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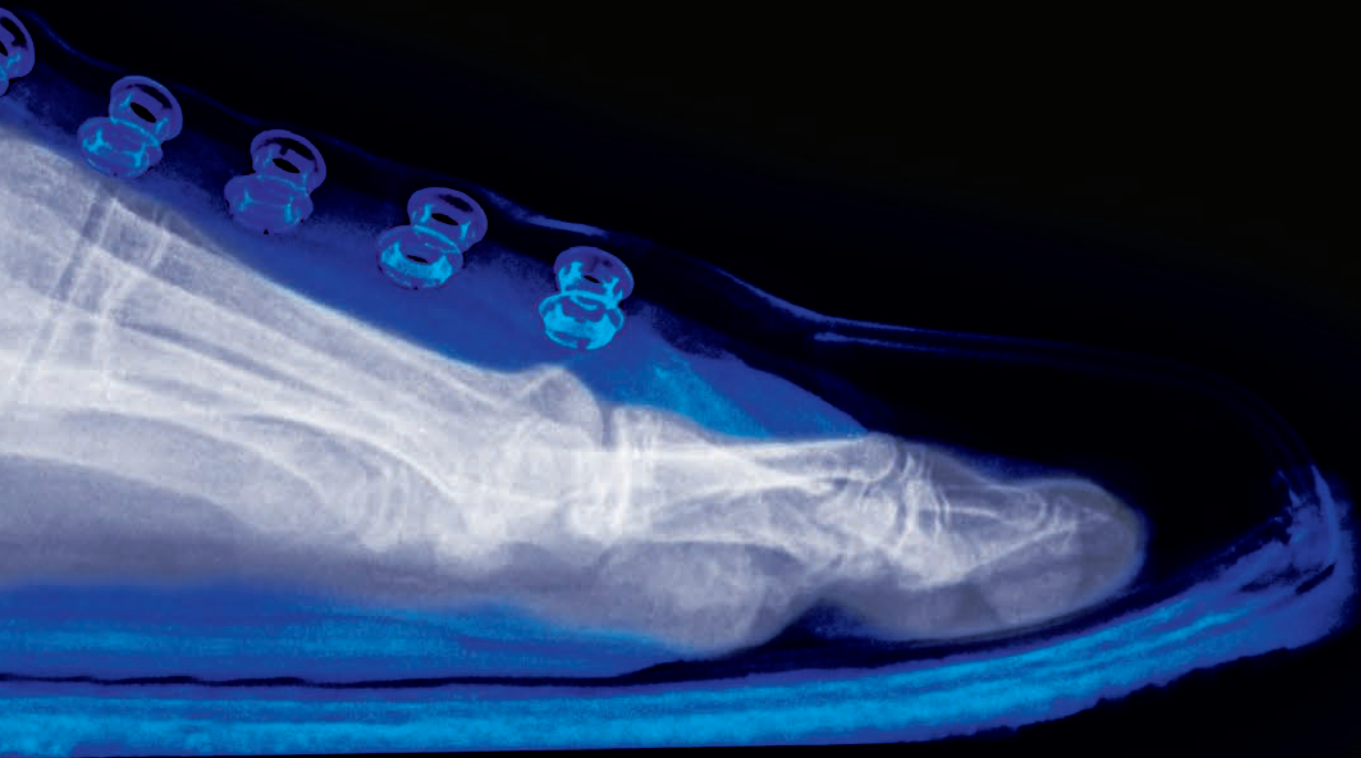
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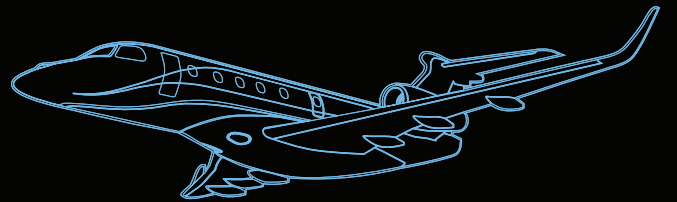


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BY EMBRAER



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# Gulfstream deliveries lag, but sales and service shine

BY CHAD TRAUTVETTER



While General Dynamics' aerospace unit reported a decrease in aircraft deliveries in the first quarter of this year, higher service income at both Gulfstream and Jet Aviation made up for the aircraft delivery shortfall, resulting in a 10.8 percent increase in revenue for the company.

Revenues and earnings at General Dynamics' aerospace unit, composed of Gulfstream Aerospace and Jet Aviation, climbed in the first quarter as higher service income more than offset fewer aircraft deliveries. Aerospace revenues in the quarter eked out a 0.8 percent year-over-year increase, to \$1.9 billion, while earnings soared 10.8 percent, to \$243 million.

## RAMP UP

Gulfstream shipped 25 aircraft (21 large-cabin jets and four super-midsize G280s) in the quarter, down from 28 (25 large-cabin, three G280s) in the same period a year ago. Speaking during a quarterly investor call on April 27, General Dynamics chairman and CEO Phebe Novakovic said Gulfstream will ramp up production in follow-on quarters to meet the forecasted

124 deliveries this year—five more units than last year.

First-quarter service revenue growth at both Gulfstream and Jet Aviation made up for the aircraft delivery shortfall, she noted. “In particular, Jet Aviation had strong performance at its FBOs in the U.S.,” Novakovic said, adding that Russian sanctions have not affected revenues at Jet Aviation and Gulfstream service center locations in Europe.

Meanwhile, Gulfstream sales remain “strong...especially in the U.S. market,” according to Novakovic. “European sales have slowed, but Western Europe is improving, as is Asia outside of China.” Overall, Gulfstream had a book-to-bill of 2.1:1 in the quarter, and backlog at the aerospace division increased to \$17.62 billion, up from \$11.93 billion a year ago. ■

## News Briefs

### CAE TO OPEN BIZAV TRAINING CENTER IN SAVANNAH

CAE has broken ground on a new business aviation training center near Gulfstream Aerospace's headquarters in Savannah, Georgia. Slated to open in mid-2023, the facility will become CAE's fifth training center dedicated to business aviation in the U.S. Plans call for the facility to eventually house four Gulfstream full-flight simulators, maintenance training devices, briefing rooms, and classrooms. The addition is part of an overarching plan to expand its training network as CAE eyes a global requirement for an additional 45,000 business aviation pilots over the next 10 years.

### TEXTRON AVIATION DELIVERS FIRST SKYCOURIER

Textron Aviation delivered the first of its Cessna SkyCouriers to launch customer FedEx Express on May 9. The aircraft represents the lead ship in a 50-unit order from FedEx, which also has options for 50 more. The high-wing twin is designed to carry a payload of up to 6,000 pounds with an 87-inch cargo door, a flat floor, and a nearly 70-inch tall and wide cabin to accept three standard LD3 air cargo containers. The clean-sheet aircraft, which has a 900-nm range, received its FAA type certification in March.

### RUNWAY EXCURSIONS, CIRCLING RISKS EYED

Runway excursions and circle-to-land approach accidents are raising concerns and warrant greater attention and risk mitigation, safety experts from the Flight Safety Foundation (FSF) and the FAA reported last month at the 2022 Business Aviation Safety Summit. More than 60 years of data covering 796 accidents involving 1,498 fatalities shows runway excursions accounted for 30 percent of the mishaps, and they are “growing in proportion, in some years exceeding 50 percent,” said FSF director of safety strategy and policy Henry Gourdji.

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# Textron Aviation deliveries, backlog soar in Q1

BY JERRY SIEBENMARK

## News Briefs

### FSI, PRESAGE TEAM ON GO-AROUND STUDY

FlightSafety International and Presage Group will partner on a psychological study of go-around decision making for Gulfstream operators, they announced last month at the 2022 Business Aviation Safety Summit. Aiming to address the root cause of runway excursions, which represent up to half of all business aviation accidents annually, the Gulfstream study will use Presage's proprietary psychological methodology "to understand human behavior in the moment" of landing decision-making. Scheduled to start this summer aboard late-model Gulfstreams, this will be the first landing/go-around decision study of two-pilot business aviation operations.

### HELINET JOINS L.A. URBAN AIR MOBILITY PARTNERSHIP

California-based helicopter operator Helinet is partnering with Urban Movement Labs to explore eVTOL applications for advanced air mobility in Los Angeles as a new member of the Urban Air Mobility Partnership. The partnership will explore how aviation operators can integrate new eVTOL technology into their operations to reduce community impacts while enhancing safety and efficiency. Helinet will share its extensive helicopter mission experience to evaluate their applicability to eVTOLs and the attendant infrastructure requirements, including the addition of electric charging capacity.

### BOEING TO LOSE \$1.2B ON NEW AIR FORCE ONE JETS

Boeing CEO Dave Calhoun said the two repurposed 747-8is slated to replace the current Air Force One airplanes now won't be ready until 2026—a two-year delay—and that Boeing expects to post a \$1.2 billion loss on the deal. He said the \$3.9 billion deal announced in 2018 to use already built but new-production, 747-8is presented "a very unique set of risks that Boeing probably shouldn't have taken."



BARRY AMBROSE

Textron Aviation delivered 39 Cessna Citation jets in the first quarter of 2022, a nearly 40 percent increase from the same quarter in 2021.

Continued strong demand for business aircraft and higher utilization of them provided lift for Textron Aviation's deliveries, profit, aftermarket services, and backlog in the first quarter, parent company Textron reported. Citation deliveries totaled 39—up from 28 in last year's first quarter—while turboprops increased to 31 from 14 in the same period.

The Wichita-based aircraft manufacturer's revenue of \$1 billion and \$121 million profit—an 11.6 percent margin—was driven by a \$152 million increase in piston, jet, and turboprop aircraft deliveries, to \$646 million, in addition to a \$61 million rise in aftermarket services, to \$394 million. Backlog swelled by \$1 billion, to \$5.1 billion, at the end of last month.

Textron president and CEO Scott Donnelly noted on an earnings call with analysts that aircraft pricing continues to remain favorable and demand is robust for both Citations and turboprops. "It's across the whole portfolio: jets, King Airs,"

Donnelly said. "Momentum continues to be strong."

Deliveries and orders are largely "U.S. centric," accounting for about 80 percent of jets and 60 percent of turboprops going to customers. "The dynamics from what we've seen over the last year kind of continued in the first quarter," Donnelly remarked. He added that the company continues to see "a fair number" of new business aircraft customers entering the market, "which is encouraging."

Production rates at Textron Aviation will increase throughout this year and may continue beyond that. "Certainly, with the demand that we're seeing and the level of backlog, we'll plan on continuing to raise those as we go into 2023," Donnelly said.

Also during the call, Donnelly noted type certification of the Cessna SkyCourier last month and explained that deliveries of the clean-sheet utility twin-turboprop would begin this quarter. ■



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## News Briefs

### NTSB: MORE NEEDS DOING ON MOST WANTED LIST

Midway through the two-year cycle for the NTSB's Most Wanted List of Transportation Safety Improvements for 2021 and 2022, the agency said it is pleased with the increased awareness and public engagement of pressing issues. However, no aviation improvements have been successfully closed. Two of the Safety Board's list of 10 key safety issues directly involved aviation: "require and verify the effectiveness of safety management systems in all revenue passenger-carrying aviation operations" and "install crash-resistant recorders and establish flight data monitoring programs."

### DAHER DELIVERS FIRST TBM 960

Daher delivered the first of its new TBM 960 single-engine turboprops to a German businessman in late April. Daher introduced the new TBM 960 in early April at Sun 'n Fun Aero Expo in Florida. The TBM 960 replaces the 940 and adds a new Pratt & Whitney Canada PT6-66XT engine with full dual-channel digital engine and propeller control. It has received EASA approval; FAA certification is pending. Daher is sold out of TBMs through September 2023, according to Nicolas Chabbert, senior v-p of Daher's Aircraft Division and CEO of Daher Aircraft and Kodiak Aircraft.

### CIRRUS CONTINUES TO EXPAND EURO FOOTPRINT

As Cirrus Aircraft sales continue to grow, the company is adding to its investments in Europe. In addition to recently opening a new sales office in Valenciennes, France, Cirrus plans to open a European regional operations office in Rotterdam, Netherlands, which will focus on sales leadership, service, and training. Last year, Cirrus delivered 442 SR series single-engine piston airplanes and 86 single-engine Vision jets. Next year, those numbers should climb 20 and 10 percent, respectively, it said.



CHAD TRAUTVETTER

Bombardier outfits its flagship Global 7500s at the Laurent Beaudoin Completion Centre in Montreal. The airframer delivered the 100th of the type in the first quarter of the year.

# Bombardier notes strong first quarter

BY CURT EPSTEIN

Bombardier experienced a strong first quarter and is well on its way toward meeting its 2022 guidance, the company said in its quarterly investor earnings call on May 5. The Canadian business jet manufacturer's \$167 million in pre-tax earnings in the quarter represented a 36 percent rise over the same period a year ago.

"Our team has been able to build on our strong performance last year and our momentum from last year," said president and CEO Éric Martel. The Canadian business jet manufacturer's \$167 million in earnings before taxes, interest, depreciation, and amortization in the quarter represented a 36 percent rise over the same period a year ago.

The company delivered 21 jets during the quarter, including nine of its flagship Global 7500s and the final three Learjets and is on track to exceed last year's delivery total of 120 aircraft by the end of 2022. As it transitions from the Challenger 350 to the Challenger 3500 the company expects deliveries in the second and third quarters to be static year-over-year, with a surge in the fourth quarter as 3500 production and deliveries ramp up. It is also actively

monitoring the supply chain situation.

Bombardier has seen strong orders thus far with a book-to-bill of 2.5:1. During the quarter, backlog subsequently rose by \$1.3 billion, to \$13.5 billion. "That is a testament to the strength of our product portfolio, as well as our sales team's ability to be responsive all around the world," said Martel.

Further, he added that the company is becoming increasingly convinced that the current levels of business aircraft activity represent a step-change for the industry, rather than merely a post-pandemic bump. Martel noted that despite the situation in Ukraine, it continues to see strong demand and activity worldwide, including in Europe.

Among Bombardier's 5,000 aircraft worldwide, fleet usage is up approximately 23 percent over pre-pandemic 2019 levels. That has led to a record quarter for its aftermarket service business, which generated \$361 million—a 34 percent increase year-over-year.

The Montreal-based company recently quadrupled the size of its Singapore service center and is in the process of expanding its London and Miami facilities, which should be completed by year-end. ■



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## News Briefs

### NETJETS EUROPE MARKS MILESTONE JET DELIVERY

NetJets has taken delivery of the 100th aircraft for its European fleet—a feat that comes as part of the fractional aircraft provider's €2.2 billion (\$2.36 billion) investment in its global fleet. The milestone aircraft is a midsize Cessna Citation Latitude, the delivery of which was marked with a celebration and water cannon salute in Cascais, Portugal. Globally, NetJets has more than 800 business jets in its fleet, ranging from the Embraer Phenom 300E light twin to the ultra-long-range Bombardier Global 7500.

### TEXTRON AVIATION ACQUIRES COMPONENTS MAKER

Textron Aviation has acquired Mistequay Group, a Saginaw, Michigan-based supplier of components for aerospace and defense OEMs that specializes in ball screw assemblies, gear systems, and actuator components. Under the Wichita-based OEM, Mistequay will operate as AeroMotion by Textron Aviation. The company's 130-employee workforce will be retained at its Saginaw and Monroe, Washington facilities. AeroMotion will expand Textron Aviation's internal capabilities and key component technologies and engineering support of its Citation product line.

### AMPAIRE SEEKS FUNDING AS SURF AIR DEAL SCUTTLES

Hybrid-electric aviation pioneer Ampaire is preparing to launch a Series B funding round after confirming that Surf Air Mobility is no longer planning to acquire the startup.

Ampaire has decided to “move forward as an independent company” as it prioritizes efforts to build hybrid-electric versions of the Cessna Grand Caravan. The Ampaire team is working on plans to convert several aircraft types to hybrid-electric propulsion, building on recently completed flight tests with its Electric EEL technology demonstrator that uses a Cessna 337 as its platform.



Embraer's executive jet line experienced a book-to-bill of 2.5:1 in the first quarter, but deliveries were off by five units.

# Embraer's backlog jumps but revenues drop

BY KERRY LYNCH

Embraer revenues dropped 26 percent in the first quarter as deliveries of its executive jets dipped and it shut production down for almost a month while reintegrating its commercial aviation business. However, continued strong sales helped push up backlog by \$300 million in the quarter, to \$17.3 billion, marking the Brazilian airframer's strongest order book since the second quarter of 2018, Embraer reported.

Embraer delivered 14 airplanes in the quarter—eight business jets (six light and two midsize jets) and six commercial aircraft. Business jet deliveries were off by a total of five units from the 13 delivered in first-quarter 2021. Even so, Embraer's book-to-bill ratio for its executive jets came in at an industry high of 2.5:1, and the manufacturer reported continued growth in the light and midsize business jet segments.

Commercial deliveries were down from nine a year ago, but Embraer said this decrease was planned as the factory remained largely closed as it reintegrated commercial aviation following the failed joint venture with Boeing. Embraer

president and CEO Francisco Gomes Neto said this shutdown was closely coordinated with its customers and the slip in deliveries was planned.

As a result, though, first-quarter revenues dropped to \$600.9 million, compared with \$807.3 million in the first three months of 2021. Revenues at Embraer's executive jets business were down by more than \$60 million, to \$89.9 million, while commercial aviation revenues plummeted by more than \$100 million, to \$169.2 million. Services and support fared better, with revenues up from \$250.6 million in 1Q2021 to \$271.2 million in 1Q2022.

Embraer posted a \$36.3 million operating loss for the quarter, slightly more than the \$33.1 million loss a year earlier.

