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BCA

Business & Commercial Aviation

# Purchase Planning Handbook

## MITIGATING OPERATIONAL RISKS

## BONUS DEPRECIATION REDUX

AVIATION WEEK NETWORK

Q1 2024

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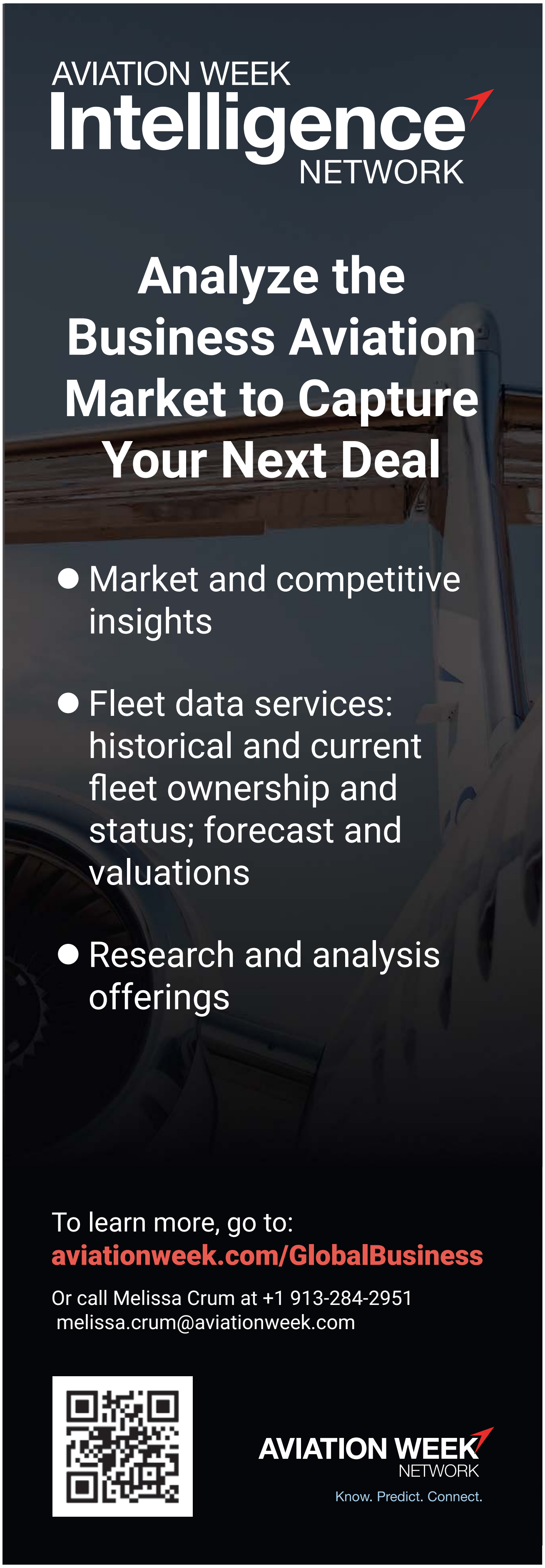

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BY INFORMA MARKETS

**BCA—Business & Commercial Aviation** (ISSN 0191-4642) is published 4 times per year by Informa Markets, a trading division of Informa PLC, 22701 W. 68th Terrace, Suite 100, Shawnee, KS 66226-3583. Also the publisher of *Advanced Air Mobility Report*, *Aviation Daily*, *Aviation Week & Space Technology*, *The Weekly of Business Aviation* and *World Aerospace Database*.

Printed in the U.S.A.

**Postmaster:** Send address corrections to BCA—Business & Commercial Aviation, 22701 W. 68th Terrace, Suite 100, Shawnee, KS 66226-3583 (present subscribers include label).

**LEE ANN SHAY**
Editor-in-Chief

# Safety and Standards

## Reexamining the checklist

**CHECKLISTS TAKE US STEP BY STEP** through a task or procedure and help ensure we don't miss something. They're straightforward and eliminate error. So why don't we follow them 100% of the time?

I thought about this when reading Roger Cox's The Crosscheck column about the frequency of fuel exhaustion accidents in general aviation (see pg. 56). Pilots use checklists all the time, and regulations spell out fuel requirements for VFR and IFR flights for Part 91 and 135 operations.

My mystification cleared when I didn't follow one of my personal checklists.

I'm in the middle of a lot of business travel and was rushing to get to the airport. I packed quickly for a four-day trip and didn't follow my "packing essentials" checklist. I was in road-warrior mode and felt confident that I could fill my suitcase and skip the checklist to save a few minutes. I did exactly what Cox cited as reasons pilots skip their checklists—they get overconfident and/or rushed.

The result for me: no belt and no international chargers—which is inconsequential compared to not having an adequate amount of fuel onboard.

Deviating from standard operation procedures is a component of Robert Sumwalt's column about safety management (see pg. 54). He addresses pushback to Safety Management Systems being potentially mandated for Part 91 and 135 operations, but stresses that "SMS has been recognized in the industry as an effective way to establish and reinforce a positive safety culture and identify deviations from [standard operating procedures] so that they can be corrected." I urge you to read his column.

Safety underpins our industry, and for general and business aviation to flourish and continue to lead innovations, we need to remember the basics.

**PPH**

We're delighted to unveil the 2024 Purchase Planning Handbook, which contains a new aircraft—the Piper M700 Fury, which the manufacturer just announced on Feb. 6. Piper expects to receive FAA certification for the aircraft, which will replace the M600, in the first quarter of this year.

In addition, Dassault certified its Falcon 6X last August and the aircraft entered service in November.

GULFSTREAM AEROSPACE

The G700 has set more than 50 city-pair speed records.

Gulfstream expected to certify the G700 in 2023, but it's still waiting as of press time. On Feb. 13, the FAA issued special conditions for the Gulfstream GVIII-G700 and GVIII-G800 for the electronic flight-control system (EFCS) that provides control-surface awareness to the flight crew.

The FAA stated the EFCS is "a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport category." It's concerned that "with an EFCS and no direct coupling from the flight deck controller to the control surface, the pilot may not be aware of the actual surface position."

Jefferies analyst Sheila Kahyaoglu opines that "General Dynamics has demonstrated a stellar clean sheet with technology so enhanced the FAA may not have a system in place to approve it just yet, hence the special condition."

The agency is accepting comments on this special condition through March 29.

On a personal note, thank you to Fred George, who developed the PPH for more than 30 years. His high standards and exactness established the highest benchmark. And congratulations to Fred on becoming a Living Legends of Aviation in January. Read about his award at: **AviationWeek.com/Biz-Av-Legendary-Evening**

Fred joins Bill Garvey, former *BCA* editor-in-chief and Situation Awareness columnist (see pg. 6), who is also part of that elite group.

Enjoy this issue.

Best wishes,
Lee Ann
*Leeann.shay@aviationweek.com*

INTERVIEW BY **LEE ANN SHAY**

# 5 QUESTIONS FOR Signature Aviation's Chief Commercial Officer

**SIGNATURE AVIATION WAS** an early adopter of pumping SAF. To find out the uptake of SAF and book-and-claim, BCA spoke with Derek DeCross, the company's chief commercial officer.

### 1 How does sustainability affect Signature's strategy?

Signature has five pillars and one of those is sustainability and community engagement. We are the first FBO worldwide to achieve carbon neutrality in our operations. We did that in 2022, and that's a commitment we've made going forward as we work toward net zero. Looking ahead, sustainability will continue to inform our company's strategy as we invest, innovate and collaborate with our key partners.

### 2 How are you reducing emissions?

We are reducing Scope 1 and 2 emissions by setting meaningful goals and achieving reduction targets through things like solar installations and electrifying ground support equipment. For Scope 3 emissions, that's through the adoption and sale of sustainable aviation fuel (SAF) and pursuing alternative technologies in private aviation as they arise. Third, it's to reduce the environmental footprint through stewardship and the use of environmentally friendly substances in our operations. We're also pursuing aggressive action in the areas of water and waste reduction. That's our high-level view.

In terms of SAF, we were the first FBO worldwide to offer a permanent supply of SAF to business aviation. We introduced it in 2020 in San Francisco. Since then, we've pumped more than 25 million gallons and expanded it to 17 physical locations.

### 3 What is the uptake for SAF?

We've seen a lot of demand. In 2020, physical SAF was 100% of our sales, but we only had the product for one or two months. Physical SAF made up 54% of sales in 2021 and 35% of sales in 2022. The biggest challenge is getting physical SAF to more locations. Book-and-claim is growing at a rapid pace to address the demand. As we get physical SAF to more locations we expect to see demand balance out.

Customers are becoming increasingly conscious of their carbon footprint. As more of their organizations' ESG targets become more advanced, they put pressure on the flight departments.

SIGNATURE AVIATION

### 4 Is more SAF pumped into the tanks of the person who is buying the fuel or is it used through book-and-claim?

About 60% is book-and-claim and 40% is pumping physical gallons into an aircraft. I think book-and-claim will continue to grow until physical SAF is available at more locations. More and more customers recognize that the way they can do the most good, without having access to SAF, is funding the solution that will progress the aviation industry to net zero by purchasing book-and-claim. They're effectively buying the carbon credits while someone else burns that fuel by proxy at a location that's more efficient, both financially and environmentally.

### 5 What's your outlook for SAF and book-and-claim in 2024?

In 2022, 110 million gallons of SAF were pumped globally, including commercial aviation, and Signature was responsible for pumping more than 8% of that global supply. If you look at the private aviation sector alone, Signature delivers about 80%. In 2023, we grew our volume by 25% versus 2022. This year, we aim to double our volume year over year, and we'll continue to procure additional gallons each year if supply allows. Even with the increased volumes, we've noticed demand is outpacing supply. The nice thing about book-and-claim is that it opens SAF supply to customers. **BCA**

**WILLIAM GARVEY**
Contributing Editor

# Lesson Completed

## The "learning, earning and giving" behind aviation's superstore

SPORTY'S

**THE YEAR WAS 1961,** a time when anything seemed possible technologically. The U.S., along with the Soviet Union, launched men—astronauts—into space. IBM delivered its first transistorized supercomputer. Disney telecast its Mickey Mouse Club program in color. The X-15 rocketplane hit 4,093 mph, a record Mach 6. And Lockheed delivered its four-engine JetStar, launching the business jet era.

By then, transistor radios were ubiquitous. But one in particular—a hand-held Realtone Voyager—had become the indispensable accessory of one young flight instructor since it delivered control tower transmissions and real-time weather. He was so taken with the thing that he bought extras to sell to his students. The device proved so popular among students and fellow pilots that he bought even more, warehousing them in his apartment bedroom and the trunk of his Studebaker.

And thus was born Sporty's Pilot Shop, which Hal Shevers, that tech-smitten CFI, would grow to become a general aviation superstore.

While he was a Purdue engineering student, Shevers joined the school's aero club, where he began accumulating licenses and ratings, eventually becoming a part-time instructor. After graduating, he became a sales trainee at Cincinnati Milling Machine Co. Alas, he and the company soon parted ways, since by then, he had confirmed that flying and making pilots brought him greater satisfaction than the sale of industrial tools.

That realization was fortuitous, since the CFI proved to be as much a product-savvy purveyor as aviation educator. The prized radio with which he keyed his career redirection was soon joined by other aviator must-haves for the flight bag, flight deck, flight line or flight planning space. The offerings would keep expanding until eventually exceeding 1,000 products—ranging from headsets and tablets to smart watches and puffer vests and made available by phone, mail, online or in person.

Within Sporty's first two years, it transferred the gear, texts, charts and more that were once consigned to Shevers' car and apartment to a storefront at Cincinnati's Lunken Airport (KLUK), where he had conducted flight training. The enterprise would eventually outgrow those facilities and move to Clermont County Airport in nearby Batavia, acquiring the fixed-based operator and assuming KI69's management in the process.

Pilot training material was a key offering from Sporty's very start. Some of those texts and videos complemented the traveling weekend ground school program that Shevers created in partnership with the Aircraft Owners and Pilots Association (AOPA). I was once among umpteen-thousands of aspiring aviators in attendance. Shevers and team went on to launch a Part 141 flight school at Clermont, aka "Sporty's Airport," which trains hundreds annually and partners with the University of Cincinnati on a professional pilot degree program.

Long an advocate of introducing youths to aviation's magic, Shevers in 2000 oversaw the creation of Sporty's Foundation with that clear focus. One of its first programs was to partner with the Experimental Aircraft Association's (EAA) Young Eagles to offer free access to Sporty's Learn to Fly course. Since then, the foundation has donated millions to a variety of aviation causes.

In 2009, Shevers sold Sporty's to long-time employees and even lent them the funds to complete the acquisition. Thereafter, the founder assumed the role of "chairman without responsibilities."

Shevers once shared with me his simple but profound life philosophy: "You learn, earn and return." In other words, work to gain knowledge formally and practically, then apply that intelligence to making a living and earning respect—then finally sharing your wealth of wisdom, talent and capital with others in need of the same.

With its founder's ninth decade approaching, Sporty's announced in January that Shevers—its "visionary leader" and long its "driving force"—had retired, leaving "an indelible mark on the industry." Sandy Shevers, Hal's wife and a 50-year employee, also retired. That notice elicited salutes and well-wishes from Jack Pelton and Mark Baker, heads of EAA and AOPA, respectively, among the many admirers of an aviator whose life's flight plan was fabulously successful and generous.

And salutes, too, for those individuals honored at the Living Legends of Aviation ceremony in Los Angeles on Jan. 19, including Gulfstream's Mark Burns, CAE's Marc Parent, Linden Blue of General Atomics, insurance broker Lance Toland and a former Apache combat pilot, the UK's Prince Harry. I was especially pleased that among the new inductees was Fred George, my longtime *BCA* colleague and senior editor, since retired. Fred's expertise in hardware evaluation and exposition is unique and well deserving of formal recognition. Congratulations to all. **BCA**


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**KENT S. JACKSON**
Contributing Editor

# Bonus Depreciation Redux

## Will Congress extend bonus depreciation?

**WILL CONGRESS RESTART** the bonus depreciation clock? Hill watchers are hopeful. The House passed the Tax Relief for American Families and Workers Act on Jan. 31 by a vote of 357-70. Senate Majority Leader Chuck Schumer expressed support for the bill. The Senate Finance Committee recommended extending 100% bonus depreciation for aircraft through the end of 2025—and through the end of 2026 for longer-production new aircraft.

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**The aircraft depreciation tax has contributed to the seller's market for the last several years, but—as of time of writing—the tax has not yet been renewed.**

The 2017 Tax Cuts and Jobs Act helped create the current seller's market for corporate aircraft. Before the 2017 changes, bonus depreciation gave the buyers of new aircraft the ability to deduct 50% of the aircraft's cost in the first year. With the 2017 changes, even a buyer of a used aircraft could deduct 100% of the cost of the aircraft in the first year.

However, the 2017 law did not change depreciation forever. It was designed with a built-in phase-out. The 100% bonus depreciation applied to new and used aircraft placed in service after Sept. 27, 2017, and before Jan. 1, 2023. The purchase of most, but not all, new aircraft would still qualify if placed in service prior to Jan. 1, 2024, and not primarily used by an air carrier or other commercial service.

A new aircraft to be used primarily in commercial service will only qualify for 100% bonus depreciation in 2023 if the aircraft has an estimated production period exceeding one year and costs more than $1 million.

Beginning in 2023, the applicable percentage for bonus depreciation phased down by 20% per year. Therefore, under the general rule, an aircraft placed in service in 2023 was eligible for 80% bonus depreciation, and in 2024 it will be eligible for 60% bonus depreciation—and so on.

The purchase of new aircraft that meet the requirements for bonus depreciation during 2023 was phased down by 20% per year as well, but on a one-year delay. So, if such an aircraft is placed in service in 2024, the purchase will be eligible for 80% bonus depreciation, 60% in 2025—and so on.

The proposed legislation extends 100% bonus depreciation, but it does not propose the gentle phase-down from the current law. Instead, the new provision drops to 20% bonus depreciation for property placed in service after Dec. 31, 2025, and before Jan. 1, 2027 (after Dec. 31, 2026, and before Jan. 1, 2028, for longer-production-period property and certain aircraft).

There was another key provision in the 2017 tax legislation that will have an effect if and when bonus depreciation goes away: We lost the "like-kind exchange" rules.

Typically, the IRS looks on any sale or "exchange" of goods as a taxable event. For years, aircraft owners were allowed to take advantage of the like-kind exchange rules of IRC § 1031. By utilizing a like-kind exchange, no gain or loss would be recognized. Without the like-kind exchange rules, if you have owned an aircraft for seven years, taken your depreciation deductions until the tax value reached $0, and then if you sold it for $1 million, you will owe tax on $1 million worth of gain (profit). With the old like-kind exchange rules, if you replaced the aircraft, then you did not owe tax on the sale of the aircraft that was replaced.

With bonus depreciation, if you sell your old airplane for $1 million, and it was fully depreciated, then you had $1 million worth of taxable gain. But, if you bought a "new-to-you" aircraft for $2 million, you had $2 million worth of "loss" to offset the gain. As the bonus depreciation percentages begin to decrease, taxpayers will begin to really miss the days of the like-kind exchange.

"No bucks, no Buck Rogers." This quote from The Right Stuff neatly sums up the interrelationship between business aviation and the tax code. If you plan to buy an aircraft for business, do not leave any detail to chance. Work with your tax professionals before the purchase to make sure that the process produces the expected tax savings. **BCA**

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

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AVIATION WEEK NETWORK
Know. Predict. Connect.

BY **JESSIE NAOR**

# Risk Mitigation In Operations

## Assessing the safety risks for private aviation and tools to mitigate them

**FROM A JET-TRACKING ENTHUSIAST** making Forbes' Top 30 Under 30 List, a pilot acting out during a mushroom-fueled incident and environmentalists gluing themselves to private jets, 2023 was quite the year. These incidents—and a tumultuous year for workforces—have flight departments and private jet operators more focused on operational safety and security than ever.

### 2023 HAZARDS REPORTED

NTSB accident and incident data is valuable but, thankfully, scarce in private aviation. Looking at safety reports from the Aviation Safety Action Program (ASAP), an FAA voluntary incident reporting program can be a more tactical lens that operators can use to shape their priorities this year.

The Air Charter Safety Foundation (ACSF) is one of the largest aggregators of this data, representing more than 300 Part 135, 91 and 91K operators. When looking into the top events of more than 2,000 ASAP reports in the ACSF database, three stood out significantly above the others: altitude deviations (12%); traffic proximity events (11%); and coordination/communication issues (9%).

### SAFETY MANAGEMENT SYSTEM MANDATE

It has been nearly a decade since the FAA announced its new compliance philosophy, which saw the agency shift away from an enforcement action philosophy.

The FAA states that the success of voluntary reporting programs like ASAP "has demonstrated that a collaborative compliance philosophy, supported by a positive safety culture, provides the highest levels of compliance with regulations, the most effective identification of hazards and the most efficient management of risks."

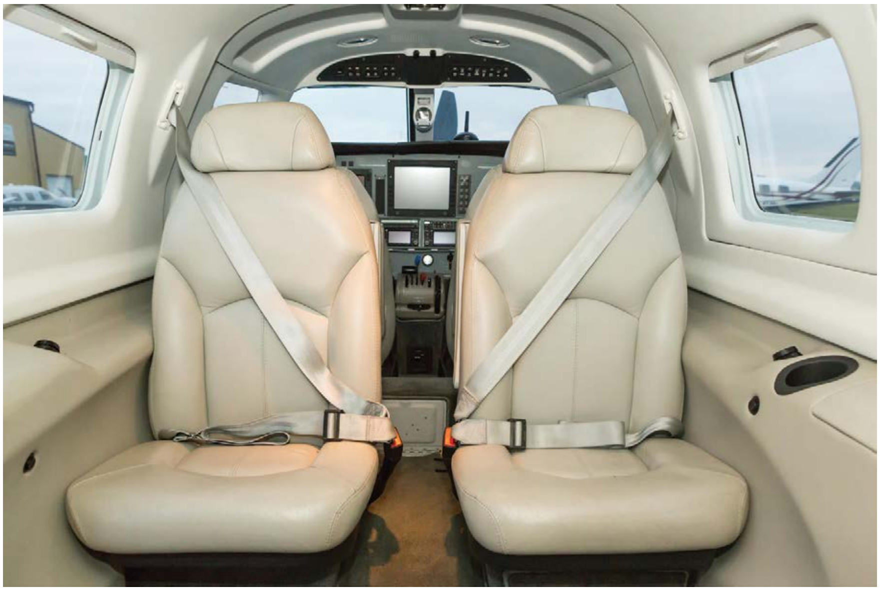
The next evolution of these programs is a legal mandate for a Safety Management System (SMS), with the final

COLIN FISHER/ALAMY STOCK PHOTO

Options to prevent flight tracking are improving.

SMS rule expected to be published mid-year, according to Chris Rochleau, chief operating officer at the National Business Aviation Association (NBAA).

NBAA has been in deep discussions with the FAA to ensure the final rule is scalable to all sizes and types of operations, but like any rulemaking, it is complicated. "I feel there has been a genuine openness on the part of the FAA to taking the industry's recommendations seriously. We hope there



NADEZDA MURMAKOVA/ALAMY STOCK PHOTO

The FAA kicked off a new Pilot Mental Health Aviation Rulemaking Committee in January.

will also be a multi-year approach to the mandate."

Beyond the scalability of the rule, some operators have had SMS programs in place for years, and the new rule will inevitably require modifications to their programs. Suran Wijayawardana, chief aviation officer at aircraft management and charter operator FlyHouse, says: "Organizations have spent years customizing their SMS to their operations. With the new rule, operators have become used to using tools that will now need to be opined upon by inspectors as well."

## RUNWAY INCURSIONS

ASAP data and other industry sources show critical stress factors in runway safety. Passenger traffic numbers, while still slightly below pre-pandemic levels, are expected to fully recover in 2024 and exceed previous years, according to Airports Council International.

In November 2023, the NBAA raised a new call to action and released a guide to mitigating runway incursion risks. "There have simply been too many close calls in 2023," Rochleau says. "We need more mentorship and education programs to support the changeover in the experience of our flight crews today."

Wijayawardana believes many factors have increased incidents, including a lack of upgraded systems and increased system load. Still, crew proficiency is critical, Wijayawardana says. "While our hiring pipelines are finally full again, pilots are upgrading to captain faster than ever and we have new trainers training our crews."

"The industry has a bad habit of training on hours and not training to proficiency," he says.

The FAA has also increased efforts to mitigate these risks by rolling out its surface safety metric and the national Runway Incursion Mitigation (RIM) initiative. At the 91 locations RIM was introduced in 2023, there was a 78% average reduction in incursions.

## FITNESS FOR DUTY

The infamous off-duty Alaskan Airlines pilot who attempted to shut off engines mid-flight has brought pilot mental health to the spotlight again. The Germanwings crash, caused by a co-pilot who had been previously declared unfit for work by his doctor, was almost a decade ago—and little has changed since. "Why didn't we do something then?" Wijayawardana asks.

While the FAA kicked off a new Pilot Mental Health Aviation Rulemaking Committee (ARC) in January to address these issues, it should be noted there was an ARC post-Germanwings crash, as well.

Many feel the FAA's approach to mental health does not match up with its compliance philosophy and seems more focused on enforcement, silencing crewmembers who need to seek help.

The NTSB held a summit on pilot mental health late last year, led by NTSB Chair Jennifer Homendy. Before the summit, she said: "Current federal rules incentivize people to either lie about their needs or avoid seeking help in the first place—and that's not safe for anyone." At the summit, she described the long wait times and expense of renewing a medical license after mental health treatment as a "bureaucratic nightmare."

## FLIGHT TRACKING

While aircraft tracking was a substantial security threat last year, Rochleau is happy to report that "wait times have significantly improved" in the Privacy ICAO aircraft address (PIA) program, which allows operators to request an alternate ICAO address during flights to protect privacy. "The PIA process now takes a matter of hours, and not days or months," Rochleau says.

Essential language for flight privacy was written into the FAA Reauthorization Act, which has a deadline of March 8, 2024, but may be hampered by politics in Congress. Rochleau hopes they will act swiftly and says, "Everyone understands the need and the importance of stability of the agency."

## CYBER AND AI

While the TSA's Secure Flight faced a bumpy rollout in private aviation last year, the new program has been fully implemented throughout the industry. Cybersecurity risks will continue to face operators and be a critical issue.

Wijayawardana emphasizes the importance of understanding who is responsible for data security, saying, "Operators, not the software providers, are legally responsible for the secure storage of passenger data." He notes that laws can vary from state to state. Operators should not rely on their software providers to ensure data security, and he stresses the importance of outside system review.

Rochleau is paying attention to the emergence of "AI and machine learning in aircraft systems," as well.

## HUMAN TRAFFICKING

A Gulfstream III recently went missing in the Caribbean, causing many to speculate the aircraft's disappearance may have been staged by a cartel. While the aircraft's fate is unknown, it reminds operators of the risks illicit actors may pose to the industry.

The Transportation Department rolled out the Blue Lightning Initiative in 2022 to help the aviation sector identify incidents of human trafficking. From 2011-20, human trafficking reports increased by a whopping 84%. "Sadly, human trafficking is becoming as lucrative as narcotics," Wijayawardana says, and operators should train employees on the risks of both.

## EMBRACING JUST CULTURE

The FAA's compliance philosophy over the last decade has allowed space for Just Culture to grow. Unlike years past, future operations will require leaders to not only understand the regulations, but also know how to apply learning methods and constantly evaluate their operations. How an organization or process is designed, as well as the quality of training, must be examined when errors occur—rather than simply assigning blame to an individual.

2024 is the year of SMS and, hopefully, a new paradigm in risk mitigation. **BCA**

OPERATIONS

BY **JEREMY KARIUKI**

# *Flying To* Mexico

## Navigating Through Ongoing Changes

**WHEN PLANNING A TRIP TO MEXICO** by business or general aviation aircraft, it is more crucial than ever to know what one may encounter upon arrival. *BCA* spoke with Rick Gardner, director of Aviation Services at CST Flight Services, on the dynamic state of Mexican airport operations and how to properly prepare for a myriad of situations.

In 2023, Mexico's defense ministry assumed control over the country's civil airports. Subsequently, changes to how Mexico's federal civil aviation authority (AFAC) operates have left travelers with a variety of inconsistencies.

"With so many new people entering in positions that interact with general aviation, regardless of where they come from, military or not, it's just a lot of new people that have to learn new jobs, new roles and may not have the greatest understanding of what they've been challenged to do," Gardner says. It's a lot of change at a large scale.

For example, Article 14A of the Mexican Tax Code dictates a $100 fee on general aviation aircraft that arrive at an international airport outside of normal operating hours. According to Gardner, enforcement of this law and the bounds of normal operating hours can vary between airports and staff. Private flights, which are normally exempt from the fee, may still have to pay at the discretion of the immigration officer.

While $100 may not be the largest hurdle to jump on a trip to Mexico, Garnder advises travelers to become familiar Mexico's recently updated Advance Passenger Information System (APIS) procedures. As of October 2023, submissions were handled through ARINC, a global aviation network by Collins Aerospace.

Operators flying into Mexico are experiencing some inconsistencies at airports.


BILL DAVIS/ALAMY STOCK

"I petitioned the Mexican government multiple times, and I received an authorization where general aviation could bypass the whole area because the whole ARINC APIS system is not cheap," he says. "They basically said the only way to submit Mexican APIS is using the ARINC-- they don't mention ARINC, but the law actually mentioned that it's ARINC, and it's basically a spreadsheet that you have to fill out. It's kind of like the U.S. APIS, but what they've done is, you can mail that to the government."

Unfortunately, several issues may arise during the process. Confirmation of an APIS submission may not be received and communication between the government and individual airports could add further confusion.

"Immigration at certain Mexican airports decided that in order for you to land at their airport, then you also needed to email that Excel spreadsheet to them," Gardner said. "That's not documented anywhere, and we've challenged headquarters in Mexico City saying 'Hey, you know, some of the airports are requesting this. What is the legal validation [and] the reason to sustain this request?' We're not getting any answers."

## DOCUMENTATION TIPS

According to the Aircraft Owners and Pilots Association (AOPA), Mexican APIS regulations for private flights mandate that a manifest, in the form of an Excel spreadsheet file, must be submitted within 24 hrs. of departure. Then, the manifest must be sent 30 min. prior to takeoff. After that, Mexican immigration will reply to confirm reception of the submission.

According to the AOPA, operators should contact the Civil Aviation Authority of the specific airport at which they plan to land.

"We have been advised that multiple pilots have been fined $4,000 USD a piece for not providing the requested notification and for not providing the officials with their solicited bribe," the AOPA wrote on its website.

According to Gardner, additional problems can arise when chartering flights to and from Mexico, due in part to new efforts made by the U.S. and Mexico to combat illegal cabotage.

"In Mexico, the tail number denotes the approved usage, unlike the U.S. So, if the tail number begins with (Mexican designation) 'XA', that's commercial and the only pilot that can fly that aircraft is a commercial pilot," Gardner said. "Even though the owner is a private pilot, he can't fly his own plane."

To help with the confusion, Gardner suggests the use of notarized letters in that case to clarify the type of flight being conducted and to verify any permissions given to operate the aircraft in its current capacity.

wDespite the number of challenges one may face when traveling across the border, Gardner maintains that travel to Mexico is still safe and can be navigated with a little extra care.

"I'm not saying don't go to Mexico, it's a great country." he says. "Just consider it as part of the adventure and bring an extra dose of patience. The beaches are still beautiful, the beer is still cold, the tequila is still great, everything is wonderful. It may be just a little bit more frustrating going through the arrival process and moving around," he says.

He stresses these are new country process and new people performing them, so patience is key right now. **BCA**

BY **BILL CAREY**

# Slowly But Surely, GA Moves To Unleaded Avgas

## An industry and FAA partnership forged in 2022 is moving the needle on phasing out 100 Low Lead

**NEARLY A HALF-CENTURY** since automakers started building cars that run on unleaded gasoline and 16 years after Nascar switched to using unleaded fuel in race cars, general aviation in the U.S. is making steady progress, with some hiccups, toward phasing out leaded avgas.

The U.S. Environmental Protection Agency (EPA) started issuing lead emissions reduction standards in the 1970s and mandated the use of unleaded fuel in passenger cars as of model-year 1975. In its early enforcement of the landmark Clean Air Act, the agency said fuel containing lead could continue being sold for off-road uses in aircraft, race cars, farm equipment and marine engines. Pressured by environmental groups, Nascar switched to unleaded fuel in 2008.

DAVID TULIS/AOPA

BILL CAREY

**Aerial view of Reid-Hillview Airport in San Jose, California, which changed from supplying 100LL to Swift UL94 unleaded avgas in 2022 after a study found elevated blood-lead levels in children living nearby.**

Piston-engine airplanes and helicopters that run on leaded avgas are the largest remaining source of lead emissions into the air, the EPA now says. In October 2023, the agency announced a final determination that lead emissions from aircraft that operate on leaded fuel contribute to air pollution and endanger public health.

The long-anticipated "endangerment finding" triggered separate rulemaking processes: The EPA will develop regulations for lead emissions from aircraft engines, and the FAA will develop standards for the composition and properties of fuel or fuel additives to eliminate lead emissions.

## EAGLE TAKES FLIGHT

It has been two years since industry associations and the FAA—eyeing efforts by local communities to shut down GA airports over various reasons including lead emissions—announced the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative with the stated goal of moving the U.S. piston-engine aircraft fleet to unleaded avgas by 2030 or sooner.

Directed by an executive committee consisting of top leaders of GA industry associations and Lirio Liu, executive director of the FAA Aircraft Certification Service, EAGLE serves an over-arching role in the transition to unleaded avgas. It aims to facilitate not only the development of new unleaded fuels to replace 100 Low Lead (100LL), the most common avgas, but also the production, distribution and supply of those fuels to airports and fixed-base operators (FBO) nationwide.

Nearly all of the roughly 170,000 active piston-engine aircraft in the U.S. burn 100LL containing the fuel additive tetra-ethyl-lead to boost octane rating, according to the Transportation Research Board (TRB). Aircraft with higher-performance, high-compression piston engines consume about 70% of the supply, the industry says.

Airports and FBOs must maintain a supply of 100LL until a 100-octane unleaded fuel becomes commercially available, EAGLE's principals say, to ensure that the aircraft engines that require it continue to operate safely and to protect the economic viability of the industry. The EPA's lead emissions endangerment finding did not ban the sale of 100LL, they emphasize.

"We've all aligned that we have to do this," says National Air Transportation Association (NATA) President and CEO Curt Castagna, who serves as the EAGLE industry co-chair. "We're in this transitional stage," he adds. "We have to protect the 100LL, we have to protect the national airspace system and at the same time we have to show progress in the evolution to phase out 100LL. What we need is a continued rationale approach."

**In 2023, the Aircraft Owners and Pilots Association flew a twin-engine Beechcraft Baron demonstration airplane with one engine running on G100UL to begin its own evaluation of new unleaded fuels.**

In December 2023, Alaska's U.S. Senators Lisa Murkowski and Dan Sullivan, both Republicans, introduced a resolution in Congress seeking to prevent EPA regulation of aircraft engine lead emissions. Such a regulation "ignores Alaska's unique geographic reliance on aviation and will cause real harm to indigenous and rural communities across the state by potentially increasing fuel costs and impacting flight availability," the senators said.

Rather than detracting from its mission, the case made by lawmakers from Alaska underscores EAGLE's argument that the transition to unleaded avgas must be done carefully, Castagna says.

"Different places in the country have different needs relative to avgas," he says. "In Alaska and Hawaii, it's critical to their way of life and how aircraft are used in their economies. That's not to minimize communities' concerns over the impact of lead, but the movement of people and goods in Alaska is a primary responsibility. We have to look at this from a national perspective."

Unveiled in public in February 2022, EAGLE helped reboot what had been a prolonged, FAA-led research and testing program, called the Piston Engine Aviation Fuels Initiative (PAFI), to qualify a high-octane unleaded avgas that could work across the wide variety of piston aircraft and engines. The FAA established PAFI in 2014; in November 2023, the agency announced that a first unleaded fuel candidate had successfully passed PAFI's initial detonation and 150-hr. engine durability test phase.

The UL100E candidate fuel, developed by a consortium of VP Racing Fuels and chemical company LyondellBasell, has advanced to full-scale engine and airframe testing on 10 engines and eight aircraft, which is expected to take 12-18 months. VP Racing Fuels has said that it completed engine durability testing of the fuel on a turbocharged Continental piston engine. Plans called for using a mixed engine fleet to include participation by Lycoming Engines during full-scale testing.

Even as UL100E moved to full-scale testing, though, work on a second fuel being evaluated under PAFI was suspended. Testing of 100M, a high-octane unleaded avgas developed by Phillips 66 and Afton Chemical, "has been paused due to issues encountered during durability testing," the FAA said in January 2024.

Phillips 66 issued a statement with similar language. "We can confirm that PAFI evaluation has been paused on the Phillips 66/Afton Chemical 100M unleaded fuel," the energy company said. "Phillips 66 is committed to its vision of developing an unleaded aviation fuel offering and is currently evaluating this product's development and all viable alternative options."

Data from the PAFI testing supports development of an industry-consensus production specification by standards organization ASTM International—key for commercialization of a new product. Once a fuel completes the PAFI regimen and ASTM publishes a production specification, GA associations expect the FAA will issue a fleetwide authorization to allow its use across the range of piston-engine aircraft.

BILL CAREY

Piston airplanes were parked last year at Leesburg Executive Airport outside of Washington, D.C., which offers aircraft tie-down and hangar storage.

In December 2023, VP Racing Fuels announced that it has formed a new company, VP Aviation, to commercialize high-octane unleaded avgas. The motorsport fuel developer based in San Antonio projects annual demand to the tune of 300 million gal. for avgas worldwide. It did not respond to interview requests.

The advance of UL100E through the PAFI process lags FAA approval of another high-octane unleaded fuel through the agency's supplemental type certification (STC) process. In September 2022, the FAA authorized most piston aircraft and engine models to use General Aviation Modification Inc.'s (GAMI) G100UL avgas. Pilots will be able to pump it by acquiring aircraft STCs costing in the hundreds of dollars based on the aircraft's engine and horsepower.

A small engineering company known for developing precision fuel injectors and aftermarket turbochargers, GAMI started work on an unleaded avgas in 2009 and years later passed on joining the industry-government PAFI program. By pursuing FAA authorization through the STC process, its fuel recipe has remained proprietary and has not undergone peer review through ASTM. GAMI has made quantities of G100UL available for testing to aircraft and engine manufacturers that sign non-disclosure agreements.

