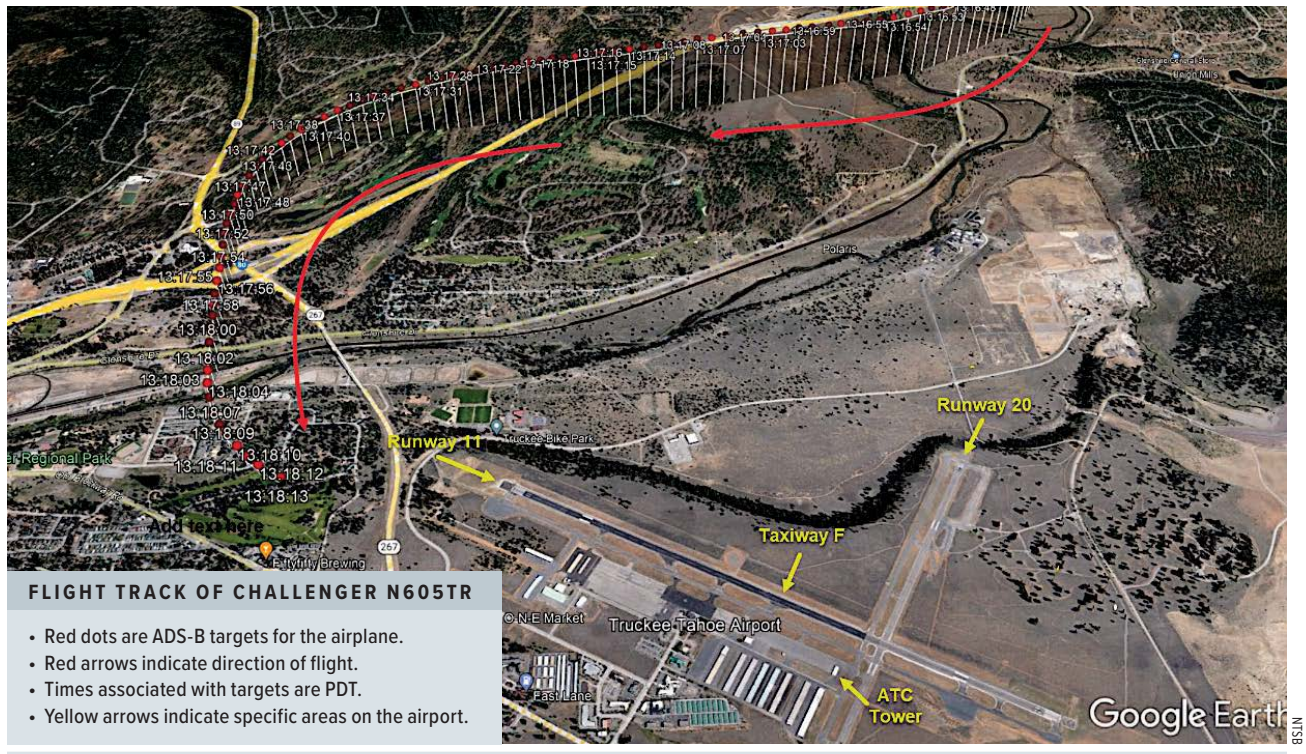
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Who's Flying This Air



IMAGINE WHAT WOULD HAPPEN if automobiles had two steering wheels, two instrument displays and two sets of pedals on the floor. There would be bent fenders, jumped curbs and even some high-speed rollovers when the two people in the front seats differed about which way they should go and how fast. Airplanes, which evolved with such dual controls, survive because pilots are trained and conditioned from their first flight to follow a basic rule: Only one pilot can control the airplane at a time.

Two pilots flying a Bombardier Challenger broke that rule during a critical phase of flight, while lining up with the runway on short final. The result was an aerodynamic stall and a catastrophic crash, with the loss of everyone on board. Why two experienced pilots would make such a basic mistake is hard to explain. The National Transportation Safety Board (NTSB)

said poor crew resource management (CRM) contributed to the cause, but there were other risk factors at work, as well.

The Bombardier Challenger 605, N605TR, departed Coeur d'Alene Airport-Pappy Boyington Field (COE), Coeur d'Alene, Idaho, at about 11:45 PDT on July 26, 2021. On board were the two pilots and four passengers. Their destination was Truckee-Tahoe Airport (TRK), Truckee, California. The airplane was newly acquired by charter operator Aeolus Air Charter, but was being operated under Part 91 as a personal flight.