Despite the down quarter, Embraer officials said they are optimistic about sales growth, including a 12.3 percent gain in backlog for its executive jet business alone in the first quarter. Embraer expects to deliver between 100 and 110 business jets and between 60 and 70 commercial aircraft this year. ■



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# Gulfstream G700 caught in FAA crosshairs

BY CHAD TRAUTVETTER

Gulfstream Aerospace parent company General Dynamics warned on an April 27 earnings call that G700 certification, planned for the fourth quarter, could be delayed by three to six months due to a new, additional requirement by the FAA. According to General Dynamics chairman and CEO Phebe Novakovic, the FAA has asked Gulfstream to perform a line-by-line validation of the software for the fly-by-wire, ultra-long-range business jet.

The disclosure validates industry fears about higher FAA scrutiny of future aircraft certifications in the wake of the Boeing Max debacle. Novakovic didn't specifically mention Boeing, instead skirting around the issue by saying the time-consuming, extra requirement "is the result of events independent of us."

Novakovic added that a delay in G700 certification will also have a knock-on effect



on the derivative G800. First flight of the G800 is planned for first-quarter 2023—timed to occur just after G700 approval—while certification has always been "six to nine months after the G700." Delayed certification will also interrupt the start of G700 deliveries, though Gulfstream would increase production of other models to

make up for the temporary shortfall, she said.

Meanwhile, all G700 structure testing is complete and FAA certification of the G700's Rolls-Royce Pearl 700 engines is expected in the coming months, she noted. Production of customer G700s is underway and the five flight-test program aircraft have logged 2,800 hours to date, she said. ■

## FAA NAMES NEW HEAD OF AIRCRAFT CERTIFICATION

The FAA is continuing to realign its senior ranks, naming long-time agency official Liro Liu to succeed Earl Lawrence as executive director of the Aircraft Certification Service, effective May 8. Lawrence, meanwhile, will shift to a new role as deputy assistant administrator of the NextGen Office.

Liu has a long background in certification and regulation, having spent more than 30 years with the FAA in roles such as executive director for rulemaking, executive director for operational safety in the Commercial Space Transportation Office, and acting deputy associate administrator for the Office of Aviation Safety.

She joined the agency in 1991 in the Los Angeles Aircraft Certification Office as a structural engineer and served as a program manager for Robinson Helicopter.

Lawrence moves out of the Aircraft Certification Service after serving as its executive director since 2018 and steering the branch through the Boeing 737 Max return-to-service activities and other changes that came in the aftermath of the Max crashes. Before taking the position, he was executive director of the Unmanned Aircraft Systems Integration Office and also has been manager of the FAA's Small Airplane Directorate.

He joined the agency in 2010 after serving as v-p of industry and regulatory affairs for the Experimental Aircraft Association. The FAA said that in his new position, he will play an instrumental role in the integration of drones into the U.S. aviation system.

The changes, however, come at a time when most of the agency's upper echelon

has, or is, undergoing a turnover. Former FAA Administrator Steve Dickson left the agency at the end of March to spend more time with his family. Replacing him on an acting basis is Billy Nolen, who joined the agency at the beginning of the year to serve as associate administrator of aviation safety. In that role, he succeeded Ali Bahrami, who stepped down at the end of June.

Temporarily replacing Nolen as acting associate administrator of aviation safety is 20-year FAA employee Christopher Rocheleau, but he is leaving the agency in June to join NBAA as COO. Also in a little more than the past year, the agency has received a new deputy administrator, Bradley Mims; associate administrator for airports, Shannetta Griffin; and acting Air Traffic Organization COO Timothy Arel. **K.L.**

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# AIN's 50th anniversary look back: June

BY CURT EPSTEIN

AIN is celebrating its golden anniversary by highlighting select news from the archives over the past half-century.

## Boeing enters the bizjet fray



(ACN July 1, 1985, p.1)

**Then:** The Boeing Commercial Airplane Company, which for years has been lingering at ringside, finally climbed through the ropes and into the business jet ring. At the Paris Air Show the giant Seattle-based manufacturer of jet airliners announced that it was launching a business jet marketing effort.

Under the banner of “Corporate 77 Series,” Boeing will now be offering every one of its airliners new and used, from the 747 jumbo down to three models of its twin-engine 737s, to corporate aviation.

Principally the Corporate 77 effort will be concentrating on the 737 line—the 737-100, the 737-200 and the latest version, the 737-300. The Seattle manufacturer sees both the 200 and 300 versions of its model as direct competition for Gulfstream Aerospace’s present offering the Gulfstream III and its forthcoming Gulfstream IV.

Boeing will offer its airliners devoid of interiors and with no avionics, save that which has to be factory installed.

**Now:** Boeing began to sell airliners for private use in the mid-1980s, but it wasn’t until July 2, 1996 that the airframer in partnership with General Electric launched the Boeing Business Jet (BBJ) brand. It has delivered 251 bizliners: 189 737s, 16 747s, five 757s, eight 767s, seventeen 777s, and sixteen 787s.

Today, the company’s lineup includes the BBJ 737 Max family (737-7,-8,-9), the BBJ 787, and at the top of its range, the BBJ 777-8 and -9.

the natural-laminar-flow-wing aircraft could be in service by 2011.

The recently-released report shows a market for between 220 and 260 Aeron SSBJs over a 10-year period with approximately 20 percent of sales coming from the fractional market. Production over a 20-year program life could exceed 500 units, Aeron noted.

**Now:** For Aeron, the dream of developing the world’s first supersonic business jet, would linger for another 16 years, until the company closed in May 2021. At the time, despite an \$11.5 billion backlog for the AS2 SSBJ, Aeron said that “in the current financial environment, it has proven hugely challenging to close on the scheduled and necessary large new capital requirements to finalize the transition of the AS2 into production.” The company had decided on a final design that had been proved out in wind tunnel tests, dozens of patents had been secured, and agreements firmed with major suppliers. Months before the announcement, Aeron broke ground on a massive \$300 million headquarters complex in Melbourne, Florida, and teased a follow-on near-hypersonic AS3 airliner. Yet, facing a dramatically ramped-up spend rate as it transitioned from design firm to aircraft developer, the company decided its operation was not sustainable and pulled the plug, leaving nearly \$100 million in outstanding claims to stand against the sale of its largely intellectual property. ■

## Aeron: viable market for SSBJ



(AIN July 2005, p.3)

**Then:** Last month at the Paris Air Show, Reno, Nev.-based Aeron said its market research, conducted over the past nine months by aerospace market research and strategy firm I2, indicates there is a sufficient demand to proceed with development of the company’s proposed supersonic business jet (SSBJ). Aeron publicly unveiled its SSBJ program last October at the NBAA Convention in Las Vegas, saying



# First flights in the past 50 years

These aircraft took to the skies for the first time during May and June, from 1972 through 2021

**1973**

May 11 – Dassault Falcon 20 •  
June 2 – Aérospatiale SA 360 Dauphin

**1974**

June 24 – Aérospatiale AS 350 Ecureuil

**1977**

May 3 – Bell 301

**1979**

May 18 – Piper PA 42 Cheyenne  
May 30 – Cessna Citation III/VI/VII

**1980**

June 20 – Beechcraft Commuter

**1982**

June 14 – Beechcraft Lightning •

**1983**

June 20 – deHavilland Canada Dash 8

**1987**

May 11 – Learjet 31

**1988**

June 14 – Schweizer 330 •  
(now branded as the S-333)

**1991**

May 31 – Pilatus PC-12 •

**1996**

June 19 – Scaled Composites Boomerang (Rutan Model 202)

**2005**

May 3 – Gulfstream G150, May 5 - Dassault Falcon 7X

**2006**

June 8 – Bell 417

**2007**

June 29 – Piasecki X-49

**2015**

May 11 – Pilatus PC-24, May 18 - Gulfstream G500  
June 13 – Airbus Helicopters H160

**2020**

May 17 – Cessna 408 SkyCourier •



# Hydrogen infrastructure challenges rival aircraft technology hurdles

BY GREGORY POLEK

Of all the various renewable energy sources under development, hydrogen represents the so-called “holy grail” in the effort to eliminate carbon emissions from future aircraft, say many scientists. But while the technology exists today to build a hydrogen-powered aircraft, prompting several start-up enterprises to develop fuel-cell-based vehicles for the burgeoning advanced air mobility industry, for example, scaling the production and distribution of hydrogen for the wider air transport market presents its own set of challenges.

While several companies continue work to advance fuel cell technology using hydrogen gas for generally small aircraft, the application of liquid hydrogen, or LH<sub>2</sub>, appears to carry the most promise for larger airliners due to its superior energy density and versatility. The use of liquid hydrogen stored in a cryogenic tank onboard to power turbine engines presents the most feasible means to introducing a passenger-carrying aircraft to the market, according to experts in the field.

NASA Cryogenics Test Laboratory principal investigator Adam Swanger explained to **AIN** that although researchers continue to study pure hydrogen fuel cell-electric architectures, the use of onboard liquid hydrogen to power a combustion engine remains a comparatively more straightforward and economically practical solution for large commercial aircraft. “These engines [represent] billions and billions of dollars, and decades of investment,” he said. “And they’re super-optimized for their application. They’re fantastic...some of the most amazing technological achievements ever, but you can’t just swap over to another fuel that easily. On the other hand, fuel cells are great because there are very few moving



An 850,000-gallon liquid hydrogen storage sphere used to provide liquid hydrogen for rockets resides at NASA’s Kennedy Space Center.

parts and they have high efficiencies. It’s not that pure fuel cell electric can’t be done, and it might be in the future, but for large aircraft that would most likely require a full, ground-up design. So, if you’re trying to get hydrogen into your aircraft as soon as possible, that’s going to be a hard sell I think.”

A recently published report by the UK’s Aerospace Technology Institute (ATI) named “green” liquid hydrogen as “the most viable zero-carbon emission fuel.” However, it added that generating, transporting, and storing the vast amounts of hydrogen needed for future use will require “unprecedented” renewable energy capacity. Delivering hydrogen to airports will present another challenge, whether through gaseous pipelines or liquid hydrogen tanker deliveries, while the refueling and servicing of hydrogen-powered aircraft will have to take place safely and efficiently alongside conventional aircraft.

Swanger explained that for hydrogen to remain in a liquid state, at a normal boiling point of -253 Celsius, requires cryogenic storage in a vessel designed to manage large heat loads and to vent boil-off gas in a safe manner. But by tackling the thermal-management challenges, one benefits from the fact that liquid hydrogen carries around 800 times the density of gaseous hydrogen, making it far more volumetrically efficient for powering passenger-carrying airplanes.

“If you leave liquid hydrogen in a container, any container—it doesn’t matter how well insulated it is—it will eventually all boil away,” said Swanger. “So you have to manage that. Conversely, using ambient temperature, high-pressure gas you don’t have to deal with the heat management as much, but the vessels [that contain the gas] are generally heavy and you can’t get as much density out of them.”

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Swanger added that two of the biggest technical challenges presented by liquid hydrogen center on minimizing boil-off losses and safely managing boil-off gas. The former typically requires a double-walled vessel, or a tank within a tank, with a high-performance vacuum insulation system between the two. “High-performance tanks help minimize boil-off, but they can’t completely eliminate it without active cooling,” he noted. “So, you’re left to deal with safely managing a flammable gas flow, and you can’t just let it go wherever it wants,” explained Swanger. “And then, during loading and unloading, you’re taking equipment that’s sitting outside warm and you have to chill it down to liquid hydrogen temperature. So you have to flow liquid through it, which boils really quickly, and it chills the hardware down until you can finally start to build up quality liquid flow through the system. You have to deal with all that boil-off gas. So boil-off gas management’s probably the most difficult technical aspect.”

Although used in industries such as steel manufacturing and pharmaceuticals as a large source of high purity hydrogen gas, until now LH<sub>2</sub> has propelled only rockets in an end-use application, and the largest liquid storage tanks in the world reside at NASA’s primary launch site at Kennedy Space Center (KSC). Product comes in tanker trucks to KSC from liquid hydrogen plants located roughly 700 miles away on the Gulf Coast. Safety regulations do not allow the trucks to vent hydrogen in transit, so the LH<sub>2</sub> absorbs heat and pressure builds in the tank during transport. After crews transfer the liquid to the massive holding tanks at the launch pads, the heat dissipates naturally through boiling, but still constitutes a loss of product due to transport.

“Of course, airport logistics present wholly different challenges, and debate continues on the best method for fueling airplanes,” said Swanger. Ostensibly, tankering liquid fuel on trucks to the airport and fueling the airplanes through basically

the same method used now for jet fuel would be the least complicated scenario, but maintaining the cold temperatures to reduce chill-down losses and venting gases would lend more complexity, he added.

Today, Latham, New York-based Plug Power ranks as the biggest purchaser of liquid hydrogen in the world. Like NASA, it stores liquid hydrogen in tanks at its facilities, but it then re-gasifies it for use in fuel-cell-powered forklifts at large warehouses for customers such as Amazon and Walmart.

Plug Power’s model of shipping LH<sub>2</sub> to its own storage facilities could, in fact, serve as a model for airports, regardless of whether the liquid gets shipped via tankers, sent via a pipeline and liquified at the airport, or both produced and liquified on site. According to the ATI report, most airports would initially prefer tanker deliveries due to its lower capital costs. However, when the frequency of tanker deliveries increases to a level that causes congestion on local roads or the off-load point, the two other options could prove the preferred solution.

### ALTERNATE OPTIONS

The choice between the second scenario, in which gaseous hydrogen gets sent via a pipeline for liquification at the point of use, and the third scenario, in which the fuel gets produced and liquified on-site, will depend largely on the size of the airport, said the report. For large airports, the energy requirement for producing and liquifying enough hydrogen will eventually prove economically unattractive, leaving the pipeline option as the most likely scenario for hubs, it added. A pipeline could also supply gaseous hydrogen for other airport uses such as heating and ground support equipment.

Swanger explained that although hydrogen is the only fuel option that industry can produce and consume without causing greenhouse emissions, doing those things in a way that makes sense economically and at the needed scale presents another obstacle to overcome. The method to produce hydrogen today predominantly involves a process

called steam methane reformation (SMR), which uses high-temperature, high-pressure steam to crack methane and extract hydrogen, thereby releasing carbon. “Really, most of the hydrogen, regardless of whether it gets liquified, comes from SMR,” said Swanger. “It’s a well-established, large-scale industrial process. Methane is carbon and hydrogen, so you’re splitting off and capturing the hydrogen and you’re left with CO<sub>2</sub> as a byproduct.”

Meanwhile, the process requires a lot of electricity, which, although getting cleaner with more renewable energy sources, still creates a large amount of carbon itself. “If you can have all of your electricity coming from renewables, you clean up that part of it, and then you can use that electricity to power a green SMR process to create hydrogen, which people are working on,” explained Swanger. “So you’d basically have SMR with carbon capture, and you don’t emit any CO<sub>2</sub>.”

Another option involves using electricity to run a device called an electrolyzer, which extracts hydrogen gas from water through electrolysis and releases the leftover oxygen into the atmosphere, or captures it for some additional use. Swanger called the process completely green when paired with renewable electricity, but not yet widely used on an industrial scale to make hydrogen. “There seems to be a lot [of study] going on in that space,” he noted. “The technology is very well understood. So right now it seems to be mostly about improving efficiency and scale-up.”

But while Swanger said he doesn’t see any technical problems he’d describe as “show stoppers,” liquid hydrogen’s challenge lies with the sheer number of hurdles to overcome related to sourcing and logistics in a relatively short period of time.

“The new hydrogen ‘wave’ is primarily driven by global climate change initiatives, so there’s a very big sense of urgency across the board, which is a good thing, but it places an additional burden on a problem with an already huge technical scope,” he explained. ■

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# Virtual reality—the future of flight training

BY STUART “KIPP” LAU

The aviation industry is facing a dilemma: There are not enough pilots to respond to the pent-up demand for air travel, forcing operators to either reduce capacity or slow expansion plans. This problem affects every segment of commercial aviation from airlines to business jet operators. Complicating this scenario is a lack of resources, both instructors and flight simulators, to train new recruits or advance pilots into the left seat in a timely fashion. One unexpected solution to this problem is virtual reality (VR).

VR is the concept of being completely immersed into a computer-generated environment—like the flight deck of an aircraft—with both visual and audible representations through a head-mounted display like a headset. The user can then interact with that environment through a mix of hand gestures or in a mixed-reality application using physical buttons or levers.

Gamers love this technology but in real life, companies around the globe realize the benefits that include reduced training costs, faster training, and

better comprehension and retention for their employees.

In a recent study, VR emerged as an amazingly effective learning modality, beating out traditional classroom instruction and e-learning by a wide margin. Consulting firm Price Waterhouse Cooper released a study in June 2021 that showed VR learners mastered content four times faster than in a classroom setting, were 275 percent more confident to apply skills learned after training, and were more emotionally connected and focused than classroom or e-learners.

VR works remarkably well in the flight training environment. Pilot Training Next is the U.S. Air Force’s (USAF) new VR-infused training program that has shaved months off its traditional undergraduate pilot training program. This saves time and money and gets pilots in the cockpit sooner.

Embry Riddle Aeronautical University (ERAU) has “front-loaded” VR into its private pilot training curriculum and has reduced the amount of time for a student to solo by 30 percent. This immersive

training experience allows the student to hit the practice area with less anxiety and more confidence and decreases the distractions encountered in the initial stages of flight training.

Knowledge retention—the ability to remember what you learn—is an important aspect of learning. For pilots, this is important; a huge part of training is memorizing procedures, checklists, and rules. VR can improve knowledge retention by up to 400 percent.

“Learning by doing” is an adage supported by studies (Edgar Dale’s Cone of Experience) that suggest students remember only 10 percent of what they read, but 90 percent of what they do. The advantage of VR is less retraining and better pilots that can recall emergency procedures and checklists.

It does not take much imagination to see how VR could reshape training in an airline or business aviation setting. The USAF and ERAU are two notable examples where VR has upset the status quo. This is certainly a case of “what is good for the goose is good for the gander.”

In traditional airline and business aviation training programs there are opportunities for improvement—both in efficiency and cost. Operators in these segments often employ a range of devices from low-tech, low-cost “paper tigers” to much more expensive computerized low-level flight training devices (FTDs) and full-flight simulators (FFS) to train simple tasks such as flight deck flows and procedures. Until the advent of VR flight-training applications, there were few devices available in between.