Last October, Aircraft Owners and Pilots Association (AOPA) President Mark Baker, who preceded Castagna as EAGLE industry co-chair, flew a twin-engine Beechcraft Baron demonstration airplane with one engine running on G100UL to kick off an AOPA evaluation of new unleaded fuels.

GAMI has arranged with Vitol, a blending company in Houston, to produce G100UL by this spring, GAMI cofounder George Braly tells BCA. He understands that Vitol is in discussions with avgas distributors to establish a distribution network.

## DUAL PATHWAYS SPARK DEBATE

GAMI's maverick status and the proprietary STC pathway to high-octane unleaded avgas have sparked a debate in the industry, with some trade groups expressing a preference for an industry-consensus fuel specification that has been vetted through the ASTM process.

"The paramount rule in this is that [fuels] are safe and we have to prove that to the FAA," General Aviation Manufacturers Association President and CEO Pete Bunce told reporters in June 2023. "The way we have done this is we have had known fuels [that] we have been able to certify and test against this standard and that standard has been given to us by ASTM."

The EAGLE position, Castagna says, is that it supports GAMI's effort to organize a production and distribution network for G100UL, but that the market ultimately will decide which fuels make it to aircraft wings.

"The question of whether or not we're going to have multiple fuels at the end of the day is not a decision that EAGLE makes," Castagna says. "We know there's 180 million gal. or so of avgas sold annually. Is there room for multiple fuels and different fuels? Really the industry, the consumers, are going to decide that ultimately. Our role with EAGLE is to facilitate the review of process and be a resource for the complete process, from science to the wing of the airplane."

Among other unleaded avgas candidates, Swift Fuels, based in West Lafayette, Indiana, was pursuing FAA STC and ASTM specification of 100R, a 100-MON (motor octane number) fuel, which it expects to supply as a fleetwide replacement for 100LL in 2025.

Swift, which discontinued its participation in the PAFI program in 2018, has produced a lower-octane unleaded avgas—UL94—since 2015. UL94 satisfies the minimum octane requirements of about 66% of the U.S. piston aircraft fleet, the company says, and is available at 36 U.S. public-use airports. "The potentially significant obstacle to the greatly expanded use of UL94," says the TRB, "is that thousands of small airports would need to invest more than $100,000 in a

LONG BEACH AIRPORT

Long Beach Mayor Rex Richardson helped pump the first gallons of UL94 supplied by Signature Flight Support at city-owned Long Beach Airport in southern California.

second avgas storage and dispensing system to accompany existing systems for supplying leaded avgas to aircraft that require fuel with enhanced octane."

## CALIFORNIA LEADS AVGAS TRANSITION

The FAA and GA associations unveiled the EAGLE initiative following a controversial decision by supervisors in Santa Clara County, California, to replace 100LL with UL94 at county-owned airports in 2022. The supervisors took that step in contravention of FAA grant commitments after a study revealed elevated blood-lead levels in children living near Reid-Hillview Airport (RHV) in San Jose. (FAA reauthorization legislation that was pending in Congress could mandate that airports continue to supply 100LL.)

Airport authorities in other states, including in Colorado and Florida, announced in 2022-23 that they had started offering UL94 alongside 100LL—or planned to supply it—by subsidizing its cost relative to the price of 100LL, helping pilots and flight schools buy the STCs needed to burn it or securing FAA grant funding to help FBOs install the fueling infrastructure.

NATA's Castagna is president and CEO of aviation property and project management firm Aeroplex Group Partners, which has helped airports in southern California transition to unleaded avgas, beginning with Santa Monica Airport in March 2022. In August 2023, Castagna and Long Beach Mayor Rex Richardson were present as FBO Signature Flight Support pumped the first gallons of UL94 at city-owned Long Beach Airport (LGB).

Since it approved a plan to reduce lead emissions from piston aircraft, the Long Beach City Council has taken a series of steps to incentivize both the delivery and use of unleaded avgas, which is offered at LGB in addition to 100LL. The council voted in December 2022 to waive fuel flowage fees per gallon of avgas pumped at the airport for three years. In November 2023, it approved reimbursements of up to $300 for aircraft owners who obtain STCs to use unleaded fuel.

More recently, on Jan. 23 this year, the council voted to approve a subsidy program to offset the cost differential between unleaded fuel and 100LL, which can be $2-$4 more per gallon for UL94. Councilors appropriated $200,000 to implement the unleaded fuel subsidy program, which will be covered by airport revenue.

LGB joined the Oxnard, Santa Monica and Van Nuys airports in supplying UL94 in southern California, as well as Hayward Executive, RHV, San Carlos and San Martin among airports in the northern part of the state.

Last December, the Livermore City Council approved a resolution requiring unleaded fuel be made available at city-owned Livermore Municipal Airport near Oakland within two years. Authorities in Los Angeles County, which includes the city of Long Beach, plan to supply unleaded avgas at county-owned Brackett Field, Compton/Woodley, Gen. William J. Fox, San Gabriel Valley and Whiteman airports by June this year.

## UND ENCOUNTERS ENGINE WEAR ISSUE

Among the early adopters of unleaded avgas are flight schools such as the School of Aviation Sciences at Utah Valley University in Provo, Utah, which received its first shipment of UL94 in April 2023.

The University of North Dakota (UND) John D. Odegard School of Aerospace Sciences, one of the nation's largest public flight schools, announced in 2022 that it would switch its 100-aircraft training fleet to using UL94 in place of 100LL avgas. Following four months and 46,000 hr. of flying, the school resumed using 100LL in October 2023 after encountering an engine wear issue, a development first reported by AVweb.

Ongoing maintenance monitoring of UND aircraft running on UL94 revealed measurable exhaust valve seat recession, primarily in Piper Archers and Seminoles powered by Lycoming engines. The university sent cylinders to Lycoming for analysis and was also working with Swift Fuels to help them understand the issue.

Though independent of the EAGLE effort, UND's experience points to some of the complexities the initiative faces in moving the U.S. piston-engine aircraft fleet wholly to unleaded fuel.

"EAGLE is aware of the fact that UND suspended the use of Swift's fuel—actually mutually agreed [with Swift] to do that," Castagna says. "EAGLE is aware of the fact that Lycoming and the FAA are working together to evaluate the recreation of that issue."

The initiative has not been made aware of any similar concerns raised by other consumers of UL94, he adds. "I know of two different flight schools that are operating with it and they have not seen the same issues that UND experienced with their valve seating problems," Castagna says. **BCA**

BY **MOLLY McMILLIN**

**MOLLY McMILLIN**
Managing Editor

# Order Backlogs, Book-To-Bill Watch Items In 2024

## Rising operator costs mean planning ahead

**BUSINESS AIRCRAFT MANUFACTURERS'** large order backlogs are expected to remain stable during 2024, with an expected book-to-bill, or orders compared to deliveries, of 1 to 1, forecasters predict.

A 1 to 1 book-to-bill is stable, but down from the frenzied years following the COVID-19 pandemic.  It's an important area to watch, Rolland Vincent, president and founder of consulting firm Rolland Vincent Associates, told attendees during Corporate Jet Investor London on Feb. 6.

Vincent forecasts a 14% rise in aircraft deliveries during 2024 compared to 2023 figures, he says.

"As deliveries ramp up, we're going to have to be very assertive and aggressive to bring sales in to replace those deliveries, especially at the high end," Vincent says.

Backlogs from the five largest OEMs totaled approximately $51 billion during 2023, up from $49 billion in 2022 and up from $39 billion in 2021, according to Vincent.

Aircraft owner and operator sentiment has begun to rebound in 2024, according to a survey by JetNet. That is positive news.

"We've been sort of struggling in the last two quarters," Vincent says. The good news is, in a preliminary check of results in a 1Q survey, sentiment is up almost 20 points, up from a decline of 3.3% in driven by optimism in the market, especially in the U.S, according to Vincent.

In the preowned market, the number of aircraft on the market has increased while the number of transactions has decreased.

Transactions declined from a high of 3,685 in 2021 to 3,160 in 2022 and to an estimated 2,465 in 2023. Inventory, meanwhile, has increased from a record low of 855 in 2021 to 1,170 in 2022 to an estimated 1,674 in 2023, according to JetNet iQ data.

"We think (the decline is) going to stabilize now as we're getting a little bit more inventory to pick from," Vincent says.

Deals for used business aircraft are taking longer than in the past year. After a strong seller's market, the market today does not lean either toward the buyer or the seller, presenters say.

At the same time, with inflation, the cost of aircraft ownership has increased dramatically in the past two-to-five years, panelists said in a discussion of the rising costs.

"The main costs have been, I think, more driven by supply, supply chain shortages, price gouging, I guess if you'd like, for certain products, such as windshields," says Darren Broderick, CEO of Asian Corporate Aviation Management (ACAM), an aircraft management company. "I'm sure everyone in the room has had that issue, where people are spending five or six times of what the actual OEM list price was."

FRANK PETERS/GETTY IMAGES

**Analyst Rolland Vincent forecasts a 14% rise in aircraft deliveries during 2024 compared to 2023 figures, he told attendees at February's Corporate Jet Investor London 2024 conference.**

The cost of fuel has risen dramatically as well.

In the past two years, the average cost of operating one of ACAM's aircraft has risen around 20%, Broderick says.

"I think more than ever, we need to really sit down with any buyer or existing customer and explain why the prices are going up – the areas they're going up – trying to manage their expectations," he says. It's important for them to sign up for maintenance programs to manage costs and to set a fixed budget every year.

ACAM has urged buyers to increase operating deposits on their aircraft in order to prebuy fuel. "That's something we've been doing a lot of in the last six months," Broderick says.

Aircraft customers have seen costs rise in their own businesses, so they tend to understand about the rising costs of operating an aircraft, he says.

Carmen Munguia, Gestair director of aircraft sales and acquisition, spends time with buyers to educate them on the costs associated with a specific aircraft along with expected maintenance costs, which helps to control frustrations down the road.

"Sometimes, you get the unexpected, even if your forecast or you try your hardest to make it work," Munguia says.

Planning ahead is key.

At the same time, the company has to be as competitive as possible, while dealing with parts and labor costs, says Fabrice Roger, JSSI senior vice president for business development. "We try to make it as fair as possible."

BY **BEN GOLDSTEIN**

# Electric FBOs

## AAM manufacturers are partnering with FBOs for initial operations

**IN PRESENTATIONS INTENDED** to drum up investor excitement, air taxi OEMs have commonly depicted large vertiport complexes located at commercial airports, amid city centers and perched atop high-rise buildings.

But the reality, at least in the early stages advanced air mobility (AAM) adoption, will likely look much more modest, as indicated by a recent spate of partnership announcements involving fixed-base operators (FBOs) and makers of electric vertical-takeoff-and-landing (eVTOL) vehicles.

The tie-ups include separate agreements between Atlantic Aviation and air taxi startups Archer Aviation, Beta Technologies and Joby Aviation, intended to electrify Atlantic's FBO sites in key markets in New York, Miami, Los Angeles and northern California. Clay Lacy Aviation, a smaller player that operates two FBOs with a third on the way, has signed similar agreements with Joby and Overair related to its facilities in Los Angeles and Orange County, California.

Conversations with executives from some of the companies involved show how both groups view FBOs and small airfields as presenting ideal launching pads to serve as key nodes in the early route networks for AAM aircraft.

### GETTING STARTED

Speaking recently to BCA, Eric Allison, Joby's head of product, described FBOs as a key part of the "first leg of the AAM infrastructure stool," which consists of existing aviation assets that can be quickly activated for low-tempo operations, which Joby expects to begin in 2025.

The second leg of the stool includes converted structures like parking garages and urban high-rises, considered to be a mid-term objective for Joby. The final leg of the stool, which represents dedicated green-field infrastructure—

ARCHER AVIATION

**A rendering of an Atlantic Aviation FBO with Archer's Midnight air taxis parked at the facility.**

including vertiports built at large commercial airports—will require more time for demand to materialize and investment dollars to flow.

"In the U.S., we're blessed with a lot of existing aviation infrastructure, including in key cities like New York and Los Angeles, that we think can be great places to begin developing our air taxi networks," Allison says. "We'll need to add electrification and some other modifications to support this new class of vehicle, but fundamentally, this is infrastructure that's already in place, and we can even increase the utilization in a way that benefits both the operator and the existing FBO."

Archer's infrastructure chief, Bryan Bernhard, echoes Allison's assessment. "In the early stages of adoption, we think existing aviation assets like FBOs will be key to unlocking entry-into-market," he says. "For us, partnering with FBOs like Atlantic Aviation is really exciting because it allows us to put a pin on a map and say, 'This is an actual operational asset that we can now begin to move forward and prepare for service.'"

Eric Newman, vice president for commercial strategy and sales at Atlantic Aviation, says that existing assets like FBOs present the "quickest and least expensive way" for OEMs to establish routes, enable testing and facilitate adoption by customers and regulators.

There will probably not be much dedicated infrastructure at Atlantic's FBOs in the early stages of operations, according to Newman. Passengers will therefore use the same lounges, terminals and facilities as regular business and general aviation travelers until demand is great enough to warrant the investment in supplemental structures.

"With the low scale we're projecting in this early stage, which could be as little as a single test flight in a day, it will be very easy to handle that initial demand," Newman says. "But depending on how fast and how large this market ultimately becomes, we may need to consider providing specialized facilities that meet the needs of those passengers."

"We don't consider this to be replacement demand, we see it as adjacent to our existing business," Newman adds. "We'll be looking at whether the existing facilities and operations can handle that [scaled traffic], or if we need to supplement and provide additional space so that every customer who comes through an Atlantic facility is receiving the level of service they expect."

## LOW OR HIGH TEMPO?

Sergio Cecutta, president of SMG Consulting, thinks that FBOs could potentially thrive during an extended period of low-tempo operations, which, if profitable, could lead them to seek out more AAM traffic in lieu of their traditional private aviation offerings. As such, he recently added Atlantic Aviation to the AAM Infrastructure Reality Index——the first FBO operator to be included in the index—which debuted in the No. 5 position with a score of 6.7/10.

"What if these guys taste the sugar, figure out it's really good and start modifying some of their facilities to AAM?" Cecutta asks. "Let's say they end up realizing they can make X amount of money from a business jet and 10 times that amount from eVTOL. At that point, they may decide they'd rather lease a vertiport even if it means eating into their own business jet offerings. They could end up being real competitors to many of these infrastructure startups."

But Scott Cutshall, vice president for sustainability and growth at Clay Lacy Aviation—which has partnered with

CLAY LACY AVIATION

Joby and Overair to electrify its FBO locations at John Wayne Airport in Orange County and Van Nuys Airport in Los Angeles—says he is skeptical of the extent to which FBOs will be able to handle high-scale AAM operations in the future, which he believes will primarily center around large commercial airports.

**Overair signed an agreement with Clay Lacy to establish charging infrastructure for its Butterfly. This is a rendering of Clay Lacy's FBO redevelopment at John Wayne Airport in Orange County, California.**

Where he does see an important role is in the early stages of adoption, however, in which he believes the small footprint of FBOs will prove to be an advantage by allowing them to be more nimble and flexible and ultimately prove out the business case for the larger airports.

"FBOs are key to starting the industry," Cutshall says. "If we don't put in the infrastructure, it's going to take years for the large airports to plan an integrated vertiport structure in the same facilities as their commercial activities ... In the meantime, FBOs can start some movement of passengers at low levels. Once that happens, airport planners will take notice." **BCA**

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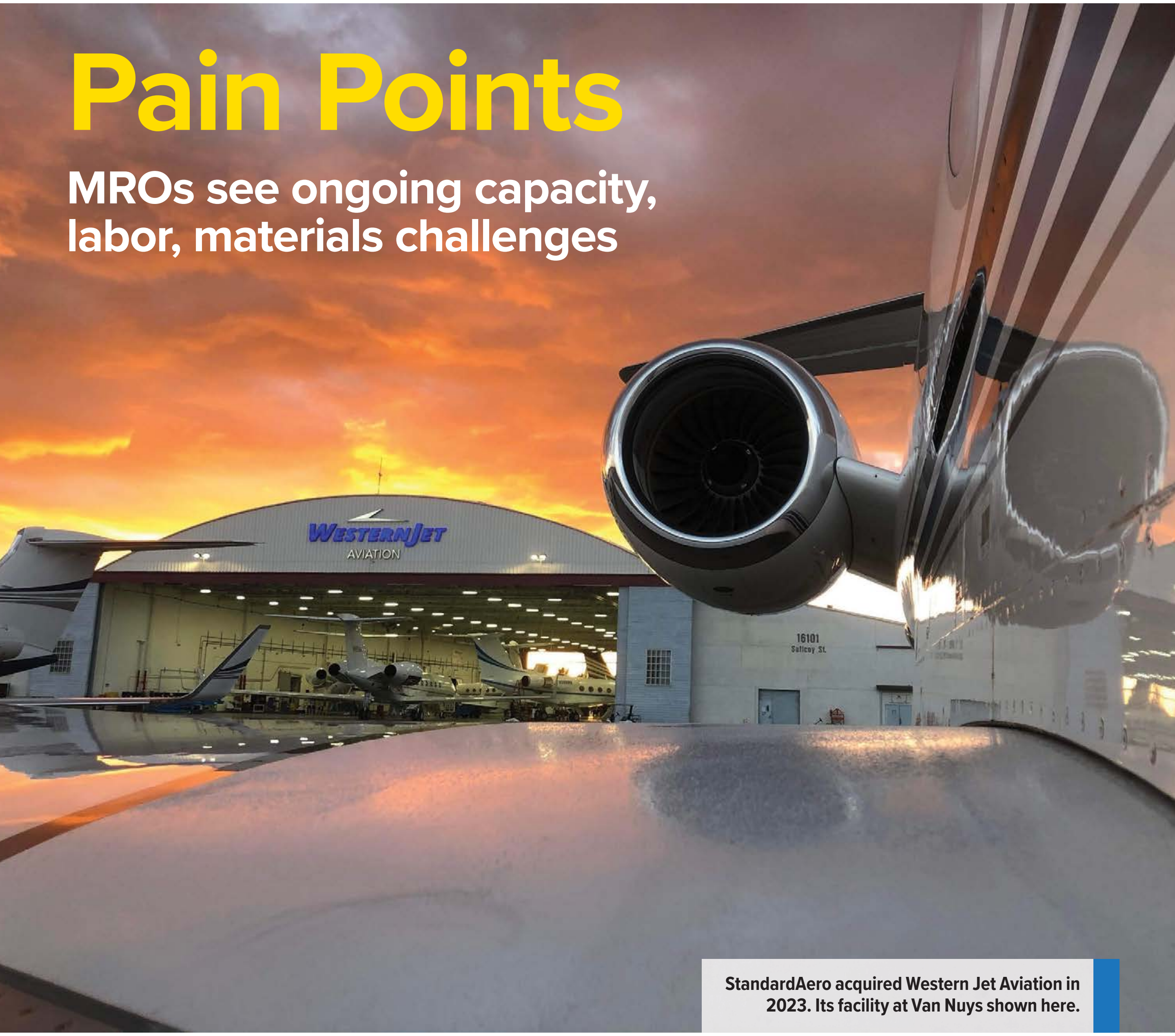
**MAINTENANCE**

BY **PAUL SEIDENMAN & DAVID SPANOVICH**

# Pain Points

## MROs see ongoing capacity, labor, materials challenges



StandardAero acquired Western Jet Aviation in 2023. Its facility at Van Nuys shown here.

STANDARD AERO

**IN THE TURBULENT WAKE OF COVID-19,** business aviation MRO continues to cope with shortages of capacity, skilled labor and supply-chain headaches.

"COVID brought about many new business aircraft owners, along with increased demand for charter and sales," remarked Michael Parrish, senior vice president for sales at Elliott Aviation in Moline, Illinois. "That created a larger demand for MRO services, without the longer-range planning that occurred in years past."

Adam Guthorn, managing director at Alton Aviation Consultancy in New York, cautions that with the forecast growth in both the business and commercial MRO markets, it does appear that the supply/demand imbalance will be fully solved within the next few years.

"Labor shortages and material availability continue to constrain maintenance capacity," he reports. "The number of aviation mechanics retiring or leaving aviation is outpacing the rate of new A&P licensees. At the same time, there has been a sharp increase in demand for commercial aviation MRO, along with sustained strong demand for business and general aviation aircraft maintenance."

The tight MRO market, Guthorn points out, impacts both airframes and engines. Airframe support is dependent primarily on labor availability, and engine-repair capacity is mostly limited by material shortages—with long lead times for parts driving extended turn-around times (TAT) for shop visits.

## GOLDEN BOLT

"Recently, there has been a lot of talk about the proverbial 'golden bolt,' or the last piece part needed to finish a maintenance event," Guthorn says. "Even if 99% of the bill of materials is in stock, MROs must wait for the last component, which increases the work in progress in the shop and limits new engine visits."

According to Fergal Whelan-Porter, CEO of Aeolus Engine Services in Dublin, Ireland, tight capacity in the engine MRO sector is due to two primary fallouts from the COVID-19 period.

"With the hiatus in shop throughput during the pandemic, many MRO shops cut staffing levels, which have been difficult to replenish in the recovery period," he explains. "Along with that, component repair MROs have not coped well with the current sudden uptick in business, leading to backlogs and delays.

ELLIOTT AVIATION

The crowded hangar at Elliot Aviation LUV underscores MRO demand.

"While their difficulties lie in the restaffing issues, there is also a shortage in manufacturer supply of key raw materials, mainly cobalt and nickel."

Aeolus Engine Services provides light maintenance, focusing on the CFM56-3, -5B and -7B. Whelan-Porter specifically cites supply-chain issues with two.

"For the CFM56-3 and CFM56-7B engines, the high-pressure turbine nozzle guide vane (HPT NGV) has become a dirty word. The repair lead time has jumped from an average six weeks pre-COVID to six to nine months today," he stresses. "But there is an increasing dearth of high-pressure compressor (HPC) and HPT airfoils—and life-limited parts (LLP)—in the market."

Whelan-Porter also notes that backlogs at component MRO shops are creating a "real problem" for the supply of used serviceable material (USM), delaying engine shop visits. "During the pandemic, there was little foresight or desire for parts suppliers to build up ready-to-go USM," he says. "Their reluctance is coming home to roost now."

As a mitigation measure, he reports that Aeolus Engine Services has increased its purchase activity in as-removed and as-is condition spare engines, which are torn down to access high-value airfoils, quick engine change (QEC) components and LLPs. "Also, several engines have gone to shops for module swaps in return for one or two serviceable powerplants with minimum maintenance requirements. We are doing anything to avoid having assets stuck in the current MRO black hole."

## BOOK IN ADVANCE

Tony Brancato, president of StandardAero Business Aviation, notes a trend toward increasing flying hours, which he expects will continue well into the future. "Flying hours drive required maintenance cycles, so the MRO industry is constantly under strain to provide capacity for scheduled maintenance while also supporting AOGs and various field-service events," he says. "Higher utilization—and older aircraft remaining in service longer than anticipated—have also driven MRO demand."

Brancato stresses that MRO capacity issues are equally problematic for both airframe and engine maintenance—but for different reasons. For airframes, he says, the limiting factor is hangar space, while for engines, it is OEM parts and material availability. "Additionally, hiring and retaining A&P mechanics and aviation technicians is very challenging across the board right now," he remarks.

For those reasons, Brancato says that StandardAero's customers are being encouraged to book their maintenance events as far out as possible. "In some cases, we've worked with customer bookings 12 or more months out. Most shop capacity is taken up to 90 days in advance of when maintenance is required," he says.

Asked if StandardAero sees other "pain points" still affecting the industry, Brancato cites the shortage of OEM constrained parts—those available only from the OEM—which are in high demand, thanks to the strength of the industry's recovery and the lingering impacts of COVID-19 on the aero-

DUNCAN AVIATION

A technician inspects an engine at Duncan Aviation's Lincoln, Nebraska, location. The company believes that MRO industry capacity will be constrained for the foreseeable future.

space industry's supply chain.

"You could look at a bucket of parts to include turbine blades, nozzles and other hot-section components as the more difficult to obtain," he says. "This is often driven by the raw material supply and availability of forgings, castings, etc. Unfortunately, availability of a single part can cause a significant impact to turnaround times, especially if the part is sole-sourced."

Brancato also points out that StandardAero is focused on acquisitions for capacity expansion—the most recent example being the purchase of Western Jet Aviation. With locations at the Van Nuys Airport in California and Miami-Opa Locka Executive Airport, the MRO is a Gulfstream specialist. "Western Jet Aviation adds 120,000 ft.2 of hangar, shop and office space, nearly 100 aviation professionals and strengthens our ability to service Gulfstream and other popular business jets."

Lincoln, Nebraska-based Duncan Aviation is also opening new hangars at both its Lincoln and Battle Creek, Michigan, locations. The two hangars, each adding 46,000 ft.2 of capacity, are slated for completion in February 2024.

"In my experience, more major airframe inspections are being scheduled than at any time in business aviation history," says Ryan Huss, Duncan Aviation's vice president for sales and marketing. "While we saw it coming, we did not think they would increase as much as they have."

Huss predicts that MRO capacity constraints will be the new normal for the foreseeable future. "For airframes, they will be driven by a shortage of hangar space and qualified technicians. With engines, it will be supply-chain issues and demand for parts due to increased flying," he says.

Kimberly Herrell, president and CEO of Schubach Aviation, cites loaner engine availability and long lead times for inspection slots as the most difficult issues noted by the Carlsbad, California-based business-jet management and charter operator. "These issues, which have been building since 2021, are currently difficult to navigate," she remarks.

Herrell points out that in the past, the company could book an airframe inspection two to three months in advance. Now, she says, that timeline is more like five to six months.

"Loaner engines are by far the most difficult and frustrating," Herrell explains. "Aircraft owners pay into these programs for years only to be told that they will have to park their aircraft for months during engine overhauls."

One bright spot has been interior modifications and avionics upgrades. As Herrell reports, there has been a slight increase in lead times, but nothing substantially different from pre-pandemic conditions. "However, for nice, custom materials, you need to order well in advance," she advises.

At the same time, she notes that "at least some MROs" have reached out to discuss the year ahead for inspections or moving things around to schedule a last-minute AOG event. But for now, she stresses, MRO shop visits need to be scheduled far in advance, if operators want to use a desired facility—at a desired time.

"At this time, I can't say that we've seen noticeable improvements in availability, but I am hopeful that the MROs can work to increase their capacity to meet the demand," she says. **BCA**

# Cirrus SR22, A Perennial Piston Best Seller

Innovations like the parachute system continue to pay dividends.

**BILL CAREY**
Contributing Editor

**INNOVATIONS THAT CIRRUS AIRCRAFT PIONEERED** with its SR20 and follow-on SR22 in the 1990s continue to pay dividends as the piston singles have dominated their category in deliveries ever since.

The four-place, composite-construction SR20 received FAA type certification in October 1998, followed two years later by the SR22, equipped with a more powerful Continental engine. The SR22-G3 (Generation 3) in 2008 came with increased range, a redesigned wing and a cockpit upgrade to Cirrus Perspective, a Garmin G1000-based avionics system with synthetic vision technology. The SR22T with turbocharged Continental engine entered service in 2011.

Featuring a roomy cabin with ample windows, butterfly entry doors and "side yoke" (sidestick) pilot controls, the series came equipped with the Cirrus Airframe Parachute System (CAPS), a rocket-propelled emergency parachute that deploys from the top of the fuselage aft of the baggage compartment. In 2003, the SR22 debuted the Avidyne Entegra avionics system, the first "glass cockpit" in its class.

MARK WAGNER/AVIATION IMAGES/AVIATION WEEK

**An SR22T-GTS G6 Carbon Edition was on display at EBACE 2023 in Geneva.**

Its reputation for ensuring safety is what pilots value most about the SR22, says Daniel Christman, a member of the senior sales staff at Lone Mountain Aircraft, who has sold more than 50 SR-series airplanes in the past year.

"When pilots think about the Cirrus, they think about the ultimate safety system on the Cirrus and that is the parachute," Christman says. "It drives pilots and their spouses to realize there is a safety net for them if there is a life-threatening emergency. Not enough can be said about this safety system that has been proven effective and saved over 250 lives."

Cirrus's introduction of the CAPS system and a glass cockpit in the SR22, both firsts in the light general aviation category, earned the airplane a place in the Smithsonian National Air and Space Museum in Washington, D.C.

## STICKER PRICE GROWTH

The 2001 factory-new, average equipped list price of the SR22 was $294,700, according to the Aircraft Bluebook. Cirrus listed the airplane last year at $772,900. The factory-new list price of the SR22T in 2011 was $449,900; in 2023 the manufacturer priced it at $887,900.

The growth in price over time has not curbed the appeal of the continuouly upgraded series, which is being refreshed yet again with the SR Series G7 (Generation 7) iteration announced on Jan. 11.

In 2022, Cirrus shipped 280 SR22Ts and 159 SR22s, according to the General Aviation Manufacturers Association (GAMA), which had not released its final shipment report for 2023. They were the top two best-selling pistons that year, exceeding the Cessna Skyhawk (151 deliveries) and the Diamond DA40 (109 deliveries). The SR20 finished fifth with 100 deliveries.

"From passenger comfort, to speed, range, payload, safety systems, and overall performance, Cirrus has come up with a formula for building an aircraft that has caused it to be the best-selling single engine piston since 2005," Christman says. "They took that title at that time and have never relinquished it."

The main competition for the SR22 was the Cessna 400/TTx, until Textron Aviation stopped its production in 2018, Christman says. Since then, "there really hasn't been a true competitor in the single-engine space," he adds. "Mainly, pilots coming out of SR22s and SR22Ts look to go to the Piper Mirage, or the (Cirrus) Vision Jet, or some other turbine

BILL CAREY

**Displayed in the Smithsonian National Air and Space Museum in Washington, D.C., this Cirrus SR22 in 2003 became the first single-engine piston airplane certified by the FAA with a 'glass cockpit' display system, supplied by Avidyne.**

equipment like a TBM or Piper Meridian. Increased speed/altitude/performance is what always drives pilots to think of "what's next" in my aircraft ownership experience."

As of the third quarter of 2023, Cirrus had delivered 225 SR22Ts and 93 SR22s, according to GAMA.

Cirrus, which was acquired by the Aviation Industry Corporation of China in 2011, has produced more than 9,000 SR-series airplanes since 1999. About 1,800 have been SR20s; the balance (7,200) SR22s and SR22Ts. Around 300 of the latter aircraft were available for sale in January, priced from $250,000 to $1.35 million depending on the model year, Christman says.

## SR22 FACTS AND FIGURES

A 310-hp Continental IO-550-N engine powers the SR22, which has a max cruise speed of 183 ktas, according to Cirrus. Base weight of the aircraft is 2,272 lbs., with useful load (pilots, passengers, baggage, usable fuel, and drainable oil) of 1,328 lbs. Cabin payload with 3-hr. trip fuel and 45 min. reserve is 963 lbs.

The SR22 requires 1,868 ft. of runway to clear a 50-ft. obstacle and 1,178 ft. for landing groundroll. Its max operating altitude is 17,500 ft.

The SR22T is powered by a 315-hp Continental TSIO-550-K turbocharged engine. Max cruise speed is 213 ktas. Its basic empty weight is 2,354 lbs.; maximum takeoff weight is 3,600 lb. The T-model requires 2,080 ft. of runway to clear a 50-ft. obstacle and 1,178 ft. for landing groundroll. Its max operating altitude is 25,000 ft.

An SR22/SR22T cabin measures 49 in. wide and 50 in. tall. The aircraft's baggage compartment, located on the left side of the fuselage aft of the cabin, features a remote-unlock keyless baggage door.

Cirrus follows the standard FAA annual inspection for the airframe and 50-hour inspection interval for the engine, Christman says. The only major required maintenance item is the CAPS and rocket motor replacement that occurs every 10 years and costs about $20,000.

Depending on the age of the airplane and whether it is under warranty, the direct operating cost for the annual and 50-hour inspections is roughly $100-$200 per hour, depending on the number of hours flown during the year, Christman says. Annual inspections cost about $5,000, a 50-hour Inspection about $1000, plus any wear and tear items that must be fixed or replaced. Depending on the model and how it is operated, the SR22/SR22T burns 13-to-18 gallons of fuel per hour.

*BCA welcomes comment and insight from aircraft dealers and brokers for its monthly 20/Twenty pre-owned aircraft market feature. The focus aircraft for February is the Bell 222 and for March the Dassault Falcon 20. To participate, contact bill.carey@aviationweek.com.* **BCA**

**The SR22 baggage compartment has a remote-unlock keyless door.**

CIRRUS AIRCRAFT

BY **BCA STAFF**

# Thriving Market

## Innovation excels across private aviation

Dassault Aviation's 6X received EASA and FAA certification in 2023.

DASSAULT

**FROM CORPORATE TITANS GLOBE-TROTTING** the new Dassault 6X (pictured), to Angel Flight volunteers lifting ill patients to lifesaving care in single-engine Piper turboprops, to Pilots N Paws volunteers liberating puppies from kill shelters to forever homes in Cessna 182Ts, people count on business aircraft every day to get the job done, safely and efficiently—and on their own timetable.

That's why we're seeing a thriving market sector despite issues with supply chains and workforce shortages, along with pressure from environmental groups. As part of its annual State of the Industry report published on Feb. 21, the General Aviation Manufacturers Association (GAMA) reported that all segments of general aviation saw an increase in shipments compared with 2022. For the first time in more than a decade, the industry delivered more than 4,000 aircraft. "This is testament to the resilience of our industry and the integral role that general and business aviation plays in our communities," says Pete Bunce, GAMA president and CEO.

Specifically, manufacturers delivered 1,682 piston-powered aircraft (an increase of nearly 12% from 2022), 638 turboprops (+10%) and 730 business jets (+2.5%). Along with more aircraft, industry also innovated with new designs and avionics. Just one example: Cirrus introduced the Auto Radar for the Vision Jet, which computes a composite real-time depiction of the weather ahead for the pilot. All he or she has to do is select the desired look-ahead range. "As civil aviation's innovation incubator, our entire GA industry is focused on new aircraft and technologies that will lead the way in safety and sustainability for the entire aviation sector," Bunce says.

*BCA* appreciates the business of business aviation and we respect the value of your time. That's why we publish this annual Purchase Planning Handbook (PPH), a comprehensive compilation of key performance parameters for aircraft ranging from single-engine Cessnas and Cirruses to ultra-long-range megamachines built by Airbus, Boeing, Bombardier, Dassault and Gulfstream, and everything in between. We save you time because all the information you need is right there.

The handbook has been a hallmark of *BCA* for more than three decades. Created by Fred George, our former chief pilot and aircraft evaluator, who also happens to be a 2024 Living Legends of Aviation inductee (see pg. 6), the PPH is the one-stop, go-to resource for engineering-caliber data about the business aircraft we fly.

Every year we ask the manufacturers of these machines to refresh and update their data in a standard format (we provide a 6-page How To manual explaining the data, along with a *BCA* Required Equipment List that you see here). When everyone plays by the same rules, we level the playing field so you the buyer, owner, flight department and chief pilot, can get a clear picture of the engineering tradeoffs that come with every aircraft design choice. We go above and beyond the spec sheets that you find online to give you a comprehensive picture of the performance you can expect for the kinds of missions you will take.

How do we know your missions? Because Fred George lived and breathed business aviation throughout those 30+ years of developing and producing the PPH, and most of you reading this have probably talked to Fred more than once over the years. You knew exactly what Fred was going to do when he arrived—tape measure in hand—on the static display at NBAA—check your numbers.

