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Business & Commercial Aviation

2020

Operations Planning Guide

A tool for planning flight department
budgets for the coming year



OPERATORS SURVEY

Pilatus PC-24

Maturing is an ongoing process

ALSO IN THIS ISSUE

The Human-Engine
Interface

Sharing Aircraft
Under Part 91

A Descent Too Late

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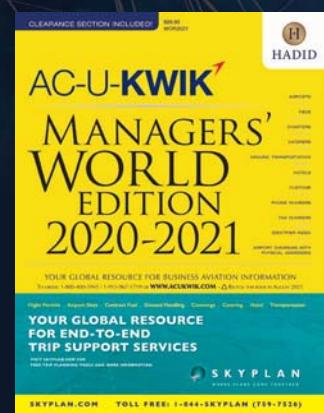
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Of What Use?

A whisper of promise

WHEN COVID-19 ARRIVED, THE AIRPLANES DISAPPEARED.

Depending upon the prevailing winds, my house is situated below the eastern and southern arrival patterns for, respectively, a nearby executive airport as well as a joint military and commercial facility, and there are days when I can take in an airshow from my office deck.

I've been enticed from my computer by everything from a Wheels Up King Air, Citation X and U.S. Coast Guard Dolphin, to a Boeing 747 Dreamlifter, V-22 Osprey (a most peculiar flying machine), C-17s galore, flights of F-35s, F-16s and F-18s, and one day a B-25. No kidding. I so welcome the aerial interruptions. But once the pandemic hit, those sounds on high ceased, their winged generators utterly absent from the sky. The novel coronavirus had killed aviation. Or so it seemed.

But while the infection grounded tens of thousands of airliners, business aircraft, lightplanes and helicopters, inflicting terrible financial hardship on ours and so many other industries along with millions of individuals, aviation did not stop. In fact, its advance continued rather dramatically. If you were unaware, it may have been because the machines involved are so hush quiet since they all use electricity rather than internal combustion to generate their propulsive power.

And while the technology may be unfamiliar and its current capability modest, Benjamin Franklin's response to a question about the value of the then remarkable hot-air balloon seems timely still, 250 years on: What is the use of a newborn child?

So, what follows is an accounting of a few aviation events that transpired while you were looking for your misplaced mask:

► NASA replaced the two piston engines on its X-57 Maxwell experimental plane with a pair of 60-kW electric cruise motors powered by lithium-ion battery packs. Startups Airflow and Electra plan to adapt its distributed electric propulsion configuration to their hybrid-electric short-takeoff-and-landing regional and logistics aircraft.

► Wisk, the urban air mobility joint venture between Kitty Hawk and Boeing, resumed flight testing of its two-place Cora



An STC is planned. This followed by six months the flight of a de Havilland Canada DHC-2 Beaver converted to electric propulsion by MagniX and Harbour Air Seaplanes.

► On June 9, the French government committed to supporting Airbus Helicopters' plans to develop a successor to its best-selling H125 Ecureuil (AStar) single-engine light helicopter, and which is intended for hybrid-electric propulsion.

► EHang received light sport aircraft (LSA) approval from the Civil Aviation Administration of China (CAAC) to begin commercial operation of its EHang 216 autonomous eVTOL air vehicle for unmanned air logistics.

► Slovenia's Pipistrel received an LSA type certificate for its all-electric Velis Electro two-seat fixed-wing trainer from the European Union Aviation Safety Agency (EASA).

► Meanwhile, Bye Aerospace of Colorado neared critical design review for its eFlyer 2 two-seat electric trainer and revealed plans to develop an electric six- to nine-seat twin in addition to the already announced four-seat eFlyer 4.

There was even more, but you get the idea. Electric propulsion is in active development for aviation. These are the early days, of course, and accordingly endurance and thus range is limited and numerous obstacles including excessive weight and high cost remain. But the benefits — zero emissions, low "fuel" expense, low vibration, simplified maintenance, nearly silent operation — are so compelling, that heavy money is being invested in e-aviation's success.

To underscore the dollar commitment, Lilium, a German e-VTOL startup, now has a valuation of more than \$1 billion, while Joby, another e-VTOL air-taxi developer, has so far raised \$720 million.

And while some av veterans probably correctly regard much of this electrification movement as a science experiment, I'm not quite so dismissive. Yes, many of the e-Av projects are likely to come to naught and their backers will lose all — in some cases fortunes. But I also noted that more than half the investment in Joby came from Toyota, the largest automaker in the world. And it is just one of many global corporate participants in the movement.

Notably, a sizeable portion of Lilium's recent funding infusion came from a Scotland-based partnership whose previous bets were placed with big-promise tech hopefuls named Space Exploration (aka SpaceX), Tesla and Amazon.

Whither a newborn indeed, Dr. Franklin. **BCA**



all-electric vertical-takeoff-and-landing (eVTOL) autonomous air taxi in the U.S. and New Zealand. Passenger-carrying trials are planned.

► Electric motor developer MagniX and certification specialist AeroTec flew a Cessna 208B Caravan at Moses Lake, Washington, on May 27 powered by a 560-kW (750-shp) electric motor.

featured are a bit of an ex-military monopoly. There are a bunch of us out here who never flew in the armed forces that are just as — and in some cases perhaps, more — knowledgeable than ex-service types. Indeed, some of the finest pilots I've ever flown with never touched a military aircraft, yet their experience seems to get short shrift. (We're also pretty fine writers, too.)

You should consider mixing it up a little. Guys like me may have only flown Embraer 600s/650s, at times out of places most people can't even spell, but we might have a thing or two to contribute from *our* perspective. And candidly, I've flown with plenty of former military guys over the years and only a few would I consider standouts.

In fact, when I did Expanded Envelope Training in the Boeing 737 at a major airline, I was the only pilot who didn't bend the jet on the first try, and then went three for three. I'm just a lowly FAR 121/135/125/91 civilian to

boot. Meanwhile, my sim partner, an A-10 driver, bent the jet three in a row. In my experience, ham-fisted single-seat fighter guys are some of the toughest people to tame on this side of the fence — from CRM to customer service (and that includes providing a smooth ride).