The results from this approach are mixed. In the case of the paper tiger, staring at a cardboard poster for hours on end, with no feedback—right or wrong—is an ineffective mode of learning. Whereas, putting a student and instructor in a FFS to teach and learn preflight tasks such as flight deck setup, engine starts, and even pre-taxi flows and procedures is extremely expensive and overkill for these training tasks.

FTDs and FFSs are better suited for teaching and improving “stick and rudder” skills in airborne aircraft. VR provides an “off-ramp” to these programs by offering a tailored solution that is appropriate to meet the needs of both the student and the organization without breaking the bank.

Visionary Training Resources (VTR) is a VR training specialist that developed its FlightDeckToGo training system to supplement higher-cost training platforms to enhance the training process. “The beauty of VTR’s FlightDeckToGo is that it expands the opportunity for pilots to easily spend more time in their new work environment, the flight deck,” said VTR CEO and co-founder Evey Cormican.

“The beauty of VTR’s FlightDeckToGo is that it expands the opportunity for pilots to easily spend more time in their new work environment, the flight deck.”

“This enables them to train anywhere and at any time, to perform that training using the most effective learning process, engaging auditory, visual, and kinetic learning centers of the brain simultaneously. This is a method which has been proven—long before VR—to be the most valuable and efficient means to learn a skill.”

FlightDeckToGo is a VR training platform comprised of a self-contained headset with embedded software, hand tracking devices, and built-in eye-tracking sensors that are fully integrated with advanced learning management systems. Unlike other VR systems, the VTR device is completely untethered—meaning it is not

connected to a computer terminal—and can be used virtually anywhere such as, at home or in a hotel room.

“VR is designed to augment simulator training, not replace it,” added VTR’s Cormican, who is a current airline captain and former simulator instructor.

“FlightDeckToGo is here to train any skill that can be off-loaded from the simulator or aircraft. It is a task-to-tool approach. The technology is ready to be utilized now. The friction resides in old methods of training and thinking.”

Accordingly, the strength of VR is to relieve dependence on expensive FTDs or FFSs. Cormican said, “The task-to-tool approach looks at all requirements. Those that can be done in VR should get developed.” She continued, “Approximately 80 percent of what a pilot needs to know is cognitive, including the headwork and the interface of pilot and flight deck. VR training is so much better than a

‘paper tiger’ and many FTD, flat panel, or cardboard bombers.

“[VR] can and will replace the low-level training devices. What it will also do is give pilots a flight deck tool they have been desperately trying to reproduce outside the airline to help funnel the information they must know in a steady, organized, easily consumable way. It is a win for the airlines and the pilots: better standardization, faster proficiency, and a stronger bottom line.”

VR has the potential to help improve the training process by increasing standardization and improving the preparedness of students. “As training center capacities are maximized,” she said, “retraining events become a challenge. VTR reduces the training outcome variability



by providing a better prepared and more standardized pilot to the simulator training environment.”

Cormican believes there are huge opportunities to not only improve training, but to use VR to improve training costs, “Time spent training in the higher-end FTDs and FFSs is currently not being utilized as efficiently as it could be. By introducing pilots to VTR’s training before they enter the FTD phase, expensive devices may be used for what they are intended: flying...not learning basic flows and procedures.”

VTR plans to leverage VR to also include an emphasis on teaching soft skills such as CRM, decision-making, and military-to-civilian transitions. Cormican believes VTR’s proprietary technology will lead to a paradigm shift in flight training.

In development for this year is the ability

for multiple pilots to work together with an instructor in a VR environment. “The benefit and desire to remotely put a crew together on the VR flight deck with an instructor was evident during Covid. The technology is now capable, and we are working through some challenges to implement and make this possible for our airline clients. Imagine the ability to have a paired crew in training work through their flows and checklists prior to going to the training center,” she said.

The next phase of VR training is exciting, Cormican provides insight into what the future may bring by saying, “The opportunities are truly staggering. Customers have asked for a ‘virtual tiger’ with checklists so the pilots can run through QRH/non-normal and normal checklists as many times as they want, to perfect responses and correct verbiage. They have asked

for normal and non-normal engine starts, ground emergencies, inflight scenarios, CRM training scenarios, and external walk-arounds. The opportunities for self-paced, instructor-led, good training are endless. Think about your best instructor on their best day training all of your pilots. Standardization and SOP compliance is the key to maintaining the safety standards aviation demands.”

In civil aviation training, VR may just be the next “big thing” that reduces the dependency on expensive training devices—both lower-level devices and full flight simulators—and the number of instructors in the “schoolhouse.” The strength of VR is the immersive experience where training becomes more efficient and less costly and pilots become more competent by retaining knowledge longer. ■

## ERAU finding early successes with virtual reality training

BY KERRY LYNCH

Embry-Riddle Aeronautical University’s (ERAU) virtual reality-based initiative, introduced six months ago for its flight training program, is already yielding results in terms of training time, costs, student preparedness, and confidence. Speaking during the recent Air Charter Safety Foundation Safety Symposium, ERAU College of Aviation assistant dean and chairman of the flight training department Ken Brynes said early results of the university’s use of virtual reality (VR) in its flight training curriculum have shown a 28 percent decrease in training time to solo. In addition, the cost of initial training completions that incorporate the use of VR has been 18 percent less than

the median for a private pilot course.

The university has also found that students who have already undergone the VR training are “very prepared” for flight, have significantly better radio communications skills, and have much lower anxiety as they begin training, which Brynes noted is an important factor in the student’s receptivity to instruction.

After years of “dabbling” with VR, Embry-Riddle rolled out its formal PILOT (Pre-flight Immersion Laboratory Operations Training) curriculum on August 28. Noting how the university has continued to increase in size, Brynes said it also “continues to expand what we do and how we do it, how we do it safely, and

how we build the next generation of aviation professionals.”

He noted that more students are interested in flight training, but the university needed to consider how it could accommodate that demand while improving efficiency and managing the increasing costs of aircraft and flight training.

The difficulty in managing that, he explained, is the variability that comes with flight training. Some students can be prepared in 50 hours and others 100. The national average is about 70 hours, he noted. This variability is not only based on the student’s capacity but many other factors, such as weather, maintenance, aircraft availability, health situations, and



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Embry-Riddle Aeronautical University uses virtual reality training in multiple ways for its pilot-students, from practicing flight maneuvers to learning how to conduct preflight inspections using checklists and air traffic control communications.

“many things that you can’t control,” Byrnes said.

He added that ERAU looked at how it could use technology “to really bridge the gap and give the students an extremely strong foundation in everything that they need to know in order to be a private pilot before they go to the airplane.”

University officials contemplated “how much can we give our students before they get to that airplane and prepare so they are not learning something for the first time at three or four dollars a minute. It makes a big difference.”

The school looked at VR as a means of “taking some of the variables we can’t control and controlling them.” He added the hope is for students to be successful soon, meet their benchmarks sooner, have increased preparation for training, and an

“How much can we give our students before they get to that airplane and prepare so they are not learning something for the first time at three or four dollars a minute. It makes a big difference.”

overall decrease in the time it takes them to completion.

Embry-Riddle has always used simulation as much as possible, including Level 6 flight training devices, he noted. The university is continuing its use and maintaining its building-block approach. Students learn concepts, then they go to the simulator to work through a maneuver.

Now, they also go to the VR trainer and

practice that maneuver on their own in a realistic scenario. “We can increase task exposure and repetition at almost no cost,” Byrnes said, adding students can repeat these tasks in the trainer rather than having to go over them numerous times in an airplane.

VR is also used for preflight checklists and air traffic control communications training. Byrnes said students are much better prepared in working with ATC in the aircraft once they’ve practiced in the VR training.

The ATC practice is particularly important because such communications can be daunting for students flying through the busy Daytona Beach airspace for the first time.

“The results are thus far good,” Brynes surmised about the VR training. “We continue to tweak it. We keep making it better.” ■

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# FlightSafety taps new tech for training

BY MATT THURBER

For visitors to various industry events during the past few years, FlightSafety International has been demonstrating examples of some of the new training technologies it is developing. But for a deeper dive into what the company's developers are working on, a trip to the FlightSafety Simulation Systems factory in Broken Arrow, Oklahoma, revealed more about how aviation training is moving quickly into the future.

At FlightSafety's Oklahoma factory, the company manufactures flight simulators and training devices for its far-flung network of learning centers and for customers that operate their own training facilities. An example of one of the deployed new training products is the use of virtual reality (VR) for Pratt & Whitney Canada PT6 engine maintenance at FlightSafety's Wichita, Kansas, learning center. FlightSafety has also deployed advanced training using augmented and mixed reality (AR and MR) technology, primarily for government customers. The U.S. Navy's Naval Aviation Training Next—Project Avenger, for example, seeks to reduce training times for new pilots. The program starts pilot trainees in MR trainers, where they can “fly” a simulated T-6B Texan II unit training device (UTD) using real power and flight controls while wearing a Varjo MR headset in preparation for flying the real airplane.

The benefit of MR is that it combines VR with actual cockpit controls and displays so the trainee gains better practice that is more transferable to the real aircraft. These devices are being used for pilot screening, cockpit familiarization, basic flight and emergency procedures, traffic pattern operations, and geographic familiarization.

Adding AR to the mix makes possible operations like flying in formation with other virtual aircraft, without the danger



FlightSafety's T-6B trainer combines real controls with a simulated outside view in the headset.

of real formation flying. Other uses include mission rehearsal, practicing aerial refueling, and other mission-related flying tasks.

FlightSafety does offer a dome-type visual system for its military aircraft simulators, and this gives pilots a better-than-360-degree view of the outside world, but dome systems are costly, with large visual displays and projector systems and significant power requirements. MR devices are much less expensive to operate, needing only to plug into an ordinary power strip, and can help shorten the initial training time, according to FlightSafety. This gives operators more flexibility for new pilot training, leaving the high-end dome system for more advanced training.

## FLYING THE UTD

During my visit to FlightSafety's Broken Arrow facility, I was invited to try out the UTD T-6B simulator, basically, the same unit that is in operation at Naval Air Station Corpus Christi in Texas. Once I put on the Varjo headset, I could “see” the outside world from my cockpit, and I was parked at

simulated Naval Air Station Whiting Field in Florida, ready to take off.

The view outside, set during the daytime, was clear and sharp, and unlike other simulators, the viewable area didn't disappear when I turned my head beyond a certain point. Whatever direction I was looking in was where I got to see, and this made the experience highly realistic.

Everyone outside the UTD, including the instructor, can watch what I'm seeing on a repeater monitor. Because I was sitting in a replica cockpit, I had the direct experience of manipulating physical controls, buttons, knobs, and switches. This added even more realism to the simulation, and I could easily feel how training in the UTD would help maximize a new pilot's knowledge before climbing into the real airplane.

After taking off from Whiting Field, I got familiar with the T-6B's controls by flying a loop and a roll and just enjoying the experience of flying this sleek, powerful turboprop trainer over simulated Florida. The instructor then generated another T-6B nearby so I scooted over to fly some

formation. I have flown formation before, and this was highly realistic, requiring a lot of effort to maintain position, using constant control movements and manipulation of the throttle, all while looking outside at the other airplane. I could easily see how spending time in this device would help prepare pilots for flying the real airplane, much more effectively than the traditional methods such as “chair flying” or even an advanced training device.

### KC-46 TANKER FLYING

FlightSafety manufactures a full KC-46 (Boeing 767) aerial refueling aircrew weapons systems trainer (WST) at Broken Arrow, and I was able to spend some time trying out both connecting to the tanker and manipulating the boom operator trainer (BOT) controls.

The simulator is a full-motion type with FlightSafety’s latest Vital glass mirror display technology. The simulator BOT station is mounted on a motion base connected to the flight deck simulator so they can both move together to give crews simultaneous experience while training in the WST. In the real KC-46, the BOT is located behind the flight deck. During this demo, we didn’t use the motion base, but it was still highly realistic.

I started the demo flying a KC-46 that needed to take on a load of fuel. Never having been anywhere near aerial refueling operations, this was a unique experience. I was told that the pilots who hook up to a tanker do so relatively quickly, swooping in near the tanker, slowing quickly, then capturing the end of the refueling drogue basket with their aircraft’s probe.

The probe on the KC-46 is above the flight deck, so I would have to slide my KC-46 up underneath the tanker and get close enough so that the drogue would disappear from my view as it hooked up.

Trying to connect to the drogue was hard enough, but getting two gigantic airplanes to fly that close to each other was, in my opinion, the hardest part. Until seeing this in the simulator, I never realized how close you have to fly to connect to a tanker.



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At the sweet spot, the tanker more than fills the view out of the windshields, and it feels like one small wrong move could lead to disaster. Which it could.

Apparently, this is easier with the motion turned on. I was too chicken to try the “swoop and hook up” method, so I inched my KC-46 slowly forward, trying to match the speed of the tanker while homing in on the drogue. Each time I got close, wake turbulence pushed my airplane aside and I had to try again. My problem was that I was too hesitant about getting up close and personal with the tanker.

Finally, after three anxious efforts to get the probe into the drogue while flying at 275 knots in close formation with the tanker filling my windshields, I managed to connect. Unfortunately, I didn’t realize that I had to keep flying my airplane while hooked up and I relaxed momentarily and disconnected before my airplane could take on any fuel.

Obviously, this was a short demo flight and some training would have helped. But I did get a good feel for the challenges of aerial refueling and especially how the urgency of

needing to fill near-empty tanks can add a significant amount of stress to the situation.

Switching to the BOT, I tried the same operation from the boom operator’s position using the remote vision system. The KC-46 boom operator doesn’t sit back in the tail of the airplane because the view of the boom and the trailing aircraft is all on video displays, not a live outside view through windows. One large display shows the view looking aft at the refueling aircraft while three displays on the top show side views of other aircraft waiting in line or the view of multiple drogues, when so equipped. The operator can select between visual or infrared views on the displays.

There are two hand controls for the boom operator. The right control moves the boom fore and aft and side to side, while the left control moves the drogue forward and back.

The BOT has settings for three levels of aggression, from 1 (easiest) to 3 (which includes turbulence and turning flight). Of course, I started with number 1, and my first job was refueling a KC-46, followed by an

F16 then an F22. Making the connections with these aircraft seemed much easier than trying to connect while flying the aircraft. The boom responded precisely to the controls, and probably because the simulated pilots flying the simulated aircraft were good at their jobs, I was able to connect in each case, even at a higher aggression level.

FlightSafety is continuing to expand its use of “immersive” technologies like these, not just for pilots but also for technician training like its VR engine courses. The company is also developing, it said, “3D aircraft walkarounds along with detailed systems demonstrations—within external doors and controls and the cockpit and cabin. This provides value to other users who may not be familiar with the aircraft to experience emergency systems and general operating systems. The goal is to increase the product experience for everyone involved with the aircraft. We believe we should not only be preparing the pilot but all involved; including the maintenance technician, cabin crew, ground crew, and the travelers themselves.” ■

## CAE puts VR to work in pilot training

BY MATT THURBER

Simulator manufacturer and training provider CAE is targeting virtual and mixed reality (VR and MR) technology for new training platforms, including its latest Sprint VR Trainer. The device includes physical stick, throttle, and rudder controls, CAE’s Medallion image generator, a VR headset, and haptic feedback for actuation of instrument panel equipment.

Sprint stands for Self-Paced, Real-time Insights for Next-generation Training, and it is designed to allow students to practice flying using a virtual coach and CAE’s Rise performance grading



Virtual reality aids preflight training.

and assessment tools. Students can use the Sprint Trainer “to practice training tasks, procedures, and maneuvers in an affordable, high-fidelity, immersive

environment to master lessons at their own pace,” according to CAE.

For military customers, CAE’s Mission Augmented Virtual Reality/Rear Crew Trainer (MAVRC) goes a step further with mixed reality (MR) technology employed in a physical replica of an aircraft fuselage. Designed to provide a realistic training environment for aircrew working in a helicopter cabin, the MAVRC allows crews to work together in a simulated outside environment that is presented on their helmet-mounted displays (HMD). The device includes working doors, a fully functioning

ramp, flat and bubble windows, and cabin displays. Training scenarios that can be replicated include medical evacuation, search and rescue, surveillance, door gunner, and confined-area landings, according to CAE.

“The HMD projects the out-the-aircraft virtual world while allowing each crew-member to see everything existing inside the aircraft,” CAE explained. “Terrain, vehicles, weather, and high-fidelity scenarios all help ensure crewmembers are fully immersed in the training tasks.”

Pilots can be added to the training scenarios by coupling the MAVRC with a full-mission simulator or flight training device. CAE also offers the option of distributed mission operations, where the MAVRC can be “networked with other training devices for comprehensive and immersive mission training and rehearsal.” ■



CAE’s use of virtual and mixed reality environments for pilot training is part of a massive investment the company made last year in the development of innovative technologies.



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# ACSF symposium highlights positive work culture issues

BY KERRY LYNCH

As aviation reporting programs continue to expand as a key means to elevate safety, so too has the need for positive cultures to ensure the success of such programs, according to speakers at the recent 14th annual Air Charter Safety Foundation Safety Symposium.

Workplace culture was among several safety themes highlighted during the two-day symposium that ran April 5-6 in Daytona Beach, Florida, with further topics surrounding health and wellbeing, among others.

Kimberly Perkins, a Gulfstream G650 captain and industry researcher, highlighted her findings from surveys that underscored the importance of culture in the flight deck and the larger organization. Surveys found when there is a positive synergy in the flight deck, pilots feel more valued and willing to ask for help or share mistakes, Perkins said. Conversely, they found pilots are about 50 percent less likely to share information when they do not get along.

Notably, 93 percent of first officers surveyed said they sometimes or always feel

compelled to adapt to the style established by the captain. Further, 75 percent said they have been hesitant in speaking up to share safety concerns because of the culture in the flight deck and 57 percent felt silenced after bringing up such a concern. “We know captains or PICs play a very large role in establishing a microculture in the flight deck,” Perkins said.