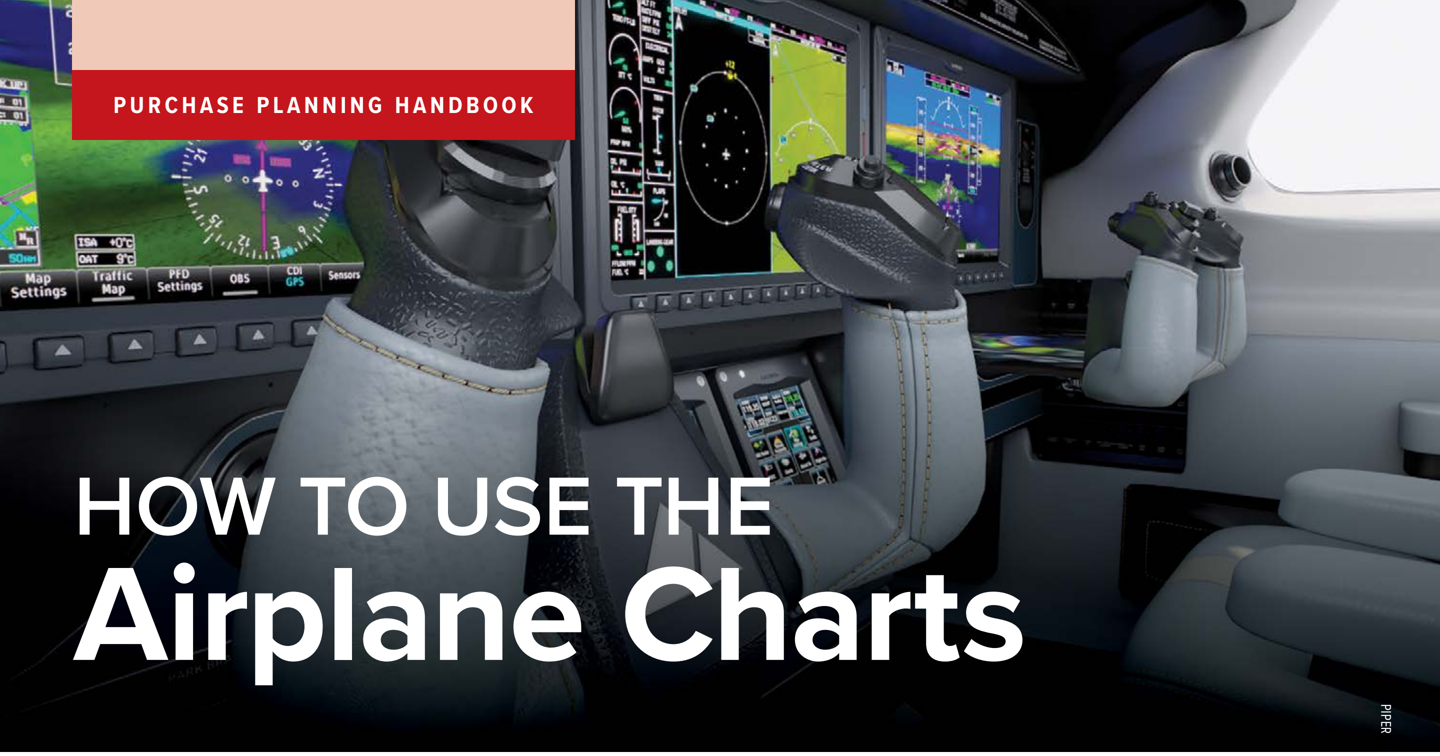
That's the kind of dedication that makes the PPH a superior product. Although Fred retired from *BCA* in 2020, we are continuing his creation and are looking to make it even better in the future. We'd very much like your help. Do you have ideas for how the PPH can be more valuable or user friendly for you and your operation? Let us know. Send an email at bcaeditors@aviationweek.com.

Here's to a great business aviation year. We trust the 2024 Purchase Planning Handbook will help you make it so. **BCA**

## BCA Required Equipment List

● Required 🔵 Dual Required

| | Single-Engine Pistons | Single-Engine Pistons, Turbocharged | Single-Engine Pistons, Pressurized | Multiengine Pistons | Multiengine Pistons, Turbocharged | Single-Engine Turboprops | Turboprops ≤12,500 lb. | Turboprops >12,500 lb. | Jets <20,000 lb. | Jets ≥20,000 lb. |
|---|---|---|---|---|---|---|---|---|---|---|
| **POWERPLANT SYSTEMS** | | | | | | | | | | |
| Autothrottles/Autothrust | | | | | | | | | ● | 🔵 |
| Batt Temp. Indicator (NiCad or LiFePO4 batteries, only) | ● | ● | ● | ● | ● | ● | ● | ● | ● | 🔵 |
| Engine Synchronization | | | | | | | | | ● | ● |
| FADEC | | | | | | | | | ● | ● |
| Fire Detection, each engine (+APU) | | | | | | ● | ● | ● | ● | ● |
| Fire Extinguishing, each engine (+APU) | | | | | | | ● | ● | ● | ● |
| Propeller, reversing | | | | | | ● | 🔵 | 🔵 | | |
| Propellers, synchronizing | | | | | | | ● | ● | | |
| Thrust Reversers | | | | | | | | | | 🔵 |
| **AVIONICS** | | | | | | | | | | |
| ADF Receiver (non U.S. deliveries or international operations) | | | | | | | ● | ● | ● | 🔵 |
| ADS-B OUT and IN (CDTI) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Air-to-Ground Transceiver or SATCOM (voice, text and low-speed data) | | | | | | | | ● | ● | |
| Angle-of-Attack Stall Margin Indicator (PFD IAS scale) | | | | | | | ● | ● | 🔵 | 🔵 |
| Altitude Alerter | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Audio Control Panel | ● | ● | ● | ● | ● | ● | 🔵 | 🔵 | 🔵 | 🔵 |
| Automatic Flight Guidance, 2-axis, altitude capture, altitude hold | ● | ● | ● | ● | | | | | | |
| Automatic Flight Guidance, 3-axis, altitude capture, altitude hold | | | | | ● | ● | ● | ● | ● | 🔵 |
| CPDLC/FANS-1/A | | | | | | | | | | ● |
| Digital Air Data Computer | ● | ● | ● | ● | ● | ● | 🔵 | 🔵 | 🔵 | 🔵 |
| DME | | | | | | | | | ● | 🔵 |
| EGT, CHT, Fuel Flow | ● | ● | ● | ● | ● | | | | | |
| EFIS, LED LCD large-format, flat-panel, PFD, MFD | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ELT | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| FMS (TSO C115, RNP, multi-sensor; triple required for ≥6,000 nm ULR jets) | | | | | | | | | | 🔵 |
| GPS (WAAS/SBAS, TSO C145/C146; LPV, LNAV/VNAV) | ● | ● | ● | ● | ● | ● | ● | ● | ● | 🔵 |
| Marker Beacon Receiver | ● | ● | ● | ● | ● | ● | 🔵 | 🔵 | 🔵 | 🔵 |
| MNPS Certification | | | | | | | | | | ● |
| OAT or SAT Indication | | | | | | ● | ● | ● | ● | 🔵 |
| Radio Altimeter | | | | | | ● | ● | ● | ● | ● |
| RVSM Certification | | | | | | | | | | ● |
| SATCOM, KU-band, KA-band, equivalent broad band performance | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SATCOM, Weather Text and GraphicsTAS or TCAS I/ACAS I | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| TCAS II/ACAS II (required for non-U.S. deliveries ≥12,500 lb. MTOW aircraft) | | | | | | | | | | ● |
| Transponder, Mode A/C/S ES | ● | ● | ● | ● | ● | ● | 🔵 | 🔵 | 🔵 | 🔵 |
| VHF Transceiver, 8.33 KHz frequency spacing | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 |
| VOR/ILS Receiver | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 | 🔵 |
| Weather Radar | | | | | | ● | ● | ● | ● | ● |
| **GENERAL** | | | | | | | | | | |
| Air Conditioning, vapor-cycle (N.A. with APU and air-cycle machine) | | | ● | ● | ● | ● | ● | ● | ● | ● |
| Air Vents, all seats | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Anti-Skid Brakes (MTOW ≥10,000 lb.) | | | | | | | | | ● | ● |
| APU (required for air-start propulsion engines and air-cycle machine air-conditioning) | | | | | | | | | ● | ● |
| Cabin-to-Flightdeck Divider Bulkhead | | | | | | | | ● | ● | ● |
| Cabin Completion | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Cabin Management System, IFE | | | | | | | | | ● | ● |
| Corrosion proofing | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Exterior paint | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Fire Extinguisher, cabin | | | | | | | ● | ● | ● | ● |
| Fire Extinguisher, flightdeck | | | | | | | ● | ● | ● | ● |
| Fuel Tanks, long-range | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Ground Power Jack | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Headrests, all seats | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Lavatory, fully enclosed | | | | | | | | | ● | ● |
| Lavatory, externally serviced toilet, fresh/gray water | | | | | | | | | | ● |
| Lights, external LED - nav/anti-collision/landing | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Lights, internal LED - cabin flood/passenger service unit/flightdeck/map | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Oxygen, all occupants (emergency O2 for pressurized aircraft; continous O2 for ≥10,000 ft. cruise) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Refreshment Center | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Seats, flightcrew, articulating - track, height, recline | | | | | | | ● | ● | ● | ● |
| Seats, passengers - recline | | | | | | | ● | ● | ● | ● |
| Shoulder Harnesses, inertial reel, all seats | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Work Tables, cabin | | | | | | | | | ● | ● |
| **ICE AND RAIN PROTECTION** | | | | | | | | | | |
| Alternate Static Air Source (not required - dual digital air data computers) | ● | ● | ● | ● | ● | ● | | | | |
| Flight Into Known Icing (FIKI) Approval | | | | | | ● | ● | ● | ● | ● |
| Fuselage Ice Protection Plates | | | | | | | ● | ● | | |
| Windshield Rain Removal (hygroscopic coating, mechanical or bleed Air) | | | | | | ● | ● | ● | ● | ● |



# HOW TO USE THE
# Airplane Charts

PIPER

Cockpit of Piper's new M700.

**FOR AN AIRCRAFT TO BE LISTED** in the Purchase Planning Handbook, a production-conforming article must have flown by March 1 of this year. The dimensions, weights and performance characteristics of each model listed are representative of the current- production aircraft being built or for which a type certificate application has been filed. The Basic Operating Weights are representative of actual production turboprop and turbofan aircraft delivered to retail customers, or manufacturers' estimates for aircraft that have yet to enter service. The takeoff field length distances are based on Maximum Take- off Weight unless otherwise indicated in the tables.

Please note that "all data preliminary" in the remarks section indicates that actual aircraft weight, dimension and performance numbers may vary considerably after the model is certified and delivery of completed aircraft begins. All data for these aircraft is highlighted with a blue tint.

## MANUFACTURER, MODEL AND TYPE DESIGNATION

There are three rows at the top of each column for a specific aircraft: The manufacturer's name, abbreviated in some cases; the commercial model name; and the type certificate data sheet model designation.

## *BCA* EQUIPPED PRICE

Price estimates are first-quarter, current-year dollars for the next available delivery. Some aircraft have long lead times, thus the actual price for future- year deliveries will be higher than our published price. Also note that manufacturers may adjust prices without notification.

**Piston-powered aircraft:** Computed retail price with at least the level of equipment specified in the "*BCA* Required Equipment List."

**Turbine-powered aircraft:** Average price of ten of the last 12 commercial deliveries, if available. The aircraft serial numbers aren't necessarily consecutive because of variations in completion time and because some aircraft may be configured for non-commercial, special missions.

## CHARACTERISTICS

**Seating Capacity:** Crew + Typical Executive Seating/Maximum Seating by certification—For example, 2 + 8/19 indicates that the aircraft requires two pilots, there are eight seats in the typical executive configuration and the aircraft is certified for up 19 passenger seats. A four-place single-engine aircraft is shown as 1 + 3/3, indicating that one pilot is required and there are three other seats available for passengers. We require two pilots for all FAR Part 25 transport-category certified turbofan airplanes. A single pilot is required for all FAR Part 23 normal categoryaircraft, including Level 4 turbine airplanes up to 19 occupants/19,000 lb. certified maximum takeoff weight, except where otherwise noted. Four crewmembers are specified for Ultra- Long-Range (ULR) aircraft—three pilots and one flight attendant.
Each occupant of a turbine-powered aircraft is assumed to weigh 200 lb., thus allowing for stowed luggage and carry-on items. In the case of piston-engine airplanes, we assume each occupant weighs 170 lb. There is no 30-lb. luggage allowance

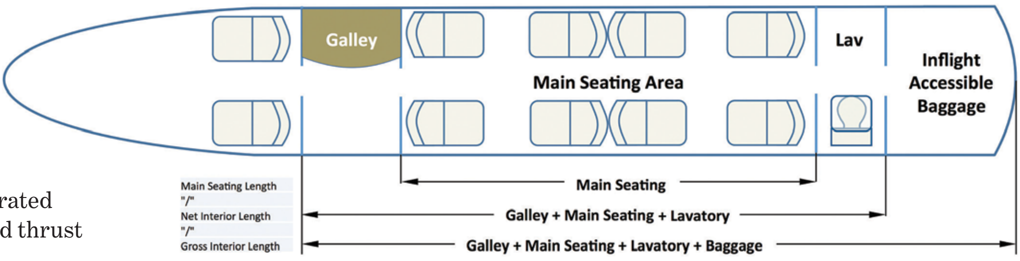
for piston-engine airplanes.

**Wing Loading:** MTOW divided by total wing area

**Power Loading:** MTOW divided by total rated horsepower or total rated thrust

**FAR Part 36 Certified Noise Levels:** Fly- over noise in A-weighted decibels (dBA) for small and turboprop aircraft. For turbofan-powered aircraft, we provide EPNdB (effective perceived noise levels) for lateral, flyover and approach.

CABIN LENGTH



## DIMENSIONS

**External Length, Height and Span** dimensions are provided for use in determining hangar and/or tie-down space requirements.

**Internal Length, Height and Width** are based on a completed interior, including insulation, upholstery, carpet, carpet padding and fixtures. Note well: These dimensions are not based upon metal-to-metal or composite airframe gross interior measurements, unless noted by the airframe manufacturer. They must reflect the actual net dimensions with all soft goods installed. *BCA* reserves the right to verify interior dimensions with on-site inspections.

As shown in the Cabin Interior Dimensions illustration, for small aircraft other than "cabin-class" models, the length is measured from the forward bulkhead ahead of the rudder pedals to the back of the rearmost passenger seat in its normal, upright position.

For so-called cabin-class and larger aircraft, we provide the net length of the cabin that may be occupied by passengers. It's measured from the aft side of the forward cabin divider to an aft point defined by the rear of the cabin floor capable of supporting passenger seats, the rear wall of an aft galley or lavatory, an auxiliary pressure bulkhead or the front wall of the pressurized baggage compartment. Some aircraft have the same net and overall interior length because the manufacturer offers at least one interior configuration with the aft-most passenger seat located next to the front wall of the aft luggage compartment.

For large aircraft, we show three interior lengths: (1) Main Seating Length, the prime section of the cabin occupied by passengers not including the galley, full-width lavatory[ies] or internal, inflight accessible baggage compartment; (2) Net Interior Length, main seating length plus galley, lavatory[ies] and inflight accessible baggage compartment[s]; and (3) Gross Interior Length, the overall length of the passenger cabin, measured from the aft side of the forward cabin divider to the aft-most bulkhead of the cabin pressure vessel.

The aft-most point of the gross interior length is defined by the rear side of a baggage compartment that is accessible to passengers in flight or the aft pressure bulkhead. The overall length is reduced by the length of any permanent mounted system or structure that is installed in the fuselage ahead of the aft bulkhead.

Interior height is measured at the center of the cross-section. It may be based on an aisle that is dropped several inches below the main cabin floor that supports the passenger seats. Some aircraft have dropped aisles of varying depths, resulting in less available interior height in certain sections of the cabin, such as the floor sections below the passenger seats.

Two width dimensions are shown for multi-engine turbine airplanes—one at the widest part of the cabin and the other at floor level. The dimensions, however, are not completely indicative of the usable space in a specific aircraft because of individual variances in interior furnishings.

## POWER

**Number of engines,** if greater than one, and the abbreviated name of the manufacturer: CFMI—CFM International, Cont—Teledyne Continental, GE, GE Honda, Hon—Honeywell Aerospace, IAE—International Aero Engines, Lyc—Textron Lycoming, PW—Pratt & Whitney, PWC—Pratt & Whitney Canada, RR- Rolls-Royce, Wms Intl—Williams International

**Output:** Takeoff-rated horsepower for propeller driven aircraft or pounds thrust for turbofan aircraft. If an engine is flat-rated, enabling it to produce takeoff-rated output at a higher than ISA (standard day) ambient temperature, the flat-rating limit is shown as ISA+XX°C. Highly flat-rated engines, (i.e., engines that can produce takeoff-rated thrust at a much higher than standard ambient temperature), typically provide substantially improved high-density altitude takeoff and climb, and high-altitude cruise performance.

**Inspection Interval** is the longest scheduled hourly major maintenance interval for the engine, either "t" for TBO or "c" for compressor-zone inspection. OC is shown only for engines that have "on- condition" repair or replace parts maintenance.

## WEIGHTS (LB.)

Weight categories are listed as appropriate to each class of aircraft.

**Max Ramp:** Maximum ramp weight for taxi.

**Max Takeoff:** Maximum takeoff weight as determined by structural limits.

**Max Landing:** Maximum landing weight as determined by structural limits.

**Zero-Fuel:** Maximum zero-fuel weight (MZFW), shown by "c," indicating the certified MZFW, or "b," a *BCA*-computed weight based on MTOW minus the weight of fuel required to fly 1.5 hr. at high-speed cruise.

Max ramp, max takeoff and max landing weights may be the same for light aircraft that may only have a certified Max Takeoff weight.

**EOW/BOW:** Empty Operating Weight is shown for piston-powered aircraft. Basic Operating Weight, which essentially is EOW plus required flight crew, is shown for turbine-powered airplanes. EOW is based on the factory standard weight, plus items specified in the *BCA* Required Equipment List, less fuel and oil. BOW, in contrast, is based on the average EOW weight of the last ten commercial deliveries, plus 200 lb. for each required crew member. We require four 200-lb. crewmembers, three flight crew and one cabin attendant, for ultra-long range aircraft.

There is no requirement to add in the weight of cabin stores, but some manufacturers choose to include galley stores and passenger supplies as part of the BOW build-up. Life vest, life rafts and appropriate deep-water survival equipment are included in the weight build-up of the 80,000-lb.-plus, ultra-long-range aircraft.

**Max Payload:** Zero-Fuel weight (ZFW)minus EOW or BOW, as appropriate. For piston-engine airplanes, Max Payload frequently is a computed value because it is based on the *BCA* ("b") computed maximum ZFW.

**Max Fuel:** Usable fuel weight based on 6.0 lb. per U.S. gallon for avgas or 6.7 lb. per U.S. gallon for jet fuel. Fuel capacity includes optional, auxiliary and long-range tanks, unless otherwise noted.

**Available Payload With Max Fuel:** Max Ramp weight minus the tanks-full weight, not to exceed Zero-Fuel weight minus EOW or BOW.

**Available Fuel With Max Payload:** Max Ramp weight minus Zero-Fuel weight, not to exceed maximum fuel capacity.

## LIMITS

*BCA* lists V speeds and other limits as appropriate to the class of aircraft. These are the abbreviations used on the charts:

**Vne:** Never-exceed speed (red line for piston-engine airplanes)

**Vno:** Normal operating speed (top of the green arc for piston-engine airplanes)

**Vmo:** Maximum operating speed (red line for turbine-powered airplanes)

**Mmo:** Maximum operating Mach number (red line turbofan-powered airplanes and a few turboprop airplanes)

**FL/Vmo:** Transition altitude at which Vmo equals Mmo (large turboprop and turbofan aircraft)

**Va:** Maneuvering speed (except for certain large turboprop and all turbofan aircraft)

**Vdec:** Accelerate/stop decision speed (multi-engine piston and light multi-engine turboprop airplanes)

**Vmca:** Minimum control airspeed while airborne (multi-engine piston and light multi-engine turboprop airplanes)

**Vso:** Maximum stalling speed, landing configuration (single-engine airplanes)

**Vx:** Best angle-of-climb speed (single-engine airplanes)

**Vxse:** Best angle-of-climb speed, one-engine inoperative (multi-engine piston and multi-engine turboprop airplanes under 12,500 lb.)

**Vy:** Best rate-of-climb speed (single-engine airplanes)

**Vyse:** Best rate-of-climb speed, one-engine inoperative (multi-engine piston and multi-engine turboprop airplanes under 12,500 lb.)

**V2:** Takeoff safety speed (large turboprops and turbofan airplanes)

**Vref:** Reference landing approach speed (large turboprops and turbofan airplanes, four passengers, NBAA IFR reserves; eight passengers for ULR aircraft)

**PSI:** Cabin-pressure differential (all pressurized airplanes)

## AIRPORT PERFORMANCE

Approved Flight Manual takeoff runway performance is shown for sea-level, standard day and for 5,000-ft. elevation/25C (77F) day, density altitude. All-engine takeoff distance (TO) is shown for single- and multi-engine piston, and turboprop airplanes with an MTOW of less than 12,500 lb. Takeoff distances and speeds assume Maximum Takeoff Weight, unless otherwise noted, such as when takeoff weight is limited because of density altitude.

**Accelerate/Stop distance (A/S)** is shown for small multi-engine piston and small turboprop airplanes. Takeoff field length (TOFL), the greater of the one-engine inoperative (OEI) takeoff distance or the accelerate/stop distance, is shown for FAR Part 23 Commuter Category/Level 4 and FAR Part 25 aircraft. If the accelerate/go and accelerate/stop distances are equal, the TOFL is the balanced field length.

**Landing Distance (LD)** is shown for FAR Part 23 Commuter Category/Level 4 and FAR Part 25 Transport Category aircraft. The landing weight is EOW plus 3 passengers or BOW plus 4 passengers, as applicable. Fuel reserves on landing are based on 100-nm NBAA IFR reserves for Part 23 aircraft and 200-nm NBAA IFR reserves for FAR 25 aircraft. We assume that 80,000+ lb. ULR aircraft will have eight passengers on board.

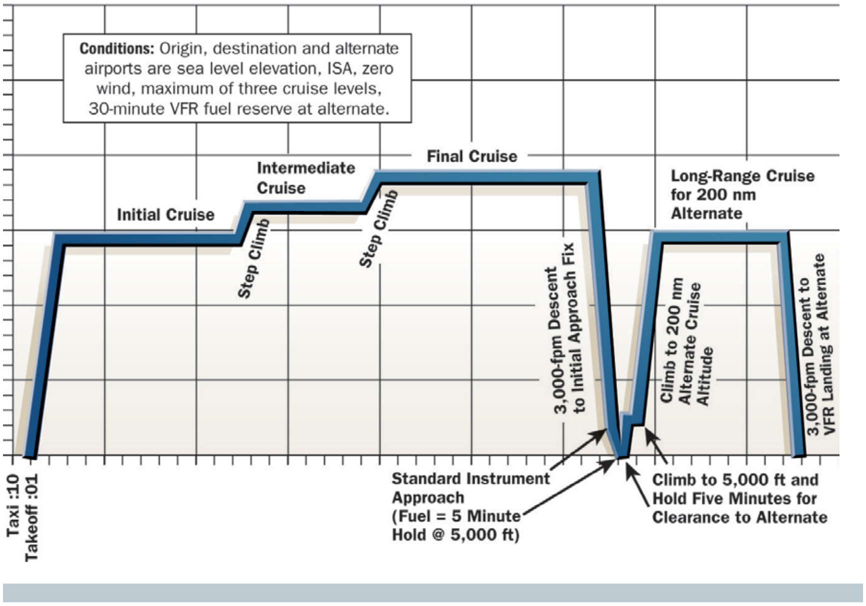
**V2 and Vref** speeds are useful for reference when comparing the TOFL and LD numbers because they provide an indication of potential minimum-length runway performance when low RCR (runway condition report) or runway gradient is a factor.

*BCA* lists two additional numbers for large turboprop- and turbofan-powered aircraft. First, we published the Mission Weight, which is the lower of: (1) the actual takeoff weight with four passengers (eight passengers for ULR aircraft) and full fuel when departing from a 5,000-ft./25C airport, or (2) the maximum allowable takeoff weight when departing with the same passenger load and at the same density altitude.

For two-engine aircraft, the mission weight when departing from a 5,000-ft., ISA+20C airport may be less than the MTOW because of FAR Part 25 second-segment, one-engine-inoperative, climb performance requirements. Aircraft with highly flat-rated engines are less likely to have a Mission Weight that is performance-limited when departing from hot-and-high airports.

We publish the NBAA IFR range for the 5,000-ft. elevation, ISA+20C departure, assuming a transition into standard-day, ISA flight conditions after takeoff. For purposes of computing NBAA IFR range, the aircraft is flown at the long-range cruise speed shown in the "Cruise" block or at the same speed as shown in the "Range" block. Missions assume four passengers and full tanks, unless otherwise noted. Thus, some aircraft, not weight-limited when departing such hot-and-high airports, actually have longer ranges than when departing sea-level facilities because they start their climbs 5,000 ft. higher on their way up to initial cruise altitude.

**NBAA IFR RANGE PROFILE**


**Conditions:** Origin, destination and alternate airports are sea level elevation, ISA, zero wind, maximum of three cruise levels, 30-minute VFR fuel reserve at alternate.

## CLIMB

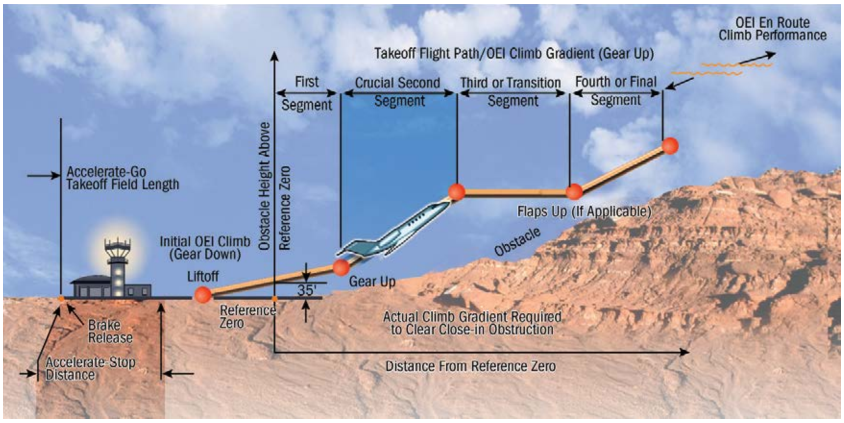
The all-engine time-to-climb provides an indication of overall climb performance, especially if the aircraft has an all-engine service ceiling well above our sample top-of-climb altitudes. We provide the all-engine time-to-climb to one of three specific altitudes, based on type of aircraft departing at MTOW from a sea-level, standard-day airport: (1) FL 100 (10,000 ft.) for normally aspirated, single- and multi-engine piston aircraft, plus pressurized single-engine piston aircraft and unpressurized turboprop aircraft; (2) FL 250 for pressurized single- and multi-engine turboprop aircraft; or (3) FL 370 for turbofan-powered aircraft. The data is published as time-to-climb in minutes/climb altitude. For example, if a non-pressurized twin-engine piston aircraft can depart from a sea-level airport at MTOW and climb to 10,000 ft. in 8 min., the time to climb is expressed as 8/FL 100.

We also publish the initial all-engine climb feet-per-nautical mile gradient, plus initial engine-out climb rate and gradient, for single- and multi-engine piston and turboprops with MTOWs of 12,500 lb. or less.

The one-engine-inoperative (OEI) climb rate for multi-engine aircraft at MTOW is derived from the Airplane Flight Manual (AFM). OEI climb rate and gradient is based on landing gear retracted and wing flaps in the takeoff configuration used to compute the published takeoff distance. The climb gradient for such aircraft is obtained by dividing the product of the climb rate (fpm) in the Airplane Flight Manual times 60 by the Vy or Vyse climb speed, as appropriate.

The OEI climb gradients we show for FAR Part 23 Level 4 and FAR Part 25 Transport Category aircraft are the second-segment net climb performance numbers published in the AFMs. Please note: the AFM net second-segment climb performance numbers are adjusted downward by 0.8% to compen-

**FAR PART 25 AND PART 23 COMMUTER CATEGORY OEI CLIMB PERFORMANCE**



sate for variations in pilot technique and ambient conditions.

The OEI climb gradient is computed at the same flap configuration used to calculate the takeoff field length.

## CEILINGS (FT.)

**Maximum Certificated Altitude:** Maximum allowable operating altitude determined by airworthiness authorities.

**All-Engine Service Ceiling:** Maximum altitude at which at least a 100-fpm rate of climb can be attained, assuming the aircraft departed a sea-level, standard-day airport at MTOW and climbed directly to altitude.

**OEI (Engine-Out) Service Ceiling:** Maximum altitude at which a 50-fpm rate of climb can be attained, assuming the aircraft departed a sea-level, standard-day airport at MTOW and climbed directly to altitude.

**Sea-Level Cabin (SLC) Altitude:** Maximum cruise altitude at which a 14.7 psia, sea-level cabin altitude can be maintained in a pressurized airplane. Note: Some aircraft equipped with digital pressurization systems have altitude-proportionate cabin pressurization systems that limit the sea-level cabin altitude to relatively low cruise altitudes.

## CRUISE

Cruise performance is computed using EOW with four occupants or BOW with four passengers and one-half fuel load. Ultra-long-range aircraft carry eight passengers for purposes of computing cruise performance. Assume 170 lb. for each occupant of a piston-engine airplane and 200 lb. for each occupant of a turbine-powered aircraft.

**Long Range:** True airspeed (TAS), fuel flow in lb./hour, (FL) flight-level cruise altitude and specific range for long-range cruise by the manufacturer.

**Recommended (Piston-Engine Airplanes)** True Air Speed (TAS), fuel flow in lb./hour, (FL) flight-level cruise altitude and specific range for normal cruise performance specified by the manufacturer.

**High Speed:** True Air Speed (TAS), fuel flow in lb./hour, (FL) flight-level cruise altitude and specific range for shorter-range, high-speed performance specified by the manufacturer.

Speed, fuel flow, specific range and altitude in each category are based on one mid-weight cruise point and these data reflect standard-day conditions. They are not an average for the overall mission and they are not representative of the above standard-day temperatures at cruise altitudes commonly encountered in everyday operations.

*BCA* imposes a 12,000-ft. maximum cabin altitude requirement on CAR3/FAR Part 23 normally aspirated aircraft. Non-pressurized, turbine-powered or turbocharged piston-engine airplanes are limited to FL 250, providing they are fitted with supplemental oxygen systems having sufficient capacity for all occupants for the duration of the mission. Pressurized CAR 3/ FAR Part 23 aircraft are limited to a maximum cruise altitude at which cabin altitude can be maintained at 10,000 ft. or below. For FAR Part 23 Category C and FAR Part 25 aircraft, the maximum cabin altitude for computing cruise performance is 8,000 ft.

To conserve space, we use Flight Levels (FL) for all cruise altitudes, which is appropriate considering that we assume standard-day ambient temperature and pressure conditions. Cruise performance is subject to *BCA*'s verification.

## RANGE

*BCA* shows various paper missions for each aircraft that illustrate range- versus-payload tradeoffs, runway and cruise performance, plus fuel efficiency. Similar to the cruise profile calculations, limits the maximum altitude to 12,000 ft. for normally aspirated, non-pressurized CAR3/FAR Part 23 aircraft, 25,000 ft. for non-pressurized turbocharged or turbine airplanes with supplemental oxygen, 10,000-ft. cabin altitude for pressurized CAR 3/FAR Part 23 airplanes and 8,000-ft. cabin altitude for FAR Part 23 Category C or FAR Part 25 aircraft.

**Seats-Full Range (Single-Engine Piston Airplanes):** Based on typical executive configuration with all seats filled with 170-lb. occupants, with maximum available fuel less 45-min. IFR fuel reserves. We use the lower of seats full or maximum payload.

**Tanks-Full Range (Single-Engine Piston Airplanes):** Based on one 170-lb. pilot, full fuel less 45-min. IFR fuel reserves.

**Maximum Fuel With Available Payload (Single-Engine Turbo-**

**props):** Based on BOW, plus full fuel and the maximum available payload up to maximum ramp weight. Range is based on arriving at destination with NBAA IFR fuel reserves, but only a 100-mi. alternate is required.

**Ferry (CAR 3/FAR Part 23 Category A and B):** Based on one 170-lb. pilot, maximum fuel less 45-min. IFR fuel reserves.

Please note: None of the missions for piston-engine aircraft include fuel for diverting to an alternate. However, single-engine turboprops are required to have NBAA IFR fuel reserves, but only a 100-mi. alternate is required.

NBAA IFR range format cruise profiles, having a 200-mi. alternate, are used for FAR Part 25 Transport Category turbine-powered aircraft. In the case of FAR Part 23 turboprops, including those certified in the Categories B and C, and FAR Part 23 turbofan aircraft, only a 100-mi. alternate is needed. The difference in alternate requirements should be kept in mind when comparing range performance of various classes of aircraft.

**Available Fuel With Max Payload (Multi-engine Turbine Airplanes):** Based on aircraft loaded to Maximum Zero-Fuel Weight with maximum available fuel up to Maximum Ramp Weight, less NBAA IFR fuel reserves at destination.

**Available Payload With Max Fuel (Multi-engine Turbine Airplanes):** Based on BOW plus full fuel and maximum available payload up to Maximum Ramp Weight. Range based on NBAA IFR reserves at destination.

**Full/Max Fuel With Four Passengers (Multi-engine Turbine Airplanes):** Based on BOW plus four 200-lb. passengers and the lesser of full fuel or maximum available fuel up to Maximum Ramp Weight. Ultra-long-range aircraft must have eight passengers on board.

**Ferry (Multi-engine Turbine Airplanes):** Based on BOW, required crew and full fuel, arriving at destination with NBAA IFR fuel reserves.

We allow 2,000-ft.-increment step climbs above the initial cruise altitude to improve specific range performance. The altitude shown in the range section is the highest cruise altitude for the trip—not the initial cruise or mid-mission altitude.

The range profiles are in nautical miles, and the average speed is computed by dividing that distance by the total flight time or weight-off-wheels time en route. The Fuel Used or Trip Fuel includes the fuel consumed for start, taxi, takeoff, cruise, descent and landing approach, but not after-landing taxi or reserves.

The Specific Range is obtained by dividing the distance flown by the total fuel burn. The Altitude is the highest cruise altitude achieved on the specific mission profile shown.

## MISSIONS

Various paper missions are computed to illustrate the runway requirements, speeds, fuel burns and specific range, plus cruise altitudes. The mission ranges are chosen to be representative for the aircraft category. All fixed-distance missions are flown with four passengers on board, except for ultra-long-range airplanes which have eight passengers on board. The pilot is counted as a passenger on board piston-engine airplanes. If an airplane cannot complete a specific fixed-distance mission with the appropriate payload, *BCA* shows a reduction of payload in the remarks section or marks the fields NP (Not Possible) at our option.

Runway performance is obtained from the Approved Airplane Flight Manual. Takeoff distance is listed for single-engine airplanes; accelerate/stop distance is listed for piston-twins and light turboprops; and takeoff field length, which often corresponds to balanced field length, is used for FAR Part 23 Category C and FAR Part 25 large Transport Category aircraft.

Flight Time (takeoff-to-touchdown, or weight-off-wheels, time) is shown for turbine airplanes. Some piston engine manufacturers also include taxi time, resulting in a chock-to-chock, Block Time measurement. Fuel Used, though, is the actual block fuel-burn for each type of aircraft, but it does not include fuel reserves. The cruise altitude shown is that which is specified by the manufacturer for fixed-distance mission.

**200 nm:** (Piston-engine airplanes)

**500 nm:** (Piston-engine airplanes)

**300 nm:** (Turbine-engine airplanes, except ultra-long-range)

**600 nm:** (Turbine-engine airplanes, except ultra-long-range)

**1,000 nm:** (All turbine-engine airplanes)

**3,000 nm:** (Ultra-long-range turbine-engine airplanes)

**6,000 nm:** (Ultra-long-range turbine-engine airplanes)

## REMARKS

In this section, *BCA* generally includes the base price, if it is available or applicable; the certification basis and year; and any notes about estimations, limitations or qualifications regarding specifications, performance or price. All prices are in 2023 dollars, FOB at a U.S. delivery point, unless otherwise noted. The certification basis includes the regulation under which the airplane was originally type certified, the year in which it was originally certified and, if applicable, subsequent years during which the airplane was re-certified.