Jason Smith
Legacy 600/650 Captain
McAllen, Texas

Editor's response: As a matter of fact, we welcome pilot-writers of every type and with all manner of backgrounds and many with civil-only experience have provided valuable insights and guidance over the years. Of the four cited in that Viewpoint, only one, James Albright, made a full career in uniform and since retiring has flown in business aviation exclusively. Meanwhile, Pat Veillette flew for an airline, then for the forest service — both helo and fixed wing — and finally ended up piloting Citations for a fractional operator. Fred George flew F-4s off Navy carriers and then Learns for a charter operator before joining us full time.

And David Esler was an Army officer but not an aviator; all his piloting time was logged in civilian aircraft. The monopoly is open to anyone serving aviation and readers well.

Best Yet

"Smoke Signals" (June/July 2020) was perhaps the best safety-related article in all my decades of reading the magazine. It was well-thought out and compellingly presented. This one could actually make some flight departments conduct some introspection. It did mine.

Randall Greene
Chairman & CEO
Safe Flight Instrument Corp.
White Plains, New York

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NEWS / ANALYSIS / TRENDS / ISSUES

► **THE STRATOS 716X, AN ALL-CARBON**, single-engine very light jet (VLJ) made its first flight, reported the Redmond, Oregon, manufacturer reported July 2, which involved a full-power takeoff, climb to 13,500 ft. and a series of maneuvers by pilot Sean VanHatten to evaluate handling and lasted 22 minutes. Flight testing is to continue for several months. The six-place, Pratt & Whitney JT15D-5-powered aircraft is 4.5 ft. longer and at 4.9 ft., a wider cabin than the 714 Proof of Concept aircraft introduced at EAA AirVenture Oshkosh in 2017. It features a Garmin flight deck and autopilot, an automated pressurization system and air conditioning. The jet is designed to cruise at 400 kts. "The first flight of the 716X



went as briefed, which is a testament to the design quality and the professionalism of the crew here at Stratos," said VanHatten. "The aircraft is well harmonized, and its directional stability was very good. The Stratos Aircraft team should be very proud of this accomplishment, and I'm looking forward to continued flight testing of this new design."

"When we introduced the Proof of Concept 714 aircraft three years ago, the marketplace interest was tremendous," "It was clear that the market is looking for the performance and comfort we were offering, but in a true six-place aircraft. We have achieved this with the 716X. With a cabin width of 4.9 ft. and height of 4.8 ft., there is plenty of room for passengers to relax on long flights. The company says Stratos 716X will be offered as kit build aircraft while the 716 will be FAA certified as a production version. The kit will be comprehensive and include a builder's assist program. "We are excited to be able to introduce the 716X builder's assist program," said CTO Carsten Sundin. "This program will allow us to deliver the 716X to a select group of customers very soon while we continue with the program for the 716 certified aircraft."



► **THE LONG-RANGE, LARGE-CABIN BOMBARDIER GLOBAL 5500** recently entered service with an unidentified operator. However, the aircraft is registered to ExecuJet Europe, the Swiss-based private charter group, according to Aviation Week Network data.

In June, Bombardier also registered a Global 6500 on the Cayman Island registry to an undisclosed customer, and a Challenger 650 and a Global 6500 to NetJets, according to Aviation Week data. The latter is the first of its kind for the fractional ownership company. The Global 5500 received its type certificate from Transport Canada and the FAA in 2019. The first delivery is a milestone for the company, which announced the Global 5500 and Global 6500 in 2018.

► **ACCELERATUM, A NEW COMPANY FOCUSED** on advancing standards and best practices in the drone industry, counts among its co-founders former FAA Administrator Michael Huerta and Jim Williams, the former manager of FAA's Unmanned Aircraft Systems (UAS) Integration Office. Other co-founders Lessing Stern and Ben Rifking, respectively the founder and CEO of Ten Eighty, a private investment firm. Stern also serves as chairman of the Aircraft Owners and Pilots Association Foundation. Acceleratum's president is Brett Feddersen, formerly FAA acting director for national security programs and incident response. The new company describes itself as a privately funded, collaborative organization that develops consensus solutions based on priorities identified by affiliate members who can include commercial drone users, municipalities, emergency service providers, manufacturers, regulators and trade associations. Project areas the company will focus on include counter-UAS detection standards, UAS certification standards, beyond-visual-line-of-sight operations and UAS traffic management system integration.

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Jet-A and Avgas Per Gallon Fuel Prices July 2020

Jet-A			
Region	High	Low	Average
Eastern	\$7.81	\$3.36	\$5.43
New England	\$7.57	\$2.92	\$4.73
Great Lakes	\$7.38	\$2.99	\$4.76
Central	\$6.22	\$2.96	\$4.06
Southern	\$7.34	\$3.00	\$5.13
Southwest	\$6.75	\$2.28	\$4.43
NW Mountain	\$7.41	\$2.60	\$4.65
Western Pacific	\$7.96	\$3.60	\$5.51
Nationwide	\$7.31	\$2.96	\$4.84

Avgas			
Region	High	Low	Average
Eastern	\$8.25	\$4.35	\$6.19
New England	\$7.45	\$4.51	\$5.54
Great Lakes	\$8.59	\$2.99	\$5.73
Central	\$7.59	\$2.92	\$4.86
Southern	\$8.15	\$3.20	\$5.97
Southwest	\$7.19	\$3.26	\$5.25
NW Mountain	\$6.45	\$3.75	\$5.30
Western Pacific	\$8.52	\$3.99	\$5.91
Nationwide	\$7.77	\$3.62	\$5.59

The tables above show results of a fuel price survey of U.S. fuel suppliers performed in July 2020. This survey was conducted by Aviation Research Group/U.S. and reflects prices reported from over 200 FBOs located within the 48 contiguous United States. Prices are full retail and include all taxes and fees.