The FAA has adopted and updated crew resource management training (CRM) guidelines over the past 18 years, but 51 percent of survey respondents said their CRM training





did not incorporate recommendations for sensitivity towards others or adapting leadership styles to others' needs. Respondents, however, overwhelmingly agreed on a need to focus on culture, Perkins said.

She further pointed out that safety management systems (SMS)—which are an upcoming requirement for Part 135 operators—call for the promotion, monitoring, and adjustment of a safety culture. “We need psychological safety for this,” Perkins said. “If people don’t feel like they’re a valued team member, if they don’t feel comfortable speaking up...they’re not going to be able to ask for help. They’re not going to be able to admit their mistakes. They’re not going to be as likely to share safety concerns.”

Perkins questioned whether organizations offer training not only to reduce human error but also to promote a positive safety culture. “I think we have a gap here.”

### STUDENT TRAUMA

Meanwhile, Robert Joyce, director of aviation safety for Safety Symposium host Embry-Riddle Aeronautical University (ERAU), stressed the importance of having a positive safety culture to maintain an operation that has 1,200 to 1,500 flying students and a flight department that amasses upwards of 100,000 hours a year.

ERAU has achieved IS-BAO Stage 3 registration—in fact, it was coming up on a renewal audit right after the symposium—and Joyce said SMS is an essential piece that involves everyone. He notes that discussing the components of SMS with students who are “still trying to figure out how to do laundry” can be challenging. “It’s just lost on them,” he said, but university instructors do take time to show the students how they contribute and are engaged with the university’s SMS.

Noting the multitude of safety reports his department sorts through every year, he said, “I’m very fortunate to be a safety director here at Embry-Riddle because, right from the president to the newest student, everybody buys into our safety culture.”



KIMBERLY PERKINS  
PILOT, RESEARCHER

“If people don’t feel like they’re a valued team member, if they don’t feel comfortable speaking up...they’re not going to be able to ask for help. They’re not going to be able to admit their mistakes. They’re not going to be as likely to share safety concerns.”

One of the goals of the university is to produce safety professionals so that when graduates begin their careers, “they know what an ASAP [aviation safety action program] is and they know what non-punitive reporting is. It’s just a way of life for us. This is how we operate.”

He expressed the view that the university’s mission is to “make dreams come true.” Most flight students coming in have long dreamed of becoming a pilot. However, “when they have a pilot deviation or they roll into the grass or cross the hold short line and they file the report, they are completely traumatized by the situation. It’s not because someone almost landed on top of them. They see that dream slipping away.”

Even in an accident situation, the student’s first questions are: “Will I get hired by an airline. What do I say in the interview?” They see their career going down the drain.” He said this underscores the need for positive communication. “I spend a lot of my day being a counselor,” he said. “And I let them talk.”

Joyce first works through those questions and builds an open line of communication before getting into the details of what happened or why it happened. “But we don’t start the investigation that way because they are completely traumatized. So that’s how the passion for aviation shapes how we approach communication. That’s how you get to successful communication.”

He pointed to the so-called “Platinum Rule” and said, “I am going to treat them the way they need to be treated at the moment. And then we’ll get their trust and get to the rest of that at that point.”

### STRESSES EVERYWHERE

Aviation stalwart and founding partner and CEO of Convergent Performance Tony Kern praised the safety record of Embry-Riddle and credited the culture it has built in facilitating that. “I think it would be wonderful if we could spread [this culture] to the rest of the industry.”

Also presenting to attendees at the Safety Symposium, Kern highlighted the importance of psychological wellness as aviation navigates through the pandemic and workers deal with an increased level of stress.

He noted everyone is operating in “uncharted waters” due to Covid and other factors. “Aviation is used to change but this is big-time change,” Kern remarked. “There are all these things going on with society and mental health is a big, big deal. Aviation is not immune.”

People can resist calls to get better when they are not optimal, often feeling that they aren’t good enough, Kern noted. These professionals may meet the regulations or have

substantial experience, but he remarked, “Does the regulator know how good you need to be? Experience is only a good thing if you are doing what’s right...Even professionals who make all the right decisions can be overwhelmed by events.”

He pointed to a need for gathering the appropriate feedback to better evaluate whether professionals are at their best selves. “Under the stresses we are under, it is very difficult to get out of our own heads.”

Kern noted that stresses now come at people from many directions beyond the traditional places and that people should be aware that they cannot fly at the same level of performance in times of high stress.

Citing social media as an example, he advised, “Right now, don’t induce stress in your life you don’t need. Reduce stress where you can—track it, assess it, but don’t ignore it.”

However, Kern also provided some encouragement: “With the challenges we face as aviators, we are uniquely qualified to handle stress. We are trained to learn from experience. We are trained to use CRM. We are trained for mutual support.”

Aviation can be part of the solution, he concluded.

## WELLBEING CHECKLISTS

Dr. Quay Snyder, president and CEO of Aviation Medicine Advisory Service, further homed in on wellbeing during the Safety Symposium. Snyder reminded of the responsibilities for remaining fit for duty and pointed out that this has been on the National Transportation Safety Board’s Most Wanted List. “Fitness for duty is one of the fundamentals of safety,” he stressed.

The difficulty is, unlike meeting other federal aviation regulations, fitness for duty is a “soft threshold...we’re always somewhere on the spectrum” and believe that it is safe to operate, he said.

Exacerbating this situation is the fact that FAA Part 67 regulations only list certain



Robert Joyce, director of aviation safety for Embry-Riddle Aeronautical University (ERAU), was among a packed lineup of speakers at ACSF's 2022 Safety Symposium. He explained how students are frequently traumatized after they make unintentional flying errors and must be listened to before safety officers can address the lessons learned from the incidents.

disqualifying medical conditions, he further noted. “There’s not a lot of references for pilots to go on. So, we’re relying on our personal assessment to determine whether we are fit to fly,” he said.

He recommended the use of fitness “checklists,” noting aviators are well-attuned to using them for aircraft and so too should be for their wellbeing. “It’s part of our standardized culture...You need a personal objective and reflective pre-flight too.”

People need to ensure they follow that checklist, Snyder maintained. If pilots find they are in a marginal category of three or so items, then perhaps they should not fly. But realistically, “How many people really do that?”

He also warned of the effects of medications on cognitive abilities, noting antihistamines were the number one drug found in an NTSB safety study surrounding the toxicology of pilots killed in aircraft crashes. For about 16 hours, just one 25-mg

dose can affect cognitive ability similar to a blood alcohol level of 0.05, he noted.

He also pointed to the growing acceptance of the use of marijuana and its legalization in various states. But for pilots, he said it is always illegal because federally it is still a Class 1 drug. In addition, he warned that there aren’t controls over what is in locally-sold marijuana, so people using it may not be aware of what they are inhaling or ingesting.

Alcoholism remains an issue, and many with substance-abuse problems can function in today’s society without notice. Those with such problems should be made aware of programs that can help them through their issues, he said, stressing the importance of peer support.

Snyder also stressed the need for proper hydration, rest, and physical and mental exercises, as well as limits on caffeine and unnecessary medication. He further encouraged attendees to reach out to others for help on any issue, whether it

be substance abuse or physical or mental health, and build a support network.

### THE GII SHUTTLE TRAINER

Former NASA chief astronaut and current chairman of the Citation Jet Pilots Association Charlie Precourt provided an overview of lessons business aviation could learn from the Space Shuttle in areas such as preparedness and flight data monitoring.

He described the Space Shuttle as a “massive amount of energy,” weighing about 4.5 million pounds at liftoff. “You have got to have it right when you are lined up,” he said, with “deep, deep planning” for that moment.

On the other end, at reentry, he asked: “What do you use for a stabilized approach. This vehicle is at 17,5000 miles per hour... You have to be prepared for this. There’s no second chance for any of this.”

While he describes the reentry as a “light show, and a visual coming across the U.S.,” Precourt said the “meat of the action” is when the vehicle is down to Mach 5 and slows from there on approach to Kennedy Space Center. “You’d swear looking out of the front of the vehicle that the trajectory has you going into the Bahamas.”

NASA modified a Gulfstream II to mirror the flight deck of the Space Shuttle.

“The Gulfstream cockpit allows us to do what we call airborne simulation,” he said. The pilots use the Gulfstream to train from the last 35,000 feet to touchdown. This is done with average descent rates of 12,000 fpm in about the time it takes a business jet from gear down to touchdown, he said. The aircraft would do a simulated touch and head back up for another simulation. The commander and safety pilot would do 10 of these per mission.

While the front of the GII may look like the Space Shuttle, the rear is full of computers that produce data for these approaches. “We were using flight data monitoring for a form of flight operations quality assurance for every single one of these approaches.” The pilots would receive immediate feedback, making every flight a training flight to achieve an accurate landing. With the data, the pilot could see results and make corrections on the next approach.

He stressed the amount of practice that goes into these missions. After the missions, a team of engineers from the mission control center would gather the data and pilots would delve into the “nitty-gritty” details. “This was critical to making sure that we didn’t run an orbiter off the runway or damage on landing,” he said.



**CHARLIE PRECOURT**  
CJP CHAIRMAN, FORMER ASTRONAUT

Precourt added that with that data, “Commanders, before they apply their first landing in the Space Shuttle, would’ve done a thousand approaches of this simulation. And you swear when you grab the orbiter’s controls for the first time, you are back in the GII simulation.”

### EXPECT THE UNEXPECTED

The 2022 ACSF Safety Symposium marked its first time it was held in a new venue, the ERAU campus in Daytona Beach. Its previous home had been the NTSB’s training center in Ashburn, Virginia. But while it moved out of the center, this year’s event still had an NTSB presence, with Board member Michael Graham discussing decision making, a key factor in managing risk. “We’re all aware that unexpected events happen every day in everything we do,” he said. “You’re driving a car, flying an airplane, whatever it is, and the decisions you make do impact your margin of safety...It’s not just enough to train for the unexpected, you must expect the unexpected.” He added that the NTSB database is full of accidents involving decisions that reduced the margin of safety and increased the likelihood of accidents.

Opening the 14th ACSF Safety Symposium was ACSF chairman Robert Ruffi, who is v-p of flight operations and director of operations for Pentastar Aviation. He noted the shift in venue aligns with the organization’s strategic goals for better outreach. According to Ruffi, ACSF is working towards deepening its ties with academia as it accumulates key safety data to address issues. ■

“What do you use for a stabilized approach. This vehicle is at 17,5000 miles per hour... You have to be prepared for this.”



# RAeS-led study calls for ‘urgent action’ on sexism in aviation

BY GREGORY POLEK



Researchers with the University of West England (UWE) in Bristol and the Royal Aeronautical Society (RAeS) have found that efforts over the years to address the lack of gender diversity among pilots and pilot trainers have largely fallen short and that sexism and sexual harassment—particularly during initial pilot training—demand “urgent action.”

A report published in March by the RAeS, which considered survey responses from 700 airline pilots around the world, 750 personal testimonials, and eight focus groups, found that while women account for 5.26 percent of the global pilot workforce, the disparity proved even more pronounced among pilot trainers. For example, women account for just 0.9 percent of type rating examiners (TREs) in the UK.

Along with frequent complaints of an “old boys network” including some among male respondents, the study found

“structural barriers” such as a lack of transparency around recruitment and selection. Meanwhile, it found that “the vast majority” of airlines and training organizations refuse to allow pilot trainers to work part-time, leading to what the researchers characterized as a disproportionate effect on women.

## DIFFERENT TREATMENT

Forty-two percent of women in the survey reported being “treated differently” than their male counterparts at work and 30 percent believed they were the victims of gender discrimination.

“Training is the first point of contact for the next generation of pilots, and if we want to attract the best talent we need to ensure we appeal to everyone with the right abilities irrespective of gender, ethnicity, or age,” said Marnie Munns, an airline pilot and one of the report’s authors. “A much more diverse training department will ensure that

there are visible role models and a more inclusive training environment for all.”

Professor Susan Durbin from UWE Bristol concurred that the industry remains “a long way” from achieving gender equality.

“For example, not offering the pilot trainer role on a part-time basis is detrimental to women as it holds them back from progressing their careers and excludes them from training roles,” she said. “I sincerely hope that the industry will seriously consider the findings of this report and take the necessary recommended actions. Through this study, we have enabled the voices of men and women in the industry to be heard; I believe it is time for the industry to listen and take urgent action.”

The report acknowledges that over the past six years the industry has instituted outreach initiatives to directly attract female interest in the profession as a way of addressing a shrinking pilot pipeline,

but that it has done little “to understand the lived experiences” of minorities in the industry, especially women.

The study found that most sexual harassment, for example, goes unreported due to the lack of processes that would alleviate the tendency of management to label women who complain as “difficult.” It added that while half of men also expressed dissatisfaction with their initial pilot training, the complaints centered mainly on the cost of training, the poor quality of some training, and, for some, exclusion from “the old boys network” and macho culture.

Another problem area, according to the report, involves the process of recruitment and selection. While most pilots, it said, understand the career path to becoming captain, the process for becoming a trainer remains vague and influenced by senior management. In addition, mostly male internal staff conduct recruitment, and recruiting departments have no formal industry recommendations with which to work except a 1,501-hour total-time requirement.

“Men were more likely to know where to find information about their training department recruitment process, be given support and encouragement to apply, and in some cases invited into the role without a formal interview, unlike women, who were generally not actively encouraged, and all went through a formal interview process,” concluded the report.

### ROLE MODELS

Yet another area of concern centers on a lack of role models and mentor support for women, due largely to a lack of female pilot trainers. The presence of more role models and mentors would also tackle the problem of women finding less support than men when applying for training, less awareness of their opportunities early in their careers, and training departments giving less encouragement to women to apply for training

“Training is the first point of contact for the next generation of pilots, and if we want to attract the best talent we need to ensure we appeal to everyone with the right abilities irrespective of gender, ethnicity, or age.”

positions than their male counterparts.

The authors of the report assert that regulators need to get more involved with training organizations because they “have a duty” of care that not only extends to the wellbeing of individuals but the safety of the flying public.

The study’s recommendations center largely on making current female trainers

more visible as role models and a call for an industry-level formal mentoring plan.

“The role of a pilot and pilot trainer is a vocation for most and requires a good deal of financial and emotional commitment,” the authors concluded. “It is a career that carries a high level of satisfaction, despite the problems identified throughout this study. The airline industry is failing many of the women, and some of the men, who follow this vocation and make

heavy financial and emotional investments. Women, who are in the minority in both the pilot and pilot trainer roles, need more support from their employers and to be treated with respect by those around them, including peers and passengers. It is of grave concern to us that the unacceptable and shocking behavior towards women during initial pilot 110 training, is still happening today.”

## Be in the Middle of it All

The JETNET iQ Summit is going to be charged with a new energy as business leaders from around the world meet at the New York Marriott Marquis, September 15-16th. Join us in Times Square and experience the excitement of business aviation’s bright new direction: **Bluer Skies. Greener Future.**

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# Desktop simulator developer addresses business jet market

BY MATT THURBER



In early January, desktop simulation company HotStart released what is likely the most comprehensive and accurate business jet simulator—the Challenger 650—for the X-Plane 11 platform. The simulator took three years to develop and faithfully replicates not only the airplane's complex systems and avionics but also real operational factors such as dealing with the FBO for fuel purchases, flight planning and FMS usage, sound such as the door closing, hydraulic pumps actuating, and other typical noises, and detailed failure modes.

“We finally have a desktop trainer of the fidelity where every button works,” said Keith Smith, founder of PilotEdge, a real-time air traffic controller service for desktop simulation. After having spent weeks learning the Challenger 650 simulator and practicing flying with it, he envisions its

use for pre-type rating training or as a way to introduce non-jet pilots to business jet operations. A candidate planning to obtain a Bombardier Challenger 650 type rating, he suggested, could study the desktop simulation before going to the training event and have a much more comprehensive training experience.

“ This level of fidelity is patently insane. ”

For example, study windows and internal status displays show detailed schematics of the airplane's systems, with depictions of valve movement, fluid flow, electrical output, and even communication over digital buses, which could help increase the student's understanding before attending ground school. And practicing going from dark cockpit to engine start using the checklists and the proper steps could greatly reduce the amount of time the student needs to spend

in a fixed-based training device or even the full-flight simulator (FFS).

Smith is so enamored of the quality of the HotStart simulator that he is trying to set up an experiment, to see if a student prepped in the Challenger 650 desktop simulator could climb into a 650 FFS and without any coaching go from dark cockpit

through engine start in far less time than a typical type rating candidate.

Another opportunity would be to create a jet transition training course, to help future business jet and airline pilots gain some understanding of jet processes and operations before they get hired by an airline or go to type rating training. The Challenger 650 shares many systems and avionics features with Bombardier's CRJ airliners and thus might be a suitable platform for that kind of preparation. One of the big challenges faced by airlines hiring

new pilots is that many of the pilot applicants have no experience operating jets and often require extra FFS time to overcome their weak areas. Spending extra time with an accurately replicated desktop simulation model before starting the airline training process could reduce the attrition problem. And these kinds of preparation courses could be taught by remote instructors to help keep costs down.

### WHY THE CHALLENGER 650?

HotStart co-founder and developer Saso Kiselkov (who goes by the moniker Totoritko on Discord, the online hangout for many desktop simulation fans), has long felt that the lack of good business jet simulations is a big problem in the desktop simulator world. There are replications of all sorts of aircraft, but so far only some light airplanes and airliners have been duplicated with relatively high levels of fidelity. “There’s a big gap in between,” he said. “That’s a space I want to play around in.”

Kiselkov, a software developer, and his partner in HotStart released a fairly accurate simulation of the TBM 900 a few years ago. While not a full “study level” simulation, the TBM 900 was a significant development, a replication of a sophisticated general aviation airplane that gave users a more faithful experience. For example,

users could go through all the checklist steps to start the TBM’s PT6 engine and deal with potential issues, such as a hot start, low battery, etc., that could cause expensive maintenance problems. The simulation also made users handle these problems, like having to recharge the battery or buy an engine overhaul if a hot start wasn’t handled correctly. The TBM’s avionics weren’t an exact replication of the real airplane’s Garmin G1000 suite, but it’s close enough to be a satisfying experience.