The two pilots had never met one another before they commenced the flight. The pilot designated as pilot in command (PIC) had been offered a position as a charter captain for Aeolus, but was flying under contract rather than as an employee. He had flown one contract trip for Aeolus that terminated in COE. The second-in-command (SIC) was an experienced contract pilot being paid a flat rate to fly the trip. He had commuted into COE from another assignment on the East Coast.

Both pilots had sound credentials. The 43-year-old captain had an Airline Transport Pilot (ATP) certificate issued by Mexico, and type ratings in the CL-600, CL-604, G-200 and

plane? Analyzing the Challenger flight that stalled on short final at Truckee.

LR-60. He had 5,685 total flight hours—3,080 of which were as PIC, and 235 of which were in the Challenger. His most recent flying job, a 4-month contract in the Middle East, ended in February 2021, and he logged only 12.3 hr. in the 90 days before the accident. After he completed a video interview over Zoom with company officials, he attended training at FlightSafety in Wilmington, Delaware. He completed his last proficiency check in the CL-605 on July 16, 10 days before the accident.

The co-pilot, who was 58 years old, had 14,401 flight hours. He had 12,355 hr. as PIC and about 4,500 hr. in the Challenger. He had an ATP and six type ratings, including the CL-604 and CL-65, and he had been manager of flight standards, check airman and aircrew designated examiner for PSA Airlines. He was a flight instructor and was also glider-qualified. He said he preferred flying as a contract pilot to full-time employment, and had been active, logging 37.9 hr. in the last 90 days. A review of his recent flights showed that he switched back and forth between PIC and SIC, depending on the needs of the client. He had also recently attended recurrent training at Wilmington, completing his last proficiency check on June 18, 2021.

The flight began routinely, with the captain flying the airplane and the co-pilot reading checklists and handling the radios. The co-pilot spoke deferentially to the captain, but in keeping with his experience as an instructor and check airman, he began prompting the captain about checklists and the planned profile of the flight. A close review of the cockpit voice recorder (CVR) transcript reveals the tone in the cockpit gradually changing. The relationship between the two pilots, sometimes referred to as command gradient, became inverted, with the co-pilot taking the initiative more and more.

During climbout, the co-pilot asked the captain what runway he planned to use at Truckee, and the captain said Runway 11.



The aircraft in a fireball after the crash.

After leveling off at FL370, the captain left the cockpit to check on the passengers. When he returned, he began a lengthy formal briefing for the approach at TRK, but was interrupted by the co-pilot, who asked, “So you do want to do the approach, or do you want to stay visual?” The captain replied that he wanted to fly the area navigation (RNAV) approach.

Then, as the captain continued his briefing, the co-pilot asked: “Did you . . . did you already program that?” The captain said, “I have . . . no, I have not programmed nothing.”

In the ensuing conversation, it was evident the captain was not very familiar with this airplane’s flight management system (FMS). He said: “In which book can I see . . . where the . . . where . . . is all the equipment that this aircraft has . . . I mean . . . uhh . . . L-P-V L-D L-NAV P-B-N G-N-S blah blah blah . . . where can I see it?”

The co-pilot loaded the RNAV approach and explained details of the system. They also discussed the fact that basic



The aircraft, N605TR.

NTSB

TRK SUGGESTED RUNWAY 29 ARRIVAL



TRUCKEE AIRPORT

APPROACH CHANGES

Truckee Airport, at 5,904 ft. above sea level, sits in a bowl. Mountains just to the south and west rise to more than 9,000 ft., and Mt. Rose, at 10,785 ft., lies just to the east of the airport. The airport authority warns pilots about potentially difficult conditions on its website. Under the heading “Pilot Essentials,” it tells pilots to expect mechanical turbulence, gusty winds and a diverse fleet of aircraft, including jets, light airplanes, flight instruction and gliders operating at the airport. The airport is in a non-radar environment, and no precision approaches are available. Density altitudes often exceed 9,000 ft. in sum-

mer. Notably, the site says, “Wildfire smoke can dramatically decrease visibility.”