For additional information, contact Aviation Research/U.S. Inc. at (513) 852-5110 or on the Internet at www.argus.aero

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Daher Launches Incentive Program for Kodiak 100



Daher has launched a new Kodiak Care Maintenance Program designed to provide free scheduled maintenance for Model Year 2020 Kodiak 100 aircraft. Customers purchasing the turboprop aircraft will receive free maintenance service during the first two years of ownership. Also, in partnership with the Aircraft Owners and Pilots Association (AOPA), customers can now finance a Kodiak 100 for a limited time at less than \$6,000 per month during the first year of ownership.

Flying Colours Delivers 12th Reconfigured Aircraft



Flying Colours Corp. has delivered a reconfigured Falcon 2000LXS to a Canadian customer, marking its 12th project for the customer in 20 years. A 13th project is in the works. The restoration included significant cabin layout modification, new seating, metal re-plating, cabinetry refinishing, carpet installation and other features. In addition, the fuselage was stripped and repainted at Flying Colours' Peterborough, Ontario headquarters, which opened in March.

► THE NATIONAL BUSINESS AVIATION ASSOCIATION'S (NBAA) DECISION TO CANCEL its annual convention, scheduled for Oct. 6-8 in Orlando, Florida, continued the novel coronavirus's unrelenting felling of aviation gatherings around the world this year.

"The promotion of safety is a primary reason NBAA was founded in 1947, and safety is at the foundation of all we are today," NBAA president and CEO Ed Bolen said upon announcing the cancellation in early July. "As COVID-19 has emerged as a pandemic, NBAA has consistently looked to local, state, federal and global health officials to inform our decisions and guide our actions with regard to live events."

Officials at the Florida Department of Health had issued an advisory recommending that individuals avoid gatherings of more than 50 people. The NBAA convention, the largest business aviation gathering in the world, typically attracts some 25,000 attendees and vendors.



Some exhibitors and consultants called the association's move difficult but necessary. Part of the reasoning was attributed to the fact that to stem the continuing spread of the virus, a number of states, including Florida, the European Union and other countries put travel restrictions in place, which complicated or made it impossible for individuals and companies to get to Orlando.

Since the pandemic began, NBAA has canceled a long list of business aviation gatherings, including its regional forums, meetings and other events. Among the largest were the Asian Business Aviation Convention & Exhibition and the European Business Aviation Association Convention & Exhibition.

Other groups have done the same. Two of the largest, **the Experimental Aircraft Association's AirVenture in Oshkosh, Wisconsin and the Farnborough International Airshow in Farnborough, England**, were to have taken place in July. Additional cancellations due to the pandemic include Sun n Fun, Lakeland, Florida; the Canadian Business Aviation Association Convention, Ontario; National Air Transportation Association's Air Charter Summit, Arlington, Virginia; JetNet iQ, White Plains, New York; STIHL National Championship Air Races, Reno, Nevada; Aerodrome + Heliports Expo, Buckinghamshire, England; Air Medical Safety Conference, Alexandria, Virginia; Aviation Week's UAM Americas, Orlando, Florida; Annual East Coast Symposium, Society of Experimental Test Pilots, Lexington Park, Maryland; Aero Friedrichshafen, Friedrichshafen, Germany; and Nall in the Fall, Triple Tree Aerodrome, Woodruff, South Carolina.



Textron Aviation, a major exhibitor, had already decided to pull out of this year's NBAA annual and all other events this year. It was likely that other companies and individuals would have followed suit. Rolland Vincent, a consultant with Rolland Vincent Associates, said and a leader in the cancelled Jetnet iQ, said a poll of potential NBAA attendees was revealing: "Attendance would have been maybe a third — maybe. . . . It was actually pretty bleak." He added, "I don't think [NBAA] had a choice."

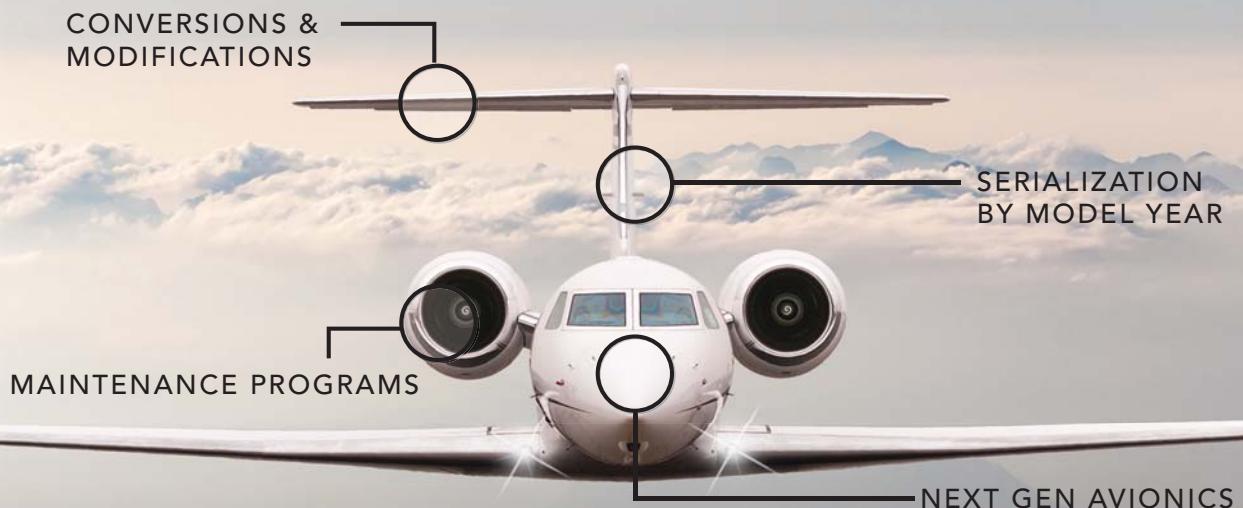
Exhibitors have long relied on the annual convention as a main venue to market products and services, meet with customers and suppliers, check out the competition and the latest in technology and innovations and new products and services. Dassault, for example, was expected to launch a new business aircraft at the show. It has postponed those plans until 2021, Vincent said.