With the Challenger 650, Kiselkov wanted to try crafting a twin-engine business jet simulation, using an airplane with transatlantic capability, but not a large-cabin, ultra-long-range jet nor a light or very light jet. A key requirement was that he have access to the actual airplane and pilots with experience flying it. The Challenger 650 met all those requirements.

At first he thought a business jet would naturally be simpler than some of the airliners that others have replicated for desktop simulation. Many of these are so-called study-level simulations, so accurate that a simmer can learn nearly as much about flying them as a real pilot going through type rating training, except of course for the experience of flying a full-flight simulator and the airplane itself.

The Challenger 650 is much more complex than the ubiquitous Boeing 737, a

popular airplane well replicated in the desktop and training simulation fields. The Challenger 650 has three hydraulic systems, “backups for backups,” three flight management computers, synthetic vision, a head-up display, and full required navigation performance (RNP) capability. “I accidentally picked the most complicated [airplane],” he recalled.

The avionics were also a consideration. While Kiselkov hasn’t announced plans for a next simulator build, he does believe that having replicated the Challenger 650’s Collins Pro Line 21 avionics, he could use those avionics building blocks in future simulator products.

### BUILDING A SIMULATION

Because Kiselkov did not have access to the aerodynamic flight model and all the data that make up a modern jet—which aircraft manufacturers provide to simulator makers—he had to figure out how to replicate the Challenger 650’s systems, avionics, flight characteristics, and failure modes. “[I’ve] been starting out with the precept that since I’m trying to simulate the real thing, it has to follow the laws of physics. If I can implement that, the real things should fall out,” he explained. “The decision to simulate nearly everything was because I knew I never would be able to intuit every possible behavior



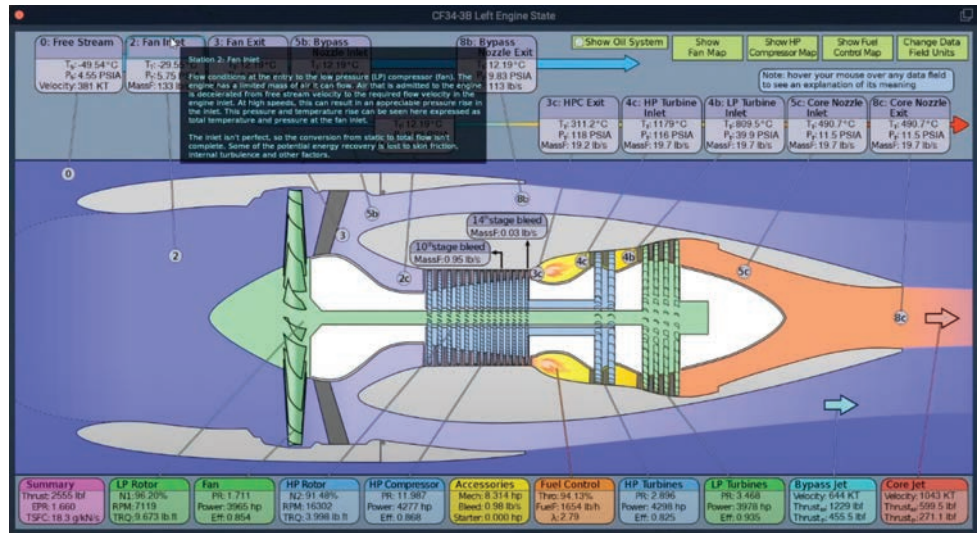
of the aircraft, engine, and systems state, but I can derive aircraft behavior from first principles.”

In designing the fundamental aspects of how the simulation works, Kiselkov could either use hard-coded tables of how various systems work, for example, if a throttle is set here, then the engine’s fan is running at such a speed. The same is true of roll rate versus the position of the yoke. And any data between the tabulated data can be interpolated. However, he said, “I do not have that level of access.”

So what Kiselkov did was “derive aircraft behavior from first principles. You imagine a hydraulic hose of a certain diameter and the fluid viscosity, and that should give me the behavior. It’s not hard-code tabulated. Then we do a little bit of tweaking here and there. I knew it’s the real thing; as long as I can get the physics right, it should come out.”

This meant a ton of work over the past three years; replicating the 650 was not a trivial task. “Doing the physics” meant locating many fine details such as dimensions and shapes of everything that makes up the airplane, engine pressure ratios, performance data, and much more. “I constructed the physical model and a simulator library into which I fed all the physical inputs. I started with data about the areas of the compressor stages, an estimate of what the turbines should do, the pressure and temperature drops. We’re mostly talking about turbomachinery terms, and compressor and turbine maps. Instead of getting engine data from [CF34 manufacturer] GE, I took some compressor maps that I found on the net and tweaked and tweaked till they matched the data.”

One of the advantages of this method, it turns out, is that Kiselkov was able to create a generic set of functions, like a simulator library, that accounts for the various engine parameters that are universal to a turbine engine. These might include drag coefficients of bearings, compression ratios, diameters of spools, etc. “This [library] is reasonably flexible,” he said,



Study windows illustrate the level of detail behind the simulation of the Challenger 650.



Every knob, button, switch, circuit breaker, and control works exactly like the real airplane.

and could be used by other developers to mimic turbine engines of various types. In fact, Kiselkov used the library to replicate the Challenger 650’s auxiliary power unit.

Having access to a real Challenger 650 and experienced pilots made it easier to verify avionics, engine, and systems behaviors, flight characteristics like flaring during landing, and every aspect of flying the airplane. “The pilots recorded photos of various states of the aircraft,” he explained, “then I constructed test suites and ran the physics and compared and made sure we came up with the correct numbers, the known states for which we have data.

“The whole thing holds together physically,” he said. “There are no sleights of hand going on. For every condition, every system, I start with the fundamental physics, like conservation of energy. Whenever you want to move something it takes energy, and that gets propagated through the entire system. It’s all interconnected.”

For those who want to dive deep into the Challenger 650’s systems and understand how they work, the HotStart simulator includes in-depth study windows, with a myriad of details on each system. This is far more than anyone gets to see in a typical type rating course. An example of this



level of detail is inertial reference system sensor performance, showing the “velocity random walk” in the x, y, and z axes. This is measured in “m/s/sqrt (HR)” and represents the error in white noise proportional to the square root of time.

Such deep detail is evident in every aspect of this simulator. The fuel computer, for another example, Kiselkov explained, “doesn’t get it right every time. It’s pretty normal during takeoff to see an increase in fuel onboard by 300 to 400 pounds. I’m not talking just the simulator but the real aircraft. The fuel computer is recreated to insane levels of detail; it’s like much of the rest of the avionics, it does not have any secret knowledge, it doesn’t know the exact value that’s in the tank, rather it just sees its simulated probes, and probes have noise and garble in them. The fuel computer has to filter and variously process that and correlate that to an internal table to what it thinks should be the fuel value. But plus or minus 4 or 5 percent on those fuel meters is perfectly acceptable.”

The HotStart Challenger 650 enables users to do en route controller-pilot data-link communications (CPDLC) as well as departure and oceanic clearances. This is basically a full implementation of the Challenger’s FANS capabilities, using a simulation of the Iridium satellite network for simulated satellite communications.

### OPERATING THE SIM

When it comes to flying the HotStart Challenger 650, all the details come together to give the user an experience that simply hasn’t before been available in business airplane desktop simulations.

Word of warning: block off plenty of time to get to know the simulation; this isn’t an aircraft you can just fire up and fly away.

HotStart offers two ways to use the simulator, a training mode for quicker starts and a career mode that makes the user go through all the steps of getting a business jet underway. This includes placing a fuel order with the HotStart FBO, using

the proper sequence of moves to open the cabin door, and removing the landing gear pins. Like the real airplane, the nose gear doors have to be opened to get to the nose gear pin. And you can’t open the nose doors without first turning on the APU and hydraulic pump 3A. If the engines need oil replenishment, then you have to use the automatic replenishment feature, which works just like the real airplane. Every system that generates audible sounds in real life is replicated in the simulation. “This level of fidelity is patently insane,” is the way PilotEdge’s Keith Smith put it.

“ The decision to simulate nearly everything was because I knew I never would be able to intuit every possible behavior of the aircraft, engine, and systems state, but I can derive aircraft behavior from first principles. ”

Once done with the external preflight, it’s time to climb into the left seat and go through the checklist. HotStart provides a regular checklist file that can be printed out and an expanded checklist that helps the user understand the steps involved. Once the avionics are on, you can use the built-in checklist in the Pro Line 21 avionics as well as an automated copilot who can run the checklist with you.

Having to go through all the steps just like the real airplane introduces the user to the location and functionality of all the switches, buttons, and knobs. Some of the checklist items are a little hard to accomplish, like

the stick shaker and pusher test, using simulated controls, but there are ways around that, using programmable buttons on simulator flight controls. Smith adopted a generic midi controller’s blank buttons to program a lot of the Challenger 650’s switches, to save time going from place to place in the flight deck on his computer monitor. Setting up X-Plane “quick looks” for each key part of the flight deck does make navigating around easier, however.

Before taking off, not only do all the checklist items need to be completed, but the user must enter a flight plan into the FMS. For more realism, you can get a digital clearance using the built-in CPDLC or use Smith’s PilotEdge ATC service for CPDLC functionality. Creating the flight plan can be done using Navigraph’s SimBrief, which automatically sends the flight plan to the FMS. Even with the flight plan automatically loaded, the pilot still has to do all the normal FMS “hand jamming” to initialize the FMS, check and set performance information, move the flight plan to the active location, etc. If anything, this simulator can teach pilots who are unfamiliar with traditional FMSs how those complex but capable devices work.

The hard part of operating the HotStart Challenger 650 simulator is getting the airplane ready to fly. Once the user is good at doing that, the flying is the icing on the cake. There are plenty of YouTube videos available that show not only the startup process but also what it’s like to fly the HotStart Challenger 650 simulator, and it is highly recommended that new users spend some time getting familiar before making their own attempts.

Because the Challenger 650 is a two-pilot airplane, Kiselkov is planning to add support for multi-crew flying over the internet. This would allow two pilots with the simulator running on each of their computers to fly the same mission together. And this will open further opportunities for training new jet pilots on two-crew operations. ■

# Travel medical emergencies: expect the unexpected

BY CURT EPSTEIN

For travelers and aircraft crews alike, experiencing a medical emergency in a foreign country is a major fear, but for corporate pilot Mark Zakula, that nightmare played out when he suffered a life-threatening issue while on a mission to Israel five years ago.

While dining with his fellow crewmembers in a Tel Aviv hotel, he suddenly felt chest pains and began sweating. He returned to his hotel room to call his company's medical provider. "That was my first mistake," he told the audience during a panel discussion on managing surprise medical issues at NBAA's Schedulers & Dispatchers Conference, held in April in San Diego. "Never ever go somewhere by yourself when you think you are having a heart attack because I could have ended up dead in my room and nobody would have known."

“It's not expected, but when it happens you're ready, it's just instinct.”

Zakula called Aircare International, which his company had recently contracted as its medical provider. "In less than a minute the ER physician was on the phone with me," he said. After hearing Zakula's symptoms, the on-call doctor advised which hospital he should go to.

He then informed his copilot that he was going to the hospital, went downstairs, and summoned a taxi for another mistake. "Don't take a taxi to go to the hospital when you are having a heart attack, call for an

ambulance just in case," he explained, adding that his co-pilot and flight attendant insisted on accompanying him.

After a battery of tests, Zakula was informed he did indeed suffer a heart attack and would require two procedures. Since payment was required at the time, Aircare guaranteed payment as part of Zakula's employer's plan. That worked out to approximately \$35,000 for six nights in the hospital, two medical procedures, and the emergency room visit. After that, Zakula returned back to the U.S., only this time he rode in the back of the airplane

watching movies, rather than occupying his seat in the flight deck.

Having previous experience as a trauma center volunteer, Zakula advised crew members to get training to spot the signs of serious illness. "It's not expected, but when it happens you're ready, it's just instinct." He also stressed that medical care systems around the world may be completely different than what is expected in the United States.

Aircare v-p of operations Karl Kamps noted that in Zakula's situation, it was important for him not to have to worry



Mark Zakula (right) shares his travel experiences as part of the Managing Surprise Medical Issues panel discussion during NBAA's Schedulers & Dispatchers Conference, which was held as a live event for the first time in two years, in San Diego. Co-presenters Karl Kamps, Aircare International's v-p of operations, and Denise Gouvin, passenger services manager with Travelers Indemnity, look on.

about how to immediately pay for his care “because most international countries that you go to, they are not going to accept your medical insurance.” He said that crews should know what benefits and services their providers offer international travelers.

A primary concern for his company is determining the level of care that is available in that country and whether the patient requires medevac to a more suitable location. In cases of inflight illness, diversion options based on the quality of care should be baked into every flight plan, and crews must be aware of how to contact their medical providers in flight.

### ONBOARD MEDICAL KITS

As well, on those aircraft that carry medical kits, Kamps stated that the crew should be familiar with their contents and their use. “When you have department meetings, pull out that medical kit so everyone can get their hands on it,” he said and suggested operators request a demo kit from their provider for that purpose. “If you don’t know what you have, how are you going to use it?” Some providers will help coordinate training days with possible scenarios that crews will have to face requiring the use of the medical kit.

Zakula added that when his company traveled to remote destinations in Africa, the medical kit would be enhanced to include IVs, sterile sutures, and even operating equipment because while a doctor might be found, they might not have the necessary supplies. Depending on the destination, medicines such as antimalarials should be preloaded and most providers will pre-fill prescriptions of specific medications that might be required of individual passengers. As well, medications have expiration dates and should be periodically replaced, along with the

batteries on some equipment. While keeping track of those expirations is typically another task for the flight crew, according to Zakula, some providers will monitor such things and automatically send alerts and replenishments.

“When you have department meetings, pull out that medical kit, so everyone can get their hands on it...”



Denise Gouvin, passenger services manager with Travelers Indemnity, explained that her department relies heavily on preflight situational planning, with medical awareness a prime consideration, particularly in the Covid era. Vaccination status and testing protocols will vary from country to country, and understanding what quarantine and transport regulations are in effect is vital should a team member contract the disease.

At each destination, the department evaluates the available care providers and in cases of international trips, will actually scout out the ground routes to the hospital from the airport and hotel. Part of the preparation against the unexpected is determining how to contact emergency medical services in each country because “911” is not universally recognized.

During the Covid-induced lull in flying, Gouvin’s department took the initiative to have all of its flight attendants become emergency medical technicians (EMT) through a program at a local college. “It has really opened up options for us when there is an unexpected medical emergency,” Gouvin said, adding that would now permit them to act as medical escorts to help transport ill passengers. It also allowed additional medical equipment to be carried onboard the aircraft because the flight attendants are now trained in its use.

As part of the preflight planning, Kamps suggested that passengers should file any pre-existing health conditions and medications with the medical provider. Understanding the level of privacy involved, and bound by federal law to protect sensitive patient health information, Aircare offers a secure app that passengers can access to upload their information directly to its

operations center, bypassing the company flight department or aircraft operator entirely. In case they are incapacitated that information will be accessible to help guide their care until they reach suitable medical assistance. In such instances, Zakula noted having dependable internet connectivity aboard the aircraft is invaluable, allowing communication of symptoms. His company even carries a device as part of its medical kit that can monitor a patient, automatically transmitting their vital signs through the internet to an emergency room physician. “If you don’t have it, think about getting it,” he said.

In cases where the crew believes a passenger may have difficulty boarding the aircraft, Kamps noted that there are services that will meet the aircraft on arrival or departure and assist them. ■

# Piasecki enters hydrogen helicopter into eVTOL race

BY MARK HUBER



The electric Piasecki PA-890 slowed-rotor compound helicopter will be powered by hydrogen and features conventional flight controls.

Frank Piasecki is most frequently remembered as the father of the tandem-rotor helicopter. However, two new designs that borrow from his research vehicles of the 1950s and 1960s could soon see new light in the emerging civil electric vertical takeoff and landing (eVTOL) and utility unmanned aerial systems military markets.

Piasecki designed and flew the second successful helicopter in the U.S., the PV-2, in 1943 and then formed and ran Piasecki Helicopter from 1946 to 1955. During that time, it produced iconic aircraft, including the tandem-rotor H-21 “flying banana,” used by militaries around the world. The mission of that company soldiers on today as Boeing Rotorcraft Systems, builder of the ubiquitous CH-47 “Chinook” series of helicopters.

Freed from the constraints of running an OEM, Piasecki returned to vertical

vehicle research and development, launching Piasecki Aircraft and designing and building some of the most innovative vertical takeoff vehicles of the day. Those included the 16H “Pathfinder” series of shaft-driven, compound helicopters and the PA-59 series of ducted fan “Air Geeps.” More recently, in 2006, the company built and demonstrated the X-49A “Speed Hawk,” a specially modified compound variant of the Sikorsky UH-60 fitted with a vectored-thrust ducted propeller that replaced the tail rotor on a conventional helicopter and provided forward thrust in addition to anti-torque, vectored thrust, and yaw control. The system also mated a lifting wing with flaperons to the fuselage.

Like most of the company’s work today, nearly all of these projects were one-offs funded by the U.S. military and/or large

defense contractors. For his innovative work, Frank Piasecki received more than 20 patents and was awarded the National Medal of Technology and Innovation by President Reagan in 1986. He died in 2008, and Piasecki Aircraft is now led by his sons John, the company CEO, and Fred, its chairman and CTO. It operates from a 100,000-sq-ft facility in Essington, Pennsylvania, and has 75 employees (including full-time equivalents). “We’re a small, innovative company,” John Piasecki told *AIN*. The company specializes in rapid prototyping and is involved in vehicle and vehicle-control projects as well as two efforts that build on Frank Piasecki’s work of more than 50 years ago: the PA-890 compound helicopter and the Aerial Reconfigurable Embedded System (ARES).