## GENERAL

The following abbreviations are used throughout the tables: **"NA"** means not available; **"—"** indicates the information is not applicable; and **"NP"** signifies that specific performance is not possible. **BCA**

# SINGLE-ENGINE PISTONS NORMALLLY ASPIRATED

| Manufacturer | | | Cirrus Design | Textron Aviation | Cirrus Design | Textron Aviation |
|---|---|---|---|---|---|---|
| Model | | | **SR20** | **Cessna Skylane CE-182T** | **SR22** | **Beechcraft Bonanza G36 G36** |
| ***BCA*** Equipped Price | | | $634,900 | $660,000 | $844,900 | $1,200,000 |
| Characteristics | | Seating | 1+3/4 | 1+3/3 | 1+3/4 | 1+4/5 |
| | | Wing Loading | 21.7 | 17.8 | 23.5 | 20.2 |
| | | Power Loading | 14.65 | 13.48 | 11.61 | 12.68 |
| | | Noise (dBA) | 83.4 | 77.7 | 83.7 | 76.7 |
| External Dimensions (ft.) | | Length | 26.0 | 29.0 | 26.0 | 27.5 |
| | | Height | 8.9 | 9.3 | 8.9 | 8.6 |
| | | Span | 38.3 | 36.0 | 38.3 | 33.5 |
| Internal Dimensions (ft.) | | Length | 8.0 | 7.2 | 8.0 | 12.6 |
| | | Height | 4.1 | 4.0 | 4.1 | 4.2 |
| | | Width | 4.1 | 3.5 | 4.1 | 3.5 |
| Power | | Engine | Lyc IO-390-C3B6 | Lyc IO-540-AB1A5 | Cont IO-550-N | Cont IO-550-B |
| | | Output (hp) | 215 | 230 | 310 | 300 |
| | | Inspection Interval | 2,000t | 2,000t | 2,000t | 1,900t |
| Weights (lb.) | | Max Ramp | 3,160 | 3,110 | 3,610 | 3,860 |
| | | Max Takeoff | 3,150 | 3,100 | 3,600 | 3,805 |
| | | Max Landing | 3,150 | 2,950 | 3,600 | 3,805 |
| | | Zero Fuel | 3,043b | 2,986b | 3,400c | 3,665b |
| | | EOW | 2,122 | 2,000 | 2,272 | 2,605 |
| | | Max Payload | 921 | 986 | 1,128 | 1,060 |
| | | Useful Load | 1,038 | 1,110 | 1,338 | 1,255 |
| | | Max Baggage | 130 | 200 | 130 | 670 |
| | | Max Fuel | 336 | 522 | 552 | 444 |
| | | Available Payload w/Max Fuel | 702 | 588 | 786 | 811 |
| | | Available Fuel w/Max Payload | 117 | 124 | 210 | 195 |
| Limits | | VNE | 201 | 175 | 205 | 203 |
| | | VNO | 164 | 140 | 176 | 165 |
| | | VA | 133 | 110 | 140 | 139 |
| Airport Performance | | TO (SL elev./ISA temp.) | 2,530 | 1,514 | 1,756 | 1,913 |
| | | TO (5,000-ft. elev.@25C) | 4,305 | 2,708 | 3,016 | TBD |
| | | VSO | 62 | 49 | 64 | 59 |
| | | VX | 81 | 65 | 88 | 84 |
| | | VY | 88 | 80 | 108 | 100 |
| Climb | | Time to Climb (min.)/Altitude | 20/FL 100 | 15/FL 100 | 11/FL 100 | TBD/FL 100 |
| | | Initial Gradient (ft./nm) | 540 | 694 | 775 | TBD |
| Ceiling (ft.) | | Service | 17,500 | 18,100 | 17,500 | 18,500 |
| Cruise | Long Range | TAS | 135 | 125 | 160 | 160 |
| | | Fuel Flow | 53 | 61 | 68 | 71 |
| | | Altitude | FL 080 | FL 100 | FL 080 | FL 080 |
| | | Specific Range | 2.547 | 2.049 | 2.353 | 2.254 |
| | Recommended | TAS | 145 | 135 | 171 | 167 |
| | | Fuel Flow | 61 | 69 | 92 | 86 |
| | | Altitude | FL 080 | FL 100 | FL 080 | FL 080 |
| | | Specific Range | 2.377 | 1.957 | 1.859 | 1.942 |
| | High Speed | TAS | 152 | 144 | 180 | 174 |
| | | Fuel Flow | 71 | 76 | 107 | 93 |
| | | Altitude | FL 080 | FL 060 | FL 080 | FL 080 |
| | | Specific Range | 2.141 | 1.895 | 1.682 | 1.865 |
| Ranges | Seats Full | Nautical Miles | 672 | 723 | 1,118 | 217 |
| | | Average Speed | 135 | 130 | 162 | 153 |
| | | Fuel Used | 275 | 379 | 492 | 115 |
| | | Specific Range/Altitude | 2.444/FL 080 | 1.908/FL 120 | 2.272/FL 080 | 1.887/FL 040 |
| | Tanks Full | Nautical Miles | 672 | 912 | 1,118 | 860 |
| | | Average Speed | 135 | 131 | 162 | 159 |
| | | Fuel Used | 275 | 471 | 492 | 403 |
| | | Specific Range/Altitude | 2.444/FL 080 | 1.936/FL 120 | 2.272/FL 080 | 2.134/FL 080 |
| Missions (4 occupants) | 200 nm | Runway | 1,685 | 1,249 | 1,303 | 1,665 |
| | | Block Time | 1 +26 | 1+37 | 1+09 | 1+11 |
| | | Fuel Used | 112 | 123 | 127 | 130 |
| | | Specific Range/Altitude | 1.786/FL 080 | 1.626/FL 120 | 1.575/FL 080 | 1.538/FL 060 |
| | 500 nm | Runway | 1,685 | 1,402 | 1,519 | 1,858 |
| | | Block Time | 3+30 | 3+52 | 2+49 | 2+54 |
| | | Fuel Used | 245 | 269 | 305 | 304 |
| | | Specific Range/Altitude | 2.041/FL 080 | 1.859/FL 120 | 1.639/FL 080 | 1.645/FL 060 |
| | | Suggested Base Price | $634,900 | NA | $844,900 | NA |
| Remarks | | Certification Basis | FAR 23, 2000<br>Includes Garmin Perspective Touch+ avionics. | FAR 23, 1996/2001 A23-6<br>Garmin G1000 NXi with GFC 700 autopilot. | FAR 23, 2000<br>Includes Garmin Perspective Touch+ avionics. | CAR 3, 1956/69/83/2005<br>A/C system standard; Garmin G1000 NXi. |

## SINGLE-ENGINE PISTONS TURBOCHARGED

| Manufacturer | | | Textron Aviation | Textron Aviation | Cirrus Design |
|---|---|---|---|---|---|
| Model | | | Turbo Skylane CE-T182T | Turbo Stationair HD CE-T206H | SR22T |
| ***BCA* Equipped Price** | | | $760,000 | $915,000 | $969,900 |
| Characteristics | | Seating | 1+3/3 | 1+5/5 | 1+3/4 |
| | | Wing Loading | 17.8 | 21.8 | 23.5 |
| | | Power Loading | 13.19 | 12.22 | 11.43 |
| | | Noise (dBA) | 75.4 | 82.6 | 80.3 |
| External Dimensions (ft.) | | Length | 29.0 | 28.3 | 26.0 |
| | | Height | 9.3 | 9.3 | 8.9 |
| | | Span | 36.0 | 36.0 | 38.3 |
| Internal Dimensions (ft.) | | Length | 7.2 | 9.3 | 8.0 |
| | | Height | 4.0 | 4.1 | 4.1 |
| | | Width | 3.5 | 3.7 | 4.1 |
| Power | | Engine | Lyc TIO-540-AK1A | Lyc TIO-540-AJ1A | Cont TSIO-550-K |
| | | Output (hp) | 235 | 310 | 315 |
| | | Inspection Interval | 2,000t | 2,000t | 2,000t |
| Weights (lb.) | | Max Ramp | 3,112 | 3,806 | 3,610 |
| | | Max Takeoff | 3,100 | 3,789 | 3,600 |
| | | Max Landing | 2,950 | 3,600 | 3,600 |
| | | Zero Fuel | 2,953b | 3,615b | 3,400c |
| | | EOW | 2,114 | 2,365 | 2,354 |
| | | Max Payload | 839 | 1,250 | 1,046 |
| | | Useful Load | 998 | 1,441 | 1,256 |
| | | Max Baggage | 200 | 180 | 130 |
| | | Max Fuel | 522 | 522 | 552 |
| | | Available Payload w/Max Fuel | 476 | 919 | 704 |
| | | Available Fuel w/Max Payload | 159 | 191 | 210 |
| Limits | | VNE | 175 | 182 | 205 |
| | | VNO | 140 | 149 | 176 |
| | | VA | 110 | 125 | 140 |
| Airport Performance | | TO (SL elev./ISA Temp.) | 1,385 | 1,970 | 1,517 |
| | | TO (5,000-ft. elev.@25C) | 1,928 | 2,845 | 2,268 |
| | | VSO | 50 | 59 | 64 |
| | | VX | 64 | 70 | 88 |
| | | VY | 84 | 88 | 103 |
| Climb | | Time to Climb (min.)/Altitude | 10/FL 100 | 12/FL 100 | 7/FL 100 |
| | | Initial Gradient (ft./nm) | 743 | 724 | 782 |
| Ceilings (ft.) | | Certificated | 20,000 | 26,000 | 25,000 |
| | | Service | 20,000 | 26,000 | 25,000 |
| Cruise | Long Range | TAS | 132 | 137 | 171 |
| | | Fuel Flow | 62 | 85 | 76 |
| | | Altitude | FL 200 | FL 240 | FL 250 |
| | | Specific Range | 2.129 | 1.612 | 2.250 |
| | Recommended | TAS | 152 | 155 | 201 |
| | | Fuel Flow | 77 | 99 | 98 |
| | | Altitude | FL 200 | FL 240 | FL 250 |
| | | Specific Range | 1.974 | 1.574 | 2.051 |
| | High Speed | TAS | 165 | 164 | 213 |
| | | Fuel Flow | 98 | 116 | 110 |
| | | Altitude | FL 200 | FL 200 | FL 250 |
| | | Specific Range | 1.684 | 1.410 | 1.936 |
| Ranges | Seats Full | Nautical Miles | 520 | 465 | 1,021 |
| | | Average Speed | 134 | 137 | 171 |
| | | Fuel Used | 291 | 358 | 486 |
| | | Specific Range/Altitude | 1.787/FL 200 | 1.299/FL 200 | 2.101/FL 250 |
| | Tanks Full | Nautical Miles | 915 | 608 | 1,021 |
| | | Average Speed | 134 | 138 | 171 |
| | | Fuel Used | 476 | 430 | 486 |
| | | Specific Range/Altitude | 1.922/FL 200 | 1.414/FL 240 | 2.101/FL 250 |
| Missions (4 occupants) | 200 nm | Runway | 1,385 | 1,420 | 1,405 |
| | | Block Time | 1+24 | 1+23 | 1+08 |
| | | Fuel Used | 144 | 163 | 197 |
| | | Specific Range/Altitude | 1.389/FL 120 | 1.227/FL 150 | 1.015/FL 100 |
| | 500 nm | Runway | 1,385 | 1,626 | 1,699 |
| | | Block Time | 3+14 | 3+22 | 2+28 |
| | | Fuel Used | 319 | 386 | 360 |
| | | Specific Range/Altitude | 1.567/FL 200 | 1.295/FL 240 | 1.389/FL 180 |
| Remarks | | Suggested Base Price | NA | NA | $969,900 |
| | | Certification Basis | FAR 23, 2006 Garmin G1000 NXi with GFC700 autopilot standard. | FAR 23, 1998 Garmin G1000 NXi with GFC700 autopilot standard. | FAR 23, 2010 Includes Garmin Perspective Touch+ avionics. |

## SINGLE-ENGINE PISTONS PRESSURIZED

| Manufacturer | | | Piper Aircraft |
|---|---|---|---|
| Model | | | M350 PA-46-350P |
| ***BCA* Equipped Price** | | | $1,875,000 |
| Characteristics | | Seating | 1+4/5 |
| | | Wing Loading | 24.8 |
| | | Power Loading | 12.40 |
| | | Noise (dBA) | 81.0 |
| External Dimensions (ft.) | | Length | 28.9 |
| | | Height | 11.3 |
| | | Span | 43.0 |
| Internal Dimensions (ft.) | | Length | 12.4 |
| | | Height | 3.9 |
| | | Width | 4.2 |
| Power | | Engine | Lyc TIO-540-AE2A |
| | | Output (hp) | 350 |
| | | Inspection Interval | 2,000t |
| Weights (lb.) | | Max Ramp | 4,358 |
| | | Max Takeoff | 4,340 |
| | | Max Landing | 4,123 |
| | | Zero Fuel | 4,123c |
| | | EOW | 3,146 |
| | | Max Payload | 977 |
| | | Useful Load | 1,212 |
| | | Max Baggage | 200 |
| | | Max Fuel | 720 |
| | | Available Payload w/Max Fuel | 492 |
| | | Available Fuel w/Max Payload | 235 |
| Limits | | VNE | 198 |
| | | VNO | 168 |
| | | VA | 133 |
| | | PSI | 5.5 |
| Airport Performance | | TO (SL elev./ISA temp.) | 2,090 |
| | | TO (5,000-ft. elev.@25C) | 2,977 |
| | | VSO | 58 |
| | | VX | 81 |
| | | VY | 110 |
| Climb | | Time to Climb (min.)/Altitude | 8/FL 100 |
| | | Initial Gradient (ft./nm) | 703 |
| Ceilings (ft.) | | Certificated | 25,000 |
| | | Service | 25,000 |
| | | Sea-Level Cabin | 12,300 |
| Cruise | Long Range | TAS | 156 |
| | | Fuel Flow | 66 |
| | | Altitude | FL 250 |
| | | Specific Range | 2.364 |
| | Recommended | TAS | 203 |
| | | Fuel Flow | 108 |
| | | Altitude | FL 250 |
| | | Specific Range | 1.880 |
| | High Speed | TAS | 213 |
| | | Fuel Flow | 120 |
| | | Altitude | FL 250 |
| | | Specific Range | 1.775 |
| Ranges | Seats Full | Nautical Miles | 535 |
| | | Average Speed | 138 |
| | | Fuel Used | 312 |
| | | Specific Range/Altitude | 1.715/FL 120 |
| | Tanks Full | Nautical Miles | 1,343 |
| | | Average Speed | 159 |
| | | Fuel Used | 670 |
| | | Specific Range/Altitude | 2.004/FL 250 |
| Missions (4 occupants) | 200 nm | Runway | 2,090 |
| | | Block Time | 1+06 |
| | | Fuel Used | 167 |
| | | Specific Range/Altitude | 1.198/FL 200 |
| | 500 nm | Runway | 2,090 |
| | | Block Time | 2+31 |
| | | Fuel Used | 350 |
| | | Specific Range/Altitude | 1.429/FL 250 |
| Remarks | | Suggested Base Price | $1,566,870 |
| | | Certification Basis | FAR 23, 1983/88 Garmin G1000 NXi with GFC 700 autopilot; pressurized and A/C. |

## MULTIENGINE PISTONS NORMALLY ASPIRATED

| Manufacturer | | | Vulcanair SpA | Textron Aviation |
|---|---|---|---|---|
| Model | | | P.68C | Beechcraft Baron G58 |
| ***BCA* Equipped Price** | | | $1,725,000* | $1,840,000 |
| Character-istics | | Seating | 1+5/6 | 1+4/5 |
| | | Wing Loading | 22.9 | 27.6 |
| | | Power Loading | 11.49 | 9.17 |
| | | Noise (dBA) | 74.7 | 77.6 |
| External Dimensions (ft.) | | Length | 31.3 | 29.8 |
| | | Height | 11.2 | 9.8 |
| | | Span | 39.4 | 37.8 |
| Internal Dimensions (ft.) | | Length | 10.6 | 12.6 |
| | | Height | 3.9 | 4.2 |
| | | Width | 3.8 | 3.5 |
| Power | | Engines | 2 Lyc IO-360-A1B6 | 2 Cont IO-550-C |
| | | Output (hp each) | 200 | 300 |
| | | Inspection Interval | 2,000t | 1,900t |
| Weights (lb.) | | Max Ramp | 4,630 | 5,524 |
| | | Max Takeoff | 4,594 | 5,500 |
| | | Max Landing | 4,365 | 5,400 |
| | | Zero Fuel | 4,167c | 5,210b |
| | | EOW | 3,153 | 3,965 |
| | | Max Payload | 1,014 | 1,245 |
| | | Useful Load | 1,477 | 1,559 |
| | | Max Fuel | 1,063 | 1,164 |
| | | Available Payload w/Max Fuel | 415 | 395 |
| | | Available Fuel w/Max Payload | 463 | 314 |
| Limits | | VNE | 194 | 223 |
| | | VNO | 154 | 195 |
| | | VA | 132 | 156 |
| Airport Performance | | TO (SL elev./ISA Temp.) | 1,312 | 2,345 |
| | | TO (5,000-ft. elev.@25C) | 4,000 | 4,144 |
| | | A/S (SL elev./ISA) | 2,150 | 3,009 |
| | | A/S (5,000-ft. elev.@25C) | 2,950 | 4,335 |
| | | VMCA | 60 | 84 |
| | | VDEC | 70 | 85 |
| | | VXSE | 82 | 100 |
| | | VYSE | 88 | 101 |
| Climb | | Time to Climb (min.)/Altitude | 12/FL 100 | 10/FL 100 |
| | | Initial Engine-Out Rate (fpm) | 217 | 390 |
| | | Initial All-Engine Gradient (ft./nm) | 1,100 | 988 |
| | | Initial Engine-Out Gradient (ft./nm) | 147 | 232 |
| Ceilings (ft.) | | Certificated | — | — |
| | | All-Engine Service | 18,000 | 20,688 |
| | | Engine-Out Service | 5,000 | 7,284 |
| Cruise | Long Range | TAS | 144 | 185 |
| | | Fuel Flow | 94 | 144 |
| | | Altitude | FL 080 | FL 080 |
| | | Specific Range | 1.532 | 1.285 |
| | Recommended | TAS | 155 | 192 |
| | | Fuel Flow | 108 | 174 |
| | | Altitude | FL 080 | FL 080 |
| | | Specific Range | 1.435 | 1.103 |
| | High Speed | TAS | 162 | 200 |
| | | Fuel Flow | 116 | 193 |
| | | Altitude | FL 080 | FL 080 |
| | | Specific Range | 1.397 | 1.035 |
| Ranges | Max Payload | Nautical Miles | 300 | 250 |
| | | Average Speed | 140 | 174 |
| | | Trip Fuel | 315 | 231 |
| | | Specific Range/Altitude | 0.952/FL 080 | 1.082/FL 040 |
| | Ferry | Nautical Miles | 1,000 | 1,480 |
| | | Average Speed | 145 | 180 |
| | | Trip Fuel | 975 | 1,081 |
| | | Specific Range/Altitude | 1.026/FL 080 | 1.369/FL 120 |
| Missions (4 occu-pants) | 200 nm | Runway | 1,450 | 2,861 |
| | | Block Time | 1+28 | 1+02 |
| | | Fuel Used | 140 | 226 |
| | | Specific Range/Altitude | 1.429/FL 080 | 0.885/FL 060 |
| | 500 nm | Runway | 1,500 | 2,940 |
| | | Block Time | 3+25 | 2+31 |
| | | Fuel Used | 375 | 531 |
| | | Specific Range/Altitude | 1.333/FL 080 | 0.942/FL 060 |
| | | Suggested Base Price | $1,725,000 | NA |
| Remarks | | Certification Basis | FAR 23, 1976/80 Garmin G1000 NXi with GFC 700 autopilot. **BCA* estimated price. | CAR 3, 1957/69/83/2005 A/C system standard; Garmin G1000 NXi; max payload mission flown with six occupants. |

## MULTIENGINE PISTONS TURBOCHARGED

| Manufacturer | | | Vulcanair SpA |
|---|---|---|---|
| Model | | | P 68C-TC |
| ***BCA* Equipped Price** | | | $1,875,000* |
| Character-istics | | Seating | 1+5/5 |
| | | Wing Loading | 20.7 |
| | | Power Loading | 10.94 |
| | | Noise (dBA) | 74.7 |
| External Dimensions (ft.) | | Length | 31.3 |
| | | Height | 11.2 |
| | | Span | 39.4 |
| Internal Dimensions (ft.) | | Length | 10.6 |
| | | Height | 3.9 |
| | | Width | 3.8 |
| Power | | Engines | 2 Lyc TIO-360-C1A6D |
| | | Output (hp each) | 210 |
| | | Inspection Interval | 2,000t |
| Weights (lb.) | | Max Ramp | 4,630 |
| | | Max Takeoff | 4,594 |
| | | Max Landing | 4,365 |
| | | Zero Fuel | 4,140b |
| | | EOW | 3,197 |
| | | Max Payload | 943 |
| | | Useful Load | 1,433 |
| | | Max Fuel | 1,062 |
| | | Available Payload w/Max Fuel | 371 |
| | | Available Fuel w/Max Payload | 490 |
| Limits | | VNE | 194 |
| | | VNO | 154 |
| | | VA | 132 |
| Airport Perfor-mance | | TO (SL elev./ISA temp.) | 1,260 |
| | | TO (5,000-ft. elev.@25C) | 2,200 |
| | | A/S (SL elev./ISA) | 1,800 |
| | | A/S (5,000-ft. elev.@25C) | 2,400 |
| | | VMCA | 66 |
| | | VDEC | NA |
| | | VXSE | 78 |
| | | VYSE | 88 |
| Climb | | Time to Climb (min.)/Altitude | 10/FL 100 |
| | | Initial Engine-Out Rate (fpm) | 240 |
| | | Initial All-Engine Gradient (ft./nm) | 1,400 |
| | | Initial Engine-Out Gradient (ft./nm) | NA |
| Ceilings (ft.) | | Certificated | 20,000 |
| | | All-Engine Service | 20,000 |
| | | Engine-Out Service | 10,000 |
| Cruise | Long Range | TAS | 144 |
| | | Fuel Flow | 104 |
| | | Altitude | FL 080 |
| | | Specific Range | 1.385 |
| | Recommended | TAS | 155 |
| | | Fuel Flow | 125 |
| | | Altitude | FL 080 |
| | | Specific Range | 1.240 |
| | High Speed | TAS | 162 |
| | | Fuel Flow | 150 |
| | | Altitude | FL 080 |
| | | Specific Range | 1.080 |
| Range | Ferry | Nautical Miles | 1,100 |
| | | Average Speed | 145 |
| | | Trip Fuel | 960 |
| | | Specific Range/Altitude | 1.146/FL 080 |
| Missions (4 occupants) | 200 nm | Runway | NA |
| | | Block Time | 1+28 |
| | | Fuel Used | 260 |
| | | Specific Range/Altitude | 0.769/FL 080 |
| | 500 nm | Runway | NA |
| | | Block Time | 3+25 |
| | | Fuel Used | 485 |
| | | Specific Range/Altitude | 1.031/FL 080 |
| | | Suggested Base Price | $1,875,000 |
| Remarks | | Certification Basis | FAR 23, 1982 Garmin G1000 NXi. *BCA* estimated data. **BCA* estimated price. |

# SINGLE-ENGINE TURBOPROPS

| Manufacturer | | | Textron Aviation | Textron Aviation | Piper Aircraft | Daher | Daher | Piper Aircraft |
|---|---|---|---|---|---|---|---|---|
| Model | | | Cessna Caravan<br>CE-208 | Grand Caravan EX<br>CE-208B | M500<br>PA-46-500TP | Kodiak 100<br>Kodiak 100 Series III | Kodiak 200<br>Kodiak 900 | M600<br>PA-46-600TP |
| ***BCA*** Equipped Price | | | $2,400,000 | $2,685,000 | $2,975,000 | $3,258,061 | $3,827,342 | $4,100,000 |
| Characteristics | | Seating | 1+9/13* | 1+9/13* | 1+4/5 | 1+6/9 | 1+6/9 | 1+4/5 |
| | | Wing Loading | 28.6 | 31.5 | 27.8 | 30.2 | 33.3 | 28.7 |
| | | Power Loading | 11.85 | 10.16 | 10.18 | 9.67 | 8.89 | 10.00 |
| | | Noise (dBA) | 79.0 | 84.1 | 76.8 | 77.0 | 79.5 | 76.8 |
| External Dimensions (ft.) | | Length | 37.6 | 41.6 | 29.6 | 33.8 | 37.7 | 29.6 |
| | | Height | 14.9 | 15.5 | 11.3 | 14.7 | 16.1 | 11.3 |
| | | Span | 52.1 | 52.1 | 43.0 | 45.0 | 45.0 | 43.2 |
| Internal Dimensions (ft.) | | Length | 12.7 | 16.7 | 12.3 | 15.8 | 18.1 | 12.3 |
| | | Height | 4.5 | 4.5 | 3.9 | 4.8 | 4.8 | 3.9 |
| | | Width | 5.3 | 5.3 | 4.1 | 4.5 | 4.5 | 4.1 |
| Power | | Engine | P&WC<br>PT6A-114A | P&WC<br>PT6A-140 | P&WC<br>PT6A-42A | P&WC<br>PT6A-34 | P&WC<br>PT6A-140A | P&WC<br>PT6A-42A |
| | | Output (shp)/Flat Rating | 675/ISA+31C | 867/ISA+24C | 500/ISA+60C | 750/ISA+7C | 900/ISA+22C | 600/ISA+45C |
| | | Inspection Interval | 3,600t | 4,000t | 3,600t | 4,000t | 4,000t | 3,600t |
| Weights (lb.) | | Max Ramp | 8,035 | 8,842 | 5,134 | 7,305 | 8,100 | 6,050 |
| | | Max Takeoff | 8,000 | 8,807 | 5,092 | 7,255 | 8,000 | 6,000 |
| | | Max Landing | 7,800 | 8,500 | 4,850 | 7,255 | 7,800 | 5,800 |
| | | Zero Fuel | 7,432b | 8,152b | 4,850c | 7,071c | 7,410c | 4,850c |
| | | BOW | 4,930 | 5,510 | 3,634 | 4,417 | 4,840 | 3,850 |
| | | Max Payload | 2,502 | 2,642 | 1,216 | 2,654 | 2,570 | 1,000 |
| | | Useful Load | 3,105 | 3,332 | 1,500 | 2,888 | 3,260 | 2,200 |
| | | Max Fuel | 2,224 | 2,246 | 1,160 | 2,144 | 2,144 | 1,742 |
| | | Available Payload w/Max Fuel | 881 | 1,086 | 340 | 744 | 1,116 | 458 |
| | | Available Fuel w/Max Payload | 604 | 691 | 284 | 234 | 690 | 1,200 |
| Limits | | VMO | 175 | 175 | 188 | 180 | 190 | 250 |
| | | VA | 150 | 148 | 127 | 143 | 155 | 151 |
| | | PSI | — | — | 5.6 | — | — | 5.6 |
| Airport Performance | | TO (SL elev./ISA temp.) | 2,055 | 2,160 | 2,438 | 1,468 | 1,504 | 2,635 |
| | | TO (5,000-ft. elev.@25C) | 2,973 | 3,661 | 3,691 | 2,396 | 2,515 | 3,998 |
| | | VSO | 61 | 61 | 69 | 60 | 65 | 62 |
| | | VX | 90 | 86 | 95 | 73 | 79 | 95 |
| | | VY | 107 | 108 | 125 | 101 | 111 | 122 |
| Climb | | Time to Climb (min.)/Altitude | 9/FL 100 | 9/FL 100 | 19/FL 250 | 10/FL 100 | 7/FL 100 | 21/FL 250 |
| | | Initial Gradient (ft./nm) | 771 | 816 | 753 | 778 | 932 | 785 |
| Ceilings (ft.) | | Certificated | 25,000 | 25,000 | 30,000 | 25,000 | 25,000 | 30,000 |
| | | Service | 25,000 | 25,000 | 30,000 | 25,000 | 25,000 | 30,000 |
| | | Sea-Level Cabin | — | — | 12,600 | — | — | 12,600 |
| Cruise | Long Range | TAS | 157 | 156 | 179 | 164 | 185 | 184 |
| | | Fuel Flow | 281 | 328 | 135 | 251 | 324 | 155 |
| | | Altitude | FL 100 | FL 100 | FL 280 | FL 120 | FL 120 | FL 280 |
| | | Specific Range | 0.559 | 0.476 | 1.326 | 0.653 | 0.571 | 1.187 |
| | High Speed | TAS | 186 | 185 | 258 | 175 | 210 | 274 |
| | | Fuel Flow | 379 | 437 | 242 | 335 | 409 | 324 |
| | | Altitude | FL 100 | FL 100 | FL 280 | FL 120 | FL 120 | FL 280 |
| | | Specific Range | 0.491 | 0.423 | 1.066 | 0.522 | 0.513 | 0.846 |
| NBAA IFR Ranges (100-nm alternate) | Full Fuel (w/available payload) | Nautical Miles | 965 | 807 | 834 | 1,005 | 925 | 1,406 |
| | | Average Speed | 156 | 156 | 171 | 175 | 210 | 179 |
| | | Trip Fuel | 1,799 | 1,761 | 748 | 1,941 | 1,903 | 1,324 |
| | | Specific Range/Altitude | 0.536/FL 100 | 0.458/FL 100 | 1.115/FL 280 | 0.518/FL 120 | 0.486/FL 120 | 1.062/FL 280 |
| | Ferry | Nautical Miles | 970 | 816 | 834 | 1,299 | 1,345 | 1,406 |
| | | Average Speed | 156 | 156 | 171 | 141 | 177 | 179 |
| | | Trip Fuel | 1,800 | 1,772 | 748 | 1,941 | 1,903 | 1,324 |
| | | Specific Range/Altitude | 0.539/FL 100 | 0.460/FL 100 | 1.115/FL 280 | 0.669/FL 200 | 0.707/FL 200 | 1.062/FL 280 |
| Missions (4 passengers) | 300 nm | Runway | 1,468 | 1,428 | 1,550 | 1,468 | 1,504 | 1,593 |
| | | Flight Time | 1+40 | 1+41 | 1+22 | 1+50 | 1+30 | 1+21 |
| | | Fuel Used | 648 | 750 | 379 | 591 | 651 | 429 |
| | | Specific Range/Altitude | 0.463/FL 100 | 0.400/FL 100 | 0.792/FL 280 | 0.508/FL 120 | 0.461/FL 120 | 0.699/FL 280 |
| | 600 nm | Runway | 1,675 | 1,792 | 1,625 | 1,468 | 1,504 | 1,687 |
| | | Flight Time | 3+17 | 3+19 | 2+32 | 3+32 | 2+55 | 2+31 |
| | | Fuel Used | 1,260 | 1,462 | 660 | 1,165 | 1,235 | 735 |
| | | Specific Range/Altitude | 0.476/FL 100 | 0.410/FL 100 | 0.909/FL 280 | 0.515/FL 120 | 0.486/FL 120 | 0.816/FL 280 |
| | 1,000 nm | Runway | NP | NP | 1,700 | 1,467 | 1,504 | 1,812 |
| | | Flight Time | NP | NP | 4+18 | 5+50 | 4+50 | 4+06 |
| | | Fuel Used | NP | NP | 985 | 1,931 | 2,014 | 1,142 |
| | | Specific Range/Altitude | NP/NP | NP/NP | 1.015/FL 280 | 0.518/FL 120 | 0.497/FL 120 | 0.876/FL 280 |
| | | Suggested Base Price | NA | NA | $2,850,000 | $2,963,765 | $3,614,996 | $3,930,000 |
| Remarks | | Certification Basis | FAR 23, 1984/98 Garmin G1000 NXi with GFC 700 autopilot. *Export only. | FAR 23, 1986/2012 Includes cargo pod; Garmin G1000 NXi with GFC 700 autopilot. *Export only. | FAR 23 A52 Garmin G1000 NXi with SVS; GFC 700 autopilot; enhanced AFCS; 1,000 nm, three occupants. | FAR 23, 2007 Normal category Includes Garmin G1000 NXi and GFC 700 autopilot with coupled GA; Summit interior. | FAR 23, 2007 Normal category Includes Garmin G1000 NXi and GFC 700 autopilot with coupled GA; Summit+ interior. | FAR 23, 2016 A62, Garmin G3000 with SVS and enhanced AFCS; HALO emergency autoland. |

# SINGLE-ENGINE TURBOPROPS

| Manufacturer | | | Piper Aircraft | Epic Aircraft | Daher | Daher | Pilatus | *Textron Aviation* |
|---|---|---|---|---|---|---|---|---|
| Model | | | **M700**<br>**PA-46-701TP** | **E1000 GX**<br>**E1000** | **TBM 910**<br>**TBM 700 N** | **TBM 960**<br>**TBM 700 N** | **PC-12 NGX**<br>**PC-12/47E** | ***Beechcraft Denali***<br>***BE-220*** |
| ***BCA*** Equipped Price | | | $4,300,000 | $4,450,000 | $4,726,638 | $5,272,895 | $6,200,000 | $6,950,000 |
| Characteristics | | Seating | 1+4/5 | 1+5/6 | 1+5/6 | 1+5/6 | 1+8/9 | 1+7/9 |
| | | Wing Loading | 28.1 | 38.6 | 38.2 | 39.4 | 37.6 | NA |
| | | Power Loading | 8.57 | 6.67 | 8.70 | 8.96 | 8.71 | NA |
| | | Noise (dBA) | 73.2 | 77.3 | 76.4 | 77.1 | 77.0 | NA |
| External Dimensions (ft.) | | Length | 29.6 | 35.8 | 35.2 | 35.2 | 47.3 | 48.8 |
| | | Height | 11.5 | 12.5 | 14.3 | 14.3 | 14.0 | 15.2 |
| | | Span | 43.1 | 43.0 | 42.1 | 42.1 | 53.3 | 54.3 |
| Internal Dimensions (ft.) | | Length | 12.3 | 13.9 | 15.0 | 15.0 | 16.9 | 16.8 |
| | | Height | 3.9 | 4.5 | 4.1 | 4.1 | 4.8 | 4.8 |
| | | Width | 4.1 | 4.5 | 4.0 | 4.0 | 5.0 | 5.3 |
| Power | | Engine | P&WC PT6A-52 | P&WC PT6A-67A | P&WC PT6A-66D | P&WC PT6E-66XT | P&WC PT6E-67XP | GE Aerospace Catalyst |
| | | Output (shp)/Flat Rating | 700/ISA+45C | 1,200/ISA+35C | 850/ISA+37C | 850/ISA+37C | 1,200/ISA+35C | 1,300/NA |
| | | Inspection Interval | 3,600t | 3,500t | 3,500t | 5,000t | 5,000t | OC |
| Weights (lb.) | | Max Ramp | 6,050 | 8,050 | 7,430 | 7,650 | 10,495 | NA |
| | | Max Takeoff | 6,000 | 8,000 | 7,394 | 7,615 | 10,450 | NA |
| | | Max Landing | 5,800 | 7,600 | 7,024 | 7,110 | 9,921 | NA |
| | | Zero Fuel | 5,050c | 7,498b | 6,032c | 6,252c | 9,039c | NA |
| | | BOW | 3,850 | 5,330 | 4,929 | 5,006 | 6,803 | NA |
| | | Max Payload | 1,000 | 2,168 | 1,103 | 1,246 | 2,236 | NA |
| | | Useful Load | 2,320 | 2,720 | 2,501 | 2,644 | 3,692 | NA |
| | | Max Fuel | 1,742 | 1,770 | 1,955 | 1,955 | 2,704 | NA |
| | | Available Payload w/Max Fuel | 578 | 950 | 546 | 689 | 988 | 1,100 |
| | | Available Fuel w/Max Payload | 1,320 | 553 | 1,398 | 1,398 | 1,456 | NA |
| Limits | | VMO | 250 | 270 | 266 | 266 | 240 | NA |
| | | VA | 151 | 170 | 160 | 160 | 166 | NA |
| | | PSI | 5.6 | 6.6 | 6.2 | 6.2 | 5.8 | 7.6 |
| Airport Performance | | TO (SL elev./ISA temp.) | 1,994 | 2,254 | 2,380 | 2,535 | 2,485 | NA |
| | | TO (5,000-ft. elev.@25C) | 3,025 | 3,193 | 3,475 | 3,680 | 4,080 | NA |
| | | VSO | 62 | 68 | 65 | 65 | 67 | NA |
| | | VX | 95 | 116 | 100 | 100 | 120 | NA |
| | | VY | 122 | 150 | 124 | 124 | 130 | NA |
| Climb | | Time to Climb (min.)/Altitude | 21/FL 250 | 12/FL 250 | 13/FL 250 | 13/FL 250 | 19/FL 250 | NA/NA |
| | | Initial Gradient (ft./nm) | 785 | 1,400 | 1,000 | 1,000 | 877 | NA |
| Ceilings (ft.) | | Certificated | 30,000 | 34,000 | 31,000 | 31,000 | 30,000 | 31,000 |
| | | Service | 30,000 | 34,000 | 31,000 | 31,000 | 30,000 | 31,000 |
| | | Sea-Level Cabin | 12,600 | 15,000 | 14,390 | 14,390 | 13,100 | 18,700 |
| Cruise | Long Range | TAS | 206 | 238 | 252 | 252 | 225 | NA |
| | | Fuel Flow | 167 | 234 | 241 | 241 | 269 | NA |
| | | Altitude | FL 300 | FL 340 | FL 310 | FL 310 | FL 300 | NA |
| | | Specific Range | 1.234 | 1.017 | 1.046 | 1.046 | 0.836 | NA |
| | High Speed | TAS | 301 | 322 | 330 | 330 | 290 | 285 |
| | | Fuel Flow | 365 | 335 | 412 | 412 | 463 | NA |
| | | Altitude | FL 250 | FL 340 | FL 260 | FL 260 | FL 240 | NA |
| | | Specific Range | 0.825 | 0.961 | 0.801 | 0.801 | 0.626 | NA |
| NBAA IFR Ranges (100-nm alternate) | Full Fuel (w/available payload) | Nautical Miles | 1,424 | 1,232 | 1,514 | 1,514 | 1,548 | 1,600 |
| | | Average Speed | 206 | 310 | 252 | 252 | 270 | NA |
| | | Trip Fuel | 1,322 | 1,374 | 1,599 | 1,599 | 2,235 | NA |
| | | Specific Range/Altitude | 1.077/FL 300 | 0.897/FL 340 | 0.947/FL 310 | 0.947/FL 310 | 0.693/FL 300 | NA/NA |
| | Ferry | Nautical Miles | 1,836 | 1,243 | 1,594 | 1,594 | 1,571 | NA |
| | | Average Speed | 206 | 312 | 252 | 252 | 275 | NA |
| | | Trip Fuel | 1,617 | 1,374 | 1,598 | 1,598 | 2,224 | NA |
| | | Specific Range/Altitude | 1.135/FL 300 | 0.905/FL 340 | 0.997/FL 310 | 0.997/FL 310 | 0.706/FL 300 | NA/NA |
| Missions (4 passengers) | 300 nm | Runway | 1,069 | 1,260 | 1,765 | 1,765 | 1,677 | NA |
| | | Flight Time | 1+09 | 1+13 | 1+00 | 1+00 | 1+08 | NA |
| | | Fuel Used | 443 | 426 | 440 | 440 | 534 | NA |
| | | Specific Range/Altitude | 0.677/FL 250 | 0.704/FL 340 | 0.682/FL 280 | 0.682/FL 280 | 0.562/FL 240 | NA/NA |
| | 600 nm | Runway | 1,213 | 1,260 | 2,005 | 2,005 | 1,866 | NA |
| | | Flight Time | 2+08 | 2+09 | 1+55 | 1+55 | 2+12 | NA |
| | | Fuel Used | 769 | 738 | 830 | 830 | 977 | NA |
| | | Specific Range/Altitude | 0.780/FL 250 | 0.813/FL 340 | 0.723/FL 280 | 0.723/FL 280 | 0.614/FL 260 | NA/NA |
| | 1,000 nm | Runway | 1,261 | 1,457 | 2,380 | 2,380 | 2,109 | NA |
| | | Flight Time | 3+36 | 3+25 | 3+10 | 3+10 | 3+40 | NA |
| | | Fuel Used | 1,115 | 1,165 | 1,320 | 1,320 | 1,525 | NA |
| | | Specific Range/Altitude | 0.897/FL 300 | 0.858/FL 340 | 0.758/FL 290 | 0.758/FL 290 | 0.656/FL 280 | NA/NA |
| | | Suggested Base Price | $4,150,000 | NA | $4,497,837 | $5,044,981 | $5,050,000 | NA |
| Remarks | | Certification Basis | FAR 23, 2016 A62 Garmin G3000 with SVS and enhanced AFCS; HALO emergency autoland; Garmin PlaneSync. | FAR 23, 2019/21 Garmin G1000 NXi; all performance at MTOW. | FAR 23, 1990/2006/07/14 Pilot door standard; five-blade propeller; Garmin G1000 NXi; elec.-heated seats; five-year system warranty. | FAR 23, 1990/2006/07/14 Pilot door standard; five-blade propeller; HomeSafe; E-throttle (PT6E-66XT EPECS); Garmin G3000; Prestige cabin; five-year system warranty. | FAR 23, 1996/2005/08/19 Typically equipped with executive interior, autothrottle. | *FAR/EASA 23 pending Typically equipped with executive interior, autothrottle.* |