The decision to cancel was the second major disruption for the convention since the turn of the century. In 2001, NBAA rescheduled the event set for New Orleans just days after the Sept. 11 terrorist attacks. It was rescheduled for later that year.

The annual convention along with the other conferences, exhibitions and meetings contribute significantly to NBAA total revenue. Accordingly, the association carries event insurance, which should help ease the financial hit. In addition, the association had some staff reductions earlier this year.

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Air BP Reaches Fueling Milestone



Air BP has marked 250,000 aircraft fuelings using its digital Airfield Automation technology. The milestone took place in Adelaide, Australia, when Air BP supplied Jet A-1 fuel to The Royal Flying Doctors Service, it said. Since it launched in May 2018, the technology has rolled out to 145 Air BP locations in 18 countries. Before the pandemic, the company was completing about 1,000 fuelings per day worldwide. The technology increases the speed and efficiency in the fueling of aircraft, it said.

Vertis Aviation Adds G450 to Management Program



Vertis Aviation, a Swiss-based charter operator, has added a Gulfstream G450 to its management program. The aircraft was added to support increased demand from an emerging set of new clients seeking safe travel options as a result of the COVID-19 pandemic, the company says. The aircraft, which is available for charter, is based in Basel, Switzerland and operated by a Swiss crew.

► **PIPISTREL'S VELIS ELECTRO TWO-SEAT TRAINER** recently became the first Western-made all-electric aircraft to earn type certification when it received a CS-LSA award from the European Union Aviation Safety Agency (EASA). Previously, the Civil Aviation Administration of China awarded LSA type and production certificates to Liaoning Ruixiang's RX1E and RX1E-A two-seat electric aircraft. The Slovenian manufacturer plans to deliver an initial 31 Velis Electros this year to customers in seven countries. Separately, the company has received EASA type certification for the aircraft's electric propulsion unit, which Pipistrel is making available to other aircraft manufacturers. The Velis Electro's powertrain is liquid cooled, including the batteries, and demonstrated the ability to withstand faults, battery thermal runways and crash loads as part of the EASA certification process, Pipistrel said. Compared with the conventional powerplant in the Virus SW121 trainer on which it is based, the Velis Electro's powertrain has fewer moving parts. The powertrain elements also have twice the lifespan compared with previous-generation electric aircraft. This reduces maintenance costs and, combined with cheaper electrical energy, lowers operating costs in the training role, Pipistrel said.



► **BLACKHAWK AEROSPACE HAS RECEIVED THE FAA APPROVAL** of its XR Upgrade Kit for the King Air 350 which increases maximum gross takeoff weight to 16,500 lb. and maintains basic aircraft empty weight that is 220 lb. lighter than comparable extended range aircraft. The changes increase payloads and provide up to 25% more endurance, it said. The upgrades involve replacing original Pratt & Whitney Canada PT6A-60A engines and 4-bladed aluminum props with new 1,200-shp PT6A-67A engines and MT 5-bladed composite propellers. Additionally, new heavy-weight landing gear is installed with high floatation tires, Raisbeck enclosed high floatation gear doors and a True Blue Power TB44 lithium-ion battery.

► **ON JULY 1, THE AIRBUS H160 TWIN-ENGINE MEDIUM HELICOPTER** was awarded type certification by EASA, but with several special conditions and deviations which the manufacturer is working to resolve. FAA certification is expected to follow shortly, allowing the Airbus OEM to make delivery to the model's launch customer, an undisclosed U.S. operator later this year. The type certificate describes the aircraft as the H160-B and clears it for day and night visual flight rules operation and instrument flight in non-icing conditions. The H160, which will replace H155, is the first product to emerge from the company since its re-branding from Eurocopter to Airbus Helicopters in 2016. The aircraft has been developed as a counter to Leonardo's dominance of the medium-helicopter market with its AW139.



► **IN WHAT COULD BE SEEN AS EVIDENCE OF BUSINESS AVIATION'S** steady recovery from its early grounding by the pandemic, Gogo Business Aviation reported it had hit 3,000 daily flights during the week of June 22, up from a single-day low of 378 flights in mid-April. Said Sergio Aguirre, president of the broadband connectivity services for business aviation, "We've strived to be a good partner with our customers to get through a very difficult time together, and we're now in the midst of a measurable recovery as flight activity increases." When many aircraft owners parked their aircraft early in the pandemic, 30% of Gogo Business Aviation's accounts reduced their spending through either account suspensions or service-plan downgrades. Subsequently, however, nearly 60% of the suspended customers reactivated their service and about 80% reverted to their original service plan. Flights flown with active Gogo service on board has continued to increase, reaching 3,039 flights on June 25, near Gogo's pre-pandemic average of 3,500 per day. Installations of new Avance L5 and L3 service is on the rise, Gogo said, adding that several other positive developments will be released soon.



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Europe Leading Bizav Activity Recovery, WingX Says

Europe is recovering the fastest in terms of business aviation activity in June, with jet and turboprop activity down 43% through June 23 compared to a year ago, according to WingX Advance. The prior week saw a 24% increase in the week's activity, and a rolling seven-day average of activity rose 70% compared to the beginning of June. Almost all flight activity is still within national borders. Activity in North America is down 29% below normal but up 20% since the start of June. Activity among providers is varied. NetJets activity is down one-third over a year ago, while Flexjet flights have risen.

SEA Prime Out at Signature Flight Support Italy



Signature Flight Support has acquired SEA Prime's 40% minority interest in Signature Flight Support Italy. It is now 100% owner of the company. The action follows Signature's initial investment in SEA Prime in 2016. Signature's network in Italy includes FBOs at Milan-Linate, Milan-Malpensa and Rome-Ciampino; trip support arrangements at Bergamo, Catania, Florence, Naples, Palermo and Pisa; and a Signature Select FBO partnership agreement at Venice-Marco Polo.