July, the month of the accident, is also the busiest, as the two pilots were about to find out. When descending to FL 200 and cleared to ALANT, an initial approach fix (IAF) for the Runway 11 approach, Oakland Center called and changed the approach. It would now be the RNAV to Runway 20, and they were cleared to a different fix, AWEGA. The captain promptly said that runway was too short. He said, “For Runway 20 . . . so we will have to circle to land . . . so we can't . . . cannot accept that.”

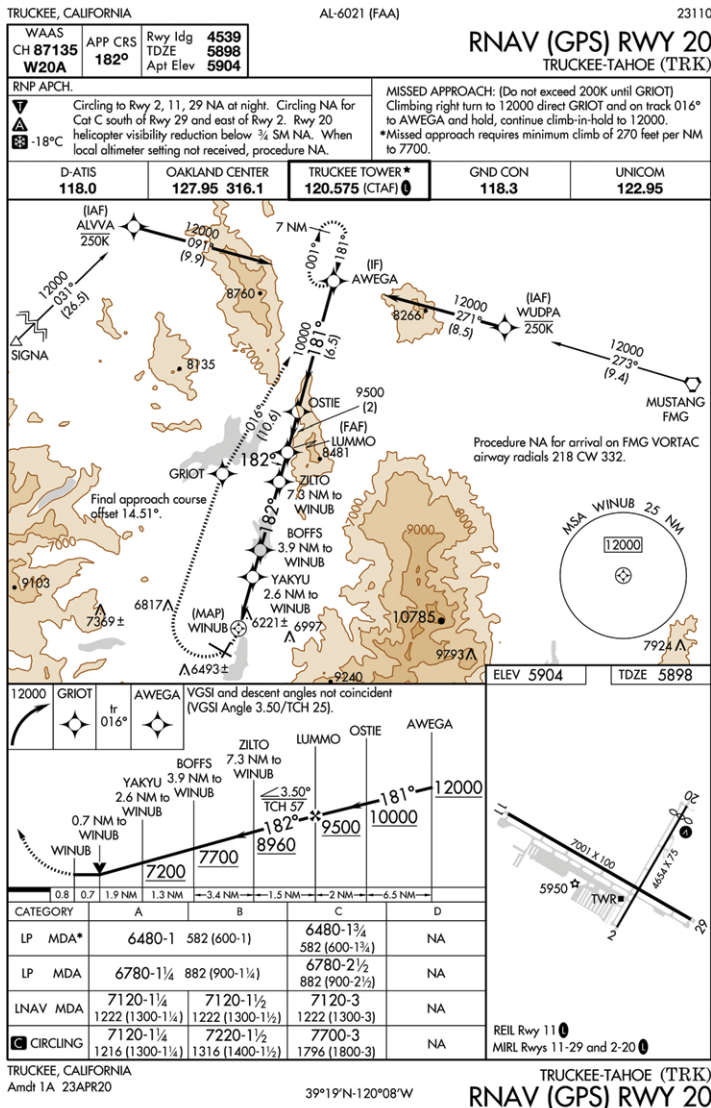
They did accept that. They would have to circle to the longer runway, maneuvering at low altitude in unfamiliar, mountainous terrain. They were also number three for the approach and would have to enter holding. Oakland then gave them another change: Holding would not be at AWEGA, but at ALVVA. They were already passing AWEGA when they got the holding clearance.

Since that fix was west of the fix toward which they were already proceeding, they needed to make a sharp right turn. The co-pilot said “I’m gonna start the turn for ya ‘cause we’re missing it.” The captain said “thank you,” and “I don’t know what it is.”

The co-pilot quickly entered the holding instruction in the FMS, showed it to the captain and told him he could now build the new approach. Events were moving fast. As they were trying to get oriented to the holding pattern, Oakland said “november five tango romeo descend and maintain one four thousand expect the approach shortly.”

information about the airplane’s weight and balance had not been loaded. Salt Lake City Center cleared them direct to TRK. When the captain started to proceed direct to the Mustang VOR, the co-pilot reminded him they were not cleared there, but to the airport. Resuming their discussion about weight and balance, the captain said, “OK ... what’s that meaning of LEMAC?” As the co-pilot began to explain the basics of arm and moment, the captain said, “Why don’t they put those kind of notes?” and “I have (aircraft) work to do with you.”