# MULTIENGINE TURBOPROPS ≤12,500-LB. MTOW

| Manufacturer | | | Viking Air | Textron Aviation | Piaggio Aero Industries SpA |
|---|---|---|---|---|---|
| Model | | | 400 Series<br>DHC-6-400 | Beechcraft King Air 260<br>B200GT | Avanti Evo<br>P.180 Avanti II |
| ***BCA*** Equipped Price | | | $7,500,000* | $7,780,000 | $8,495,000 |
| Characteristics | | Seating | 1+19/19 | 1+8/10 | 1+7/9 |
| | | Wing Loading | 29.8 | 40.3 | 70.3 |
| | | Power Loading | 10.08 | 7.35 | 7.12 |
| | | Noise (dBA) | 85.6 | 81.2 | 74.0 |
| External Dimensions (ft.) | | Length | 51.8 | 43.8 | 47.3 |
| | | Height | 19.5 | 14.8 | 13.0 |
| | | Span | 65.0 | 57.9 | 47.1 |
| Internal Dimensions (ft.) | | **Length:** OA/Net | 18.4/24.5 | 16.7/16.7 | 17.5/17.5 |
| | | Height | 4.9 | 4.8 | 5.8 |
| | | **Width:** Max/Floor | 5.4/4.4 | 4.5/4.1 | 6.1/3.5 |
| Power | | Engines | 2 P&WC<br>PT6A-34 | 2 P&WC<br>PT6A-52 | 2 P&WC<br>PT6A-66B |
| | | Output (shp each)/Flat Rating | 620/ISA+27C | 850/ISA+37C | 850/ISA+28C |
| | | Inspection Interval | 4,000t | 3,600t | 3,600t |
| Weights (lb.) | | Max Ramp | 12,600 | 12,590 | 12,150 |
| | | Max Takeoff | 12,500 | 12,500 | 12,100 |
| | | Max Landing | 12,300 | 12,500 | 11,500 |
| | | Zero Fuel | 12,300c | 11,000c | 10,200c |
| | | BOW | 7,794 | 8,830 | 8,350 |
| | | Max Payload | 4,506 | 2,170 | 1,850 |
| | | Useful Load | 4,806 | 3,760 | 3,800 |
| | | Max Fuel | 3,129 | 3,645 | 2,802 |
| | | Available Payload w/Max Fuel | 1,677 | 115 | 998 |
| | | Available Fuel w/Max Payload | 300 | 1,590 | 1,950 |
| Limits | | VMO | 170 | 259 | 260 |
| | | VA | 136 | 181 | 202 |
| | | PSI | — | 6.5 | 9.0 |
| Airport Performance | | TO (SL elev./ISA temp.) | 1,490 | 2,111 | 3,196 |
| | | TO (5,000-ft. elev.@25C) | 2,031 | 3,099 | 4,700 |
| | | A/S (SL elev./ISA temp.) | 2,220 | 3,687 | 5,750 |
| | | A/S (5,000-ft. elev.@25C) | 2,800 | 4,859 | 7,400 |
| | | VMCA | 66 | 86 | 100 |
| | | VDEC | NA | 94 | 106 |
| | | VXSE | NA | 115 | 132 |
| | | VYSE | 82 | 121 | 140 |
| Climb | | Time to Climb (min.)/Altitude | 7/FL 100 | 13/FL 250 | 10/FL 250 |
| | | Initial Engine-Out Rate (fpm) | 340 | 682 | 670 |
| | | Initial All-Engine Gradient (ft./nm) | 856 | 1,170 | 1,067 |
| | | Initial Engine-Out Gradient (ft./nm) | 249 | 364 | 287 |
| Ceilings (ft.) | | Certificated | 25,000 | 35,000 | 41,000 |
| | | All-Engine Service | 26,700 | 35,000 | 41,000 |
| | | Engine-Out Service | 11,600 | 26,000 | 22,500 |
| | | Sea-Level Cabin | — | 2,700* | 24,000 |
| Cruise | **Long Range** | TAS | 142 | 256 | 304 |
| | | Fuel Flow | 413 | 430 | 438 |
| | | Altitude | FL 100 | FL 350 | FL 390 |
| | | Specific Range | 0.344 | 0.595 | 0.694 |
| | **High Speed** | TAS | 186 | 310 | 378 |
| | | Fuel Flow | 633 | 750 | 783 |
| | | Altitude | FL 100 | FL 260 | FL 310 |
| | | Specific Range | 0.294 | 0.413 | 0.483 |
| NBAA IFR Ranges (100-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 161 | 321 | 774 |
| | | Average Speed | 147 | 267 | 297 |
| | | Trip Fuel | 576 | 870 | 1,315 |
| | | Specific Range/Altitude | 0.280/FL 100 | 0.369/FL 330 | 0.589/FL 390 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 925 | 1,403 | 1,366 |
| | | Average Speed | 142 | 291 | 300 |
| | | Trip Fuel | 2,784 | 2,941 | 2,165 |
| | | Specific Range/Altitude | 0.332/FL 100 | 0.477/FL 330 | 0.631/FL 390 |
| | **Full Fuel** (w/4 passsengers) | Nautical Miles | 949 | 1,038 | 1,376 |
| | | Average Speed | 140 | 288 | 300 |
| | | Trip Fuel | 2,792 | 2,225 | 2,165 |
| | | Specific Range/Altitude | 0.340/FL 100 | 0.467/FL 330 | 0.636/FL 390 |
| | **Ferry** | Nautical Miles | 975 | 1,420 | 1,389 |
| | | Average Speed | 138 | 293 | 304 |
| | | Trip Fuel | 2,800 | 2,942 | 2,165 |
| | | Specific Range/Altitude | 0.348/FL 100 | 0.483/FL 330 | 0.642/FL 390 |
| Missions (4 passengers) | **300 nm** | Runway | 907 | 3,504 | 2,350 |
| | | Flight Time | 1+42 | 1+03 | 0+53 |
| | | Fuel Used | 1,091 | 869 | 725 |
| | | Specific Range/Altitude | 0.275/FL 100 | 0.345/FL 250 | 0.414/FL 310 |
| | **600 nm** | Runway | 1,120 | 3,587 | 2,550 |
| | | Flight Time | 3+19 | 2+03 | 1+45 |
| | | Fuel Used | 2,123 | 1,494 | 1,220 |
| | | Specific Range/Altitude | 0.283/FL 100 | 0.402/FL 290 | 0.492/FL 350 |
| | **1,000 nm** | Runway | NP | 3,677 | 2,700 |
| | | Flight Time | NP | 3+28 | 3+05 |
| | | Fuel Used | NP | 2,147 | 1,672 |
| | | Specific Range/Altitude | NP/NP | 0.466/FL 330 | 0.598/FL 390 |
| | | Suggested Base Price | NA | NA | NA |
| Remarks | | Certification Basis | EASA/FAR 23, 2010 A57<br>**BCA* estimate. | FAR 23, 1973/80/2008/11<br>STC SA02131SE<br>Collins Pro Line Fusion standard;<br>Wi-Fi optional; autothrottles standard.<br>*Optional press'n. sched. | EASA 23, 2014; FAR 23, 2015<br>Includes Collins Pro Line 21 avionics; TCAS I; Iridium satcom; RVSM approved; optional 390-lb. capacity. |

# MULTIENGINE TURBOPROPS >12,500-LB. MTOW

| Manufacturer | | | Textron Aviation | Textron Aviation | Textron Aviation | Textron Aviation |
|---|---|---|---|---|---|---|
| Model | | | **SkyCourier (Freighter) CE-408** | **SkyCourier (Passenger) CE-408** | **Beechcraft King Air 360 B300** | **Beechcraft King Air 360ER B300ER** |
| ***BCA*** Equipped Price | | | $7,962,400 | $8,614,000 | $9,255,000 | $9,760,000 |
| Characteristics | | Seating | 1+1/11 | 1+19/19 | 1+9/11 | 1+9/11 |
| | | Wing Loading | 43.0 | 43.0 | 48.4 | 53.2 |
| | | Power Loading | 8.56 | 8.56 | 7.14 | 7.86 |
| | | Noise (dBA) | 84.6 | 84.6 | 72.9 | 81.5 |
| External Dimensions (ft.) | | Length | 55.1 | 55.1 | 46.7 | 46.7 |
| | | Height | 20.7 | 20.7 | 14.3 | 14.3 |
| | | Span | 72.3 | 72.3 | 57.9 | 57.9 |
| Internal Dimensions (ft.) | | **Length:** OA/Net | 23.3/23.3 | 23.3/19.5 | 19.5/19.5 | 19.5/19.5 |
| | | Height | 5.9 | 5.9 | 4.8 | 4.8 |
| | | **Width:** Max/Floor | 6.4/5.8 | 6.2/5.8 | 4.5/4.1 | 4.5/4.1 |
| Power | | Engines | 2 P&WC PT6A-65SC | 2 P&WC PT6A-65SC | 2 P&WC PT6A-60A | 2 P&WC PT6A-60A |
| | | Output (shp each)/Flat Rating | 1,110/ISA+35C | 1,110/ISA+35C | 1,050/ISA+10C | 1,050/ISA+10C |
| | | Inspection Interval | 6,000t | 6,000t | 3,600t | 3,600t |
| Weights (lb.) | | Max Ramp | 19,070 | 19,070 | 15,100 | 16,600 |
| | | Max Takeoff | 19,000 | 19,000 | 15,000 | 16,500 |
| | | Max Landing | 18,600 | 18,600 | 15,000 | 15,675 |
| | | Zero Fuel | 17,200c | 17,575c | 12,500c | 13,000c |
| | | BOW | 11,200 | 12,725 | 9,955 | 10,215 |
| | | Max Payload | 6,000 | 4,850 | 2,545 | 2,785 |
| | | Useful Load | 7,870 | 6,345 | 5,145 | 6,385 |
| | | Max Fuel | 4,826 | 4,926 | 3,611 | 5,192 |
| | | Available Payload w/Max Fuel | 3,044 | 1,419 | 1,534 | 1,193 |
| | | Available Fuel w/Max Payload | 1,870 | 1,495 | 2,600 | 3,600 |
| Limits | | MMO | 0.40 | 0.40 | 0.58 | 0.58 |
| | | Trans. Alt. FL/VMO | 120/210 | 120/210 | 210/263 | 240/245 |
| | | VA | NA | NA | 184 | 182 |
| | | PSI | — | — | 6.8 | 6.8 |
| Airport Performance | | TO (SL elev./ISA temp.) | 2,740* | 3,660* | 3,300 | 4,057 |
| | | TOFL (5,000-ft. elev.@25C) | 4,305* | 4,850* | 5,376 | 7,675 |
| | | Mission Weight | 19,000 | 19,000 | 14,196 | 16,100 |
| | | NBAA IFR Range | 797 | 792 | 1,549 | 2,257 |
| | | V2 | 98 | 98 | 109 | 111 |
| | | VREF | 96 | 96 | 100 | 104 |
| | | Landing Distance | 2,366 | 2,378 | 2,390 | 2,728 |
| Climb | | Time to Climb (min.)/Altitude | 37/FL 250 | 37/FL 250 | 15/FL 250 | 18/FL 250 |
| | | *FAR 25 Initial Engine-Out Rate (fpm) | 350 | 350 | 622 | 337 |
| | | FAR 25 Initial Engine-Out Gradient (ft./nm) | NA | NA | 304 | 182 |
| Ceilings (ft.) | | Certificated | 25,000 | 25,000 | 35,000 | 35,000 |
| | | All-Engine Service | 25,000 | 25,000 | 35,000 | 35,000 |
| | | Engine-Out Service | 13,900 | 13,900 | 21,500 | 17,100 |
| | | Sea-Level Cabin | — | — | 2,700 | 2,700 |
| Cruise | **Long Range** | TAS | 160 | 160 | 235 | 238 |
| | | Fuel Flow | 630 | 630 | 362 | 402 |
| | | Altitude | FL 120 | FL 120 | FL 330 | FL 330 |
| | | Specific Range | 0.254 | 0.254 | 0.649 | 0.592 |
| | **High Speed** | TAS | 210 | 210 | 312 | 303 |
| | | Fuel Flow | 1,020 | 1,020 | 773 | 764 |
| | | Altitude | FL 120 | FL 120 | FL 240 | FL 240 |
| | | Specific Range | 0.206 | 0.206 | 0.404 | 0.397 |
| NBAA IFR Ranges (100-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 100 | 85 | 896 | 1,316 |
| | | Average Speed | 189 | 182 | 273 | 261 |
| | | Trip Fuel | 609 | 533 | 1,891 | 2,880 |
| | | Specific Range/Altitude | 0.164/FL 120 | 0.159/FL 120 | 0.474/FL 350 | 0.457/FL 350 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 783 | 783 | 1,485 | 2,223 |
| | | Average Speed | 205 | 205 | 280 | 269 |
| | | Trip Fuel | 3,915 | 3,915 | 2,944 | 4,528 |
| | | Specific Range/Altitude | 0.200/FL 120 | 0.200/FL 120 | 0.504/FL 350 | 0.491/FL 350 |
| | **Full Fuel** (w/4 passengers) | Nautical Miles | 792 | 787 | 1,533 | 2,271 |
| | | Average Speed | 208 | 206 | 285 | 271 |
| | | Trip Fuel | 3,946 | 3,925 | 2,951 | 4,533 |
| | | Specific Range/Altitude | 0.201/FL 120 | 0.201/FL 120 | 0.519/FL 350 | 0.501/FL 350 |
| | **Ferry** | Nautical Miles | 795 | 790 | 1,560 | 2,338 |
| | | Average Speed | 207 | 207 | 289 | 276 |
| | | Trip Fuel | 3,956 | 3,936 | 2,958 | 4,543 |
| | | Specific Range/Altitude | 0.201/FL 120 | 0.201/FL 120 | 0.527/FL 350 | 0.515/FL 350 |
| Missions (4 passengers) | **300 nm** | Runway | 1,631 | 2,737 | 2,586 | 2,795 |
| | | Flight Time | 1+28 | 1+29 | 1+02 | 1+05 |
| | | Fuel Used | 1,545 | 1,538 | 881 | 919 |
| | | Specific Range/Altitude | 0.194/FL 120 | 0.195/FL 120 | 0.341/FL 250 | 0.326/FL 250 |
| | **600 nm** | Runway | 1,902 | 3,141 | 2,702 | 2,927 |
| | | Flight Time | 2+54 | 2+55 | 2+02 | 2+07 |
| | | Fuel Used | 3,007 | 3,005 | 1,470 | 1,529 |
| | | Specific Range/Altitude | 0.200/FL 120 | 0.200/FL 120 | 0.408/FL 290 | 0.392/FL 290 |
| | **1,000 nm** | Runway | NP | NP | 2,827 | 3,048 |
| | | Flight Time | NP | NP | 3+27 | 3+35 |
| | | Fuel Used | NP | NP | 2,102 | 2,195 |
| | | Specific Range/Altitude | NP/NP | NP/NP | 0.476/FL 330 | 0.456/FL 330 |
| | | Suggested Base Price | $7,750,000 | $8,350,000 | NA | NA |
| Remarks | | Certification Basis | FAR 23, 2022 A64 Normal category (Level 1) Garmin G1000 NXi; 800-lb. payload for *BCA* missions. *AE TOD 50-ft. obstacle. | FAR 23, 2022 A64 Normal category (Level 4) Garmin G1000 NXi. *OEI TOFL 35-ft. obstacle. | FAR 23, 1989 Commuter category Collins Pro Line Fusion MultiScan Radar and iTAWS; Wi-Fi optional; RVSM app'd.; also available as 350HW with 16,500-lb. MTOW, 15,675-lb. MLW; autothrottles standard. | FAR 23, 1989/2007 Commuter category Collins Pro Line Fusion MultiScan Radar and iTAWS; Wi-Fi optional; RVSM approved; autothrottles standard. |

## JETS <10,000-LB. MTOW

| Manufacturer | | | Cirrus Design |
|---|---|---|---|
| Model | | | Vision G2+<br>SF-50 |
| ***BCA*** Equipped Price | | | $3,290,000 |
| Characteristics | | Seating | 1+4/6 |
| | | Wing Loading | 30.7 |
| | | Power Loading | 3.25 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | 79.6/70.9/80.3 |
| External Dimensions (ft.) | | Length | 30.7 |
| | | Height | 10.9 |
| | | Span | 38.7 |
| Internal Dimensions (ft.) | | **Length:** OA/Net | 11.5/9.8 |
| | | Height/Dropped Aisle Depth | 4.1/NA |
| | | **Width:** Max/Floor | 5.1/3.1 |
| Baggage | | **Internal:** Cu. ft./lb. | 24/NA |
| | | **External:** Cu. ft./lb. | 30/NA |
| Power | | Engine(s) | 1 Wms Intl<br>FJ33-5A |
| | | Output (lb. each)/Flat Rating | 1,846/ISA+10C |
| | | Inspection Interval/Manu. Service Plan Interval | 4,000t/— |
| Weights (lb.) | | Max Ramp | 6,040 |
| | | Max Takeoff | 6,000 |
| | | Max Landing | 5,550 |
| | | Zero Fuel | 4,900c |
| | | BOW | 3,860 |
| | | Max Payload | 1,040 |
| | | Useful Load | 2,180 |
| | | Max Fuel | 2,000 |
| | | Available Payload w/Max Fuel | 180 |
| | | Available Fuel w/Max Payload | 1,140 |
| Limits | | MMO | 0.530 |
| | | Trans. Alt. FL/VMO | FL 183/250 |
| | | PSI | 7.1 |
| Airport Performance | | TOFL (SL elev./ISA temp.) | 1,920 |
| | | TOFL (5,000-ft. elev.@25C) | 3,045 |
| | | Mission Weight | 6,000 |
| | | NBAA IFR Range | 1,098 |
| | | V2 | 91 |
| | | VREF | 87 |
| | | Landing Distance | 1,628 |
| Climb | | Time to Climb/Altitude | 23/310 |
| | | FAR 25 Engine-Out Rate (fpm) | NA |
| | | FAR 25 Engine-Out Gradient (ft./nm) | NA |
| Ceilings (ft.) | | Certificated | 31,000 |
| | | All-Engine Service | 31,000 |
| | | Engine-Out Service | — |
| | | Sea-Level Cabin | NA |
| Cruise | **Long Range** | TAS | 259 |
| | | Fuel Flow | 300 |
| | | Altitude | FL 310 |
| | | Specific Range | 0.863 |
| | **High Speed** | TAS | 305 |
| | | Fuel Flow | 384 |
| | | Altitude | FL 310 |
| | | Specific Range | 0.794 |
| NBAA IFR Ranges (100-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 461 |
| | | Average Speed | 233 |
| | | Trip Fuel | 745 |
| | | Specific Range/Altitude | 0.619/FL 310 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 1,171 |
| | | Average Speed | 233 |
| | | Trip Fuel | 1,611 |
| | | Specific Range/Altitude | 0.727/FL 310 |
| | **Four Passengers** (w/available fuel) | Nautical Miles | 622 |
| | | Average Speed | 233 |
| | | Trip Fuel | 941 |
| | | Specific Range/Altitude | 0.661/FL 310 |
| | **Ferry** | Nautical Miles | 1,220 |
| | | Average Speed | 233 |
| | | Trip Fuel | 1,760 |
| | | Specific Range/Altitude | 0.693/FL 310 |
| Missions (4 passengers) | **300 nm** | Runway | 1,867 |
| | | Flight Time | 1+12 |
| | | Fuel Used | 548 |
| | | Specific Range/Altitude | 0.547/FL 310 |
| | **600 nm** | Runway | 2,036 |
| | | Flight Time | 2+36 |
| | | Fuel Used | 914 |
| | | Specific Range/Altitude | 0.656/FL 310 |
| | **1,000 nm** | Runway | 2,437 |
| | | Flight Time | 4+18 |
| | | Fuel Used | 1,401 |
| | | Specific Range/Altitude | 0.714/FL 310 |
| Remarks | | Certification Basis | FAR 23, 2016/18 Garmin Perspective Touch+ avionics; RVSM standard; Safe Return emergency autoland; Cirrus IQ standard. |

## JETS <20,000-LB. MTOW

| Manufacturer | | | Nextant Aerospace | Embraer |
|---|---|---|---|---|
| Model | | | Nextant 400 XTi<br>BE 400A | Phenom 100 EX<br>EMB-500 |
| ***BCA*** Equipped Price | | | $4,650,000 | $5,495,000 |
| Characteristics | | Seating | 2+7/9/9 | 1+7/7/7 |
| | | Wing Loading/Power Loading | 67.6/2.67 | 53.1/3.09 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | 76.9/91.5/88.8 | 81.6/70.8/86.1 |
| External Dimensions (ft.) | | Length | 48.4 | 42.1 |
| | | Height | 13.9 | 14.3 |
| | | Span | 43.5 | 40.4 |
| Internal Dimensions (ft.) | | **Length:** Main Seating/Net/Gross | 15.5/15.5/— | 11.0/11.0/11.0 |
| | | Height/Dropped Aisle Depth | 4.8/flat floor | 4.9/0.3 |
| | | **Width:** Max/Floor | 4.9/4.0 | 5.1/3.6 |
| Baggage | | **Internal:** Cu. ft./lb. | 27/410 | 4/26 |
| | | **External:** Cu. ft./lb. | 26/450 | 60/419 |
| Power | | Engines | 2 Wms Intl<br>FJ44-3AP | 2 P&WC<br>PW 617F1-E |
| | | Output (lb. each)/Flat Rating | 3,052/ISA+7C | 1,730/ISA+8C |
| | | Inspection Interval/Manu. Service Plan Interval | 5,000t/— | 3,500t/— |
| Weights (lb.) | | Max Ramp | 16,500 | 10,748 |
| | | Max Takeoff | 16,300 | 10,703 |
| | | Max Landing | 15,700 | 9,998 |
| | | Zero Fuel | 13,000c | 9,072c |
| | | BOW | 10,950 | 7,297 |
| | | Max Payload | 2,050 | 1,775 |
| | | Useful Load | 5,550 | 3,451 |
| | | Max Fuel | 4,912 | 2,804 |
| | | Available Payload w/Max Fuel | 638 | 647 |
| | | Available Fuel w/Max Payload | 3,500 | 1,676 |
| Limits | | MMO | 0.780 | 0.700 |
| | | Trans. Alt. FL/VMO | FL 290/320 | FL 280/275 |
| | | PSI/Sea-Level Cabin | 9.1/24,000 | 8.3/21,280 |
| Airport Performance | | TOFL (SL elev./ISA temp.) | 3,821 | 3,190 |
| | | TOFL (5,000-ft. elev.@25C) | 5,088 | 5,663 |
| | | Mission Weight | 14,500p | 10,703 |
| | | NBAA IFR Range | 1,197 | 1,113 |
| | | V2 | 116 | 99 |
| | | VREF | 105 | 95 |
| | | Landing Distance | 2,960 | 2,473 |
| Climb | | Time to Climb/Altitude | 16/FL 370 | 19/FL 370 |
| | | FAR 25 Engine-Out Rate (fpm) | 305 | 747 |
| | | FAR 25 Engine-Out Gradient (ft./nm) | 158 | 453 |
| Ceilings (ft.) | | Certificated | 45,000 | 41,000 |
| | | All-Engine Service | 45,000 | 41,000 |
| | | Engine-Out Service | 27,500 | 24,045 |
| Cruise | **Long Range** | TAS/Fuel Flow (lb./hr.) | 406/740 | 340/543 |
| | | Altitude/Specific Range | FL 450/0.549 | FL 410/0.626 |
| | **High Speed** | TAS/Fuel Flow (lb./hr.) | 447/968 | 406/955 |
| | | Altitude/Specific Range | FL 430/0.462 | FL 330/0.425 |
| NBAA IFR Ranges (FAR Part 23, 100-nm alternate; FAR Part 25, 200-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 1,024 | 466 |
| | | Average Speed | 367 | 325 |
| | | Trip Fuel | 2,411 | 1,036 |
| | | Specific Range/Altitude | 0.425/FL 450 | 0.450/FL 410 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 1,895 | 1,194 |
| | | Average Speed | 384 | 333 |
| | | Trip Fuel | 3,953 | 2,196 |
| | | Specific Range/Altitude | 0.479/FL 450 | 0.544/FL 410 |
| | **Four Passengers** (w/available fuel) | Nautical Miles | 1,801 | 1,092 |
| | | Average Speed | 383 | 333 |
| | | Trip Fuel | 3,706 | 2,038 |
| | | Specific Range/Altitude | 0.486/450 | 0.536/FL 410 |
| | **Ferry** | Nautical Miles | 1,981 | 1,254 |
| | | Average Speed | 381 | 329 |
| | | Trip Fuel | 3,986 | 2,220 |
| | | Specific Range/Altitude | 0.497/FL 450 | 0.565/FL 410 |
| Missions (4 passengers) | **300 nm** | Runway | 3,015 | 2,909 |
| | | Flight Time | 0+48 | 0+53 |
| | | Fuel Used | 786 | 753 |
| | | Specific Range/Altitude | 0.382/FL 390 | 0.398/FL 390 |
| | **600 nm** | Runway | 3,044 | 3,121 |
| | | Flight Time | 1+30 | 1+45 |
| | | Fuel Used | 1,323 | 1,236 |
| | | Specific Range/Altitude | 0.454/FL 430 | 0.485/FL 390 |
| | **1,000 nm** | Runway | 3,101 | 3,179 |
| | | Flight Time | 2+28 | 2+54 |
| | | Fuel Used | 2,145 | 1,919 |
| | | Specific Range/Altitude | 0.466/FL 450 | 0.521/FL 410 |
| Remarks | | Certification Basis | FAR 25, 1981/85<br>STC 02371LA<br>STC 10959SC<br>STC 03960AT | FAR 23, 2008 |

# JETS <20,000-LB. MTOW

| Manufacturer | | | Textron Aviation | Honda Aircraft Co. | Textron Aviation | Textron Aviation | Embraer | Pilatus Aircraft |
|---|---|---|---|---|---|---|---|---|
| Model | | | **Citation M2 Gen2 CE-525** | **HondaJet Elite II HA-420** | **Citation CJ3+ CE-525B** | **Citation CJ4 Gen2 CE-525C** | **Phenom 300E EMB-505** | **PC-24** |
| ***BCA*** Equipped Price | | | $6,150,000 | $7,170,000 | $10,415,000 | $11,855,000 | $12,495,000 | $13,510,000 |
| Characteristics | | Seating | 1+7/7/7 | 1+5/7/7 | 1+8/9/9 | 1+9/10/10 | 1+7/10/10 | 1+8/10/10 |
| | | Wing Loading/Power Loading | 44.6/2.72 | 62.9/2.71 | 47.2/2.46 | 51.8/2.36 | 60.5/2.67 | 56.0/2.74 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | 85.9/73.2/88.5 | 85.5/73.1/87.4 | 88.7/74.0/88.6 | 92.8/75.6/89.5 | 89.2/70.6/88.9 | 90.3/79.2/92.1 |
| External Dimensions (ft.) | | Length | 42.6 | 42.6 | 51.2 | 53.3 | 51.2 | 55.2 |
| | | Height | 13.9 | 14.9 | 15.2 | 15.4 | 16.7 | 17.3 |
| | | Span | 47.3 | 39.8 | 53.3 | 50.8 | 52.2 | 55.8 |
| Internal Dimensions (ft.) | | **Length:** Main Seating/Net/Gross | 8.8/11.0/11.0 | 12.1/12.1/NA | 12.3/15.7/15.7 | 12.9/17.3/17.3 | 14.8/17.2/17.2 | 17.0/17.0/23.0 |
| | | Height/Dropped Aisle Depth | 4.8/0.4 | 4.8/NA | 4.8/0.4 | 4.8/0.4 | 4.9/0.3 | 5.1/flat floor |
| | | **Width:** Max/Floor | 4.8/3.1 | 5.0/NA | 4.8/3.1 | 4.8/3.3 | 5.1/3.6 | 5.6/3.8 |
| Baggage | | **Internal:** Cu. ft./lb. | —/— | NA/NA | —/— | 7/40 | 10/77 | 90/530 |
| | | **External:** Cu. ft./lb. | 46/725 | 62/750 | 65/1,000 | 71/1,000 | 74/573 | NA/NA |
| Power | | Engines | 2 Wms Intl FJ44-1AP-21 | 2 GE Honda HF-120-H1A | 2 Wms Intl FJ44-3A | 2 Wms Intl FJ44-4A | 2 P&WC PW 535E1 | 2 Wms Intl FJ44-4A-QPM |
| | | Output (lb. each)/Flat Rating | 1,965/ISA+7C | 2,050/ISA+10C | 2,820/ISA+11C | 3,621/ISA+11C | 3,478/ISA+15C | 3,420/ISA+23C |
| | | Inspection Interval/Manu. Service Plan Interval | 3,500t/5,000 | 5,000t*/— | 4,000t/5,000 | 5,000t/5,000 | 5,000t/— | 5,000t/5,000 |
| Weights (lb.) | | Max Ramp | 10,800 | 11,180 | 14,070 | 17,230 | 18,618 | 18,840 |
| | | Max Takeoff | 10,700 | 11,100 | 13,870 | 17,110 | 18,552 | 18,740 |
| | | Max Landing | 9,900 | 10,360 | 12,750 | 15,660 | 17,273 | 17,340 |
| | | Zero Fuel | 8,500c | 9,300c | 10,675c | 12,500c | 14,264c | 14,660c |
| | | BOW | 6,990 | 7,422 | 8,540 | 10,280 | 11,628 | 11,561 |
| | | Max Payload | 1,510 | 1,878 | 2,135 | 2,220 | 2,636 | 3,099 |
| | | Useful Load | 3,810 | 3,758 | 5,530 | 6,950 | 6,990 | 7,279 |
| | | Max Fuel | 3,296 | 3,138 | 4,710 | 5,828 | 5,404 | 5,965 |
| | | Available Payload w/Max Fuel | 514 | 620 | 820 | 1,122 | 1,586 | 1,314 |
| | | Available Fuel w/Max Payload | 2,300 | 1,880 | 3,395 | 4,730 | 4,354 | 4,180 |
| Limits | | MMO | 0.710 | 0.720 | 0.737 | 0.770 | 0.800 | 0.740 |
| | | Trans. Alt. FL/VMO | FL 305/263 | FL 302/270 | FL 293/278 | FL 279/305 | FL 276/320 | FL 280/290 |
| | | PSI/Sea-Level Cabin | 8.5/22,027 | 8.8/23,060 | 8.9/23,586 | 9.0/24,005 | 9.4/25,560 | 9.3/25,100 |
| Airport Performance | | TOFL (SL elev./ISA temp.) | 3,210 | 3,699 | 3,180 | 3,410 | 3,209 | 3,090 |
| | | TOFL (5,000-ft. elev.@25C) | 5,580 | 5,637 | 4,750 | 5,180 | 5,374 | 5,600 |
| | | Mission Weight | 10,700 | 11,100 | 13,870 | 16,788 | 18,552 | 18,326 |
| | | NBAA IFR Range | 1,204 | 1,380 | 1,918 | 2,109 | 2,033 | 2,125 |
| | | V2 | 111 | 117 | 114 | 117 | 111 | 108 |
| | | VREF | 101 | 108 | 98 | 98 | 103 | 90 |
| | | Landing Distance | 2,340 | 2,912 | 2,394 | 2,450 | 2,212 | 2,120 |
| Climb | | Time to Climb/Altitude | 18/FL 370 | 16/FL 370 | 15/FL 370 | 14/FL 370 | 14/FL 370 | 14/FL 370 |
| | | FAR 25 Engine-Out Rate (fpm) | 618 | 634 | 808 | 839 | 872 | 665 |
| | | FAR 25 Engine-Out Gradient (ft./nm) | 334 | 284 | 425 | 430 | 471 | 379 |
| Ceilings (ft.) | | Certificated | 41,000 | 43,000 | 45,000 | 45,000 | 45,000 | 45,000 |
| | | All-Engine Service | 41,000 | 43,000 | 45,000 | 45,000 | 45,000 | 45,000 |
| | | Engine-Out Service | 26,800 | 26,400 | 26,250 | 28,200 | 30,137 | 29,100 |
| Cruise | **Long Range** | TAS/Fuel Flow (lb./hr.) | 323/516 | 360/543 | 352/624 | 377/812 | 385/783 | 372/837 |
| | | Altitude/Specific Range | FL 410/0.626 | FL 430/0.663 | FL 450/0.564 | FL 450/0.464 | FL 450/0.492 | FL 450/0.444 |
| | **High Speed** | TAS/Fuel Flow (lb./hr.) | 401/920 | 419/999 | 415/1,197 | 442/1,470 | 464/1,549 | 436/1,513 |
| | | Altitude/Specific Range | FL 350/0.436 | FL 330/0.419 | FL 350/0.347 | FL 370/0.301 | FL 350/0.300 | FL 330/0.288 |
| NBAA IFR Ranges (FAR Part 23, 100-nm alternate; FAR Part 25, 200-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 751 | 612 | 1,080 | 1,425 | 1,381 | 1,168 |
| | | Average Speed | 358 | 332 | 366 | 407 | 397 | 377 |
| | | Trip Fuel | 1,600 | 1,255 | 2,381 | 3,753 | 3,369 | 3,099 |
| | | Specific Range/Altitude | 0.469/FL 410 | 0.488/FL 430 | 0.454/FL 450 | 0.380/FL 450 | 0.410/FL 450 | 0.377/FL 450 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 1,357 | 1,523 | 1,814 | 1,913 | 1,932 | 1,945 |
| | | Average Speed | 372 | 347 | 377 | 413 | 393 | 388 |
| | | Trip Fuel | 2,675 | 2,601 | 3,846 | 4,904 | 4,450 | 4,978 |
| | | Specific Range/Altitude | 0.507/FL 410 | 0.586/FL 430 | 0.472/FL 450 | 0.390/FL 450 | 0.434/FL 450 | 0.391/FL 450 |
| | **Four Passengers** (w/available fuel) | Nautical Miles | 1,183 | 1,358 | 1,825 | 1,927 | 2,010 | 2,003 |
| | | Average Speed | 370 | 346 | 376 | 416 | 387 | 393 |
| | | Trip Fuel | 2,352 | 2,366 | 3,767 | 4,920 | 4,471 | 5,095 |
| | | Specific Range/Altitude | 0.503/FL 410 | 0.574/FL 430 | 0.484/FL 450 | 0.392/FL 450 | 0.450/FL 450 | 0.393/FL 450 |
| | **Ferry** | Nautical Miles | 1,400 | 1,605 | 1,900 | 1,955 | 2,094 | 2,172 |
| | | Average Speed | 378 | 344 | 383 | 420 | 380 | 359 |
| | | Trip Fuel | 2,705 | 2,622 | 3,872 | 4,955 | 4,498 | 5,122 |
| | | Specific Range/Altitude | 0.518/FL 410 | 0.612/FL 430 | 0.491/FL 450 | 0.395/FL 450 | 0.466/FL 450 | 0.424/FL 450 |
| Missions (4 passengers) | **300 nm** | Runway | 2,625 | 3,372 | 2,608 | 2,669 | 2,899 | 2,280 |
| | | Flight Time | 0+52 | 0+53 | 0+49 | 0+46 | 0+49 | 0+50 |
| | | Fuel Used | 804 | 715 | 969 | 1,087 | 998 | 956 |
| | | Specific Range/Altitude | 0.373/FL 370 | 0.420/FL 390 | 0.310/FL 370 | 0.276/FL 390 | 0.301/FL 390 | 0.314/FL 450 |
| | **600 nm** | Runway | 2,692 | 3,413 | 2,609 | 2,715 | 2,868 | 2,315 |
| | | Flight Time | 1+38 | 1+40 | 1+35 | 1+27 | 1+29 | 1+34 |
| | | Fuel Used | 1,362 | 1,185 | 1,571 | 1,865 | 1,653 | 1,666 |
| | | Specific Range/Altitude | 0.441/FL 390 | 0.506/FL 430 | 0.382/FL 410 | 0.322/FL 410 | 0.363/FL 410 | 0.360/FL 450 |
| | **1,000 nm** | Runway | 3,009 | 3,473 | 2,720 | 2,770 | 2,831 | 2,355 |
| | | Flight Time | 2+42 | 2+43 | 2+36 | 2+23 | 2+24 | 2+33 |
| | | Fuel Used | 2,018 | 1,872 | 2,315 | 2,747 | 2,533 | 2,625 |
| | | Specific Range/Altitude | 0.496/FL 410 | 0.534/FL 430 | 0.432/FL 430 | 0.364/FL 430 | 0.395/FL 450 | 0.381/FL 450 |
| Remarks | | Certification Basis | FAR 23, 2013 | FAR 23, 2015/2019<br>*Mature TBO. | FAR 23, 2004/14<br>Commuter category<br>Garmin G3000 avionics. | FAR 23, 2010<br>Commuter category | FAR 23, 2009/20<br>Commuter category | EASA CS-23, 2017/23;<br>FAR 23, 2018/23<br>SN 501 and above approved for unpaved runway operations. |