► **JAPAN'S NATIONAL POLICE AGENCY HAS ORDERED ONE H225** twin-engine heavy helicopter and four H135 twin-engine light helicopters from Airbus Helicopters. The five aircraft are part of a planned fleet modernization, Airbus announced on June 24. The organization already operates 12 H135s, H155s, and six AS365 Dauphin models. It also has a single H215 and two H225s on order. The National Police Agency uses its aircraft for law enforcement, personnel and VIP transport and disaster relief missions. The agency buys



helicopters for the police forces of Japan's numerous prefectures, purchasing aircraft from other manufacturers including Bell, Leonardo and Sikorsky.

► **AVANT AEROSPACE, A SUBSIDIARY** of West Star Aviation and a supplier of aircraft parts, spares, equipment, and tooling, has relocated from Dallas to Hangar #12 at the St. Louis Downtown Airport. The new location is close to West Star's full-service maintenance, repair and overhaul facility in East Alton, Illinois. The company relocated its offices and inventory to the 20,000-sq.-ft. space to centralize its inventory and improve efficiency. Avant has expanded its services to include Bombardier, Textron, Piaggio and Gulfstream aircraft. All equipment and parts repairs are provided by OEMs or Authorized Repair Agents.

► **EMBRAER'S SERVICES AND SUPPORT DIVISION** has completed the first conversion of a Legacy 450 to a Praetor 500 for an undisclosed customer. The midsize jet conversion was performed at Embraer's Executive Jet Service Center at Bradley International Airport in Windsor Locks, Connecticut. The change converts the Legacy 450, with a 2,900-nm range, into a Praetor 500, with a 3,340-nm range. To generate the range improvement, Embraer replaced the level-sensing wiring in the fuel tanks, moved the overwing gravity fueling ports, relocated the fuel measurement system and reinforced the wing ribs to hold the additional weight. Mechanics also installed the swept winglets of the Praetor, and placards and logos were replaced. The adjustments included updates to the flight control systems, including a new avionics load for the Collins Aerospace Pro Line Fusion flight deck. Embraer announced the Praetor 500 and Praetor 600 in 2018. They received FAA, European Union Aviation Safety Agency (EASA) and ANAC certifications less than a year later.



► **A LAW PASSED BY THE U.S. CONGRESS A DECADE AGO** called for the FAA to establish a database noting the employment, training and competence histories for airline pilots. The purpose of the mandate was to enhance safety for passengers on commercial aircraft, but the draft rule's impact on FAR Part 91 operators will be considerable, opponents say, and their efforts to amend the proposed legislation is ongoing. This is just one step in a pretty long game," said Doug Carr, vice president for Regulatory and International Affairs at the National Business Aviation Association (NBAA). The association has been critical of the rule, which Carr described as "a full-frontal assault" on business aviation. Objections to the mandate include the administrative burdens imposed to comply and that requirement to include reports of training flights may discourage pilots from undergoing additional training. It also creates a new definition of a "corporate flight department" which, opponents say, is inappropriate to many operators and could have a negative effect on aircraft purchase decisions. These concerns were raised by the industry during an advanced rulemaking committee consultation, which took place soon after Congress passed the bill. But "The last engagement we had with the FAA on this topic was back in 2010," Carr said, adding he was confident that substantive discussions will take place. "We are still far from any end state."

Questions for Roei Ganzarski

1 How did you arrive at your current position?

Ganzarski: Early in 2018 I got a phone call out of the blue from a representative of Clermont Group, a Singapore-based business group that invests in a variety of industries all over the world. One of its investments was in an Australian R&D effort refining and developing electric motors. Those engineers came up with a 350-hp motor that many suggested could be ideal for the aviation industry. At that point, they pivoted the outfit as a commercial entity and invited me to come have a look. I went to Australia and after ten minutes of meeting the amazing engineers and seeing the prototype they had built, I was sold. I knew that leading this effort would be my next role since, if successful, it could change the face of aviation and transportation. We moved the operation to Redmond since it's a hub of both aerospace and of innovation. I still don't know how they got my name.

2 Changing the face of aviation? How?

Ganzarski: Commercial aviation is not serving well what we call "middle mile" travel, those of trips of 50 to 1,000 mi. The carriers can't make money with smaller aircraft, so they use aircraft with 75 seats or more, and small or medium sized cities can't generate enough traffic to support them. So, service declines or disappears while ticket prices increase, sometimes by a lot — \$500 for a 250-mi. roundtrip is not uncommon. As a result, people spend days on the highway. Meanwhile, electric propulsion is ideal for 5-to-12-passenger aircraft operating trips of up to 125 mi. in our magnified, or retrofitted, aircraft or 500 mi. in a clean-sheet design like Eviation's Alice using today's battery technology. Doing so can reduce operating costs while reconnecting cities and towns with fast, frequent, affordable and clean commercial service. It can help make small, wonderfully livable locales economic engines.

3 But a range of 125 mi. seems kind of pathetic.

Ganzarski: In 2018 the scheduled carriers flew nearly 2 million trips of less than 100 mi., another 3.5 million trips of 100 to 200 mi. and 45% of all airline flights were less than 500 mi. And that doesn't include trips by island service providers like Harbour Air of Vancouver or Cape Air in Cape Cod, Massachusetts. Nor does it include cargo flights to small towns by FedEx or DHL or any business, charter or special operations like sky divers. So, the data show us there's lots of opportunity for both magnification of aircraft and moreover for electric clean-sheet designs. And that will only increase as battery technology and range improves, which it is.

4 What's the status of magniX's projects?

Ganzarski: Today in addition to our 375-hp magni250 we have a 751-hp magni500 which we've now used to fly a DHC Beaver and Cessna Grand Caravan, now an eBeaver and eCaravan. Both are undergoing FAA Part 33 certification process and we hope to have certification by the end of next year. It is key to Harbour Air's plan to reequip its 43-aircraft fleet to all-electric power beginning in 2022. Meanwhile, Eviation of Israel, a sister company, is developing Alice, a nine-passenger commuter, which will be powered by three magni250 motors. It should be flying in the next 12 months, certified in 2022 and in passenger service the following year. Cape Air will likely be the launch customer. Meanwhile, we're talking to operators interested in STCing the eCaravan and other aircraft for magnifications. And we're happy to talk with anyone else interested in converting a PT-6 powered aircraft — a great engine, by the way — to electric power.