RNAV (GPS) RUNWAY 20



RNAV (GPS) runway 20 at Coeur d'Alene Airport-Pappy Boyington Field (COE), Coeur d'Alene, Idaho.

tower uh . . . roger report the airport in sight when you're breaking off the approach you can either enter the downwind for one one or you can enter . . . you can enter a uh left downwind for one one or you can go over the top left downwind for two nine."

The traffic pattern depiction on the Truckee Airport website shows overflying the airport and entering a left base for Runway 29 is recommended. The two pilots had apparently not checked the website. They were still looking for the airport.

While the co-pilot was finishing the radio call, the captain called "gear down," and the co-pilot said, "oh [expletive] you came off . . . what are you . . . ah never mind." His composure was starting to fray. He said he had intermittent ground contact, then while he was trying to run the before-landing checklist the captain said, "So it's to the left, right?" The co-pilot told him, "It's to the left."

As the electronic voice announced "approaching minimums," neither pilot could see the airport. Then, even though he was in the right seat, the co-pilot saw it and realized they were in too close. He said, "Make a right-hand turn 90 deg." The tower cleared them to land, but the captain just asked "Where?"

They were well within the 3-nm circling radius for their category C airplane, but the captain did not set up a downwind. Instead, he took up a heading that angled toward the final approach course. Seeing both the runway and the developing overshoot, the co-pilot called out, "Roll out . . . turn the autopilot off," and "I'm going to get your

speed under control for you." The airspeed was 162 kt., well above the maximum for circling of 140 kt. The power came back, the airplane began to slow, and the captain finally picked up the runway. However, they were high and overshooting the runway centerline.

The co-pilot began asking to take control of the airplane, a request he repeated four times. The spoilers deployed to their full open position. A sink rate warning sounded, followed by a stick shaker and a pull up warning. The captain cried out, "What are you doing?" as the co-pilot continued to ask for control of the airplane. The stick pusher engaged, and the airplane entered a rapid left roll. The nose fell through, and the airplane descended rapidly into the ground. A large fireball erupted.

Investigators from the NTSB were assisted by representatives

When they were cleared for the RNAV Runway 20 approach, they were at 21,225 ft. above mean sea level. They were going back to AWEGA to start the approach and needed to be at 12,000 ft. when they crossed that fix. The co-pilot asked, "Are you gonna be able to get down?" The captain replied in the affirmative. From that point on, they struggled to get down and remained above the approach charted profile until reaching YAKYU, only 3.4 nm from the airport.

Their speed was also high. Past the IAF, calibrated airspeed was still 250 kt., and ground speed was 300 kt. The co-pilot said, "Gotta get this thing slowed down." He suggested they do a 360-deg. turn to lose altitude, but the captain declined, saying "No, I can do it." They started deploying flaps and gradually began to slow.

When the co-pilot checked in with Truckee Tower, the tower said, "Challenger six zero five tango romeo Truckee

from the FAA, Bombardier, TSB of Canada, Rockwell Collins, Midwest ATC Service and General Electric. Both the flight data recorder (FDR) and voice recorder were recovered, and the quality of the recordings was excellent. The recorders showed that there were no airplane systems or engine malfunctions. The investigation focused on operational factors and aircraft performance. Top officials at Aeolus and simulator instructors who trained the pilots were interviewed, and a performance specialist analyzed the airplane's flight path and flight controls to determine what caused the airplane to stall.

Airworthiness investigators discovered that the basic operating weight (BOW) entered into the airplane's FMS was wrong. It had defaulted to a standard weight of 24,000 lb. because a maintenance provider had not uploaded the actual BOW. The actual BOW was 26,244 lb. As a result, the FMS computed a Vref landing speed of 118 kt, which is 6 kt slower than the proper Vref of 124 kt.

The performance study showed the discrepancy did not contribute to the stall because the airplane was flying faster than the correct reference speed before it stalled. The study showed that it was the full deployment of the spoilers about 12 sec. before the accident than most degraded the stall margin.

A review of the pilots' certifications and training showed they were qualified to conduct the Part 91 flight. But analysis of their performance on the accident flight found three significant failures.

- They flew the circling approach at a speed exceeding the limit for their category C approach category.
- They failed to establish a proper downwind leg of the circle-to-land maneuver.
- They failed to see the runway early in the approach, probably because visibility was reduced by smoke.