## JETS ≥20,000-LB. MTOW

| Manufacturer | | | Textron Aviation | Embraer | Textron Aviation | Embraer | Gulfstream Aerospace |
|---|---|---|---|---|---|---|---|
| Model | | | **Citation XLS+ Gen2 CE-560XL** | **Praetor 500 EMB-545** | **Citation Latitude CE-680A** | **Praetor 600 EMB-550** | **Gulfstream 280 G280** |
| ***BCA*** Equipped Price | | | $16,110,000 | $19,995,000 | $19,995,000 | $23,295,000 | $24,500,000 |
| Characteristics | | Seating | 2+9/12/12 | 2+7/9/9 | 2+9/9/9 | 2+8/12/12 | 2+9/10/19 |
| | | Wing Loading/Power Loading | 54.6/2.47 | 77.7/2.87 | 56.8/2.61 | 88.7/2.85 | 80.0/2.60 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | 86.8/72.3/92.8 | 84.1/73.5/89.9 | 87.7/73.5/87.7 | 86.9/75.1/90.3 | 89.5/75.2/90.5 |
| External Dimensions (ft.) | | Length | 52.5 | 64.6 | 62.3 | 68.1 | 66.8 |
| | | Height | 17.2 | 21.1 | 20.9 | 21.2 | 21.3 |
| | | Span | 56.3 | 70.5 | 72.3 | 70.5 | 63.0 |
| Internal Dimensions (ft.) | | **Length:** Main Seating/Net/Gross | 14.3/18.5/18.5 | 17.4/20.6/24.0 | 15.9/21.8/21.8 | 21.3/24.1/27.5 | 17.7/25.8/32.3 |
| | | Height/Dropped Aisle Depth | 5.7/0.7 | 6.0/flat floor | 6.0/flat floor | 6.0/flat floor | 6.1/4.5 |
| | | **Width:** Max/Floor | 5.5/3.9 | 6.8/4.7 | 6.4/4.1 | 6.8/4.7 | 6.9/5.4 |
| Baggage | | **Internal:** Cu. ft./lb. | 10/100 | 40/418 | 27/245 | 45/418 | 154/1,980 |
| | | **External:** Cu. ft./lb. | 80/700 | 110/880 | 100/1,000 | 110/880 | —/— |
| Power | | Engines | 2 P&WC PW545C | 2 Hon HTF7500E | 2 P&WC PW306D1 | 2 Hon HTF7500E | 2 Hon HTF7250G |
| | | Output (lb. each)/Flat Rating | 4,119/ISA+10C | 6,540/ISA+18C | 5,907/ISA+15C | 7,528/ISA+18C | 7,624/ISA+17C |
| | | Inspection Interval/Manu. Service Plan Interval | 5,000t/— | OC/— | 6,000t/— | OC/— | OC/— |
| Weights (lb.) | | Max Ramp | 20,530 | 37,699 | 31,050 | 42,990 | 39,750 |
| | | Max Takeoff | 20,330 | 37,567 | 30,800 | 42,857 | 39,600 |
| | | Max Landing | 18,700 | 34,172 | 27,575 | 37,478 | 32,700 |
| | | Zero Fuel | 15,360c | 25,959c | 21,430c | 28,660 | 28,200c |
| | | BOW | 12,990 | 23,038 | 18,656 | 24,658 | 24,200 |
| | | Max Payload | 2,370 | 2,921 | 2,774 | 4,002 | 4,000 |
| | | Useful Load | 7,540 | 14,661 | 12,394 | 18,332 | 15,550 |
| | | Max Fuel | 6,740 | 13,051 | 11,394 | 16,138 | 14,600 |
| | | Available Payload w/Max Fuel | 800 | 1,610 | 1,000 | 2,194 | 950 |
| | | Available Fuel w/Max Payload | 5,170 | 11,740 | 9,620 | 14,330 | 11,550 |
| Limits | | MMO | 0.750 | 0.830 | 0.800 | 0.830 | 0.850 |
| | | Trans. Alt. FL/VMO | FL 265/305 | FL 295/320 | FL 298/305 | FL 295/320 | FL 280/340 |
| | | PSI/Sea-Level Cabin | 9.3/25,230 | 9.7/27,140 | 9.7/26,800 | 9.7/27,140 | 9.2/25,000 |
| Airport Performance | | TOFL (SL elev./ISA temp.) | 3,600 | 4,222 | 3,580 | 4,717 | 4,750 |
| | | TOFL (5,000-ft. elev.@25C) | 5,500 | 5,692 | 5,070 | 6,431 | 7,320 |
| | | Mission Weight | 20,330 | 37,567 | 30,675 | 42,857 | 39,600 |
| | | NBAA IFR Range | 2,019 | 3,412 | 2,700 | 4,040 | 3,700 |
| | | V2 | 118 | 119 | 115 | 128 | 137 |
| | | VREF | 106 | 101 | 95 | 104 | 115 |
| | | Landing Distance | 2,710 | 2,086 | 2,085 | 2,165 | 2,365 |
| Climb | | Time to Climb/Altitude | 16/FL 370 | 14/FL 370 | 16/FL 370 | 13/FL 370 | 14/FL 370 |
| | | FAR 25 Engine-Out Rate (fpm) | 741 | 743 | 652 | 777 | 680 |
| | | FAR 25 Engine-Out Gradient (ft./nm) | 377 | 375 | 340 | 364 | 298 |
| Ceilings (ft.) | | Certificated | 45,000 | 45,000 | 45,000 | 45,000 | 45,000 |
| | | All-Engine Service | 45,000 | 43,000 | 43,000 | 43,000 | 44,100 |
| | | Engine-Out Service | 28,400 | 27,513 | 27,620 | 28,189 | 28,000 |
| Cruise | **Long Range** | TAS/Fuel Flow (lb./hr.) | 353/865 | 426/1,352 | 368/1,114 | 433/1,449 | 459/1,522 |
| | | Altitude/Specific Range | FL 450/0.408 | FL 450/0.315 | FL 430/0.330 | FL 450/0.299 | FL 450/0.302 |
| | **High Speed** | TAS/Fuel Flow (lb./hr.) | 431/1,238 | 469/2,018 | 432/1,765 | 466/1,826 | 482/1,877 |
| | | Altitude/Specific Range | FL 410/0.348 | FL 390/0.232 | FL 390/0.245 | FL 430/0.255 | FL 410/0.257 |
| NBAA IFR Ranges (FAR Part 23, 100-nm alternate; FAR Part 25, 200-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 1,175 | 2,819 | 2,135 | 3,277 | 2,628 |
| | | Average Speed | 353 | 423 | 394 | 426 | 447 |
| | | Trip Fuel | 3,533 | 9,963 | 7,901 | 12,600 | 9,667 |
| | | Specific Range/Altitude | 0.333/FL 430 | 0.283/FL 450 | 0.270/FL 450 | 0.260/FL 450 | 0.272/FL 450 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 1,877 | 3,282 | 2,645 | 3,878 | 3,688 |
| | | Average Speed | 349 | 419 | 401 | 425 | 451 |
| | | Trip Fuel | 5,175 | 11,322 | 9,586 | 14,357 | 12,837 |
| | | Specific Range/Altitude | 0.363/FL 430 | 0.290/FL 450 | 0.276/FL 450 | 0.270/FL 450 | 0.287/FL 450 |
| | **Four Passengers** (w/available fuel) | Nautical Miles | 1,877 | 3,340 | 2,678 | 4,018 | 3,703 |
| | | Average Speed | 349 | 417 | 401 | 423 | 451 |
| | | Trip Fuel | 5,175 | 11,342 | 9,594 | 14,404 | 12,843 |
| | | Specific Range/Altitude | 0.363/FL 430 | 0.294/FL 450 | 0.279/FL 450 | 0.279/FL 450 | 0.288/FL 450 |
| | **Ferry** | Nautical Miles | 1,982 | 3,416 | 2,731 | 4,102 | 3,787 |
| | | Average Speed | 345 | 417 | 405 | 421 | 451 |
| | | Trip Fuel | 5,275 | 11,357 | 9,628 | 14,436 | 12,872 |
| | | Specific Range/Altitude | 0.376/FL 430 | 0.301/FL 450 | 0.284/FL 450 | 0.284/FL 450 | 0.294/FL 450 |
| Missions (4 passengers) | **300 nm** | Runway | 2,732 | 2,673 | 2,760 | 2,745 | 2,860 |
| | | Flight Time | 0+47 | 0+48 | 0+46 | 0+46 | 0+47 |
| | | Fuel Used | 1,229 | 1,564 | 1,610 | 1,558 | 1,405 |
| | | Specific Range/Altitude | 0.244/FL 430 | 0.192/FL 430 | 0.186/FL 390 | 0.193/FL 450 | 0.214/FL 450 |
| | **600 nm** | Runway | 2,781 | 2,690 | 2,845 | 2,746 | 2,885 |
| | | Flight Time | 1+29 | 1+28 | 1+29 | 1+26 | 1+26 |
| | | Fuel Used | 2,079 | 2,494 | 2,573 | 2,580 | 2,309 |
| | | Specific Range/Altitude | 0.289/FL 430 | 0.241/FL 450 | 0.233/FL 430 | 0.233/FL 450 | 0.260/FL 450 |
| | **1,000 nm** | Runway | 3,064 | 2,858 | 2,951 | 2,810 | 3,020 |
| | | Flight Time | 2+26 | 2+21 | 2+25 | 2+18 | 2+18 |
| | | Fuel Used | 3,216 | 3,802 | 3,989 | 3,969 | 3,539 |
| | | Specific Range/Altitude | 0.311/FL 430 | 0.263/FL 450 | 0.251/FL 430 | 0.252/FL 450 | 0.283/FL 450 |
| Remarks | | Certification Basis | FAR 25, 1998/2004/08/22 | RBAC/FAR 25, 2015/19; EASA CS-25, 2015/19 Mod: DCA 0550-000-00100-2018 | FAR 25, 2015 Garmin G5000. | RBAC/FAR/EASA CS-25, 2014/19; ANAC, 2019 Mod: DCA 0550-000-00026-2016 | FAR 25, 2012; EASA CS-25, 2013 |

## JETS ≥20,000-LB. MTOW

| Manufacturer | | | Bombardier | Textron Aviation | Bombardier | Dassault | Dassault |
|---|---|---|---|---|---|---|---|
| Model | | | Challenger 3500<br>BD-100-1A10 | Citation Longitude<br>CE-700 | Challenger 650<br>CL-600-2B16 | Falcon 2000LXS<br>Falcon 2000EX | Falcon 900LX<br>Falcon 900EX |
| ***BCA*** **Equipped Price** | | | $27,700,000 | $29,995,000 | $33,300,000 | $37,000,000 | $45,000,000 |
| Characteristics | | Seating | 2+9/11/19 | 2+8/12/12 | 2+12/13/19 | 2+8/10/19 | 2+12/12/19 |
| | | Wing Loading/Power Loading | 77.6/2.77 | 73.5/2.58 | 98.6/2.61 | 81.2/3.06 | 92.9/3.27 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | 87.6/75.3/89.6 | 88.4/72.9/89.9 | 86.2/81.2/90.3 | 91.7/76.4/90.5 | 90.3/78.2/92.1 |
| External Dimensions (ft.) | | Length | 68.7 | 73.2 | 68.4 | 66.3 | 66.3 |
| | | Height | 20.0 | 19.4 | 20.7 | 23.3 | 25.2 |
| | | Span | 69.0 | 68.9 | 64.3 | 70.2 | 70.2 |
| Internal Dimensions (ft.) | | **Length:** Main Seating/Net/Gross | 16.6/25.2/28.6 | 16.5/25.2/28.1 | 15.4/25.6/28.3 | 17.1/26.2/31.0 | 23.5/33.2/39.3 |
| | | Height/Dropped Aisle Depth | 6.0/flat floor | 6.0/flat floor | 6.0/flat floor | 6.2/flat floor | 6.2/flat floor |
| | | **Width:** Max/Floor | 7.2/5.1 | 6.4/4.1 | 7.9/6.9 | 7.7/6.3 | 7.7/6.3 |
| Baggage | | **Internal:** Cu. ft./lb. | 106/750 | 112/1,115 | 112/900 | 131/1,600 | 127/2,866 |
| | | **External:** Cu. ft./lb. | —/— | NA/NA | —/— | 8/92 | —/— |
| Power | | Engines | 2 Hon<br>HTF 7350 | 2 Hon<br>HTF7700L | 2 GE<br>CF34-3B | 2 P&WC<br>PW308C | 3 Hon<br>TFE731-60 |
| | | Output (lb. each)/Flat Rating | 7,323/ISA+15C | 7,665/ISA+19C | 9,220*/ISA+15C | 7,000/ISA+15C | 5,000/ISA+17C |
| | | Inspection Interval/Manu. Service Plan Interval | OC/— | OC/— | OC/— | 7,000c/— | 6,000c/— |
| Weights (lb.) | | Max Ramp | 40,750 | 39,700 | 48,300 | 43,000 | 49,200 |
| | | Max Takeoff | 40,600 | 39,500 | 48,200 | 42,800 | 49,000 |
| | | Max Landing | 34,150 | 33,500 | 38,000 | 39,300 | 44,500 |
| | | Zero Fuel | 28,200c | 26,800c | 32,000c | 29,700c | 30,864c |
| | | BOW | 24,800 | 23,600 | 27,150 | 24,750 | 26,750 |
| | | Max Payload | 3,400 | 3,200 | 4,850 | 4,950 | 4,114 |
| | | Useful Load | 15,950 | 16,100 | 21,150 | 18,250 | 22,450 |
| | | Max Fuel | 14,045 | 14,500 | 19,852 | 16,660 | 20,905 |
| | | Available Payload w/Max Fuel | 1,905 | 1,600 | 1,298 | 1,590 | 1,545 |
| | | Available Fuel w/Max Payload | 12,550 | 12,900 | 16,300 | 13,300 | 18,336 |
| Limits | | MMO | 0.830 | 0.840 | 0.850 | 0.862 | 0.870 |
| | | Trans. Alt. FL/VMO | FL 295/320 | FL 293/325 | FL 222/348 | FL 250/370 | FL 250/370 |
| | | PSI/Sea-Level Cabin | 8.8/23,338 | 9.7/26,800 | 8.8/23,000 | 9.3/25,300 | 9.6/25,300 |
| Airport Performance | | TOFL (SL elev./ISA temp.) | 4,835 | 4,810 | 5,640 | 4,675 | 5,360 |
| | | TOFL (5,000-ft. elev.@25C) | 6,809 | 6,810 | 9,025 | 6,840 | 7,615 |
| | | Mission Weight | 40,600 | 38,725 | 48,200 | 42,010 | 48,255 |
| | | NBAA IFR Range | 3,400 | 3,500 | 4,044 | 4,100 | 4,685 |
| | | V2 | 133 | 136 | 147 | 127 | 134 |
| | | VREF | 111 | 110 | 117 | 106 | 111 |
| | | Landing Distance | 2,303 | 2,595 | 2,368 | 2,295 | 2,455 |
| Climb | | Time to Climb/Altitude | 14/FL 370 | 13/FL 370 | 21/FL 370 | 17/FL 370 | 19/FL 370 |
| | | FAR 25 Engine-Out Rate (fpm) | NA | 1,330 | NA | 463 | 723 |
| | | FAR 25 Engine-Out Gradient (ft./nm) | NA | 456 | NA | 221 | 324 |
| Ceilings (ft.) | | Certificated | 45,000 | 45,000 | 41,000 | 47,000 | 51,000 |
| | | All-Engine Service | 44,000 | 45,000 | 37,200 | 42,315 | 39,630 |
| | | Engine-Out Service | 27,500 | 28,420 | 20,000 | 21,010 | 24,980 |
| Cruise | **Long Range** | TAS/Fuel Flow (lb./hr.) | 442/1,473 | 449/1,478 | 424/1,828 | 437/1,485 | 431/1,665 |
| | | Altitude/Specific Range | FL 450/0.300 | FL 450/0.304 | FL 410/0.232 | FL 450/0.294 | FL 430/0.259 |
| | **High Speed** | TAS/Fuel Flow (lb./hr.) | 470/1,656 | 478/1,937 | 470/2,089 | 483/2,325 | 474/2,225 |
| | | Altitude/Specific Range | FL 450/0.284 | FL 430/0.247 | FL 410/0.225 | FL 390/0.208 | FL 390/0.213 |
| NBAA IFR Ranges (FAR Part 23, 100-nm alternate; FAR Part 25, 200-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 2,814 | 3,074 | 3,015 | 2,915 | 3,790 |
| | | Average Speed | 432 | 452 | 416 | 427 | 422 |
| | | Trip Fuel | 10,628 | 11,600 | 14,255 | 11,438 | 16,340 |
| | | Specific Range/Altitude | 0.265/FL 450 | 0.265/FL 450 | 0.212/FL 410 | 0.255/FL 450 | 0.232/FL 430 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 3,297 | 3,422 | 3,979 | 3,990 | 4,565 |
| | | Average Speed | 434 | 453 | 418 | 430 | 421 |
| | | Trip Fuel | 12,164 | 12,763 | 17,940 | 14,798 | 18,909 |
| | | Specific Range/Altitude | 0.271/FL 450 | 0.268/FL 450 | 0.222/FL 410 | 0.270/FL 470 | 0.241/FL 430 |
| | **Four Passengers** (w/available fuel) | Nautical Miles | 3,377 | 3,500 | 4,025 | 4,065 | 4,650 |
| | | Average Speed | 434 | 454 | 419 | 430 | 420 |
| | | Trip Fuel | 12,193 | 12,763 | 17,959 | 14,798 | 18,909 |
| | | Specific Range/Altitude | 0.277/FL 450 | 0.274/FL 450 | 0.224/FL 410 | 0.275/FL 470 | 0.246/FL 430 |
| | **Ferry** | Nautical Miles | 3,435 | 3,500 | 4,100 | 4,155 | 4,740 |
| | | Average Speed | 434 | 454 | 418 | 431 | 419 |
| | | Trip Fuel | 12,214 | 12,787 | 17,988 | 14,798 | 18,909 |
| | | Specific Range/Altitude | 0.281/FL 450 | 0.274/FL 450 | 0.228/FL 410 | 0.281/FL 470 | 0.251/FL 430 |
| Missions (4 passengers) | **300 nm** | Runway | 3,612 | 2,744 | 3,387 | 2,795 | 2,730 |
| | | Flight Time | 0+48 | 0+44 | 0+48 | 0+47 | 0+47 |
| | | Fuel Used | 1,573 | 1,516 | 1,573 | 1,525 | 1,595 |
| | | Specific Range/Altitude | 0.191/FL 450 | 0.198/FL 450 | 0.191/FL 410 | 0.197/FL 470 | 0.188/FL 470 |
| | **600 nm** | Runway | 3,655 | 2,880 | 3,415 | 2,855 | 2,865 |
| | | Flight Time | 1+29 | 1+23 | 1+28 | 1+27 | 1+27 |
| | | Fuel Used | 2,527 | 2,457 | 2,810 | 2,465 | 2,625 |
| | | Specific Range/Altitude | 0.237/FL 450 | 0.244/FL 450 | 0.214/FL 410 | 0.243/FL 470 | 0.229/FL 470 |
| | **1,000 nm** | Runway | 3,714 | 3,025 | 3,444 | 2,920 | 2,880 |
| | | Flight Time | 2+23 | 2+16 | 2+20 | 2+20 | 2+20 |
| | | Fuel Used | 3,822 | 3,746 | 4,502 | 3,755 | 4,070 |
| | | Specific Range/Altitude | 0.262/FL 450 | 0.267/FL 450 | 0.222/FL 410 | 0.266/FL 470 | 0.246/FL 450 |
| Remarks | | Certification Basis | FAR 25 A98; JAR 25 Chg. 15 Collins Pro Line 21 Advanced. | FAR 25, 2019 Garmin G5000. | FAR 25, 1980/83/87/95/2006/15 Collins Pro Line 21 Advanced.<br>*9,220 max takeoff; 8,729 normal takeoff. | FAR/EASA CS-25, 2013 EASy II flight deck; 2024 delivery price; FalconEye available. | FAR 25/EASA CS-25, 1979/2010 EASy II flight deck; 2024 delivery price; FalconEye available. |

## JETS ≥20,000-LB. MTOW

| Manufacturer | | | Bombardier | Gulfstream Aerospace | Dassault | Airbus | Airbus |
|---|---|---|---|---|---|---|---|
| Model | | | **Global 5500**<br>**BD-700-1A11** | **Gulfstream 500**<br>**GVII-G500** | **Falcon 6X** | **ACJTwoTwenty**<br>**BD500-1A10** | **ACJ320neo**<br>**A320-271N*** |
| ***BCA*** **Equipped Price** | | | $47,900,000 | $49,950,000 | $54,900,000 | $80,000,000* | $117,000,000** |
| Character-istics | | Seating | 3+13/16/19 | 2+13/19/19 | 3+12/16/19 | 5+8/19/135** | 4+19/NA/195*** |
| | | Wing Loading/Power Loading | 90.6/3.06 | 83.8/2.63 | 99.4/2.87 | 116.2/2.88 | 132.1/3.25 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | 88.9/79.7/89.4 | 87.7/75.3/91.0 | 91.1/80.8/89.8 | 87.9/79.6/91.3 | 86.4/81.7/92.4 |
| External Dimensions (ft.) | | Length | 96.8 | 91.2 | 84.3 | 114.8 | 123.3 |
| | | Height | 25.5 | 25.5 | 24.5 | 38.7 | 38.6 |
| | | Span | 94.0 | 86.3 | 85.1 | 115.1 | 117.4 |
| Internal Dimensions (ft.) | | **Length:** Main Seating/Net/Gross | 27.2/40.7/45.7 | 26.3/41.5/47.6 | 27.5/40.3/46.0 | 51.6/78.1/78.1 | 91.0/91.0/91.0 |
| | | Height/Dropped Aisle Depth | 6.2/flat floor | 6.2/flat floor | 6.5/flat floor | 6.9/flat floor | 7.4/flat floor |
| | | **Width:** Max/Floor | 7.9/6.5 | 7.6/6.1 | 8.5/7.2 | 10.8/10.1 | 12.1/11.7 |
| Baggage | | **Internal:** Cu. ft./lb. | 195/1,000 | 175/2,250 | 155/2,210 | 150***/NA | NA/NA |
| | | **External:** Cu. ft./lb. | —/— | —/— | —/— | 177/2,300 | 650/NA |
| Power | | Engines | 2 RR<br>BR700-710D5-21* | 2 P&WC<br>PW814GA | 2 P&WC<br>PW812D | 2 P&W<br>PW1524G**** | 2 P&W<br>PW1127G |
| | | Output (lb. each)/Flat Rating | 15,125/ISA+15C | 15,144/ISA+15C | 13,500/ISA+20C | 24,400/ISA+15C | 26,800/ISA+15C |
| | | Inspection Interval/Manu. Service Plan Interval | OC/— | OC/— | OC/— | OC/— | OC/— |
| Weights (lb.) | | Max Ramp | 92,750 | 80,000 | 77,900 | 141,000 | 175,045 |
| | | Max Takeoff | 92,500 | 79,600 | 77,500 | 140,500 | 174,165 |
| | | Max Landing | 78,600 | 64,350 | 66,200 | 112,500 | 148,592 |
| | | Zero Fuel | 58,000c | 52,100c | 45,900c | 108,000c | 141,757c |
| | | BOW | 50,861 | 46,850 | 40,880 | 87,675*** | 110,000**** |
| | | Max Payload | 7,139 | 5,250 | 5,020 | 20,325 | 31,757 |
| | | Useful Load | 41,889 | 33,150 | 37,020 | 53,325 | 65,045 |
| | | Max Fuel | 38,967 | 30,250 | 33,800 | 50,578 | 60,812 |
| | | Available Payload w/Max Fuel | 2,922 | 2,900 | 3,220 | 2,747 | 4,233 |
| | | Available Fuel w/Max Payload | 34,750 | 27,900 | 32,000 | 33,000 | 33,288 |
| Limits | | MMO | 0.900 | 0.925 | 0.900 | 0.820 | 0.820 |
| | | Trans. Alt. FL/VMO | FL 308/340 | FL 290/340 | FL 295/350 | FL 275/330 | FL 250/350 |
| | | PSI/Sea-Level Cabin | 10.3/30,125 | 10.7/31,900 | 10.4/31,000 | 9.3/NA | 9.2/NA |
| Airport Perfor-mance | | TOFL (SL elev./ISA temp.) | 5,340 | 5,300 | 5,115 | 5,478 | 6,333 |
| | | TOFL (5,000-ft. elev.@25C) | 7,284 | 7,300 | 6,760 | 8,706 | 8,189 |
| | | Mission Weight | 92,500 | 79,600 | 75,320 | 140,500 | 174,165 |
| | | NBAA IFR Range | 6,310 | 5,400 | 5,600 | 5,686 | 6,000 |
| | | V2 | 133 | 148 | 138 | NA | NA |
| | | VREF | 108 | 117 | 110 | 110 | 115 |
| | | Landing Distance | 2,195 | 2,645 | 2,420 | 2,300 | 2,565 |
| Climb | | Time to Climb/Altitude | 18/FL 370 | 16/FL 370 | 22/FL 370 | 23/FL 370 | 19/FL 350 |
| | | FAR 25 Engine-Out Rate (fpm) | NA | 644 | NA | NA | NA |
| | | FAR 25 Engine-Out Gradient (ft./nm) | NA | 261 | NA | NA | NA |
| Ceilings (ft.) | | Certificated | 51,000 | 51,000 | 51,000 | 41,000 | 41,000 |
| | | All-Engine Service | 41,000 | 43,400 | 41,500 | 41,000 | 41,000 |
| | | Engine-Out Service | 25,100 | 27,400 | NA | 24,000 | 23,000 |
| Cruise | **Long Range** | TAS/Fuel Flow (lb./hr.) | 488/2,815 | 488/2,417 | 459/2,390 | 432/3,507*** | 447/4,046**** |
| | | Altitude/Specific Range | FL 450/0.173 | FL 470/0.202 | FL 430/0.192 | FL 410/0.123 | FL 410/0.110 |
| | **High Speed** | TAS/Fuel Flow (lb./hr.) | 505/3,016 | 516/3,048 | 499/3,220 | 465/3,937*** | 465/4,681**** |
| | | Altitude/Specific Range | FL 410/0.167 | FL 430/0.169 | FL 410/0.155 | FL 410/0.118 | FL 410/0.099 |
| NBAA IFR Ranges (FAR Part 23, 100-nm alternate; FAR Part 25, 200-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 5,037 | 4,670 | 4,980 | 3,105 | 2,500 |
| | | Average Speed | 477 | 480 | 453 | 422 | 447 |
| | | Trip Fuel | 31,785 | 24,987 | 29,346 | 28,150 | 27,152 |
| | | Specific Range/Altitude | 0.158/FL 470 | 0.187/FL 490 | 0.170/FL 470 | 0.110/FL 390 | 0.092/FL 370 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 5,893 | 5,238 | 5,420 | 5,684 | 6,000 |
| | | Average Speed | 479 | 481 | 454 | 427 | NA |
| | | Trip Fuel | 36,124 | 27,406 | 31,146 | 46,528*** | 55,832 |
| | | Specific Range/Altitude | 0.163/FL 470 | 0.191/FL 490 | 0.174/FL 490 | 0.122/FL 410 | 0.107/FL 410 |
| | **Four Passengers** (w/available fuel) | Nautical Miles | 6,038 | 5,408 | 5,665 | 5,724 | 6,060 |
| | | Average Speed | 479 | 481 | 454 | 427 | NA |
| | | Trip Fuel | 36,186 | 27,468 | 31,146 | 46,550 | 55,368 |
| | | Specific Range/Altitude | 0.167/FL 490 | 0.197/FL 510 | 0.182/FL 490 | 0.123/FL 410 | 0.109/FL 410 |
| | **Ferry** | Nautical Miles | 6,095 | 5,476 | 5,735 | 5,763 | 6,100 |
| | | Average Speed | 479 | 481 | 454 | 427 | NA |
| | | Trip Fuel | 36,209 | 27,491 | 31,146 | 46,571 | 55,394 |
| | | Specific Range/Altitude | 0.168/FL 490 | 0.199/FL 510 | 0.184/FL 490 | 0.124/FL 410 | 0.110/FL 410 |
| Missions (4 passengers) | **300 nm** | Runway | 2,540 | 3,595 | 2,835 | 3,201 | 3,235 |
| | | Flight Time | 0+47 | 0+45 | 0+46 | 0+53 | 0+53 |
| | | Fuel Used | 2,542 | 2,405 | 2,385 | 3,264 | 3,489 |
| | | Specific Range/Altitude | 0.118/FL 430 | 0.125/FL 470 | 0.126/FL 490 | 0.092/FL 390 | 0.086/FL 370 |
| | **600 nm** | Runway | 2,557 | 3,615 | 2,845 | 3,268 | 3,297 |
| | | Flight Time | 1+25 | 1+22 | 1+26 | 1+36 | 1+34 |
| | | Fuel Used | 4,008 | 3,659 | 3,705 | 5,330 | 5,790 |
| | | Specific Range/Altitude | 0.150/FL 490 | 0.164/FL 510 | 0.162/FL 490 | 0.113/FL 410 | 0.104/FL 410 |
| | **1,000 nm** | Runway | 2,583 | 3,640 | 2,865 | 3,327 | 3,402 |
| | | Flight Time | 2+14 | 2+11 | 2+18 | 2+34 | 2+27 |
| | | Fuel Used | 6,033 | 5,351 | 5,520 | 8,136 | 8,780 |
| | | Specific Range/Altitude | 0.166/FL 490 | 0.187/FL 510 | 0.181/FL 490 | 0.123/FL 410 | 0.114/FL 410 |
| Remarks | | Certification Basis | FAR 25, 1998/2004/19; EASA CS-25, 2004<br>Global Vision flight deck; ModSums: 700T901902, 700T03185, 700T63572.<br>*Marketed as Pearl 15. | FAR 25, 2018; EASA CS-25, 2019 | FAR/EASA CS-25, 2023<br>EASy IV flight deck; DFCS; 2024 delivery price; FalconEye; Dual HUD with FalconEye available. | FAR 25, 2015<br>**BCA* estimate.<br>**Airliner configuration.<br>***ACJ estimate.<br>****Also available with PW1521G rated at 21,000 lbf; includes five additional center tanks and VIP cabin. | FAR 25, 1999/2016<br>*Also available as -251N with CFM LEAP1A-26 engines rated at 26,600 lbf; includes four additional center tanks and VIP cabin.<br>***BCA* estimate.<br>***Airliner configuration.<br>****ACJ estimate. |