The PA-890 is an all-electric, hydrogen-powered, slowed-rotor, and winged compound helicopter designed to fly missions currently provided by conventional, FAR Part 27, single-pilot IFR-certified helicopters, including ones operated as air ambulances and for law enforcement. The design goals for the aircraft are a 50 percent reduction in operating costs compared with those of conventional turbine helicopters, zero emissions, a 200-nm range (with IFR reserves), and a very low external noise signature. The design utilizes a four-bladed main rotor, a variable-incidence wing that rotates up to 90 degrees to minimize download for efficient hovering; a swiveling tail rotor that produces anti-torque at hover and slow vehicle speeds and then rotates to maximize forward propulsion efficiency; digital motor controls; and conventional

flight controls rather than a costlier fly-by-wire system. When it comes to systems design on the aircraft, John stated, “We’re trying to minimize the complexity wherever we can to simplify certification and lower costs.”

The fuselage will be made using a variety of materials, including carbon fiber. John said that embracing traditional helicopter architecture substantially lowers the project’s risk. “There are a lot of novel [eVTOL] configurations proposed out there that will require the development of a new FAA certification basis. This represents a significant risk. We are able to meet our design objectives with a compound helicopter that can be certified under existing Part 27 conventional helicopter standards. So, given the lower risk of the certification process and the

simplicity of the design, in our minds, it reduces costs both in terms of acquisition and operations” by using a design that more closely parallels that of a conventional helicopter, albeit a compound one.

That compound configuration maintains the aircraft’s efficient hover capabilities with a low disk loading rotor and a variable-incidence wing that minimizes rotor wash download in a hover. As the aircraft increases forward speed, more lift is produced by the variable-incidence wing, unloading the main rotor, allowing it to operate at a lower rpm, and decreasing drag. “A large, single rotor has low disc loading and low pounds per square foot of disc area and is a very efficient hovering device,” John explained, citing its advantage over “high disk loading solutions like small props, tiltrotors, or even jet engines,

## PIASECKI ARES: RETURN OF THE “AIR GEEP.”

Piasecki developed its first ducted fan “Air Geep,” the PA-59K, in 1958. The ducted fan vehicle was originally designed “to provide ground combat elements with an aviation capability,” said John Piasecki. “When troops were driving along and got to a blown-up bridge or a hill and needed to get to the other side, they could fly. It was a short-range mission.”

Modern warfare needs are different, but a similar vehicle could still be the solution. That is what is driving the Piasecki Aerial Reconfigurable Embedded System (ARES) ducted tiltrotor. “Requirements are emerging for distributed operations,” he said. “Look at what is going on in Ukraine right now. The military needs to be able to sustain small, disaggregated, highly mobile combat units on the ground. Large, concentrated formations of troops and equipment are at extreme risk. Both the [U.S.] Marines and the Army are moving toward small disaggregated unit operations over extended areas. This



is going to require a huge increase in vertical lift logistics capability suitable for direct resupply of small units independent of ground-based logistics. Small units can only handle about 3,000 pounds per delivery without materials handling equipment and still retain the mobility required for survival in a high-threat environment.”

ARES is a scalable, modular system designed to sustain those operations with remotely piloted and/or autonomous troop, casualty, and supply transport with mission module payloads as well as those for intelligence, surveillance, and reconnaissance, as well as weapons

platforms. Unlike the Air Geep’s fixed ducted fan system, the ducts on ARES tilt from vertical to horizontal as the aircraft goes from hover to wingborne forward flight. The ARES is sized for payloads up to 3,000 pounds and mission ranges that exceed 300 miles. It is sized to operate off small deck ships and deliver cargo directly to small units in a city

street. Because the vehicle’s rotors have both collective and cyclic controls, the ducts can generate a pitching moment “that facilitates maintaining a small aircraft footprint,” John said.

For now, powerplants on the ARES will be conventional—the current test aircraft uses a pair of Honeywell HTS900 turboshafts—but John Piasecki said there is the potential for a hybrid fuel cell-powered solution in the future. The program has received funding from the Army, DARPA, the Marine Corps, and the Air Force and has had partners including Lockheed Martin.

**M.H.**



Piasecki is designing the PA-890 for maximum efficiency rather than forward speed and maneuverability.

like in the case of the Harrier [military AV-8B Harrier II jump jet]. So, that's important because a lot of the customers that we're working with have requirements for the ability for sustained hover. However, helicopter rotors are not very efficient in forward flight due to asymmetric rotor flow with retreating blade stall on one side and compressibility effects on the advancing rotor tips. Compounding the helicopter by adding a variable incidence wing and thrusting tail rotor allows us to slow the main rotor significantly, improving forward flight efficiency and range, while reducing noise."

Electric propulsion makes it demonstrably easier to control main rotor speed and achieve noise reduction, John said, noting that "electric motors are very easily operated at different RPMs." He added that the external noise profile of the PA-890 has been predicted to be a relatively quiet 68-73 decibels by researchers at Penn State and Continuum Dynamics, which employed an integrated, high-fidelity model and the Penn State-WOPWOP helicopter main rotor noise predictive tool. "The fundamentals of acoustics are driven by some key aircraft parameters," he said. "One of them is [blade] tip speed and the other is blade loading. Across both those parameters, a compound helicopter does extremely well."

The swivel tail rotor/thruster was selected for its light weight and efficiency in hover and the PA-890's moderate forward design speed of 120-140 knots. With the PA-890, Piasecki is designing for maximum efficiency as opposed to forward speed and combat maneuverability, as was the case with its previous designs such as the 16H and the XP49-A that used ducted propellers for thrust vectoring control and propulsion. John remarked that commercial customers are not clamoring for higher speed, but are interested in lower operating costs.

John said the company rejected a battery-only electric design based on performance and a hybrid propulsion system based on cost, given the low associated energy density and limited life cycles. However, hybrid diesel-electric and hydrogen fuel cells remain options. "Hybrid turned out to be excellent from a performance and cost point of view, but it still had a residual carbon footprint. Hydrogen fuel cells offered double the cost-saving and have zero carbon footprint," he said.

But traditional hydrogen fuel cells didn't fit the bill, either. Last August, Piasecki signed an agreement with California-based HyPoint to collaborate on the development of turbo air-cooled, high-temperature hydrogen fuel cell systems for the eVTOL market. John pointed out that the "turbo" hydrogen fuel cells have five times the energy density

of existing lithium-ion batteries and up to three times the specific power of existing hydrogen fuel cells. The deal with HyPoint calls for the development of five 650-kW hydrogen fuel cell systems for the PA-890. Piasecki and HyPoint intend to make the new system available to other eVTOL makers. HyPoint said its design yields 2,000 watts per kilogram of specific power, more than triple the power-to-weight ratio of traditional, low-temperature liquid-cooled, hydrogen fuel cells. On-aircraft certification testing could begin as early as 2024.

"The weight and the cost of managing the low-temperature fuel cell systems make those powerplants heavy and complex. The exciting thing about the technology that we're working on with HyPoint is that, by virtue of being a turbo air-cooled, high-temperature fuel cell system, operating temperature is managed by air and the resulting water is exhausted in vapor form, eliminating all the weight and complexity of low temp fuel cell water management systems. The resulting impact on performance is pretty significant, as is the specific power improvement, over a low-temperature fuel cell," John said. The high-temperature cell will operate at around 300 degrees Fahrenheit and, other than the turbo, will have no moving parts.

Piasecki entered an MOU with air ambulance provider and helicopter services company Metro Aviation earlier this year to collaborate on the design of the aircraft and is working with other end-users as well. Although yet undisclosed, Piasecki characterized the end-users as "mostly fleet operators." The company hopes to have a prototype flying in the 2024-2025 timeframe and is targeting certification for 2027. Initially, John said, he expects acquisition prices to be on par with those for comparable Part 27 conventional helicopters but believes the model will best them on price once production increases and economies of scale can be achieved. ■

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# Electric and autonomous aircraft operators face Part 135 certification challenges

BY GREGORY POLEK



Joby's strategy calls for certification of its eVTOL aircraft followed by approval to operate them under Part 135 charter rules.

Several of the leading players in the burgeoning advanced air mobility (AAM) field aspire not only to design and build eVTOL and eSTOL aircraft but abandon the model followed by traditional aircraft manufacturers and operate the equipment themselves. In the process, though, the AAM upstarts must assume a significant regulatory challenge and establish operating credentials under FAA Part 135 rules or equivalent legal structures in other countries.

Some have found the process so onerous that they've opted to effectively buy approval with the acquisition of a company with an existing certificate. Others, such as eVTOL developer Joby Aviation, have taken the direct route, filing an initial Part

135 application in June 2021 and recently announcing it had begun the fourth stage of a five-stage process.

Joby, in fact, appears to have gotten further with its effort than any of its fellow aspiring AAM providers, creating a Part 135 organization that will initially operate a Cirrus SR22 light aircraft and a "small number" of other traditional fixed-wing aircraft to allow for it to "mature passenger operations in an efficient manner." Plans call for scaling manuals and procedures to support the eVTOL aircraft for which it expects to gain certification in 2024.

The company explained to **AIN** that the use of conventional aircraft will allow it to build the foundation for operations,

maintenance, safety, customer handling, manuals, processes, and standard operating procedures ahead of the launch of eVTOL service. It added that the approach will also allow it to progressively improve software tools related to customer booking, pilot tools, fleet management, and multi-modal trip integration.

"We are planning well in advance to ensure we have all the pieces in place to allow for a smooth launch of our commercial eVTOL service," said Joby head of operations and people Bonny Simi. "We are specifically doing a clean-sheet Part 135 because we think it's critically important to design the operation, procedures, and enabling technology platform together specifically for this



new type of operation. Existing technology platforms simply aren't sufficient to efficiently support eVTOL operations. By building our technology platform in-house and exercising it with our Part 135 operation well in advance of eVTOL service, we can reduce complexities as we scale.

The company expects to receive its Part 135 certificate "later this year" and to begin operations with traditional aircraft shortly thereafter. Asked what regulatory exemptions Joby thinks it will need to launch its Part 135 operations with the eVTOL aircraft, Simi noted that the company designed the vehicle with operational and design regulations in mind, using traditional communications, surveillance, and navigation equipment to allow for operation in today's system and as regulations evolve.

On the reason Joby chose to apply for a new Part 135 certificate rather than, in effect, buying an existing certificate, Simi



**BONNY SIMI**  
JOBY HEAD OF OPERATIONS

“We are laying the foundation for a full safety management system, completely integrated into our operations, even though this is not FAA-required.”

explained that starting from scratch allowed the company to customize manuals and procedures applicable to its eVTOL aircraft. “By planning well in advance, we are able to establish a clean-sheet 135 operation with the added level of robustness we want for our service right from the start,” she said. “For example, we are laying the foundation for a full safety management system [SMS], completely integrated into our operations, even though this is not FAA-required.”

In fact, National Air Transportation Association senior vice president for safety and education Keith DeBerry stressed the importance of understanding the processes associated with SMS, the design and implementation of which he said will become mandatory for Part 135 operators for the first time under a Notice of Proposed Rulemaking the FAA expects to issue in August or September. Regulations began requiring SMS for Part 121 carriers in 2018.

In an interview with FutureFlight, DeBerry outlined the procedure for gaining a Part 135 certificate, starting with a request for an application either in writing or in the form of informal meetings with district office personnel. During the so-called pre-application process, or Phase 1, the applicant needs to request access to the FAA Safety Assurance System (SAS) external portal—a free web-based application designed to allow for more direct, streamlined, and timely communication with the agency.

The FAA encourages applicants to take a free online training course that gives instructions on registering for SAS external portal user access and how to use it. The applicant then needs to submit a re-application statement of intent (PASI) to the local Flight Standards District Office (FSDO) via the SAS portal. Once the FAA accepts the PASI, the office manager starts the certificate service oversight process, which the FAA uses to determine whether it has the resources it needs to conduct a Part 135 review. If it determines it does not, it places the applicant on a waitlist.



**KEITH DEBERRY**  
NATA SENIOR V-P SAFETY AND EDUCATION

“The pre-application is just to kind of see if you're serious.”

“The pre-application is just to kind of see if you're serious,” DeBerry explained. “Because there are a lot of people that put in a pre-application and they just drop it. It talks a little bit about your economic authority (a separate application that must go through the U.S. Department of Transportation); it talks about going through all the prerequisites to make sure that they're not really going to have any issues. But it's not a lengthy process and it's not a convoluted process, and the reason for that is the formal application process becomes onerous.”

Once the FAA certification team receives all the documents required during the pre-application phase, the formal application process, or Phase 2, begins. Initial requirements involve the submission of 10 checklist items, including an application letter, company manuals, training curricula, management resumes, proof of aircraft ownership or lease holdings, and proposed operation specifications.

Next, Phase 3 involves undergoing a design assessment during which inspectors perform a review of manuals and other documents to ensure regulatory compliance and adherence to safe practices. DeBerry stressed the particular importance of SMS for applicants entering Phase 3.



Xwing's autonomous flight system is undergoing testing in a Cessna Caravan single-engine turboprop.

“So if you were trying to get a certificate, my advice is to go ahead and develop your systems with SMS in mind,” stressed DeBerry, who further explained that SMS serves as a sort of umbrella over the entire organization, aiding efficiency and creating a cultural mindset that stresses safety first. Proper safety practices mitigate hazards, against which a team needs to create a formal process to either eliminate the hazard or reach a point of acceptable risk. “There are really only four components to a safety management system,” he added. “It’s the safety policy, safety risk assurance, safety management, and then safety education. The safety risk management and the safety assurance aspects have interoperability, but that’s the heart and soul of a safety management system.”

DeBerry also emphasized the importance of close communication between the applicant and the FAA’s certification project manager and certification project team, noting that a breakdown in communication will ultimately cause delays. “If we don’t get that right, it slows things down and it causes people to lose time and money,” he said. “At the end of the day, everyone needs

to work together because if there was no Part 135 or Part 121, if there was no aviation, the FAA wouldn’t have a job. So it doesn’t behoove the FAA to be a roadblock and make things really cumbersome.”

NATA also recommends that operators access the data collection tools (DCTs) collected by the aviation safety inspector in accordance with the comprehensive assessment plan and perform a self-audit. The FAA inspector uses DCTs to document assessments of the applicant’s design of systems, surveillance of certificate holder performance, identification of safety concerns or statutory/regulatory noncompliance, and any other relevant information. The DCT information helps the principal inspector, training center program manager, and certification project manager assess the applicant’s system performance and design.

“All the stuff the FAA can get the certificate holder should be able to get also,” he explained. “We look at the design of the system and then we look at the performance of the system because if we just look at the design, we can write a manual and document a process that would probably

make you cry, it would be so good. But can you do what you say you’re going to do?”

Design assessments include elements dedicated to fatigue, education, awareness, training, and weight and balance control. Crucially, the FAA will require applicants to provide a compliance statement, or letter of compliance, that lays out how one would comply with each specific Part 135 requirement that applies to a particular operation.

According to some experts close to the process, securing the resulting letter of compliance can be an especially challenging stage to complete. Essentially, applicants have to incorporate all the Part 135 regulations and then list exactly how their companies will comply with each item.

“Once you get past Phase 3, which is the crux of everything, you’ve got everything documented, [answering] who’s going to get trained, how are they going to get trained, who’s going to accept responsibility for risk under safety risk management...That’s considered a Phase 3 gate,” said DeBerry. “It’s like designing an airplane; you look at everything and anything that can happen. And if it does happen, you need to ask how bad it

is really going to hurt; that way you get to a risk score. Once you have that, you have a pretty solid system.”

After the FAA affirms the documented process as sound, Phase 4 starts, at which point the agency looks at the actual performance. During Phase 4, the certification team determines the effectiveness of the applicant’s proposed procedures and programs for training and directing personnel in the performance of their duties. Essentially, the emphasis lies with compliance with regulations and the operating procedures contained in the applicant’s manuals.

DeBerry noted that Phase 4 involves proving runs to ensure a process works as intended. “So a proving run would basically be, for example, [a case when] you’re piloting a triple seven and coming back from Gatwick in England to Atlanta, and so an FAA inspector could hand you a card and want you to simulate an engine shutdown in operation, and you would take all the steps except shut the engine down,” he explained. “Another case would be, as you’re getting ready to push back from the gate and the brakes locked; how are you going to handle this situation? Do you have people qualified? Do you have the proper tools? So a proving run clearly demonstrates that you have done the things that you said you would do in your document process.”

After satisfying the FAA of all Phase 4 requirements, the fifth and final phase begins and essentially involves administrative functions and documenting operations specifications, explained DeBerry. Once done with all the required paperwork, the agency issues the certificate.

In practice, though, even getting to the point at which a FSDO begins the Part 135 review process could take months or even years, if the experience of California-based autonomous flight technology pioneer Xwing serves as any guide. In an interview with FutureFlight, Xwing chief technology officer Maxime Gariel explained that the company originally sought to apply for its own Part 135 certificate but found little hope

of getting past even Phase 1 within a timeframe the company considered reasonable.

“We decided to apply over two and a half years ago with the Oakland FSDO [in Alameda, California], and we got no response for a month,” said Gariel. “Eventually we found that we were number five in the pile but number one had been in the works for years. At that point, we thought we were never going to get it. So we decided to acquire our first Part 135 [San Antonio Air Charter], which was doing cargo and passenger operations.”



MAXIME GARIEL  
CHIEF TECHNOLOGY OFFICER, XWING

“Right now, the pilot is in charge of weight and balance. What happens when the pilot is remote? Who’s taking that responsibility?”

Gariel explained that it took about four to five months to add its Cessna 208B Grand Caravans to the then-dormant certificate, get its minimum equipment list approved, and complete all the necessary documentation as part of a process he described as “pretty quick.”

The company then began commercial flights in December 2020 as a means to learn how to manage a Part 135 operation before exploring what elements it needed to change. “One of the key things was, for

instance, weight and balance,” said Gariel. “Right now, the pilot is in charge of weight and balance. What happens when the pilot is remote? Who’s taking that responsibility? So those are the things we are working on to be able to update the certificate and provide an equivalent level of safety.”