The crew should have abandoned the approach when it became unstabilized. The co-pilot apparently got on the controls even though the captain never relinquished them. Both pilots forgot about safety as they attempted to salvage the approach. They lacked clear communication and failed to recognize their own degraded performance and vigilance.

HIRING, TRAINING AND CRM

There were two parts to the NTSB's probable cause: the co-pilot's steep turn, and the captain's failure to correct the co-pilot's actions. There were three contributing factors: the co-pilot's deploying the spoilers, the captain's poor setup of the circling approach and both pilots' self-induced pressure to perform and poor crew resource management (CRM).

While these conclusions are certainly true enough, looking at the facts with a different lens produces some additional issues. If, in addition to the crew's unsafe acts and environmental factors, we look at supervisory and organizational factors, there is more to the story.

The company, Aeolus, took a very hands-off approach to the accident flight. They put pilots they barely knew into the cockpit of a newly acquired airplane they themselves had not properly inspected. The youthful entrepreneur who was the

CEO had ambitions to grow and then sell the company, but he lacked aviation knowledge and experience commensurate with his responsibilities. He hired the accident captain without checking his visa status and did not realize he was not eligible to be a full-time employee. Had he checked, the captain would not have been piloting on the flight.

None of the company's managers questioned whether the captain, who had been idle for a while, might need more training and familiarization than he received at the Part 142 school and by reading the company's general operations manual online. None of the managers looked into the risks of flying into Truckee, which was affected by forest fires and was a tricky place to fly into—especially on one of the pilot's first flights in the airplane. The managers seemed to rely heavily on the internet and Zoom to find and screen applicants. Interviews with the managers revealed a kind of cut-and-paste hiring mentality, matching credentials with needs instead of in-depth personnel decision-making.

There were far more risks to the accident flight than seemed apparent at the beginning. If either pilot had done some homework and checked the Truckee Airport website, they could have planned accordingly. The website is very candid about the potential hazards there. The airport says many accidents occur during attempted circling approaches. The NTSB database lists 79 accidents at TRK—more than Aspen, with 33, and even more than JFK, with 73.

Even the most diabolical simulator instructor could not have constructed a more difficult scenario than what the two accident pilots encountered. They had multiple revised clearances with no notice or time to adjust. They experienced true airspeeds about 20 kt. greater than calibrated, and that probably contributed to the overshoot. They were surprised by how much the smoke from all the forest fires reduced the visibility and hampered the captain's awareness of the airport layout. He may have refrained from turning all the way to downwind for fear of losing sight of the runway.

The captain was behind the airplane almost from the start of the flight. It seemed like he did not know where he was most of the time. The co-pilot, in contrast, knew exactly where he was and what to do. He got more and more frustrated as the flight progressed and the captain resisted his help. He was so confident in his ability to maneuver the airplane that he tried to salvage an increasingly untenable approach. As we see so often, the increasing stress of a developing bad situation caused tunneling of attention in both pilots.

Hardest to accept are the actions of the co-pilot. Patient, alert, knowledgeable and experienced, he let his guard down at the last minute. As a contract pilot, and before that as a check airman, he switched back and forth between left and right seats constantly. As the SIC, calling for a go-around would have been appropriate; grabbing the controls was not. Adjusting from instructor to PIC to SIC blurs the roles and makes it hard to stay in character. Ironically, he knew this. He had accepted a job as an FAA inspector in order to quit contract flying and have a more regular schedule with a clearer role.

BCA



JESSIE NAOR
Contributing Columnist

Who's Handling the Money? a Guide to Aircraft Escrow

In business aircraft deals, the devil is in the details.

IN MAY, DEBRA MERCER-ERWIN, owner of Wright Brothers Aircraft Title and Aircraft Guaranty Corp., was convicted of money laundering, wire fraud and other drug-related charges. She was accused of using her Oklahoma City-based business, a large aircraft title and escrow service, to run a Ponzi scheme, defrauding investors of up to \$240 million, according to reports.

While this was a unique event, the case has placed a focus on the importance of closely vetting those involved in an aircraft transaction, particularly those in business aviation where transactions regularly exceed millions of dollars.