5 Sorry, but why would anyone with a PT-6 make the switch to electric power?

Ganzarski: Because its costs are 40-80% lower than those of a PT-6 since it uses no Jet A and has minimal maintenance requirements. Plus it's odorless, nearly silent in operation and produces zero emissions. That's all part of changing the face of aviation, and why I'm so excited about being here and what's coming next. **BCA**



Roei Ganzarski

CEO

magniX

Redmond, Washington

Israeli-born Ganzarski came to the U.S. in 1997 to study at the University of Washington. After earning his MBA, he joined the Boeing family of companies where he advanced as an executive in the company's Flight Services division over the next 13 years. Then in 2012, he accepted an offer to lead BoldIQ, the on-demand scheduling optimization company based upon the former DayJet's scheduling software. He moved to magniX as CEO in 2018 and the following year also assumed the chairmanship of Eviation.



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How to Use the Planning Guide Tables



DASSAULT

BY PAUL LAFATA plafata@airpowersgi.com

This year's *Guide* covers turbine powered, in production aircraft. For out of production aircraft data contact AirPower Software Group, Inc. Aircraft operating costs are presented in a format that separates information into six areas: Direct Mission Costs, Fixed Annual Costs, Variable Costs, Annual Cockpit Subscription Services Costs, Annual Cabin Subscription Services Costs and Annual Trip Support Costs.

Aircraft Category:

Aircraft are grouped into six categories reflecting similarity of aircraft size, mission, and operations. Category 1 aircraft are turboprops weighing less than 12,500 lb. and very light jets weighing less than 10,000 lb.; Category 2, multi-engine turboprops weighing 12,500 lb. or more and light jets weighing 10,000 to 19,999 lb.; Category 3, jets weighing 20,000 to 29,999 lb.; Category 4, jets weighing 30,000 to 40,999 lb.; Category 5, jets weighing 41,000 lb. and up; and Category 6, ultra-long-range jets with NBAA IFR ranges above 6,000 nm. Certain data are common to all aircraft in a category for purposes of calculating mission cost by listed range including

airframe systems parts and labor, engine reserves, APU reserves, and propeller reserves for turboprop aircraft. Fixed costs, annual cockpit subscription services costs, annual cabin services costs and annual trip support cost figures are provided for reference only and are not included in the Direct Operating Cost (DOC) figure for each of the Mission Ranges.

BCA Equipped Price

This number is taken from the June 2020 *Purchase Planning Handbook*, and reflects BCA-equipped, completed aircraft. The listed price is based on the latest model produced.

Direct Mission Costs

Mission Costs are calculated based on the business aircraft missions shown in BCA's June 2020 *Purchase Planning Handbook*. Three missions are shown for each aircraft: 300 nm, 600 nm, and 1,000 NM. Ultra-long-range aircraft (Category 6) missions are 1,000 nm, 3,000 nm, and 6,000 nm. The fuel expense for each mission is based on the fuel burn figure for the mission, provided by the OEM, and calculated under

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

Direct Mission Costs include a bundling of mission fuel consumed from BCA's *Purchase Planning Handbook*, maintenance labor, parts, and reserve costs from the Variable Costs section of this *Guide*, apportioned to the actual flight time for the listed nm mission length. Fuel price used is based on a nationwide average price of \$4.06 per gallon for Jet-A at press time. Fuel consumption calculations account for taxi, takeoff, climb, cruise, descent, and landing for the applicable mission as appropriate for the aircraft category. (Note: Longer missions will lower average hourly fuel burns due to more time in cruise; conversely, shorter missions will increase average hourly fuel burn figures since proportionally more time is spent in the takeoff and climb phase rather than cruise.)

2020 Operations Planning Guide

Fixed Costs (Annual)

This area of expense includes those costs that must be borne by a flight department irrespective of the level of aircraft utilization. 2019 and 2020 have been transitional years particularly for flight department salaries and the recent impact of COVID-19 shutdown this year. Airline demand for qualified pilots has waned, retirements and industry factors have resulted in compensation leveling off in 2020. Salary surveys published last year quickly become obsolete. 2020 has shaped up as somewhat normalized as qualified crew demand and supply balanced more evenly.

Salaries: Included are salaries for Flight Crew, Cabin Crew and Director of Maintenance where appropriate. We interviewed Sheryl Barden, CEO at Aviation Personnel International (API) (www.apiaviation.com) for state of the industry insights with respect to aviation salaries and the impact of business curtailment and travel limitations. Barden's overarching message is this: "We don't know what we don't know. At the time of publication, we are beginning to see a return of flight operation and some hiring in business aviation." Barden went on to say, "we anticipate significant airline furloughs in the 4th quarter in response to the pandemic. However, airline retirements will continue as pilots reach 65 years of age. As flying returns pilots will be called back from furlough, and the pilot shortage will be back."

Barden also noted that "corporate flight department crew retention is paramount in anticipation of the economy coming back. Most organizations are planning for a return to full flight operations domestically and globally once assured that they will not be caught in a quarantine when returning to the United States. Salary adjustments for 2020, started the year on a potential upward trajectory however, the impact of COVID-19 will likely keep salary increases for flight departments flat. Overall, flight operations have been impacted and there is no one size fits all formula that can be applied to define current operations. In general, flight departments are moving forward with new protocols to ensure that business aviation can support the host organization safely and efficiently in a COVID-19 world/economy."

Barden believes retention strategies including bonuses, restricted stock, work-life balance, and general working conditions in flight departments, large

or small, play key roles in mitigating personnel churn and attracting talent when needed. As Barden noted, "multiple aircraft flight departments may or may not employ pilots as first officers instead opting to qualify all pilots as captains. Directors of Maintenance can have a direct impact on airframe resale value by ensuring a high degree of aircraft maintenance and repair status along and associated documentation according to Barden." In summary, variation across the industry relative to total compensation is substantial. Therefore, benefits are not a calculated factor in salary estimates which would ordinarily cover health care, retirement, bonuses, restricted stock, and other benefits typical for a corporate flight department. Included are salaries for Flight Crew, Cabin Crew and Director of Maintenance where appropriate. Salary data are based on available insights from varied industry sources including API Aviation.