Now in the process of testing its autonomous flight system in the experimental Grand Caravan, Xwing last May filed a petition with the FAA to autonomously operate the aircraft on revenue flights from a ground-control station and under the supervision of an on-board pilot-in-command on its Part 135 certificate. As part of the petition, Xwing asked for several exemptions to fly cargo within controlled airspace.

The petition went for public comment in September and the last comment entry appeared in October, said Gariel. “We haven’t heard back officially yet but I would hope to have some good news in the near future...But we don’t have any idea right now what the position is.”

Xwing hopes to fly the autonomously piloted 208 in regular commercial service by the end of 2024. Gariel stressed that the company won’t ask for too much “right away” from the FAA, but rather accept operational limitations to the Part 135 certificate at first that would require it to fly only over sparsely populated areas, for example. “We all need to get comfortable with it,” he said. “So we’re going to make some concessions on what we can do because it’s a new type of aircraft.”

As some of the new AAM pioneers get closer to achieving type certification, some appear to have revised their planned business models. Last year, Germany’s Lilium announced a partnership with established business aviation services group Luxavia, which will support planned commercial services using its established network of air operator certificates in multiple countries. More recently, Lilium reached an agreement with major private aircraft operator and fractional ownership group NetJets, which also plans to become an

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LINDA EPSTEIN

## Ross Aviation Goes Hawaiian

Ross Aviation has expanded its FBO network into the Pacific with the announcement of its purchase of Air Service Hawaii and its six facilities scattered throughout the islands. Tracing its history back to 1948, Air Service Hawaii operates a flagship location at Honolulu Daniel K. Inouye International Airport, as well as on Lanai, Maui, Hilo, Kauai, and Kona. At the latter, it is developing the first FBO to include a 5,000-sq-ft terminal and a 38,000-sq-ft business jet hangar that is expected to be completed by year-end.

“Air Service Hawaii is a premier aircraft services provider and a key member of the Hawaiian aviation community,” said Ross CEO Brian Corbett. “Their unique Aloha spirit of warmth and friendliness fits perfectly with our flight hospitality standards.”

The addition brings Ross to 25 locations in the U.S. and Caribbean. Ross is finalizing a merger with Atlantic Aviation that will see its locations likely rebranded as Atlantic FBOs, and including the Air Service Hawaii acquisition by Ross, would make Atlantic only the second FBO chain to have more than 100 locations worldwide. A Ross Aviation spokesman told **AIN** the negotiations for Air Service Hawaii predated the merger discussions with Atlantic.

## Universal Aviation Adds Five FBOs to Global Network

With international private aviation traffic strongly rebounding, Universal Aviation—the ground handling arm of Universal Weather and Aviation—has added five more locations to its certified global FBO network. Each of these facilities has passed the Houston-based company’s audit for ground handling, quality, training, safety, consistency, and customer service standards.

The facilities include Skylink Executive in Cyprus, an IS-BAH Stage 2-registered facility located at Larnaca International

Airport; Nile Valley Aviation at Cairo International Airport, the first ground handler to be certified by Egypt’s Civil Aviation authority; German Aviation Service’s facility at Frankfurt International Airport, which can handle everything from private jets to head-of-state aircraft; Peru’s Servicio Universal de Aviacion at Jorge Chavez International Airport in Lima, which has been in operation for nearly a half-century; and Standard Aviation at Cyril E. King Airport in St. Thomas, which has after-hours customs clearance and hangar space to accommodate ultra-long-range business jets. These locations bring the Universal network to 70 FBOs worldwide.

## Carver Aero Is Now Revv Aviation

Illinois-based aviation services provider Carver Aero has rebranded itself as Revv Aviation, a move the company describes as a reflection of the rapid growth it has experienced over the past two years.

Early in 2020, CL Enterprises acquired Carver Aero, which at the time consisted of the FBOs at Iowa’s Davenport Municipal and Muscatine Municipal Airports, a Part 135 charter operation, and a Part 145 repair station at Davenport.

Since then, it has gone on to add the Advanced Air FBO, flight school, charter operation, and maintenance shop at Council Bluffs Municipal Airport in Iowa; Janesville Jet Center, the lone service provider at Southern Wisconsin Regional Airport; and LumanAir Aviation Services, an FBO at Aurora Municipal Airport near Chicago, along with aircraft maintenance and servicing company ATS Illinois. It also was recently awarded a five-year lease to take over as the sole service provider at Schaumburg Regional Airport in Illinois.





## Capital Jet Center, West Virginia International Yeager Airport

It's been four years since West Virginia International Yeager Airport (KCRW) suddenly found itself in the FBO business. Back in 2018, the airport board voted to void its contract with its long-time service provider after the president of that company pled guilty to federal charges of illegally storing hazardous waste from the FBO, thus paving the way for the airport to take over the facility. At the time, the airport director noted the trend of airports of KCRW's size reclaiming their FBOs for self-management and indicated that the decision to buy back the FBO did not hinge entirely on the legal matter.

The airport originally opened in 1947 as Kanawha Airport and was renamed in 1985 to honor native son and aviation legend Chuck Yeager. Upon assuming FBO operations, it rebranded the facility as Capital Jet Center (CJC), befitting its role as the private aviation gateway to the state's capital of Charleston.

Located at the southeastern end of the field, the FBO offers a 2,800-sq-ft, two-story terminal with an upstairs pilot lounge boasting views of the ramp, a snooze room, shower facilities, flight planning/weather area, two a/v-equipped conference rooms seating six and 10 respectively, and crew cars. Rental cars can be obtained at the commercial terminal or be delivered to the FBO ahead of arriving flights.

KCRW is the state's only international airport and in April it celebrated the ribbon-cutting of its U.S. Customs facility. The \$4 million, 5,000-sq-ft building is linked to the terminal by a glass-sheathed hallway and is staffed from 9 a.m. to 5 p.m. on weekdays but can also provide after-hours clearance by appointment.

Home to several dozen aircraft, the airport complex offers several community hangars for a total of 55,000 sq ft of space. It can provide shelter for aircraft up to the



Capital City Jet Center, the airport-operated FBO at West Virginia International Yeager Airport, recently renewed its entire fleet of aircraft tanker trucks. The facility provides fueling service to the airport's general, commercial, and military aviation clients and pumps more than 2 million gallons a year.

latest large-cabin business jets, and CJC will soon be acquiring a Lektro aircraft tug to move them. As well, the airport is looking to issue an RFI on the construction of up to three 10,000-sq-ft private hangars.

The airport, which has a 6,800-foot runway, is open 24/7 and its FBO handles many overnight emergency medical flights of patients heading to the city's two major hospitals.

General manager for customer service Andrea Gritt noted that activity thus far in 2022 is exceeding the Covid-impacted 2020 totals by 80 percent and is on a pace to exceed pre-Covid 2019 levels. With 8.5 acres of ramp space, the airport is looking ahead to future growth. "Right now with our ramp size we are getting constricted, and then if things continually increase at the pace they've been increasing we'll be vastly constricted," added Kevin Brown, who heads up the FBO's aviation services.

Looking to eventually double its existing ramp, the airport's first phase of construction—paid for by a mixture of FAA AIP grants, state infrastructure funds, and airport

capital—could possibly begin this summer and would involve paving some greenfield property as well as converting the underused parallel Taxiway Charlie into an aircraft parking area.

The FBO has a staff of 28 and its NATA Safety 1st-trained line staff provides all fueling services on the field to business, commercial, military, and general aviation traffic. It pumps on average 2.3 million gallons a year from its fuel farm which has a capacity of 40,000 gallons of jet-A and 10,000 gallons of avgas.

The Epic Fuels-branded facility just renewed its fleet of refuelers last year, receiving four new jet tankers as well as a pair of 1,000-gallon avgas trucks.

"At CJC we try to have a 'can-do attitude' and help every customer that walks through our door," Gritt told *AIN*. She recalled an instance when a based customer mentioned he was bringing a newly-adopted puppy home on his return flight. The staff sprang into action and arranged a welcome party for the dog on its arrival, much to the delight and amusement of its owner. **C.E.**

BY JERRY SIEBENMARK



## ExecuJet MRO Nears Completion of New Dubai Facility

ExecuJet MRO Services expects to open a new business aviation MRO center in Dubai by the third quarter. The 15,000-sq-m (163,000-sq-ft) facility is designed to accommodate 18 to 24 business jets at a time, including the Dassault Falcon 6X and 10X, as well as other large-cabin business jets.

Located at Al Maktoum International Airport, the new facility also will serve as ExecuJet's regional headquarters in Dubai. It replaces the base maintenance offered by ExecuJet at Dubai International Airport, although that location will continue to offer AOG services. ExecuJet has provided maintenance services in Dubai for more than 20 years.

The Dassault Aviation-owned company is a factory service center for in-production Falcons and provides line and base maintenance for Bombardier, Embraer Executive Jets, and most Hawker business jets.

## MRO Insider Expands Network of Mx Providers, FBOs

Over the past 12 months, MRO Insider has added more than 70 business aircraft maintenance locations in the U.S. from 14 companies providing AOG services, scheduled maintenance, and parts. The additional locations push the total number of provider locations to 350 in the U.S., UK, Mexico, and Brazil, the company said this week.

The Michigan-based provider of app-based maintenance quotes also reported adding six FBOs to its platform—for a total of 14—since unveiling a new feature late last year. This feature allows these FBOs to provide MRO Insider users quotes on fuel, hangar services, transportation, and lavatory and other services.

## SmartSky Partners on Improving MRO Workflows

Connectivity provider SmartSky Networks has partnered with Neo NextGen to develop customized digital services for MRO providers. Using SmartSky's Skytelligence platform, the companies are working with Montreal-based aircraft components MRO AJW Technique in the development of these services.

The use of the Skytelligence platform and application programming interfaces is expected to enable access to data that will help Neo NextGen improve workflows and create new efficiencies for MROs.

## Survey Finds New Barriers to MRO Growth

While spending in the aircraft MRO sector will approach pre-Covid-19 levels in 2023, the industry faces tough obstacles, according to Oliver Wyman's annual MRO survey, *The Quest for Stability*. According to the survey, spending will reach nearly \$80 billion next year, though growth could be stifled over the next decade by inflation, labor shortages, and sustainability.

Eighty percent of North American respondents said finding technicians has become challenging, while 65 percent of respondents in Europe and 79 percent in other geographies report similar issues.

Another major barrier to growth will be inflation driven in part by a 5 percent increase in materials costs anticipated by 60 percent of respondents. Finally, while 90 percent of respondents cited sustainability as a priority for MRO-related activities, it will become a required cost of doing business and not a differentiator.

Strategies to overcome these challenges could include having a clear outlook on future labor plans; finding creative ways to attract and retain talent; mitigating cost increases; increasing labor efficiency; and meeting customer and investor sustainability demands, the report concluded.





## Aircraft Specialties looks to grow through expanding services

Aircraft Specialties (ASI) got its start 37 years ago focusing on wheel and brake repair and overhaul for commercial, government, military, and corporate aircraft—including the VC-25 that transports the U.S. president. “ASI has the capabilities to work on any wheel or brake,” ASI director of sales, procurement, and marketing Eugene Portela told **AIN**. “We have unlimited [capabilities] for all makes; all models provided we could get the technical data.”

But in recent years the Omaha, Nebraska-based, privately held company has mostly focused on wheels and brakes for corporate operators and flight departments as well as business jet OEMs including Bombardier and Textron Aviation. The company keeps on hand 300 overhauled wheel and brake exchange units for immediate shipment.

At the same time, ASI has been diversifying its business, becoming a distributor of unrelated aircraft products such as fire safety equipment, cleaning supplies, O-rings, and fluid containers from companies such as Real Clean Aviation Products, Rapco Fleet Support, and Hot-Stop L lithium-ion fire containment kits.

Diversification at the FAA and EASA Part 145-certified company continues with ASI awaiting FAA approval to expand its ops-specs to include repair of aircraft components such as hydraulics and other parts. “That paperwork is already filed so we expect to have that literally any day, we’re hoping,” Portela added. The company’s in-house machine shop is equipped with CNC lathes and mills for wheel and brake repair and overhaul as well as for fabricating other parts and tools. Other services ASI provides include tool calibration—such as gauges and torque wrenches—parts sourcing, and strategic partnerships with MROs for the repair of starter-generators,



Aircraft Specialties maintains a stock of 300 overhauled wheel and brake exchange units for immediate shipment, and the company is also adding new capabilities and services.

relays, and other electro-mechanical products. Those partnerships “allow us to have our customers not only get their wheels and brakes serviced through us but allow them to have other components serviced within the ASI family,” Portela explained.

Nearly two years ago, ASI moved to a 43,000-sq-ft building, construction of which began in the throes of the Covid-19 pandemic. “We started building and Covid

hit,” Portela said. “We had a big decision to make: do we continue to build, or do we stop? We kind of threw all the chips to the middle. This is what our plan was, and we moved ahead with the plan.” The shop portion of the building was designed for efficiency, he added, and as a result, ASI has improved its service and turn times with the same number of employees, which now number 45. **J.S.**

BY DAVID JACK KENNY

The material on this page is based on reports by the official agencies of the countries having the responsibility for aircraft accident and incident investigations. It is not intended to judge or evaluate the ability of any person, living or dead, and is presented here for informational purposes.

## Preliminary Reports

### Water-drop Helicopter Destroyed by Post-crash Fire

Garlick Helicopters (Bell) UH-1H,  
Feb. 14, 2022, 36 km north of  
Launceston, Tasmania, Australia

The solo pilot was killed and the 1965-vintage helicopter destroyed when it went down in an open paddock after an unsuccessful water drop. The Launceston-based helicopter, flown by its owner, was in its fifth consecutive day of fire-fighting operations using a water bucket suspended from a 140-foot-long line. Tasmanian Fire Service (TFS) fire commanders supervising the operation from an AS350 identified a localized hot spot and tasked the UH-1H to address it. The aircraft departed the staging area at 15:10 and filled the bucket just upstream of a small dam. The AS350 crew watched him drop the water but miss the target, which they described as unusual. The UH-1H then made a gradual left turn and tracked away from the target.

The AS350 pilot, suspecting a problem with the older helicopter, made a climbing 360-degree turn to clear the way, then saw it descend into the paddock and hit the ground. He did not hear any radio calls. A witness at the staging area also saw the UH-1H miss its target, descend, and enter a hover before yawing rapidly twice and descending out of sight. The AS350 landed adjacent to the wreckage, where a fuel-fed fire was spreading rapidly. Two other helicopters arrived from the staging area to apply fire suppressant but were unable to save the pilot or his helicopter. Ground scars showed that it had hit the ground tail-first, with subsequent contact by the skids, main rotor blades, and cabin.

The helicopter was originally delivered to the U.S. military, then converted for civilian

use in 2007. It was exported to Australia in September 2014 and registered in the restricted category for use in firefighting, external loads, wildlife conservation, agriculture, and forestry. An additional Special Certificate of Airworthiness in the limited category was issued in May 2015 for “adventure” flights. The tail rotor gearbox was replaced in December 2021. A 150-hour inspection was completed in January 2022 and a 25-hour inspection and lubrication was performed the day before the accident. As of Jan. 30, 2022, it had flown 7,746 total hours.

### Obscuration Brings Down Avalanche Control Flight

Airbus Helicopters AS350B3,  
March 16, 2022, 35 nm north of  
Nelson, British Columbia, Canada

The pilot and two avalanche technicians escaped with minor injuries after their helicopter’s tail rotor made contact with either a tree or the ground. The team was dropping explosive charges about 100 feet below a ridgeline and 20 feet above the ground at an altitude of approximately 7,000 feet when they “encountered an area of reduced visibility,” causing the pilot to lose visual references. The pilot responded to the tail-rotor strike by immediately attempting a forced landing. The helicopter hit the hard snowpack and rolled over, causing the main rotor blades to strike and partially sever the tail boom. A minute and a half later the last explosive charge they’d dropped detonated 25 feet away but did not trigger release of the snow pack.

All three occupants were able to extricate themselves, and the technicians recovered the remaining explosive charges from the wreckage. The emergency locator transmitter activated and the Canadian Mission Control Centre notified the Joint Rescue Coordination Centre in Victoria but the

crew had already contacted a nearby ski operator via portable radio, so no search-and-rescue effort was required.

### Two Fatalities in Mercy Flight Training Accident

Bell 429, April 26, 2022, Elba, New York

The helicopter crashed about one hour 45 minutes into a training flight, killing the two “highly seasoned” pilots on board: a Mercy Flight EMS pilot and a company instructor from Bell’s Texas headquarters. Both were 60 years old. The accident occurred about 1:00 p.m. in a residential neighborhood in upstate New York. Witnesses saw the helicopter and heard a loud boom before they “saw the helicopter falling from the sky.” A small fire was quickly extinguished. The state police reported that it struck power lines as it fell.

The flight originated at the Genessee County Airport in Batavia at 11:15. The aircraft spent an hour in the airport traffic pattern before departing northbound at an altitude of 2,000 feet. The debris field extended some 2,000 feet, and on April 27, an NTSB investigator reported that the tail boom was found 300 feet from the fuselage, suggesting that it had separated in flight. Despite severe impact damage, investigators hope to recover data from the electronic monitoring and recording systems on board.

## Final Reports

### Nose Gear Failure Traced to Incorrect Towbar Adapter

Honda Aircraft HA-420, Oct. 7, 2019,  
Charleston, South Carolina

A towbar adapter lug mistakenly left in the



nose gear axle assembly prevented the nose gear from extending for landing, resulting in substantial damage to the fuselage and pressure vessel but no injuries. The NTSB's final report noted that "The adapter lug was not a Honda Aircraft part, nor was it the OEM-specified lug for the accident airplane.... The clearance between the nose landing gear door and the nose landing gear axle without the... lug inserted measured approximately 11/16-inch." With the adapter lug inserted, "...approximately 1.5 inches of the adapter lug extend[ed] from the axle assembly," resulting in "a considerable negative clearance between the fuselage and the adapter lug."