Unfortunately, bringing in an escrow agent tends to be one of the last steps in the buying process. Because of that, it is not uncommon for buyers and sellers to rely on the recommendations of others when choosing an agent.

Unlike the real estate industry, where escrow and title agents are licensed and regulated by state commissions, there are no similar requirements with escrow services. Thus, the onus is on the parties involved to do their due diligence, particularly when it comes to the handling of large sums of money.

There are a number of items to consider when choosing a firm. They include:

- Reputation and transaction experience
- Insurance coverage and limits
- Security processes

A hotly contested topic in the industry is whether to choose a law firm that offers title and escrow services or whether to use a firm whose sole focus is title and escrow. Both will tell you that one of the most important items to evaluate are the quality of their transactions experience and the company's reputation. A firm that specializes only in small aircraft, for example, won't have the depth of experience needed in a deal involving a \$50 million aircraft transaction. Asking for client recommendations can shed light on a firm's timeliness to responding to issues and professionalism.

In addition, "the capital depth of the company is important," says Jack Gilchrest of Gilchrest Aviation Law, particularly when working on high-value deals. One method of understanding a firm's resources is through its insurance coverage. While errors and omissions insurance is standard at almost every firm, it doesn't really protect buyers and sellers from many things that can go wrong in aircraft deals.

There are many coverage types and limits, including liability for employee theft, fraud, forgery, cybersecurity, social engineering and more. Read with care as each may carry a different limit and companies may have different types of



JESSIE NAOR

coverages. In addition, be sure to ensure all parties are listed as additionally insured on policies, Gilchrest says.

In the past, bonding has been touted as a great tool to protect funds. But while many firms claim to be bonded, obtaining a bond is nearly impossible for large deals. Experts interviewed by the author didn't know of any firm that holds a bond today, and insurance and bonding are vastly different methods of protection. Bond levels to cover large aircraft would be exorbitantly expensive to carry for even the largest of title companies and law firms, they say.

SECURITY PROCESSES

Understanding the security processes of any firm is key as well. Social engineering attacks and scammers impersonating individuals involved in a transaction to gain access to funds or personal information are common risks and something many firms take steps to protect against. Confirming wiring instructions and account numbers through a multi-step process and being wary of any last-minute changes in bank information or important details are critical to avoiding a scam.

Multi-factor authentication methods, such as verbal or video verification, pin numbers and passwords are all tools to ensure funds go to the right place. Clay Healy of AIC Title encourages the use of a virtual data room that allows everyone involved in the transaction to view the progress and verification of milestones, thus keeping all parties accountable and aware of any hurdles slowing the transaction process. Data backups and storage systems are also vital to ensuring information stays secure and is deleted when the data is no longer needed.

LAW FIRMS VERSUS ESCROW PROVIDERS

Law firms have an advantage in some areas over companies that solely focus on title and escrow services. Attorneys have

governing bodies overseeing their activities, such as state bar associations, and thus could lose their license to practice law if there were serious violations of professional ethics. It's important to note, however, that professional liability and malpractice insurance coverages may not apply in all situations during these transactions.

One of the more critical services a law firm offers over others is its skill in mediating a dispute. When a disagreement arises, buyers may have millions of dollars held in escrow that could take many months to be returned. Escrow agents who are not part of a law firm or who do not have in-house counsel may be more apt to send disputes directly to a legal process known as an interpleader. This process can result in funds being held—in some of the worst cases for more than eight months—and require costly attorney fees to resolve.

Brian Burget, of McAfee & Taft, says in the rare event a dispute proceeds to interpleader action, his firm includes the attorney fees incurred, while escrow agents without those services will typically send third-party attorney bills to those involved in the dispute to pay. He has yet to have been involved in a dispute that has led to the interpleader process, however.

Title companies warn that buyers and sellers should be aware of conflicts of interest. While attorneys are bound to professional ethics, there is still a human component to an

aircraft deal. If one side of the transaction has a stronger relationship, it could influence the dispute process. Understanding the relationship between the law firm and all the parties involved in the transaction is something to be mindful of. There may also be differences in the price of various services.

Understanding who has access to the accounts matters as well. At McAfee & Taft, “no one other than shareholders in the firm have access to touch accounts,” Burget says, which means only attorneys with a minimum of eight years’ experience in the firm can authorize any movement of funds. While most escrow and title companies have limited the individuals with access to funds, it’s a good question to ask in the due diligence process.