Flight Crew Training: Expenses shown are based on average transaction costs for representative aircraft models. Actual expenses can vary due to market capacity fluctuations, changes in training locations, and other factors such as training volume and length of commitment. The crew training landscape has changed significantly over the last 24 months with several acquisitions and new developments. FlightSafety and Textron Aviation announced a joint venture to serve operators of the Cessna, Hawker and Beechcraft product lines. Simcom Aviation Training was acquired by Flexjet and Nextant parent company, Directional Aviation, which marked a major new entrant into the business aviation training space. Lastly, CAE purchased Bombardier's business aircraft training unit. Additionally, there has been continued expansion of in-aircraft or hybrid training options (flight training device with in-aircraft training) for non-type rated turboprop aircraft as well as several owner-flown jets. Insurance underwriters continue to expand the number of approved training providers for these platform types, and many of operators are seeking training options that are closer to their base location, or that require less time away from it.

Training costs remained effectively flat for current production aircraft. Training expenses shown are based on average transaction costs for representative aircraft models. Actual expenses can vary due to market capacity fluctuations, changes in training locations, and

other factors such as training volume and length of commitment.

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

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

Hull and Liability Insurance: Aircraft hull and liability (and all aviation insurance in general) premiums have changed significantly since last year's publication particularly for single pilot, owner flown, high asset value aircraft.

About Airpower Software Group, Inc.

Our mission is to provide the aviation marketplace with data and information necessary to make informed decisions and manage risk. Our premier product, Aircraft Budget Analyzer (www.AircraftBudgetAnalyzer.com), is used to perform flight department budgetary planning, side by side aircraft operating cost and performance comparisons including charter and leasing strategies, and solutions to aid in the identification of business aircraft suitable for various mission needs. AirPower Software conducts research and data collection related to aircraft operating costs for both in and out of production aircraft, primarily focused on fixed wing, turbine powered platforms, and a limited number of high-performance piston aircraft. For out-of-production aircraft contact AirPower Software at Support@Airpowersgi.com, or go to AircraftBudgetAnalyzer.com for a free PlaneFastFacts® summary report.

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Market forces impacting premiums include global catastrophic property/casualty loss events, aviation losses in the sector, cost of repairs and loss of underwriting facilities over the last 24 months limiting competition. All these factors have made the smaller market space restrictive on high hull and liability limit aircraft along with forcing tighter requirements on pilot qualifications. Hull and liability rates reflected in the Guide are established based on key experience and type specific training as noted below. Actual premiums can vary significantly from those noted in 2020 and beyond. Tom Hauge, National Sales Director at Wings Insurance (<https://www.wingsinsurance.com>) shared insights for this year's Planning Guide. "My job as an insurance broker is akin to that of a salesman. "I work to position the buyer in the best possible light to the underwriter. The level of thoroughness achieved through interviews with my clients can directly correlate to the quality of the quote. Come prepared to give your broker all the information needed to put you in front of an underwriter." Your broker will ask about your:

► Pilot experience (the more detail provided, the better). Pilots without prior make/model experience, adequate turbine time as PIC, and prior overall experience can dramatically impact the overall total annual premiums. Premium variation can be 100% higher or more from previous years depending on experience metrics noted.

► Planned utilization for the aircraft, including estimated annual flight hours, territory you plan to operate in and how you will use the aircraft.

► Detailed training plan (if you are transitioning into a higher performance aircraft or turbine transition, this area is particularly important to define).

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

► Where you fly.

► Owner-flown versus professionally crewed aircraft.

► Size of the aircraft make/model pool and overall safety record.

► How many times a year you utilize the aircraft/flight hours estimated per annum.

► Expectations on liability coverages/any third-party passenger exposure.

► Where the aircraft is based and how it is secured when finished flying.

► Number of underwriting companies willing to write coverage for a specific aircraft type and planned crew operation.

Hauge advises "when you get down to

the final step of selecting one insurance policy over another, choose the proper policy for broadness of coverage, liability limit needs, checkout or transition requirements and finally pricing. Other considerations include: Do you plan to dry lease time in the aircraft to a third party? Does the policy cover this use? Can dry leasing be added to the policy if so at what additional cost? What minimum experience requirements do your pilots need to have to be approved by the policy underwriting company or what might be the requirements/minimum experience threshold to add additional pilots? Do all your pilots currently hold these qualifications and experience, and if not, what will be required to have them approved by the insurance underwriting company?"

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

Hull Insurance per \$100: This is the factor used as a multiplier to arrive at the total annual cost of hull insurance for a particular aircraft. It is derived from actual aviation insurers' quotes. Insurance quotes can vary greatly depending upon if the aircraft is covered under a fleet policy or a standalone policy. The first number reported is the estimated annual cost of hull insurance for a particular aircraft based on its BCA-equipped price as reported in the June 2019 *Purchase Planning Handbook*. The cost is computed by multiplying the cost per \$100 of hull insurance factor by the BCA equipped aircraft price. The figure includes war risk coverage, which constitutes on average \$0.03 to \$0.05 per \$100 of hull insurance.

Liability Insurance: This figure represents the total annual cost for liability insurance for an aircraft model. Aircraft in Categories 1 and 2 are assumed to carry \$5 million in liability insurance;

Category 3 aircraft carry \$100 million; and Categories 4 through 6 carry \$200 to \$500 million in liability insurance coverage depending on make and model. The annual cost is computed by multiplying the amount of liability coverage in millions by a per \$M factor supplied by a leading provider of this type of insurance coverage.

Maintenance Software: The figure shown for maintenance Software Programs represents the average annual cost for a software program to track maintenance activities, intervals, and expenses. This number represents an average cost and should be utilized as a budgetary planning estimate.