# ULTRA-LONG-RANGE JETS

| Manufacturer | | | Bombardier | Gulfstream Aerospace | Dassault | Gulfstream Aerospace | Gulfstream Aerospace |
|---|---|---|---|---|---|---|---|
| Model | | | Global 6500<br>BD-700-1A10 | G600<br>GVII-600 | Falcon 8X<br>Falcon 7X | G650<br>GVI | G650ER<br>GVI |
| ***BCA*** **Equipped Price** | | | $58,000,000 | $59,950,000 | $65,700,000 | $68,500,000 | $70,500,000 |
| Characteristics | | Seating | 4+13/17/19 | 4+16/19/19 | 3+12/14/19 | 4+16/19/19 | 4+16/19/19 |
| | | Wing Loading/Power Loading | 97.5/3.29 | 81.5/3.02 | 95.9/3.62 | 77.6/2.95 | 80.7/3.07 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | 88.7/82.2/89.4 | 88.3/78.3/91.3 | 88.7/80.1/90.6 | 89.8/77.5/88.3 | 89.6/78.7/88.3 |
| External Dimensions (ft.) | | Length | 99.4 | 96.1 | 80.2 | 99.8 | 99.8 |
| | | Height | 25.5 | 25.3 | 26.1 | 25.7 | 25.7 |
| | | Span | 94.0 | 94.1 | 86.3 | 99.6 | 99.6 |
| Internal Dimensions (ft.) | | **Length:** Main Seating/Net/Gross | 27.3/43.3/48.3 | 32.0/45.2/51.3 | 29.8/42.7/50.1 | 32.7/46.8/53.6 | 32.7/46.8/53.6 |
| | | Height/Dropped Aisle Depth | 6.2/flat floor | 6.2/flat floor | 6.2/flat floor | 6.3/flat floor | 6.3/flat floor |
| | | **Width:** Max/Floor | 7.9/6.5 | 7.6/6.1 | 7.7/6.3 | 8.2/6.7 | 8.2/6.7 |
| Baggage | | **Internal:** Cu. ft./lb. | 195/1,000 | 175/2,500 | 140/2,004 | 195/2,500 | 195/2,500 |
| | | **External:** Cu. ft./lb. | —/— | —/— | —/— | —/— | —/— |
| Power | | Engines | 2 RR<br>BR700-710D5-21* | 2 P&WC<br>PW815GA | 3 P&WC<br>PW307D | 2 RR<br>BR700-725A1-12 | 2 RR<br>BR700-725A1-12 |
| | | Output (lb. each)/Flat Rating | 15,125/ISA+15C | 15,680/ISA+15C | 6,722/ISA+17C | 16,900/ISA+15C | 16,900/ISA+15C |
| | | Inspection Interval/Manu. Service Plan Interval | OC/— | OC/— | 7,200c/— | 10,000t/— | 10,000t/— |
| Weights (lb.) | | Max Ramp | 99,750 | 95,000 | 73,200 | 100,000 | 104,000 |
| | | Max Takeoff | 99,500 | 94,600 | 73,000 | 99,600 | 103,600 |
| | | Max Landing | 78,600 | 76,800 | 62,400 | 83,500 | 83,500 |
| | | Zero Fuel | 58,000c | 57,440c | 41,000c | 60,500c | 60,500c |
| | | BOW | 52,230 | 50,900 | 36,800 | 54,500 | 54,500 |
| | | Max Payload | 5,770 | 6,540 | 4,200 | 6,000 | 6,000 |
| | | Useful Load | 47,520 | 44,100 | 36,400 | 45,500 | 49,500 |
| | | Max Fuel | 44,715 | 41,500 | 35,141 | 44,200 | 48,200 |
| | | Available Payload w/Max Fuel | 2,805 | 2,600 | 1,259 | 1,300 | 1,300 |
| | | Available Fuel w/Max Payload | 41,750 | 37,560 | 32,200 | 39,500 | 43,500 |
| Limits | | MMO | 0.900 | 0.925 | 0.900 | 0.925 | 0.925 |
| | | Trans. Alt. FL/VMO | FL 308/340 | FL 290/340 | FL 270/370 | FL 290/340 | FL 290/340 |
| | | PSI/Sea-Level Cabin | 10.3/30,125 | 10.7/31,900 | 10.2/30,300 | 10.7/31,900 | 10.7/31,900 |
| Airport Performance | | TOFL (SL elev./ISA temp.) | 6,145 | 5,700 | 5,880 | 5,858 | 6,299 |
| | | TOFL (5,000-ft. elev.@25C) | 8,509 | 8,493 | 8,540 | 8,771 | 11,131 |
| | | Mission Weight | 99,500 | 94,600 | 72,591 | 99,600 | 103,600 |
| | | NBAA IFR Range | 6,990 | 6,630 | 6,415 | 6,890 | 7,437 |
| | | V2 | 138 | 142 | 138 | 146 | 148 |
| | | VREF | 109 | 109 | 107 | 115 | 115 |
| | | Landing Distance | 2,231 | 2,365 | 2,245 | 2,445 | 2,445 |
| Climb | | Time to Climb/Altitude | 21/FL 370 | 18/FL 370 | 20/FL 370 | 19/FL 370 | 21/FL 370 |
| | | FAR 25 Engine-Out Rate (fpm) | NA | 403 | 774 | 503 | 435 |
| | | FAR 25 Engine-Out Gradient (ft./nm) | NA | 170 | 339 | 207 | 176 |
| Ceiling (ft.) | | Certificated | 51,000 | 51,000 | 51,000 | 51,000 | 51,000 |
| | | All-Engine Service | 41,000 | 41,900 | 40,075 | 41,300 | 40,600 |
| | | Engine-Out Service | 22,000 | 24,200 | 26,645 | 24,900 | 23,700 |
| Cruise | **Long Range** | TAS | 488 | 488 | 459 | 488 | 488 |
| | | Fuel Flow | 2,986 | 2,809 | 2,254 | 2,865 | 2,930 |
| | | Altitude | FL 430 | FL 450 | FL 430 | FL 450 | FL 450 |
| | | Specific Range | 0.163 | 0.174 | 0.204 | 0.170 | 0.167 |
| | **High Speed** | TAS | 505 | 516 | 497 | 516 | 516 |
| | | Fuel Flow | 3,094 | 3,590 | 3,172 | 3,679 | 3,730 |
| | | Altitude | FL 410 | FL 410 | FL 390 | FL 410 | FL 410 |
| | | Specific Range | 0.163 | 0.144 | 0.157 | 0.140 | 0.138 |
| NBAA IFR Ranges (200-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 5,954 | 5,665 | 5,555 | 5,912 | 6,459 |
| | | Average Speed | 478 | 481 | 452 | 481 | 481 |
| | | Trip Fuel | 38,783 | 34,478 | 29,507 | 36,285 | 40,285 |
| | | Specific Range/Altitude | 0.154/FL 470 | 0.164/FL 470 | 0.188/FL 470 | 0.163/FL 490 | 0.160/FL 490 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 6,547 | 6,544 | 6,325 | 6,959 | 7,507 |
| | | Average Speed | 479 | 482 | 453 | 482 | 482 |
| | | Trip Fuel | 41,835 | 38,518 | 32,558 | 41,129 | 45,129 |
| | | Specific Range/Altitude | 0.156/FL 470 | 0.170/FL 490 | 0.194/FL 470 | 0.169/FL 510 | 0.166/FL 510 |
| | **Eight Passengers** (w/available fuel) | Nautical Miles | 6,636 | 6,630 | 6,235 | 6,890 | 7,437 |
| | | Average Speed | 480 | 481 | 453 | 482 | 482 |
| | | Trip Fuel | 41,870 | 38,543 | 32,204 | 40,820 | 44,820 |
| | | Specific Range/Altitude | 0.158/FL 470 | 0.172/FL 490 | 0.194/FL 470 | 0.169/FL 510 | 0.166/FL 510 |
| | **Ferry** | Nautical Miles | 6,754 | 6,767 | 6,475 | 7,083 | 7,636 |
| | | Average Speed | 480 | 483 | 454 | 482 | 482 |
| | | Trip Fuel | 41,916 | 38,584 | 32,653 | 41,168 | 45,168 |
| | | Specific Range/Altitude | 0.161/FL 490 | 0.175/FL 490 | 0.198/FL 470 | 0.172/FL 510 | 0.169/FL 510 |
| Missions (8 passengers) | **1,000 nm** | Runway | 2,718 | 3,655 | 2,715 | 3,300 | 3,300 |
| | | Flight Time | 2+14 | 2+10 | 2+12 | 2+10 | 2+10 |
| | | Fuel Used | 6,219 | 5,872 | 5,440 | 5,942 | 5,942 |
| | | Specific Range/Altitude | 0.161/FL 490 | 0.170/FL 510 | 0.184/FL 450 | 0.168/FL 510 | 0.168/FL 510 |
| | **3,000 nm** | Runway | 3,487 | 3,870 | 3,730 | 3,590 | 3,590 |
| | | Flight Time | 6+21 | 6+17 | 6+19 | 6+17 | 6+17 |
| | | Fuel Used | 17,490 | 16,102 | 15,945 | 16,280 | 16,280 |
| | | Specific Range/Altitude | 0.172/FL 490 | 0.186/FL 490 | 0.188/FL 450 | 0.184/FL 510 | 0.184/FL 510 |
| | **6,000 nm** | Runway | 5,482 | 5,115 | 5,785 | 5,240 | 5,240 |
| | | Flight Time | 12+32 | 12+26 | 12+45 | 12+28 | 12+28 |
| | | Fuel Used | 37,302 | 34,243 | 32,200 | 34,622 | 34,622 |
| | | Specific Range/Altitude | 0.161/FL 490 | 0.175/FL 490 | 0.186/FL 470 | 0.173/FL 510 | 0.173/FL 510 |
| Remarks | | Certification Basis | FAR 25, 1998/2003/19 EASA CS-25, 1998/2019 BEVS and Global Vision flight deck standard. ModSums: 700T901901, 700T03185, 00T63572. *Marketed as Pearl 15. | FAR 25, 2019 EASA CS-25, 2020 | FAR/EASA CS-25, 2016 EASy IV flight deck; DFCS; 2024 delivery price; FalconEye; Dual HUD with FalconEye available. | FAR, EASA CS-25, 2012 | FAR 25, 2014; EASA CS-25, 2018; ASC 014 |

# ULTRA-LONG-RANGE JETS

| Manufacturer | | | Gulfstream Aerospace | Bombardier | Gulfstream Aerospace | Bombardier |
|---|---|---|---|---|---|---|
| Model | | | **G800<br>GVIII-G800** | **Global 7500<br>BD-700-2A12** | **G700<br>GVIII-G700** | **Global 8000<br>BD-700-2A12** |
| ***BCA* Equipped Price** | | | $75,500,000 | $78,000,000 | $80,000,000 | $81,000,000 |
| Characteristics | | Seating | 4+16/19/19 | 4+17/19/19 | 4+16/19/19 | 4+17/19/19 |
| | | Wing Loading/Power Loading | 82.2/2.89 | 91.6/3.04 | 83.8/2.95 | 91.6/3.04 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | NA/NA/NA | 91.6/80.3/88.8 | NA/NA/NA | 91.6/80.3/88.8 |
| External Dimensions (ft.) | | Length | 99.8 | 111.0 | 109.9 | 111.0 |
| | | Height | 25.5 | 27.0 | 25.4 | 27.0 |
| | | Span | 103.0 | 104.0 | 103.0 | 104.0 |
| Internal Dimensions (ft.) | | **Length:** Main Seating/Net/Gross | 32.7/46.8/53.6 | 36.0/54.4/60.6 | 40.8/56.9/63.7 | 36.0/54.4/60.6 |
| | | Height/Dropped Aisle Depth | 6.3/flat floor | 6.2/flat floor | 6.3/flat floor | 6.2/flat floor |
| | | **Width:** Max/Floor | 8.2/6.7 | 8.0/6.8 | 8.2/6.7 | 8.0/6.8 |
| Baggage | | **Internal:** Cu. ft./lb. | 195/2,500 | 195/2,500 | 195/2,500 | 195/2,500 |
| | | **External:** Cu. ft./lb. | —/— | —/— | —/— | —/— |
| Power | | Engines | 2 RR<br>BR700-730B2-14* | 2 GE<br>Passport 20-19BB1A | 2 RR<br>BR700-730B2-14* | 2 GE<br>Passport 20-19BB1B |
| | | Output (lb. each)/Flat Rating | 18,250/NA | 18,920/ISA+15C | 18,250/NA | 18,920/ISA+1C |
| | | Inspection Interval/Manu. Service Plan Interval | NA/— | OC/— | NA/— | OC/— |
| Weights (lb.) | | Max Ramp | 106,000 | 115,100 | 108,000 | 115,100 |
| | | Max Takeoff | 105,600 | 114,850 | 107,600 | 114,850 |
| | | Max Landing | 83,500 | 87,600 | 83,500 | 87,600 |
| | | Zero Fuel | 60,500c | 67,500c | 62,750c | 67,500c |
| | | BOW | 54,300 | 61,700 | 56,765 | 60,900 |
| | | Max Payload | 6,200 | 5,800 | 5,985 | 6,600 |
| | | Useful Load | 51,700 | 53,400 | 51,235 | 54,200 |
| | | Max Fuel | 49,400 | 51,510 | 49,400 | 51,925 |
| | | Available Payload w/Max Fuel | 2,300 | 1,890 | 1,835 | 2,275 |
| | | Available Fuel w/Max Payload | 45,500 | 47,600 | 45,250 | 47,600 |
| Limits | | MMO | 0.925 | 0.925 | 0.935 | 0.940 |
| | | Trans. Alt. FL/VMO | FL 290/340 | FL 350/320 | FL 290/340 | FL 350/320 |
| | | PSI/Sea-Level Cabin | 10.7/31,900 | 10.3/30,125 | 10.7/31,900 | 10.7/31,900 |
| Airport Performance | | TOFL (SL elev./ISA temp.) | 6,000 | 5,760 | 5,995 | 5,760 |
| | | TOFL (5,000-ft. elev.@25C) | 9,872 | 8,679 | 9,751 | 8,679 |
| | | Mission Weight | 105,600 | 114,850 | 107,600 | 114,850 |
| | | NBAA IFR Range | 8,025 | 7,800 | 7,765 | 8,030 |
| | | V2 | NA | 137 | 154 | 137 |
| | | VREF | 115 | 108 | 118 | 108 |
| | | Landing Distance | 2,500 | 2,240 | 2,552 | 2,216 |
| Climb | | Time to Climb/Altitude | 17/FL 370 | 20/FL 370 | 17/FL 370 | 20/FL 370 |
| | | FAR 25 Engine-Out Rate (fpm) | NA | NA | NA | NA |
| | | FAR 25 Engine-Out Gradient (ft./nm) | NA | NA | NA | NA |
| Ceiling (ft.) | | Certificated | 51,000 | 51,000 | 51,000 | 51,000 |
| | | All-Engine Service | NA | 43,000 | 43,000 | 43,000 |
| | | Engine-Out Service | NA | 26,600 | 23,200 | 26,600 |
| Cruise | **Long Range** | TAS | 488 | 488 | 488 | 488 |
| | | Fuel Flow | 2,800 | 2,983 | 2,904 | 2,924 |
| | | Altitude | FL 450 | FL 450 | FL 450 | FL 450 |
| | | Specific Range | 0.174 | 0.164 | 0.168 | 0.167 |
| | **High Speed** | TAS | 516 | 516 | 516 | 516* |
| | | Fuel Flow | 3,438 | 3,207 | 3,598 | 3,099 |
| | | Altitude | FL 430 | FL 450 | FL 430 | FL 450 |
| | | Specific Range | 0.150 | 0.161 | 0.143 | 0.167 |
| NBAA IFR Ranges (200-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 7,050 | 6,930 | 6,835 | 7,031 |
| | | Average Speed | 482 | 482 | 482 | 481 |
| | | Trip Fuel | 42,522 | 44,501 | 42,070 | 44,510 |
| | | Specific Range/Altitude | 0.166/FL 490 | 0.156/FL 510 | 0.162/FL 470 | 0.158/FL 510 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 7,952 | 7,700 | 7,745 | 7,949 |
| | | Average Speed | 483 | 482 | 483 | 482 |
| | | Trip Fuel | 46,526 | 48,512 | 46,334 | 48,921 |
| | | Specific Range/Altitude | 0.171/FL 510 | 0.159/FL 510 | 0.167/FL 490 | 0.162/FL 510 |
| | **Eight Passengers** (w/available fuel) | Nautical Miles | 8,025 | 7,770 | 7,765 | 8,006 |
| | | Average Speed | 483 | 483 | 483 | 482 |
| | | Trip Fuel | 46,544 | 48,526 | 46,340 | 48,940 |
| | | Specific Range/Altitude | 0.172/FL 510 | 0.160/FL 510 | 0.168/FL 490 | 0.164/FL 510 |
| | **Ferry** | Nautical Miles | 8,190 | 7,903 | 7,920 | 8,143 |
| | | Average Speed | 483 | 483 | 483 | 482 |
| | | Trip Fuel | 46,587 | 48,570 | 46,384 | 48,986 |
| | | Specific Range/Altitude | 0.176/FL 510 | 0.163/FL 510 | 0.171/FL 490 | 0.166/FL 510 |
| Missions (8 passengers) | **1,000 nm** | Runway | 3,500 | 3,375 | 2,960 | 3,364 |
| | | Flight Time | 2+10 | 2+11 | 2+10 | 2+11 |
| | | Fuel Used | 5,621 | 6,191 | 5,852 | 6,089 |
| | | Specific Range/Altitude | 0.178/FL 510 | 0.162/FL 510 | 0.171/FL 490 | 0.164/FL 510 |
| | **3,000 nm** | Runway | 3,660 | 3,510 | 3,320 | 3,495 |
| | | Flight Time | 6+17 | 6+18 | 6+17 | 6+18 |
| | | Fuel Used | 15,396 | 17,002 | 16,050 | 16,713 |
| | | Specific Range/Altitude | 0.195/FL 510 | 0.176/FL 510 | 0.187/FL 490 | 0.180/FL 510 |
| | **6,000 nm** | Runway | 4,490 | 4,573 | 4,690 | 4,430 |
| | | Flight Time | 12+27 | 12+28 | 12+27 | 12+28 |
| | | Fuel Used | 32,758 | 35,795 | 34,049 | 34,886 |
| | | Specific Range/Altitude | 0.183/FL 510 | 0.168/FL 510 | 0.176/FL 490 | 0.172/FL 510 |
| Remarks | | Certification Basis | FAR 25 pending;<br>EASA CS-25 pending<br>*Marketed as Pearl 700. | FAR 25, 2018<br>EASA CS-25, 2019 | FAR 25 pending;<br>EASA CS-25 pending<br>*Marketed as Pearl 700. | FAR 25, 2018;<br>EASA CS-25, 2019<br>*Mach 0.920 alternate high-speed cruise but reduced range.<br>All data preliminary. |

# ULTRA-LONG-RANGE JETS

| Manufacturer | | | Boeing | Airbus | Boeing | Boeing |
|---|---|---|---|---|---|---|
| Model | | | **BBJ MAX7**<br>**737-7** | **ACJ319neo**<br>**A319-153N*** | **BBJ MAX8**<br>**737-8** | **BBJ MAX9**<br>**737-9** |
| ***BCA*** Equipped Price | | | $97,500,000* | $107,500,000** | $115,000,000* | $124,000,000* |
| Characteristics | | Seating | 4+19/NA/172 | 4+19/NA/160 | 4+19/NA/189 | 4+19/NA/220 |
| | | Wing Loading/Power Loading | 132.0/3.35 | 130.8/3.22 | 135.1/3.25 | 145.2/3.49 |
| | | **Noise (EPNdB):** Lateral/Flyover/Approach | NA/NA/NA | 86.1/80.7/91.8 | 88.5/82.6/94.2 | NA/NA/NA |
| External Dimensions (ft.) | | Length | 116.7 | 111.0 | 129.7 | 138.2 |
| | | Height | 40.3 | 38.6 | 40.3 | 40.3 |
| | | Span | 117.8 | 117.4 | 117.8 | 117.8 |
| Internal Dimensions (ft.) | | **Length:** Main Seating/Net/Gross | 85.7/85.7/85.7 | 79.0/79.0/79.0 | 98.5/98.5/98.5 | 107.2/107.2/107.2 |
| | | Height/Dropped Aisle Depth | 7.1/flat floor | 7.4/flat floor | 7.1/flat floor | 7.1/flat floor |
| | | **Width:** Max/Floor | 11.6/10.7 | 12.1/11.7 | 11.6/10.7 | 11.6/10.7 |
| Baggage | | **Internal:** Cu. ft./lb. | NA/NA | NA/NA | NA/NA | NA/NA |
| | | **External:** Cu. ft./lb. | 274/NA | 128/NA | 593/NA | 775/NA |
| Power | | Engines | 2 CFMI<br>LEAP-1B27 | 2 P&W<br>PW1127G | 2 CFMI<br>LEAP-1B28 | 2 CFMI<br>LEAP-1B28 |
| | | Output (lb. each)/Flat Rating | 26,400/ISA+15C | 26,800/ISA+15C | 27,900/ISA+15C | 27,900/ISA+15C |
| | | Inspection Interval/Manu. Service Plan Interval | OC/— | OC/— | OC/— | OC/— |
| Weights (lb.) | | Max Ramp | 177,500 | 173,283 | 181,700 | 195,200 |
| | | Max Takeoff | 177,000 | 172,401 | 181,200 | 194,700 |
| | | Max Landing | 145,600 | 140,875 | 152,800 | 163,900 |
| | | Zero Fuel | 138,700c | 116,845c | 145,400c | 156,500c |
| | | BOW | 101,550 | 104,000*** | 105,200 | 111,750 |
| | | Max Payload | 37,150 | 12,845 | 40,200 | 44,750 |
| | | Useful Load | 75,950 | 69,283 | 76,500 | 83,450 |
| | | Max Fuel | 67,690 | 66,209 | 69,553 | 73,097 |
| | | Available Payload w/Max Fuel | 8,260 | 3,074 | 6,947 | 10,353 |
| | | Available Fuel w/Max Payload | 38,800 | 56,438 | 36,300 | 38,700 |
| Limits | | MMO | 0.820 | 0.820 | 0.820 | 0.820 |
| | | Trans. Alt. FL/VMO | FL 260/340 | FL 250/350 | FL 260/340 | FL 260/340 |
| | | PSI/Sea-Level Cabin | 9.0/24,000 | 9.2/NA | 9.0/24,000 | 9.0/24,000 |
| Airport Performance | | TOFL (SL elev./ISA temp.) | 6,820 | 6,217 | 6,600 | 8,380 |
| | | TOFL (5,000-ft. elev.@25C) | NA | 8,189 | NA | NA |
| | | Mission Weight | NA | 172,401 | NA | NA |
| | | NBAA IFR Range | 6,810 | 6,750 | 6,680 | 6,600 |
| | | V2 | NA | NA | NA | NA |
| | | VREF | 118 | 119 | 120 | 122 |
| | | Landing Distance | 2,360 | 2,740 | 2,335 | 2,520 |
| Climb | | Time to Climb/Altitude | 23/FL 360 | 19/FL 350 | 25/FL 360 | 25/FL 340 |
| | | FAR 25 Engine-Out Rate (fpm) | NA | NA | NA | NA |
| | | FAR 25 Engine-Out Gradient (ft./nm) | NA | NA | NA | NA |
| Ceiling (ft.) | | Certificated | 41,000 | 41,000 | 41,000 | 41,000 |
| | | All-Engine Service | 41,000 | 41,000 | 41,000 | 41,000 |
| | | Engine-Out Service | NA | 24,000 | NA | NA |
| Cruise | **Long Range** | TAS | 456 | 447 | 456 | 456 |
| | | Fuel Flow | NA | 4,004*** | NA | NA |
| | | Altitude | FL 410 | FL 410 | FL 410 | FL 410 |
| | | Specific Range | NA | 0.112 | NA | NA |
| | **High Speed** | TAS | 471 | 465 | 471 | 471 |
| | | Fuel Flow | NA | 4,637*** | NA | NA |
| | | Altitude | FL 410 | FL 410 | FL 410 | FL 410 |
| | | Specific Range | NA | 0.100 | NA | NA |
| NBAA IFR Ranges (200-nm alternate) | **Max Payload** (w/available fuel) | Nautical Miles | 3,060 | 5,250 | 2,655 | 2,615 |
| | | Average Speed | 439 | 447 | 439 | 439 |
| | | Trip Fuel | 33,177 | 51,295 | 30,419 | 32,397 |
| | | Specific Range/Altitude | 0.092/FL 370 | 0.102/FL 410 | 0.087/FL 370 | 0.081/FL 350 |
| | **Max Fuel** (w/available payload) | Nautical Miles | 6,525 | 6,750 | 6,465 | 6,255 |
| | | Average Speed | 448 | 442 | 450 | 450 |
| | | Trip Fuel | 63,026 | 61,436 | 64,874 | 68,030 |
| | | Specific Range/Altitude | 0.104/FL 410 | 0.110/FL 410 | 0.100/FL 410 | 0.092/FL 410 |
| | **Eight Passengers** (w/available fuel) | Nautical Miles | 6,810 | 6,750 | 6,680 | 6,600 |
| | | Average Speed | 448 | 442 | 450 | 450 |
| | | Trip Fuel | 63,214 | 61,436 | 64,981 | 68,195 |
| | | Specific Range/Altitude | 0.108/FL 410 | 0.110/FL 410 | 0.103/FL 410 | 0.097/FL 410 |
| | **Ferry** | Nautical Miles | 6,885 | 6,870 | 6,755 | 6,660 |
| | | Average Speed | 448 | NA | 450 | 450 |
| | | Trip Fuel | 63,250 | 60,994 | 65,022 | 68,212 |
| | | Specific Range/Altitude | 0.109/FL 410 | 0.113/FL 410 | 0.104/FL 410 | 0.098/FL 410 |
| Missions (8 passengers) | **1,000 nm** | Runway | 3,640 | 3,543 | 3,345 | 3,630 |
| | | Flight Time | 2+26 | 2+26 | 2+25 | 2+25 |
| | | Fuel Used | 8,909 | 8,591 | 9,255 | 9,793 |
| | | Specific Range/Altitude | 0.112/FL 410 | 0.116/FL 410 | 0.108/FL 410 | 0.102/FL 410 |
| | **3,000 nm** | Runway | 3,940 | 4,114 | 4,055 | 4,505 |
| | | Flight Time | 6+51 | 6+54 | 6+49 | 6+48 |
| | | Fuel Used | 25,596 | 25,148 | 26,782 | 28,430 |
| | | Specific Range/Altitude | 0.117/FL 410 | 0.119/FL 410 | 0.112/FL 410 | 0.106/FL 410 |
| | **6,000 nm** | Runway | 5,480 | 5,308 | 5,720 | 6,545 |
| | | Flight Time | 13+26 | 13+38 | 13+23 | 13+23 |
| | | Fuel Used | 54,502 | 53,086 | 57,265 | 61,004 |
| | | Specific Range/Altitude | 0.110/FL 410 | 0.113/FL 410 | 0.105/FL 410 | 0.098/FL 410 |
| Remarks | | Certification Basis | FAR 25, 2023 A137, A141<br>VIP cabin; includes seven auxiliary fuel tanks.<br>**BCA* estimate. | FAR 25, 1999/2018<br>*Also available as -271N with CFM LEAP1A-26 engines with 26,600 lbf; includes five additional center tanks plus VIP cabin.<br>***BCA* estimate.<br>***ACJ estimate. | FAR 25, 2017 A137, A141<br>VIP cabin; includes seven auxliary fuel tanks.<br>**BCA* estimate. | FAR 25, 2018 A137, A141<br>VIP cabin; includes eight auxiliary fuel tanks.<br>**BCA* estimate. |

IMPACT

BY **ROBERT L. SUMWALT**

# Just Forget SMS

## Don’t get hung up on the term "system"

DESIGNER491/ALAMY STOCK PHOTO

**IN NOVEMBER 2015,** a chartered Hawker 700 stalled and crashed while on a non-precision approach to Akron, Ohio. The two pilots and the seven paying passengers were killed. NTSB determined the probable cause was “the flight crew’s mismanagement of the approach and multiple deviations from company standard operating procedures, which placed the airplane in an unsafe situation.” The safety agency also identified the operator’s “casual attitude toward compliance with standards; its inadequate hiring, training and operational oversight of the flight crew; [and] the company’s lack of a formal safety program.”

The NTSB, which I was part of at the time, noted that the operator did not have a Safety Management System (SMS). In citing the critical role that SMS can play, we wrote that SMS “has been recognized in the industry as an effective way to establish and reinforce a positive safety culture and identify deviations from [standard operating procedures] so that they can be corrected.” We concluded that SMS could benefit all Part 135 operators because they require the operators to incorporate formal system safety methods into their internal oversight programs. With that, NTSB recommended that FAA require all Part 135 operators to establish SMS. We reiterated that recommendation following seven other Part 135 crashes, which claimed 39 fatalities. We even placed the issue on our Most Wanted List. Congress apparently agreed with the our stance and, in 2020, mandated that FAA initiate rulemaking for Part 135 operators.

In response, last year the FAA issued the long-awaited notice of proposed rulemaking (NPRM). Since then, there has been a great deal of hand-wringing and complaining about what some view as an overburdensome requirement. Of course, this is only the proposed rule, and what the final rule will contain, or when it will be issued, is anyone’s guess. By government rulemaking practices, the public is invited to comment on the proposed rule, via a Notice of Proposed Rulemaking (NPRM). Before a final rule is enacted, the FAA must consider these comments and explain howit addressed them.

Many of the comments I have read are supportive, but some among the 200 total writers remarked on suggested changes for the final rule. I also ran across some interesting comments, such as one that referred to an “onerous task of implementing a Safety Management System and all the administrative functions that come with such a program.” Another referred to “FAA's over-regulation [that] smothers more and more small operators.” That commenter ended with, “When does it stop—when we all go out of business?”

For those who feel that SMS is onerous or over-regulation, here’s my advice: Just forget SMS.

Instead, think of it this way: The things that are part of a fully functioning SMS are the very things a professionally run aviation provider should be doing in the first place. Yes, you need a safety policy. Yes, a professional flight department should be assessing risks and mitigating those that are unacceptable. Yes, there should be safety assurance to verify that risk controls are effective. And, yes, the organization should strive to have a positive safety culture and actively practice safety promotion. Each of these components is a prescribed ingredient of SMS.

The late Don Arendt of FAA once told me that perhaps we should change the name of the Safety Management System to simply Safety Management. Don’s point was ingenious: The term Safety Management System makes people think the SMS is something they have or want. Safety Management, on the other hand, implies the active management of safety.

SMS provides a businesslike framework for actively managing safety. Consider the business approach that organiza-

Think of an SMS program as active safety management.

tions use for managing their finances: They have a chief financial officer. Their financial accounting is in line with generally accepted accounting principles. They conduct internal and external audits. They report irregularities before they become major issues. Why do they do these things? Because finances are important to them. By the same line of reasoning, if safety is important, should not safety be managed by a similar process? SMS provides that very process.

Whatever you call it, a professional flight department does the things associated with having an SMS, regardless of whatever they call it. It is about doing the right things for those who rely on your company to provide the safe service for which they are paying. Why would you want to do anything less? As aptly stated in the NPRM: "As a fundamental matter, the flying public expects safe carriage from operators offering flight services for hire. Irrespective of whether an operator employs one pilot or a thousand, that company has the same responsibility to conduct safe operations."

My biggest concern with mandating SMS is that some organizations will simply buy an off-the-shelf product to show compliance. Although consultants can be helpful in assisting to develop an SMS, the system needs to be customized for the organization. As acknowledged in one NPRM comment: "A properly functioning Safety Management System can be a tremendous benefit to all the stakeholders, but merely satisfying regulatory requirements is not good business for either FAA or industry."

SMS needs to be scalable to fit the size of the organization. Certainly, the SMS for a two-aircraft Part 135 operator does not need to be the same as NetJets' safety system. Even the FAA's advisory circular on SMS (AC 120.92B) states, "An SMS does not have to be an extensive, expensive or sophisticated array of techniques to do what it is supposed to do."

Documentation and record-keeping are key components of SMS. I once ran a small Fortune 500 flight department with two aircraft. We started the SMS journey by writing down the manner in which we intended to operate. This evolved into a flight operations manual that included our safety policy. It was jointly signed by the CEO and myself, as the aviation department manager. This satisfied the SMS safety policy requirement.

Before I arrived, corporate management would say they wanted to go to a certain town, and the pilots would dutifully comply. If there was an airport, they went. But, over time, we realized we were just blindly accepting risks. If you are going to accept risks, at least know what you are accepting. So, we changed. Before agreeing to go to a new airport or implementing a new procedure, we did our best to identify the potential hazards, followed by assessing the level of associated with those hazards. For those that were above our comfort level, we took measures to mitigate the risks. In SMS vernacular, that is the safety risk management component of SMS. The process provided us with quantitative information we could take to senior leadership to explain our decision-making. Instead of pushing back, they appreciated that we were looking out for their safety by taking a risk-based approach to decision-making.

Safety assurance means, among other things, making sure you are following your processes and that the risk-management controls you have implemented are effective. It also involves data collection and analysis to seek out anything of safety significance. Sources of data may include reports submitted to the company incident-reporting system, flight dispatch logs and crew duty records. For a small flight department, "most of the data/information-gathering for monitoring of operational processes will likely occur as a normal business process by the management personnel who are directly involved in the day-to-day operations," states FAA AC 120.92B. Safety assurance also involves continuous improvement. When safety deficiencies are identified, they must be corrected.

The final element of SMS—safety promotion—involves cultivating a positive safety culture. It also necessitates effective communications. In addition to clearly communicating safety hazards, FAA states safety communications may be something as simple as periodic safety meetings and posting information on bulletin boards.

Some of these requirements may sound onerous. If you do not like the term SMS, just forget it. However, do not forget that the things that are associated with SMS are the things that a good flight department should be doing in the first place. It is about ensuring you are providing the highest levels of safety for those who are paying for your services. Now that is something not to forget. **BCA**

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***Robert L. Sumwalt*** *is executive director for the Boeing Center for Aviation and Aerospace Safety at Embry-Riddle Aeronautical University. He was a member of the NTSB from 2006-21, where he served as chairman from 2017-21. Before that, he managed a corporate flight department for a Fortune 500 company, and previously was an airline pilot for 24 years. He recently co-authored the third edition of Safety Management Systems in Aviation, with Alan Stolzer and John Goglia.*

**ROGER COX**
Contributing Editor

# Keep To Checklist For Fuel

## The alternative is not good

TRANSPORTATION SAFETY BOARD OF CANADA

**The Air Tindi DHC-6-300 Twin Otter landed in a watery peat bog called a "muskeg" in Canada.**

**FUEL EXHAUSTION ACCIDENTS** are common in general aviation. They are far less common in commercial, professionally flown operations. The NTSB database shows 669 fuel exhaustion-caused events, but only 10 of those took place in Part 135 operations. One significant reason for better fuel management by professionals is the use of checklists. Checklists are available in Part 91 operations, but they are required in Part 135 operations.

It is therefore notable and somewhat surprising to see the reasons why professionally flown aircraft run out of fuel. A number of recent Part 135 fuel exhaustion events were caused by older, very-high-time pilots who were just overconfident in their ability to stretch their fuel supplies. They knew how much fuel they had—and proceeded anyway. No checklist could help a pilot in a situation like that.

More common are cases where pilots rushed through their flight preparations and did not use a checklist to verify the fuel load, even though they were supposed to. Typically, they had just decided to stop using their normal checklist.

Why do pilots who should know better quit using their checklists? A 2021 accident in Canada provides a classic example.

Air Tindi flight TIN223 departed Yellowknife Airport (CYZF) at 17:48 MDT on Nov. 1, 2021. There were two pilots and three passengers onboard, and the VFR flight was conducted under Canadian Air Regulations (CAR) Part 703, Air Taxi Operations. The airplane was a de Havilland DHC 6-300 Twin Otter, registered as C-GNPS. The destination was Fort Simpson Airport (CYFS), 196 nm (225 mi.) away. The planned fuel for the fight was 2,500 lb.

The fuel onboard at the time of departure was 533 lb. No fuel truck showed up after the airplane landed, and the two pilots went into the terminal. When they returned, the captain noticed an old fuel slip stuffed into a door pocket and assumed it was for the next flight. It was not—and he did not check the slip. At 17:50, the fuel truck operator called the Air Tindi flight coordinator to ask if the flight needed fuel. The coordinator told him the flight had already left.

Twenty-five minutes after they departed, a low-fuel-level caution light should have come on. At that time, there was still 60 gal. of fuel onboard, enough to fly for 40 more minutes at cruise power. However, the pilots did not see the low-fuel light until 18:26, 38 min. after takeoff. They diverted to the nearest airport—Fort Providence Aerodrome (CYJP). They shut down the left engine and feathered the prop to conserve fuel and began a slow descent. At 18:43, 11 nm from CYJP and passing 3,300 ft., the right engine quit. The captain chose a flat area and landed at 18:51, just 6.7 nm from the airport.

The area they landed in was a cold, watery peat bog called a "muskeg" in Canada. Damage to the airplane was limited to the nose bulkhead, nose landing gear, nose skins and nose structure. There were no injuries initially, but everyone experienced hypothermia before they were rescued.