Most importantly, the process of vetting any firm or key individuals involved in these transactions must take place well before an offer on an aircraft is made. Legal case searches and even Google can be used to understand the background of those involved in a deal.

In the end, buyers and sellers must take responsibility to protect themselves and their deals. **BCA**

Jessie Naor is the author of the Sky Strategy column in BCA and CEO of FlyVizor, an aviation M&A advisory and business consulting firm. She is a former founder and president of GrandView Aviation.

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1

as 20ms—suitable for video calls, streaming and online gaming. Due to the sheer number of satellites in LEO, Starlink's coverage area reaches globally, including polar regions. marketplace.aviationweek.com/company-spacex

2 | Wing-side Service

COMPANY: **Moment**

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2

4 | Certified Performance

COMPANY: **Satcom Direct**

PRODUCT: Satcom Direct's (SDs) Plane Simple Ku-band tail mount antenna system recently received its FAA STC for the Gulfstream G650. SD offers six different satellite service packages for aviation, including its preferred Ku-band service, Intelsat Flex-Exec. The service offers improved speeds up to 15/2 Mbps with consistent connectivity through its wide global coverage, even over high-traffic routes. Additionally, FlexExec is the only satellite operator within Service Organization Control 3 (SOC 3) compliance, according to Intelsat. marketplace.aviationweek.com/company-satcom-direct

3 | Flexible Range

COMPANY: **SpaceX**

PRODUCT: For the first time in the industry, Starlink received its supplemental type certification (STC) on the Gulfstream G650. Via a constellation of over 4,500 satellites in low-Earth orbit (LEO), Starlink offers up to 350 Mbps with a latency as low



3

5 | Exceptional Speed

COMPANY: **Inmarsat**

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4



5

HALO 350

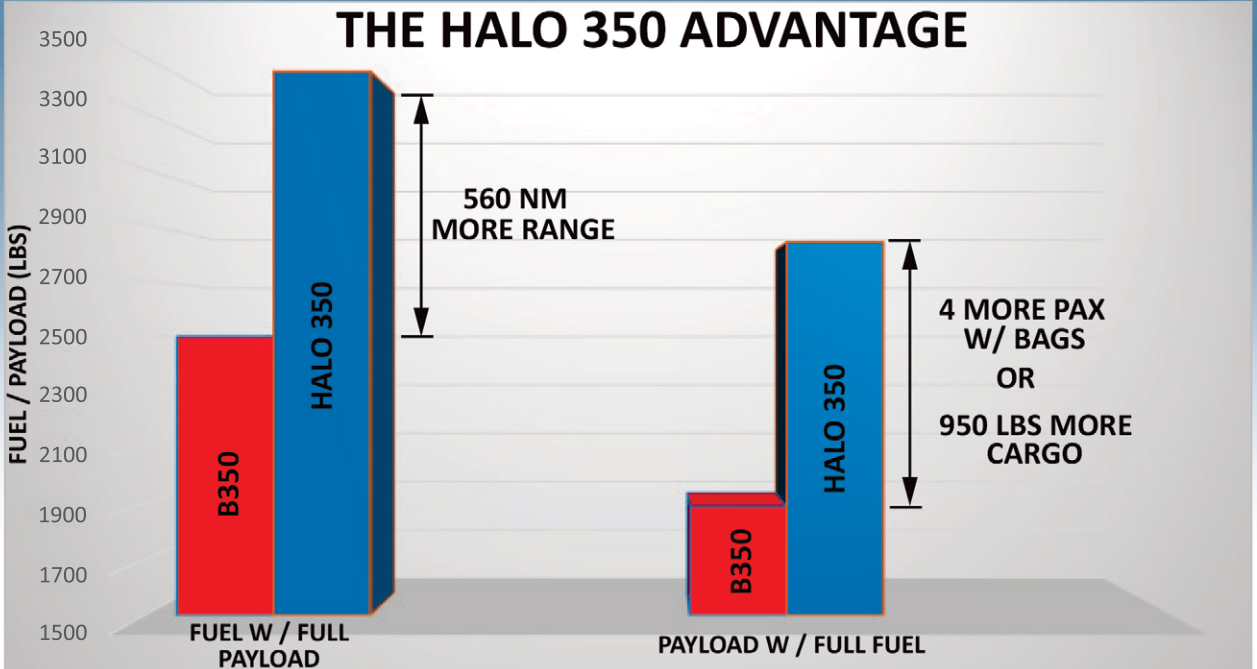
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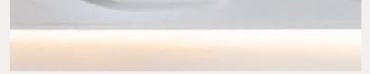
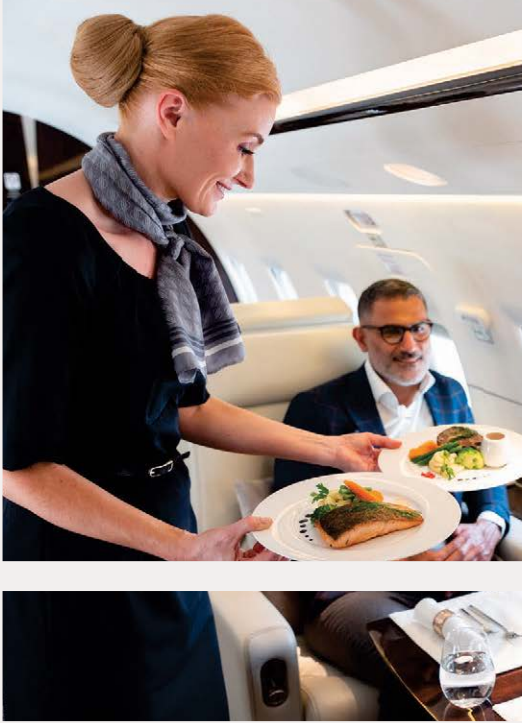
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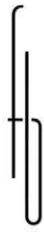