The accident occurred at the end of an IFR flight from the Fort Lauderdale, Florida, Executive Airport to Charleston with one pilot and four passengers on board. During the approach, the pilot moved the gear selector down, producing green indications for the mains but a yellow nose gear light and an audible "gear unsafe" warning. The pilot requested a fly-by and the tower controllers advised that the "doors did not look right." After two unsuccessful attempts to cycle the gear, the pilot performed the emergency extension procedure without effect, then made a normal approach and landing. The airplane slid to a stop on the runway and the occupants deplaned. The FBO that handled the airplane on the ground reported that "they use pin adapters when connecting the nose wheel to the towbar, because the wheel hubs are too small for the universal towbar hookup."

## Distraction Contributed To Spatial Disorientation

Beech 200, Feb. 20, 2020, Coleman, Texas

The pilot of a King Air that crashed in central Texas was likely distracted "from his primary task of monitoring the flight instruments while in IMC" by efforts to reset an open circuit breaker, the NTSB

concluded. All three on board were killed when the twin-engine turboprop crashed into an open field before dawn, creating a 570-foot debris path with heavily fragmented wreckage.

The airplane was in the initial climb of an IFR flight from Abilene to Harlingen, Texas, when the pilot reported freezing drizzle and light rime icing between 6,500 and 8,000 feet; then, at 11,600 feet, he reported problems with deicing equipment and requested a return to Abilene Regional Airport. The controller cleared them direct to the airport and issued descents to 11,000 and then 7,000 feet. When asked if there was an emergency, the pilot replied that they "blew a breaker" that would not reset when they entered icing conditions.

The controller issued a descent to 5,000 feet on a heading of 310 degrees and advised to expect the ILS 35R approach. The pilot reported "faulty instruments" and gave his altitude as 4,700 feet. The controller instructed him to maintain 5,000 and the pilot said he was "pulling up;" no further communications were received. The flight's radar track ended with a decreasing-radius right turn consistent with spatial disorientation. The airplane's logbooks showed that discrepancies with the prop and surface deice circuit breakers had been addressed in January; however, the heavy impact damage made it impossible to determine which breakers might have opened during the flight.

## Loose Kneeboard Causes Undershoot

Cessna 208B, July 17, 2021, Old Sarum Airfield, Wiltshire, United Kingdom

The pilot's attempt to retrieve a kneeboard from the right footwell while descending through 200 feet on final approach led to a "very hard" touchdown in a field just short of the runway threshold. The nose gear of the skydiving platform (registration "G-OJMP") collapsed after striking the

berm bordering the airfield. The pilot, who was not wearing the shoulder straps of his five-point harness, suffered two small cuts on his chin inflicted by his full-face oxygen mask. The airplane, according to Britain's Air Accident Investigation Branch, "was damaged beyond economical repair."

The accident occurred on the fourteenth of 20 planned circuits to drop skydivers to land on the airfield. The pilot shortened his approach to avoid gliders in the vicinity that he could not acquire visually. During the initial descent on downwind, the metal kneeboard he'd used to log flight details slipped out from under his flight bag in the right front seat and fell into the footwell. After initially dismissing its significance, on short final he became concerned that it might interfere with the rudder pedals while landing on the 18-meter-wide (60-foot) runway. At about 200 feet agl, he verified that the Caravan was "on an appropriate flight path" and bent over to pick it up. When he looked up, the airplane was "a lot lower than expected" and he pitched up abruptly.

The cockpit image recorder showed that the Caravan was descending at 2,000 fpm as it passed through 350 feet. The pilot explained that he didn't secure the kneeboard to his leg for fear it might cause a control restriction, and did not wear his shoulder straps because they inhibited his ability to look over his shoulder at the jumpers, but that he'd "always" secure them in the future. ■

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BY GORDON GILBERT

## JUST AROUND THE CORNER

June 10, 2022

### U.S.: Pilot Records Database Reporting

By June 10, 2022, begin reporting information to the Pilot Records Database about individuals employed as pilots in commercial operations (including Part 135 air taxi and Part 91 air tour operators). Required information encompasses drug and alcohol testing results; training, qualification, and proficiency records; final disciplinary action records; records concerning separation of employment; and verification of a motor vehicle driving record search.

### Within 6 Months

NEW

June 12, 2022

#### Australia: Medical Certification

Australia's Civil Aviation Safety Authority is seeking input on its review of Part 67 general aviation pilot medical policies. The aim of the review is to simplify and modernize CASA's approach to medical certification. CASA has identified six broad areas for the review, including an overall examination of Part 67 to ensure it is up to date and eliminates confusion that has resulted from previous updates. Comments on the proposal are due by June 12, 2022.

UPDATE

June 17, 2022

#### Europe: Rotorcraft Safety Update

EASA has extended the comment deadline by one month to June 17, 2022 on a notice of proposed amendment to address three safety recommendations stemming from the investigation of an accident involving an Airbus Helicopters EC225LP on April 29, 2016 in Norway. All 13 persons aboard perished in the crash. The accident was a result of a fatigue fracture in a second-stage planet gear in the epicyclic module of the main rotor gearbox.

NEW

Aug. 8, 2022

#### Europe: Remote Airport ATS

This Notice of Proposed Amendment (NPA) from EASA addresses the evolving technological, procedural, and operational aspects

of remote airport air traffic services (ATS), with the aim of facilitating its safe and uniform implementation by EASA member states and promoting the development and deployment of new digital technologies. Remote provision of air traffic services, referred to as digital towers, enables ATS from airports where direct visual observation is not available. Instead, the view of the entire airport is through digital technology. Comments on the NPA are due Aug. 8, 2022.

Sept. 16, 2022 and Sept. 16, 2023

#### U.S.: UAS Remote ID

New FAR Part 89 requires that after Sept. 16, 2022, no unmanned aircraft system can be produced without FAA-approved remote ID capability. After Sept. 16, 2023, no unmanned aircraft can be operated unless it is equipped with remote ID capability as described in new Part 89 or is transmitting ADS-B Out under Part 91.

NEW

Sept. 30, 2022

#### Europe: Passenger Entry Requirements

Scheduled to start at the end of September, new passenger reporting requirements by the European Union Aviation Safety Agency apply to entry into European Union countries of non-EASA charter flights and professional-piloted Part 91 operations. The requirements do not apply to individuals who own and pilot their own aircraft into the EU.

Oct. 31, 2022

#### EASA: Reduced Fuel Loads

The European Union Aviation Safety Agency has published rules that permit operators to reduce the amount of contingency fuel normally required to be carried, thereby reducing the CO2 emissions and the overall environmental impact of the flight. While the rules recognize that extra fuel needs to be carried to account for unexpected situations that delay or prevent landing at the original destination, EASA says that "The amount of additional fuel required can be optimized, while continuing to ensure high safety levels, due to improved risk assessment, calculations based on better data, and better decision making." The new rules are scheduled to go into effect on Oct. 31, 2022.

Nov. 13, 2022

#### Australia: Airport Certification

Revised Australian airport certification regulations (CASR Part 139) and an accompanying revised manual of standards (MOS) went into effect on Aug. 13, 2021. Under a transition period, operators of certified airports have until Nov. 13, 2022 to fully comply with the requirements and MOS publications.

Dec. 12, 2022

#### Canada: Duty/Rest Regulations

Revisions to duty time and rest regulations for Canadian-registered commuter and air

taxi operators of turbine and non-turbine aircraft (CAR Parts 704 and 703) go into effect on Dec. 12, 2022. Transport Canada said the changes include: prescribed flight and duty time limits that respect modern scientific research and international standards to limit the amount of time a crew member can be on the job, and fatigue risk-management systems that will require operators to demonstrate that any variance to the prescribed flight and duty time limits will not adversely affect the level of flight crew fatigue or alertness.

Dec. 31, 2022

### New Zealand: ADS-B Out Mandate

Covid-19 pandemic implications prompted New Zealand to extend its ADS-B Out compliance date for one year from the previous deadline of Dec. 31, 2021. The ADS-B provisions, already mandatory for aircraft flying above 24,500 feet, will apply in the rest of New Zealand's controlled airspace by Dec. 31, 2022.

Dec. 31, 2022

### Mexico: CVRs and FDRs

Cockpit voice and flight data equipment requirements for turbine aircraft operations (including air taxis) go into force incrementally from Dec. 31, 2020 through Dec. 31, 2022 based on the number of aircraft that are in an operator's fleet. The rules generally apply to turbine airplanes with 10 or more passenger seats and large turbine helicopters.

For the most current compliance status, see:

[www.ainonline.com/cc](http://www.ainonline.com/cc)

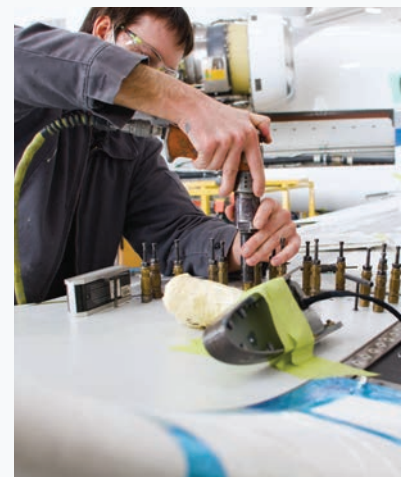
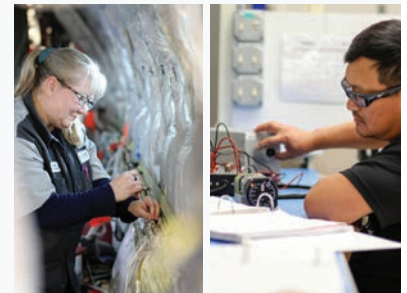
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BY KERRY LYNCH

*Aircraft Component Repair* named **Dennis Suedkamp** CEO. Suedkamp has more than 10 years of executive management and leadership experience including as president of Velocity Aerospace and most recently as president and CEO of Fastener Technology.



NICOLE ALEXANDER

The *Wichita Aero Club* named **Nicole Alexander** to succeed **Dave Franson** as president. Franson, who retired June 1, has led the club since its founding in 2008 and has served in the industry since the early 1970s, holding roles with organizations

including Cessna Aircraft, AlliedSignal Aerospace, Bombardier, and NBAA, among others. Alexander has 15 years of experience in both the private and public sector, serving as press secretary for then-Rep. Jerry Moran (R-Kansas) and later heading up public affairs for Hawker Beechcraft. She most recently was v-p of marketing and communications for Wichita accounting firm AGH CPAs & Advisors.

*King Aerospace* appointed **Greg Watson** as COO. Watson brings more than two decades of aviation experience to King Aerospace, previously holding management roles with Limco Airrepair, Collins Aerospace, Goodrich Landing Gear, and Safran. In addition, King Aerospace named **Warren Orr** chief people officer. Orr brings more than 30 years of human resources leadership experience to his new role, including holding positions with Berry Aviation and L2 Aviation as well as for non-aviation entities such as Hanger, Dell, IE Discovery, GO Executive Solutions, AT&T, and IKEA North America.



DAWUD CROOMS

*Atlantic Aviation* named **Dawud Crooms** to the newly created executive team position of general counsel. Previously associate general counsel for 7-Eleven, Crooms has nearly a 15-year legal background in areas such as mergers and acquisitions, corporate

governance, commercial contracting, and international corporate law.

*Signature Aviation* appointed **Derek DeCross** as senior v-p of global customer engagement.

DeCross most recently was senior v-p of global sales for IHG Hotels & Resorts, where he led sales initiatives for IHG's portfolio of 17 brands and also represented the company as a member of the US Travel & Tourism Advisory Board, the Business Travel News Advisory Board, and the Hospitality Sales and Marketing Association International Board.

*Gulfstream Aerospace* promoted **Scott Nelson** to division v-p of North American sales. He is succeeding **William McLeod**, who is retiring after spending 40 years—his entire career—with Gulfstream. Nelson has served with Gulfstream since 2006, beginning as a financial analyst for new aircraft sales. He has since held a range of financial management roles, most recently as director of aircraft sales finance. Gulfstream also named **Beth O'Neill** regional v-p of sales for metropolitan New York. She succeeds **Michael Swift**, who was recently promoted to regional senior v-p of sales for Europe, the Middle East, Africa, and the Indian subcontinent. O'Neill joins Gulfstream with more than 20 years of experience in aircraft financing, including as Bank of America Merrill Lynch's director of corporate aircraft finance-northeast.



SCOTT NELSON

*Argus International* has brought **John Eichten** on board as senior v-p of consulting for the Denver firm's Prism business. Eichten joins Argus with 38 years of industry experience, most recently holding sales, marketing, and business development positions with Aloft AeroArchitects.



JOHN EICHTEN

*Guardian Jet* appointed **Rafael Mugnaini** as v-p for South America. Mugnaini has more than 20 years of experience in developing new markets, including with Brazilian trading company Com-export, TAM Aviação Executiva, and Embraer Executive Jets.

*Southern Cross Aircraft* promoted **Andres Castillo** to v-p for Latin America. Castillo joined the aircraft brokerage 10 years ago, has since relocated to the U.S., and has increased responsibilities and territories. Southern Cross also named

**Diego Garcia** director of its newly created Surjet Management boutique management firm. Garcia has top leadership experience with JetKore and Volans Aircraft Management and has also served with Banyan Air Service.

CAE appointed **Patrick Shanahan** to its board of directors. Shanahan brings more than 30 years of defense experience to his new role, serving as acting U.S. secretary of defense in 2019 and as deputy secretary of defense from 2017 to 2019 as well as senior v-p for supply chain and operations at Boeing.

**Todd Young** was appointed as a non-executive member of the advisory board of *Marsh Broth-ers Aviation*. Young brings more than 35 years of experience in aviation, serving with Bombardier, De Havilland Canada, and most recently his own firm, Young Aerospace Group.

*Blackhawk Aerospace* president and CEO **Jim Allmon** was named to the Texas Aerospace and Aviation Advisory Committee, which advises on the attraction and retention of aviation business in the state. Allmon, who was appointed to a five-year term, founded Blackhawk in 1999 and before that was president and CEO of Aurora Aviation.



JIM MORRIS

**Jim Morris** joined *Bargate Murray* as head of aviation. Morris has spent more than 31 years as a pilot and attorney, including flying a range of piston, turboprop, and jet aircraft over 10 years with the Royal Air Force.

*Hartzell Propeller* appointed **Mitch Heaton** as director of business development and new technology including the company's programs involving advanced air mobility. Heaton brings experience leading strategy and business development across multiple industries to his new role, including as v-p of economic development for the Dayton (Ohio) Development Coalition and executive v-p of growth strategies for Woodard Development.

*Precise Flight* promoted **Tyler Tuttle** to director of engineering. Tuttle joined Precise Flight in 2019 and has more than 14 years of experience overseeing new product development, product quality assurance, and manufacturing innovation, also including with Nosler and Precision Castparts.

The *General Aviation Manufacturers Association* (GAMA) added **Joan Serra** as regulatory affairs

manager for Europe and **Megan Brien** as manager of meetings and member engagement. Serra previously served as manager of regulatory affairs for Evelop Airlines and also has spent time as a graduate trainee with the European Union Aviation Safety Agency and an economic regulatory framework intern with the International Civil Aviation Organization. Brien previously managed programs, events, and communications for the Association of Government Accountants and also has been a customer service manager for a manufacturing facility.

*West Star Aviation* promoted **Jessie Melvin** to become the first female lead aviation maintenance technician at its East Alton, Illinois facility. Melvin, who joined West Star in 2017 as an apprentice, will remain in the Bombardier department with responsibility for Global projects. In addition, West Star promoted **Jeff Yeager** to landing gear senior team lead and hired **Darin Perryman** as accessories and landing gear program manager at its Grand Junction, Colorado, facility.



JESSIE MELVIN



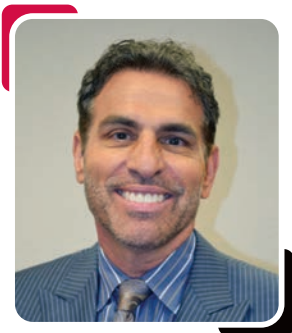
## AWARDS AND HONORS

NBAA presented former FAA Administrator **Steve Dickson** with its American Spirit Award for his "incomparable achievements in advancing America's aviation interests." The association's board of directors honored Dickson shortly before he stepped down as administrator in late March. Dickson departed the agency after steering it through one of its most difficult periods, including managing the aviation system through the Covid-19 pandemic and the intense scrutiny that followed the Boeing Max crashes. "Steve embodies leadership, integrity, and love of country," said NBAA president and CEO Ed Bolen. "Aviation has been very fortunate to have someone like Steve Dickson in the left seat, moving our industry forward."

NBAA noted that Dickson acted "swiftly and decisively" to address the challenges that came with the pandemic, including ATC and other system disruptions, and credited Dickson for redoubling the agency's focus on environmental sustainability, the introduction of emerging technologies, and initiatives to foster the aviation workforce.

operating partner and add as many as 150 of the seven-seat Lilium Jet to its fleet.

Some eVTOL aircraft developers, including the UK's Vertical Aerospace and Embraer subsidiary Eve Urban Air Mobility, have chosen to adhere to a traditional business model and sell their new vehicles directly to established operators. Eve has begun the process of merging with a special purpose acquisition company called Zanite, established by business aviation entrepreneur Kenn Ricci, whose interests include fractional operator Flexjet.



**KENN RICCI**

**PRINCIPAL, DIRECTIONAL AVIATION CAPITAL**

Ricci told a recent briefing for prospective investors in Eve, which seeks a Wall Street flotation, that he purposely chose the company because it does not intend to operate the aircraft. "We avoided any opportunity where companies wanted to build and operate the aircraft," he stated. "It's a bridge too far to be both the manufacturer and the airline. You are competing with our own customers, and the capital needs are just too high."

The second half of this decade should determine whether the mold-breaking, vertically integrated business models under pursuit by Joby and rivals including Archer and Volocopter will prove realistic. Many of the new players have told investors they will be fully operational with revenue streams in just a couple of years from now. Achieving that goal for first-time operators could see an intense compliance scramble as companies deal with type certification and preparations for manufacturing. ■



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