Air Tindi had 14 normal checklists in addition to its cockpit and cabin preparation checks. Three of them—the Before Start, Taxi and Cruise checklists—required that fuel quantity be verified. On the Before Start checklist, the captain interrupted his own checklist to talk to a passenger, and skipped over the fuel item. He ran the Taxi checklist alone, silently and from memory, and again missed the fuel. The first officer (FO) did not challenge him. The FO ran the Cruise checklist silently and without using the list.

A senior investigator from the Transportation Safety Board of Canada (TSB) gave two main explanations for the failure of the pilots to properly use their checklists. The first was the development of informal procedures, which he called "adaptation." Pilots may experiment with boundaries to become more productive, focusing on the achievement of a goal instead of focusing on a threat. When they take higher-risk actions and there are no repercussions, they become habituated to the risk.

The investigator found that several of the senior captains at the company had developed the unsafe practice of doing checklists from memory, and this had become routine for them.

The second explanation was group dynamics and influence. Individuals may be unaware of when they have been influenced by other people. They may do things they would not normally do. They are influenced by experience, seniority, personality, social status or motivation. Examples of influence include compliance, conformity and group-think.

The FO had been hired in April 2021, and had been released to line flying for only two months when the accident occurred. His total time on the DHC-6 was 84.9 hr. The captain, on the other hand, had been with the company for 13 years, had more than 2,900 hr. in the airplane and was a training pilot.

The FO and several other new FOs knew and discussed the fact that some senior captains had developed the practice of doing challenge and response checklists silently, by memory and by themselves. They discussed this with some training captains, but did not submit any safety reports about it. They knew the company continued to pass these captains on checks without comment.

The pilots were at fault, but the company let this happen. Company managers like the chief pilot and director of training should be diligent about enforcing procedural compliance.

It is not enough to sit back and wait for safety reports to come in. Well-run companies are strict about procedure. Checklists are the backbone of procedure. Running them right should be a high emphasis item—all the time. The payoff for good checklist discipline is a better safety record.

To read more about good checklist design and use, see FAA Advisory Circular AC 120.71B, Standard Operating Procedures and Pilot Monitoring Duties for Flight Deck Crewmembers. **BCA**

BY **ROGER COX**

# Identifying Cause **In a Fatal Heli-Skiing Crash**

## Attempting to land on a mountain in Alaska.

**HELI-SKI OPERATORS** take skiers to snowy mountaintops so they can ski down areas of fresh snow in places where most others cannot go. For the customers, it is fun, but for the pilots and the guides, it is also risky. Many things can go wrong. A lot did go wrong on a heli-ski flight that took place on March 27, 2021, near Palmer, Alaska.

That day, an Airbus AS-350B3 pilot attempted to land on a ridgeline in the Chugach Mountains east of Anchorage. Snow was blowing up from the surface, and visibility was falling. The helicopter struck rocks and began sliding backward, down the mountainside. It eventually fell 500 ft. before coming to a stop. The pilot and four passengers died, and one passenger survived.

From the time the helicopter crashed at 18:35 Alaska Standard Time, until the time the surviving passenger was extricated from the wreckage and began the flight to the hospital, 6 hr. 40 min. had passed.

When investigators arrived, they pursued several safety-related issues, but two stood out. Why did the pilot not execute an escape maneuver, and why did it take so long for the survivor to be rescued?

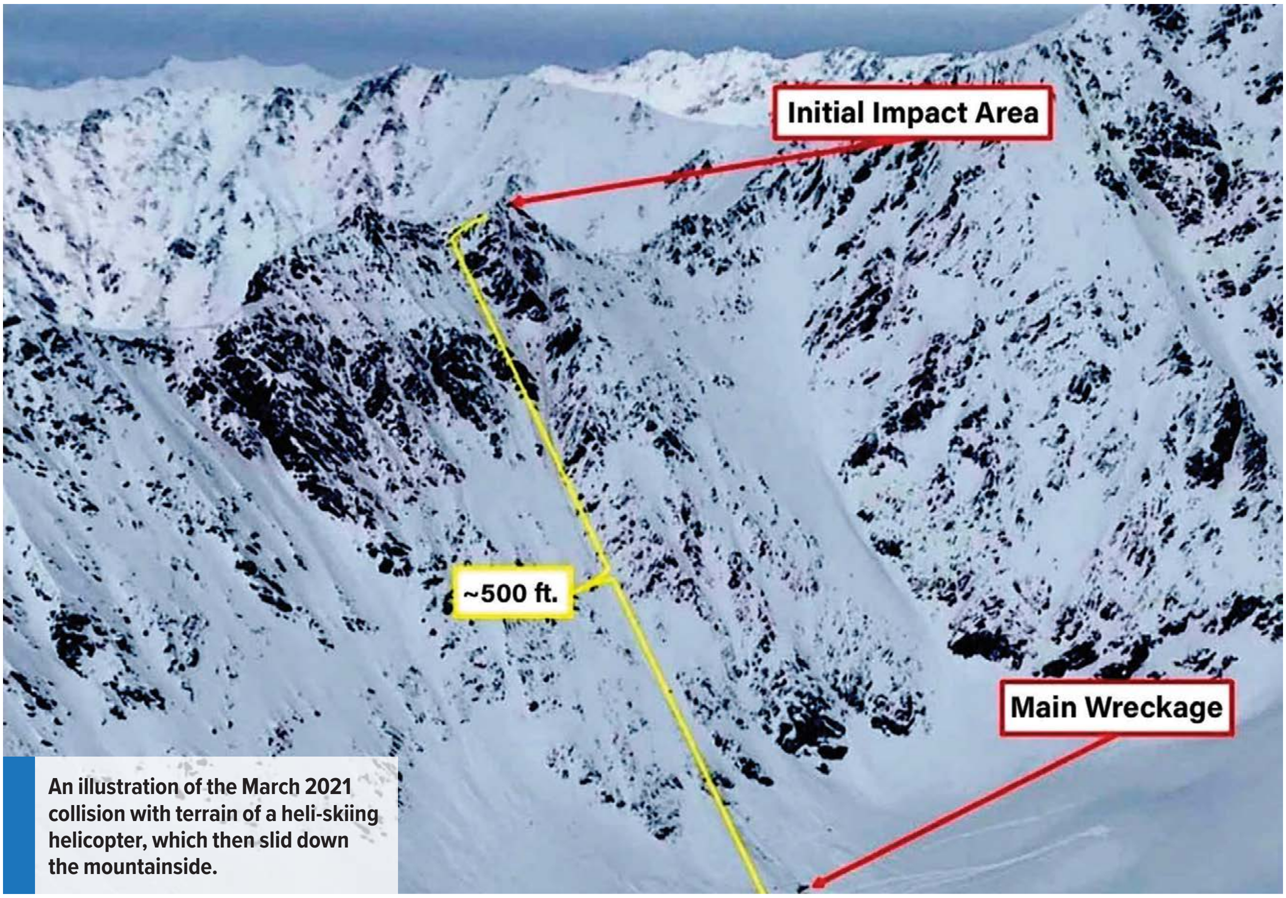
PHOTOS: NTSB

**Soloy Helicopters operated the accident helicopter under contract to Tordrillo Mountain Lodge.**

Soloy Helicopters of Wasilla, Alaska, operated the helicopter as a 14 CFR Part 135 flight. It was under contract to Tordrillo Mountain Lodge, which employed the guides and provided hospitality to the skiers. The division of responsibilities between these two companies became an issue for the NTSB.

The helicopter took off from its base at Wasilla Airport (PAWS) at 14:40. It took about 10 min. to fly to a residence by Wasilla Lake, where it landed to pick up its passengers. Two guides and three skiers boarded, and the helicopter took off again, this time headed for the Chugach Mountains to find good ski runs. A Garmin Aera 660 portable GPS on board recorded the aircraft's movements.

From 16:12 to 18:07, the helicopter made numerous drop-



An illustration of the March 2021 collision with terrain of a heli-skiing helicopter, which then slid down the mountainside.

The helicopter eventually fell 500 ft. before coming to a stop.

offs and pickups of the skiers in the mountains east of Wasilla. At 18:27, it took off and began a climb to 5,900 ft. while tracking along a rising ridgeline. At 18:33, it began maneuvering at slow speed only 14 ft. above terrain that was at 6,266 ft.

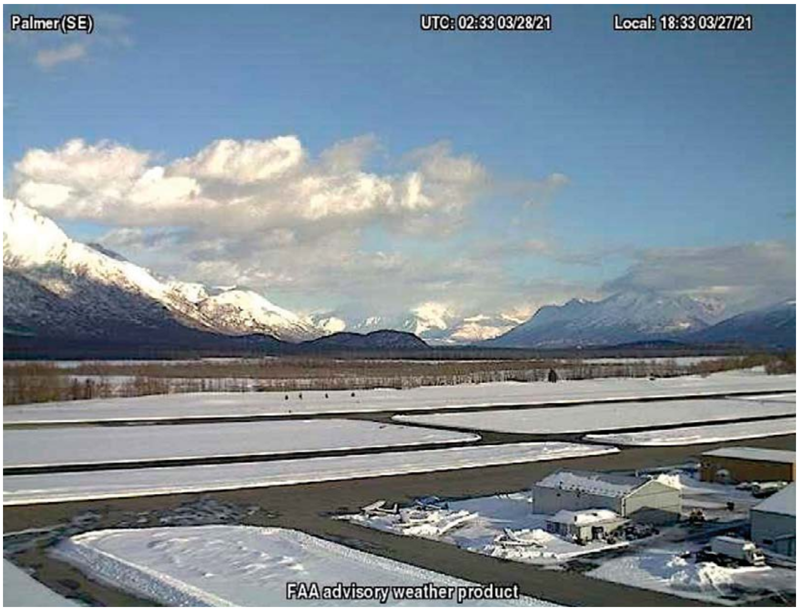
The pilot attempted to land on the ridgeline, but pulled up before making a second attempt. The helicopter became engulfed in fog and snow, and someone called out, "no, no, don't do it." The helicopter began "going backward real fast" and rolled backward down the mountain.

The GPS stopped recording data at 1836:42. It was then near the final resting point of the main wreckage. When responders later viewed the accident site from the air, it was evident the helicopter struck rocks about 15-20 ft. below the top of the ridgeline.

## PROLONGED RESPONSE

When the aircraft came to rest, the surviving passenger found himself stuck in snow and lodged between two other passengers and unable to move. He saw the passenger who had been to his right sitting outside in the snow. That passenger spoke to the passenger still inside the aircraft, but eventually he began sliding downhill and stopped responding.

A Tordrillo lodge heli-ski guide who had been monitoring the accident flight with a Garmin InReach satellite communicator attempted to contact the aircraft at 19:04. He notified a supervisor at 19:15 that he had no positive communications with the aircraft. Another experienced guide discussed the situation with the lodge's co-owner, and they concluded the crew on the flight was "taking their time and enjoying the last run of the day."



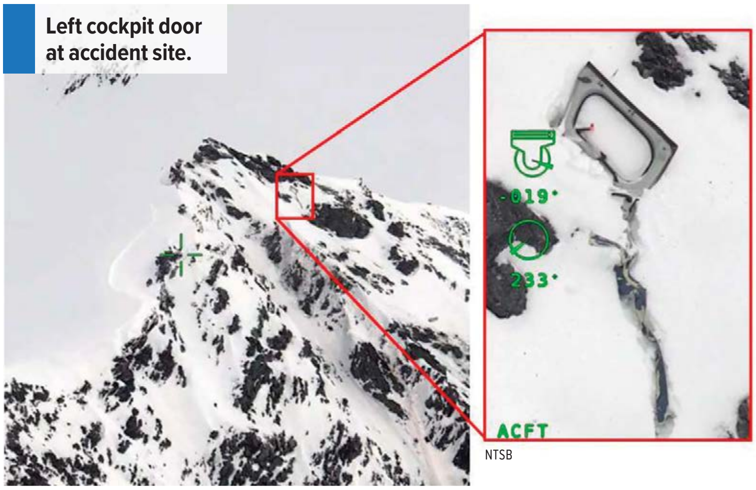
**FAA weather camera pointed east toward the accident area.**

FAA

That guide, who was the owner of another heli-ski lodge, began checking on the missing flight. Several helicopters not part of the Soloy/Tordrillo operation were alerted to a possible downed aircraft. More than an hour went by before the lodge owner called Soloy's director of operations to discuss the situation.

Finally, at 20:30, Tordrillo Mountain Lodge activated its emergency response plan, followed by Soloy at 20:32. However, the Alaska Rescue Coordination Center (AKRCC) did not record being notified until 21:10.

A helicopter from another heli-ski operation first located the wreckage at 21:36. The crew told AKRCC the accident location was on the "Knik (Glacier) side of the ridge." When an Alaska Air National Guard HH-60 helicopter arrived, it was too heavy to descend in a hover, and the crew needed 30 min. to dump fuel down to a safe weight. Two pararescuers finally arrived on the scene at 00:15. The surviving passenger was still wearing his seatbelt and had to be cut out of his seat. At 01:15 the rescue helicopter departed with the victim and arrived at a hospital in Anchorage at 01:36.



**Left cockpit door at accident site.**

NTSB

## THE INVESTIGATION

The main wreckage of the AS-350B3 ski-tour helicopter came to a stop on its right side about 500 ft. below the top of the ridgeline. Additional debris extended down to about 900 ft. below the ridge. The emergency locator transmitter (ELT) was still attached to the airframe, but its external antenna was missing.

The NTSB's airworthiness group examined the main wreckage in the month following the March 2021 accident, but other wreckage was not recovered for more than a year. The investigators did not find any malfunctions or failures that might have caused the accident.

The first person the NTSB interviewed was the surviving passenger. He had suffered severe frostbite, rib fractures and contusions, and hypothermia so advanced that his body temperature was only 28C when he was rescued. The interview was 11 days after the accident and was done using FaceTime. He said the pilot first attempted to land, but then "went up to try to get into the right position." The snow was "really light," and as the pilot tried again to land, the helicopter was "engulfed in a fog, which made it appear like a white room."

The surviving passenger confirmed that it was the passenger sitting to his right who had cried out "no, no, no, don't do it!" He had been skiing with both of the other passengers for 10 years or more. He said the pilot was having trouble staying level on the earlier drop-offs, and the helicopter was not level when they touched down the first time. He also said the pilot was new.

When safety investigators later interviewed operator Soloy Helicopter's director of operations and other company officials, one of their areas of focus was on the pilot's experience and training.

The pilot, 33, held a commercial pilot certificate with rotorcraft helicopter and instrument helicopter ratings. His FAA first-class airman medical certificate was dated Feb. 10, 2021, and there were no limitations. He had logged 3,286 flight hours, 1,505 of which were in the make and model of the accident aircraft. He had flown 178 hr. in Alaska, 105 hr. of heli-ski flying and a total of 59 hr. of simulated instrument time. Soloy's safety manager called him a "journeyman" pilot, not a high-time pilot compared to other pilots at Soloy.

Before coming to Soloy, the accident pilot had flown Grand Canyon and Monument Valley tours with Sundance Helicopters and glacier tours in Juneau with Northstar Helicopters. He first started working part-time for Soloy in 2019, flying oil drillers. In 2021, he was flying heli-ski operations in a contract with Chugach Powder Guides before he was asked to fly the Tordrillo Mountain Lodge contract.

When the accident pilot first took his instrument helicopter check in 2013, he was disapproved for "performance maneuvers." Later, he also was disapproved on his first attempt to complete his flight instructor instrument helicopter rating. The areas he had to repeat were "flight by reference to instruments" and "instrument approach procedures."

The visual condition the surviving passenger described was a "white-out," and it was probably caused by the helicopter's rotor wash while the aircraft hovered over the ridgeline. Given the pilot's relatively low experience in Alaska and possible poor instrument proficiency, he may have been unprepared to cope with the situation.

Safety investigators examined the pilot's training at Soloy. The company's controlled flight into terrain (CFIT) training for the pilot could not be verified, and he had not been checked for proficiency in recovery from inadvertent instrument conditions, ATC communication or instrument approach flying.

## OTHER FACTORS

The accident helicopter's instrument panel was recovered virtually intact. It had a full set of flight instruments, including attitude and directional indicators, altimeter and vertical speed, airspeed and even a radar altimeter. The pilot should have been able to transition to instruments long enough to escape the white-out area.

An NTSB meteorologist determined that winds near the accident site at 6,000 ft. would have been out of the north at around 20 kt. This would have resulted in downslope wind flow south of the mountain ridges in the vicinity of the accident site, possibly accounting for the direction at which the helicopter fell.

Soloy Helicopters is based at Wasilla Airport and operated 17 helicopters at the time of the accident. The company employed 20 pilots, many of whom were only seasonally employed. Founded in 1979, Soloy provides helicopter support for various industry and government services in Alaska. It specializes in precision long-line work with drill-exploration programs.

The company had a risk assessment form for the heli-ski operation, but filled it out just once, at the beginning of the season. The director of operations explained that most of the risk factors remained the same for every flight, and the pilot could assess the few variables like the weather. A pilot could decline to take a flight if he felt the weather was unacceptable.

An NTSB survey of three other Alaska helicopter operators who conducted heli-ski or remote operations found that two of them required pilots to do a risk assessment every day and one required pilots to do one before each flight.

When safety investigators tried to find out who or what was responsible for the delay in beginning the search for the downed ski-tour helicopter, they must have felt like they were pulling on a string that would not end. Instead of a clear chain of command, operational control was diffused to multiple parties. The first person they spoke with was the guide who had initially expressed concern about lost communication with the accident aircraft. It turned out that he did not work for either Soloy, the flight's operator, or Tordrillo Mountain Lodge, the heli-ski tour organizer.

There were multiple heli-ski guide outfits operating in the mountains north and east of Anchorage. The hospitality company owners, the guides and the helicopter company owners all knew each other and had a "gentleman's agreement" to monitor each other's flights. Each of the guide companies had their own tracking devices linked to their guides, but none of them had FAA authority to control a helicopter flight.

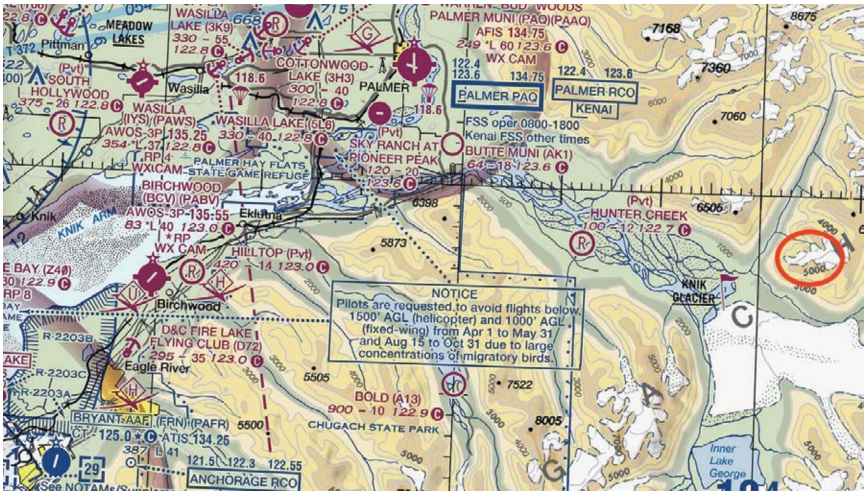
FAA

The instrument panel of the accident helicopter was largely intact

It was Soloy Helicopters, a Part 135 operator, that had the responsibility for flight locating. But its director of operations (DO) said he had delegated locating responsibility to the guide company. Of all the people who were concerned about the non-responsive helicopter, the DO was the one most out of the loop. He expected Tordrillo Mountain Lodge, the guide company, to initiate an emergency response, but the owner of that company was uncertain about what happened and hesitated to act.

Soloy did not have written authority from the FAA to delegate its flight-locating responsibilities to anyone else. Any such delegation, if approved, would have to be stated in the company's Operations Specifications (Ops Spec A008). It was not there. One of the main purposes of 14 CFR Part 135.77, "Operational Control," and Part 135.79, "Flight Locating Requirements," is to prevent mixups like the one that happened at Soloy Helicopters.

Another string the NTSB had to pull was why the FAA principal operations inspector (POI) had not been aware of Soloy's unauthorized delegation of its flight-locating authority. She also had not caught shortcomings in Soloy's flight check ride profile. She may have failed to question Soloy's practices because she had been chief pilot there in 2013 and did not consider the company to be a risky operator. In fact, she said: "Soloy is one of my best operators. They're very receptive and forthcoming in our relationship."

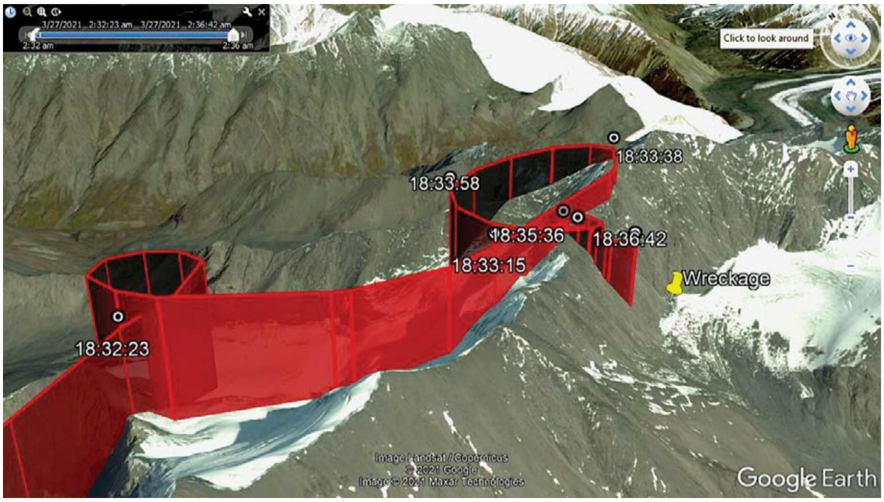


FAA

**Anchorage, Alaska, sectional chart showing location of the helicopter accident.**

## CONCLUSIONS AND COMMENTS

The NTSB determined that due to deficiencies in Soloy's training program and Part 135 check rides, it is likely the accident pilot did not meet the qualification standards to be in command of the fatal flight.



NTSB

**Helicopter's path before the accident.**

The safety board's primary probable cause was "the pilot's failure to adequately respond to an encounter with white-out conditions, which resulted in the helicopter's collision with terrain." Two contributing causes were "the operator's inadequate training program and pilot competency checks," and "the FAA POI's insufficient oversight of the operator." The board added that delayed notification of search-and-rescue organizations contributed to the severity of the surviving passenger's injuries.

One of the unique factors that affects helicopter operators in Alaska is the vast distances they must travel to service some of their contracts. Oil drilling and mining sites, for example, are located far from operators' bases. A helicopter might be contracted to operate for a week somewhere on the North Slope. It makes sense to have someone at the location maintain a company flight plan and be ready to alert search-and-rescue when an aircraft is overdue. But the helicopter operator would have to maintain tight control of the process, and it would have to be approved by the FAA.

Throughout the accident interviews and the report, people used the terms "flight following" and "flight locating" interchangeably. However, flight locating is the only term applicable to Part 135. Paraphrasing 135.79, it means: the operator must provide at least as much information as would be provided in an FAA VFR flight plan; the operator must provide timely notification to FAA or search-and-rescue organizations when an aircraft is overdue or missing; and the operator must provide the location, date and estimated time for a flight to check in if it is in a remote area.

Flight locating does not require the use of flight-tracking devices. It seems that the presence of GPS and satellite communications devices went beyond the regulatory language. Many Part 135 operators now have trackers like Spidertracks or Garmin inReach, and they have begun to use the term flight-following to refer to the tracking they do with these devices.

In its report, the NTSB said the term "flight follower" referred to personnel who perform various flight-support duties. The term may also be confused with VFR flight following, a service provided by air traffic control to VFR flights. It is called the Radar Traffic Information Service, and it is described in Paragraph 4-1-15 of the Aeronautical Information Manual.

There is an added concern to be mentioned in this case. Despite the NTSB's findings, Soloy is considered by many in Alaska to be one of the most reputable helicopter operators in the state. Based on the interview with its safety manager, the company has an extensive voluntary safety management system (SMS) and has been through multiple audits. It seems odd that the SMS did not catch the training and checking deficiencies the NTSB found, and that the unapproved system of delegating flight locating did not come to the attention of company or FAA officials before the accident.

It seems that despite the promise of SMS, "reactive" methods like accident investigations are still needed to ensure system safety. **BCA**

**JESSIE NAOR**
Contributing Columnist

# Profiteering In FAA Certification Services

Supply and demand leading to price gouging

Recently, increasing numbers of certification services have been carried out by designees.

SAZONOFF/GETTY IMAGES

**MORE THAN 90%** of the FAA's certification work is performed by designees, not full-time employees, according to the agency. Designees perform tasks such as medical licensing, pilot exams, airworthiness inspections and more on behalf of the FAA. These certifications are critical processes in the business aviation industry, and while services performed by FAA inspectors cannot be charged to end users, designees are permitted to charge for these services.

While designees have been used since the inception of the FAA as a "force multiplier" to their workforce, the lack of oversight in what designees are allowed to charge for services is creating a moral hazard as the agency is more short-staffed than ever. Services that would be free if conducted by an employee—where that employee is unavailable due to workload—can be sought from designees, who are only required by law to ensure their fees are reasonable.

## REASONABLE FEES, WITHOUT OVERSIGHT

The definition of reasonable, however, seems to go unchecked. The importing of aircraft from overseas requires an airworthiness certificate, which is performed specifically by a Designated Airworthiness Representative of Maintenance (DAR-T). According to multiple sources, it is not uncommon to pay $5,000-$10,000 to issue a standard certificate of airworthiness on a foreign aircraft.

The FAA "does not regulate what DARs charge" and "DAR-Ts set their own rates," according to the agency.

With the costs of travel and other fees, the process could reach $20,000-$30,000, depending on the complexity of the location or aircraft. This fee often comes as a surprise to aircraft buyers. Due to a shortage of FAA representatives to do the work in a timely manner and a small pool of designees from which to choose, buyers sometimes have no choice but to pay whatever is demanded.

If the work were to be conducted by a FAA representative, the fees charged would be based on hourly work rates, plus expenses incurred with no flat fees for certificates—a seemingly reasonable approach to the pricing of such services.

Designee invoices commonly include business-class airfare, per diems, certification services, daily rates and more. In 2004, there were more than 400 DAR-Ts and today, there are barely over 200—and only 18 living outside of the U.S. Compounding the issue is the use of territories where designees are only permitted to work in certain locations unless authorized.

When asked about the almost 50% decline in DAR-Ts available, the FAA says: "There are more resources to complete the work today than there were 20 years ago. Many Organizational Designation Authorization (ODA) holders can perform the same functions as DAR-Ts, and the number of ODA holders has increased over the last several years. Local demand drives the determination for additional DAR-Ts."

## ACCOUNTABILITY

Procuring a lucrative designee certification is largely based on who you know—and the discretion of individuals within regional offices. These issues were highlighted by a Government Accountability Office (GAO) report in the early 2000s. In the report, the GAO noted that while designees played a critical role in the functions of the FAA, much more oversight and accountability was needed.

The FAA has been whiplashed by Congress and the Transportation Department over the use of designees. For many years, the agency was encouraged to increase the pool of designees to work more efficiently, then told to reduce designees and have more FAA employees conduct certification work, particularly after the Boeing 737 MAX 8 crashes. Regardless of political pressures, the FAA has always relied heavily on designees to fulfil directives, and without a major shift in staffing levels, it has no choice but to do so.

While designees are a way to expand the FAA's certification abilities, it also requires more personnel to oversee and train these extensions of the workforce. "The ratio of designees to FAA staff is about 6 to 1 in the Aircraft Certification Service, about 5 to 1 in Flight Standards and about 440 to 1 in Aerospace Medicine," according to the 2004 GAO report. At the time of the report, there were 4,100 FAA inspectors to 13,600 total designees.

Perhaps the most alarming issue came to light in the GAO report regarding the selection process of designees:

We also found that field offices did not consistently follow established policy for selecting designees ... 19 of the 62 experts on our panel believed that FAA does not consistently follow its own designee selection criteria ... but rather appoints designees based on personal associations. Moreover, 9 of the 17 FAA inspectors and engineers on our panel rated the practice of awarding delegation status based on personal associations with FAA management as a "great" or "very great" weakness of the designee programs.

In the GAO report, the FAA states that "personal associations is an important factor in selecting and appointing designees."

JULIAN ELLIOTT PHOTOGRAPHY/GETTY IMAGES

**Some pilots have had a hard time scheduling checkrides—and the cost per checkride has risen.**

## UNFAIR SYSTEM FOR USERS—AND FAA

The combination of an exclusionary process of selecting designees and a lack of rules on what these designees are allowed to bill for their services affects the entire safety oversight system.

For one, it drives up the price of certifications, particularly when a certain designee type is in short supply. It could also affect the supply of qualified aviation inspectors willing to work for the FAA: If a designee can make more than a safety inspector's salary, they may be less inclined to take full-time positions. Scores of payments for certification services are being directed to private individuals instead of to the FAA's budget.

To put the amount in context, Designated Pilot Examiners (DPEs) conducted 91,000 checkrides in 2021 versus 700 checkrides completed by FAA inspectors. Based on the average cost of $750 for a checkride from a DPE, that could be up to $68 million in fees paid for checkrides.

This is just one individual designee program—there are 12 others.

Based on a survey conducted by Middle Tennessee State University, 18% of DPEs conduct checkrides as their full-time career and of all full- and part-time DPEs, they conduct an average of 10 checkrides per month. At $750 per ride, a six-figure income can be obtained with only 12 checkrides per month. For DAR-Ts working overseas, charging $5,000-$10,000 per airworthiness certificate, incomes are likely much higher.

The FAA is restricted by law to introduce new user fees to cover the cost of recruiting, training and overseeing designees, but they can request that Congress allow to them charge application or renewal fees for designees, or other such efforts. User fees have been a highly contentious topic over the years, with most industry trade groups battling against bills introducing concepts like per-flight fees. However, these designee services are a unique area that could represent a highly profitable business for individuals. Yet annual training for some designee roles is a mere $50 per year.

While trade groups have fought to keep FAA fees at bay, the result has been the increasing privatization of "free" FAA certification services with no financial oversight. While most designees may charge fair prices, particularly when they have competition from other designees, without pricing regulation, the opportunity for price gouging will grow higher the more scarce the pool of designees.

## A PRIVILEGE, NOT A RIGHT

FAA guidance for the designee program frequently points out that being a designee is a privilege, not a right. The privatization of government services is not uncommon, and it can be a great way to supplement government workforces, but only if it is conducted in a fair and open manner to the public, with pricing controls.

But bestowing the privilege of conducting FAA certifications with unregulated pricing makes the system unfair to users—and costly to those who need it most. The industry has a right to demand fair prices from the designee system, a right to understand how many positions are available and a right to conduct certifications if they are duly qualified and trained, regardless of personal relationships. **BCA**

BY **JEREMY KARIUKI**

# Sustainability Services

Notable options for the race to net-zero

### 1 | Level Up

**COMPANY: 4AIR**

**PRODUCT:** 4AIR's voluntary program is designed to help companies reduce their carbon footprint based on their level of "sustainability ambition." Through sustainable aviation fuel (SAF) documentation and tracking, as well as regulatory monitoring and compliance, 4AIR incorporates verified emission offset credits that support clean energy projects worldwide. According to 4AIR, this approach includes "not only carbon dioxide emissions from aircraft and ground operations, but climate-changing emissions from all sources, including water vapor, aerosol sulphates and nitrous oxides." **marketplace.aviationweek.com/company/4air**

### 2 | Innovation For Good

**COMPANY: Jet.AI**

**PRODUCT:** Jet.AI's DynoFlight service allows customers to purchase carbon offset removal credits (CORCs) by Puro.Earth. According to Jet.AI, CORCs are "a superior class of carbon credits," with each one representing one metric ton of carbon dioxide physically removed from Earth's atmosphere. With DynoFlight, customers will also be able to estimate carbon emissions based on a library of more than 250 aircraft models using either SAF or Jet-A fuel. Alongside data collected over time, customers can track offsets and purchase credits for individual flights. **marketplace.aviationweek.com/company/jetai**

1 4AIR

2

3 NETJETS®

4 NBAA NATIONAL BUSINESS AVIATION ASSOCIATION

### 3 | Going Green For Blue Skies

**COMPANY: NetJets**

**PRODUCT:** Blue Skies by NetJets allows customers to purchase carbon credits based on annual flight hours, calculated by "multiplying the carbon offset hourly rate for their aircraft type by total share size." According to NetJets, the program is offered through the company's partnership with Climate Impact Partners, which verifies the use of carbon credits through "high quality projects chosen by NetJets to reduce global CO2 emissions and deliver positive impacts for local communities." **marketplace.aviationweek.com/company/netjets**

### 4 | Department-Wide Initiative

**COMPANY: National Business Aviation Association (NBAA)**

**PRODUCT:** The NBAA offers a Sustainable Flight Department Accreditation Program to help companies take a holistic approach to reaching net-zero operations. Through the program, participants will gain access to the NBAA's environmental sustainability resources regarding flights, operations, ground support and infrastructure. According to the NBAA, each individual accreditation is valid for three years. **marketplace.aviationweek.com/company/nbaa**

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Planning a trip to Mexico?

VIEWPOINT

**CRAIG GOTTLIEB**
Guest Columnist

# Broadening the Pool

## Finding enough qualified MRO talent may require a more skills-based approach to recruiting

**A FEW MONTHS AGO I SAT,** very frustrated, waiting for my car dealership to complete some minor maintenance. As I begrudgingly paid the invoice, the manager apologized and offered an interesting explanation for the delay. He was short on mechanics, evidently because they had better opportunities at a defense contractor across the river that was rapidly snapping up any candidate with a hint of technical skills in its efforts to rapidly scale production.

Thankfully, the dealership gradually found new workers. Wait times are down, and the experience taught me a lesson about workforce and sourcing talent. As commercial and defense MROs look to serve imminent growth, how might they, too, reconsider the persistent constraints of workforce availability?

Viewed through the MRO lens, the state of the workforce is often described with words such as “competitive” and “scarcity.” The characterization of talent availability as a headwind for MRO growth extends from science, technology, engineering and mathematics (STEM) graduates to skilled shop floor workers and is consistently echoed in Accenture’s biannual commercial aerospace research. While demographics and macroeconomics will always shape facts on the ground, MROs can take specific steps to mitigate their impact and constraints on capacity, throughput, customer service and profitability.

It starts with thinking differently about talent. MROs have always cared about their employees understanding the product and the tasks they perform. To address the talent shortfall, MROs must go beyond considering knowledge and experience to view talent through the lens of skills. MROs have drawn the path to knowledge and proficiency in a very straight line. Hiring graduates from key university programs, creating trade apprenticeships, tapping into military veterans and targeting underrepresented communities are all important steps in building the MRO workforce. A skills-based approach to talent takes things further by asking the basic question of what it takes to do a job well. The answers can be surprising.

It starts with understanding the specific skills that underpin competency in the work of a given role. This allows companies to identify candidates they may not have traditionally sourced, developed or borrowed. For example, in digital MRO, the skills required to develop a consumer-facing mobile app are directly transferrable to the flight line. On the shop floor, individuals from industries as varied as agriculture and network installation possess the core mechanical know-how to fill increasingly difficult positions in MRO.

A skills-based approach can also help MROs more easily identify internal candidates for “upskilling” or “reskilling” into new roles, moving into adjacent areas of need or for leadership and succession planning at a time of workforce transition. It also provides employees with a clearer view of how their individual skills fit into the success of the business.

However, this approach will not solve MRO workforce challenges immediately, since the industry has some very specific workforce constraints. In this highly regulated industry, experience and certifications are mandatory. Just because someone may have applicable skills for a mechanic role does not automatically confer them airframe and powerplant certification.

MROs and their industry partners will need to continue to invest internally and with OEMs, operators and regulators to improve the scale, pace and robustness of the certification process. Creating a skills-based organization may expand the pools from which to source talent, but the industry ecosystem must be ready to bring those candidates over the finish line to operate at the necessary levels of safety and regulatory standards.


FREER LAW/ALAMY STOCK PHOTO

Skills from other industries could be the foundation needed to succeed in MRO roles.

The MRO industry is aggressively working to expand traditional sources of talent and make inroads into underrepresented sources of talent. Taking a skills-based approach can broaden these talent pools, create the foundation for structured and analytically driven talent sourcing and give internal candidates a marketplace in which their skills become a currency for career growth and customer success.

In a world where talent is “scarce” for MROs, shifting to skills creates opportunity to identify, attract and retain the people who will secure our industry’s return to growth. **BCA**

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