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RAPHAEL HADDAD
Guest Columnist

Airlines Bet On GA

Airlines are interested in private aviation, particularly in innovative businesses, such as Wheels Up.

DELTA AIR LINES' INVOLVEMENT in Wheels Up, and in the private aviation market, is nothing new: Delta already owns 20% after merging Delta Private Jets with the company in 2020.

This recent investment, however, may have been influenced by recent surges in demand for both private jet travel, and on the commercial aviation side, first and business-class seats. As a result, airlines are betting on a new era of luxury travel with investments in their cabins and lounges. As competition in the airline market rises

The future of many airlines rests on a balancing act between investing, reaching net-zero targets, and making enough profit to do so. Many are looking to both fleet and business fleet, business diversification, and even inter-industry collaboration to ensure their futures align with the best course for survival as competition among airlines heats up.

A sharp rise in demand for luxury goods and personalized experiences, which has rebounded rapidly following Covid-19 lockdowns in 2020, is spearheading a boom in first-class and business-class flight bookings, leading big airlines to bet on a new era of luxury travel with investments in their cabins and lounges. There is also the possibility of more collaboration between the private aviation sector and commercial sector as commercial airline businesses look to where the potential for the winning innovations—both sustainability and luxury-related—are.

Ultimately, with commercial aircraft order books booming, I believe the strategically successful airline of the future will offer a mosaic of solutions and business models, a part of which may involve inter-industry collaboration with the private aviation sector. This is something that is not entirely new to airline business models, but what we have seen recently in the further investment in Wheels Up by Delta Air Lines is an evolution of this model. Delta and CEO Ed Bastian are perhaps pioneers in this regard, diversifying the airline's offering by investing directly in the business aviation charter market.

If the surge in personalized, luxury and private travel continues beyond trend—which I believe it will—we can expect to see other major carriers invest in business aviation, and particularly in the technology and innovative offers the private aviation sector can offer commercial customers.

BCA

Raphael Haddad is president of Jetcraft Commercial, the commercial division of global aircraft trading firm Jetcraft. The company specializes in commercial aircraft sourcing, re-leasing and disposal.



OLEG VANOV/GETTY IMAGES

due to the high demand for travel generally, is there a business case for carriers to diversify their offering even further by investing in or collaborating more with the private aviation sector?

Many believe we are going to be seeing more of this kind of investment by airlines in the private aviation market, particularly in innovative businesses, like Wheels Up.

Achieving long-term stability is no small feat for the airline carriers of today, with tough economic conditions, unstable micro and macro environments, and a much more considered, researched clientele making strategizing for future success almost impossible.

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