Hangar/Office Facilities: Expenses shown here are based on national average annual costs reported by flight departments in 2017 and escalated for 2020 based on the annual rate of expected inflation. The figures shown in each cost area are broken down by the six aircraft categories and will generally be the same for all aircraft included in the same category. This figure is an annual cost per aircraft and includes hangar and office rent as well as additional facilities costs such as utilities, ground upkeep, snow removal, janitorial service, and insurance (other than aircraft insurance).

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

Variable Costs (Per Flight Hour): These expenses are directly related to operation of the aircraft and are represented as an hourly cost figure. Included are Maintenance Labor Expense, Parts Expense, Engine, APU, Avionics and Propeller reserve expenses as appropriate. For in-production aircraft it is assumed the aircraft is covered by manufacturer's warranty. Figures shown are based on aircraft OEM direct estimates with warranty effect incorporated unless otherwise noted by an (*). For OEMs that did not participate this year, an inflation escalation was added to the most current available data and noted in the remarks section.

Service center maintenance labor expense is computed by multiplying the Maintenance Man-Hours per Flight Hour ratio by the nationwide average service center hourly maintenance labor cost (Category 1: \$105/hr.; Category 2: \$105/hr.; Category 3: \$110/hr.; Category 4: \$115/hr.; Category 5: \$120/hr.;

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Category 6: \$120/hr.). Labor expenses for each Category noted here were used in the preparation of in production aircraft maintenance labor costs per flight hour.

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

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

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

Engine Reserves and APU Reserves (where applicable): These expenses are based on OEM input for in-production aircraft where provided. Engine and APU OEMs and 3rd party service providers offer programs designed to fix or cover operator's scheduled and

unscheduled maintenance requirements on a per hour, fee paid basis. Engine and or APU loaners may not be covered by these programs for unscheduled events resulting in significant out of service time for the aircraft. Consult policy terms and conditions or the Service Provider for specifics.

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

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

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

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

consulted for price quotes. Expenses shown vary depending on cockpit avionics equipment configurations and are approximated averages for in production aircraft.

Annual Cabin Services Costs

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

Annual Trip Support Costs

Annual trip support expenses are similar for all aircraft in a particular category, reflecting comparable aircraft capabilities and mission utilization. Trip Expenses includes catering service, flight crew travel, international trip support, concierge, ground handling and landing/parking fees. Fees reflected are annual numbers assigned to specific aircraft categories. For aircraft in categories 5 – 6, 400 annual flight hour utilization rates were used to arrive at budgetary planning estimates. For categories 1 – 4, 250 annual flight hour utilization rates were used. Mission durations vary substantially which resulted in a change in the way these costs were calculated for the 2020 *Operations Planning Guide*. Many Operators elect to use a service provider in the case of concierge and international trip support due to complexities associated with overflight and landing permitting and other logistical arrangement. International Trip Support and Concierge was not factored in for aircraft in categories 1 – 4 unless otherwise noted, or the aircraft had

sufficient NBAA IFR range to justify a budgetary planning estimate.

Operations Planning (Aircraft Acquisition – new for 2020): Selecting a new or replacement airplane can be a complex, daunting task particularly for first time buyers and those upgrading to a new platform. Acquisition planning involves a thorough operational needs review to ensure the right aircraft for your unique mission needs is purchased. We interviewed Michelle Wade, Managing Partner at Jetstream Aviation Law, P.A. (<https://jetstreamlaw.com>), this year to add new perspective to the overall Operations Planning Guide.

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

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

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

Tax Goals: Wade emphasized this is an area that: “particular attention needs to be paid to. Missteps here can be costly. Defining tax goals is essential, including both federal and state tax factors. One significant decision in an owner’s federal tax planning includes whether to take a tax deduction for bonus depreciation. Bonus depreciation may allow the owner to deduct the entire purchase price on the owner’s tax return in the year of purchase, however it is important to understand

the impact of IRS bonus depreciation regulations on the planned flight operations.”

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

Financing: Wade stated: “the process of identifying potential aviation lenders, obtaining quotes, and selecting a lender should begin at least several months before funds are needed. It takes time to provide the required due diligence to the selected lender, obtain loan approval, review the loan documentation, and negotiate important business points into the loan documents while ensuring a smooth closing.”

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

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

Insurance premiums have increased as noted in the *Operations Planning*

Guide Hull and Liability Insurance sections, and the desired coverage limits must be balanced against insurance premium payments.”

Purchase Agreement: Wade said: “once the desired aircraft is identified and basic business points of the acquisition negotiated, the parties will execute a sales agreement. For new aircraft, the manufacturer provides their standard sales agreement. Certain terms are not negotiable, but others can be revised to ensure a good delivery experience for everyone.

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

Planning for the delivery when negotiating the purchase agreement can create an easier closing experience.”

In summary, there are many other details to be planned and executed in the purchase of a new aircraft. The use of experienced expertise is essential to avoid delays and unexpected surprises during the planning and purchasing process. Working with an experienced team will significantly streamline and ensure your experience is a good one.

General: Abbreviations and annotations are used throughout the tables: “NA” means not available or not applicable to a particular aircraft model. As an example single pilot (*SP) certified aircraft will not include a salary for the copilot in the Guide table; “NP” signifies that the specific performance is not possible; “OC” means On Condition; and “INCL” indicates a particular cost item is combined with another specifically noted item.

Model Footnotes: (1) Cirrus Aircraft offers the JetStream program; an all-inclusive operating cost per flight hour product which includes recurrent training, all scheduled and unscheduled maintenance, all subscriptions and more. Variable costs, which are normally included in JetStream, are broken out only for the purposes of calculating direct mission costs for each of the pre-defined ranges and are based on the JetStream 2 yr./600 hr. Program, and AirPower’s estimates.

Cessna Citation Longitude APU reserves included in the engine reserve cost. **BCA**

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

Manufacturer	Mahindra Aerospace	Textron Aviation	Piper Aviation	Textron Aviation
Aircraft Model	Airvan 10	Cessna Caravan	M500	Grand Caravan EX
Category (1-6)	1	1	1	1
BCA Equipped Price	\$1,700,000	\$2,000,000	\$2,250,000	\$2,250,000
DIRECT COSTS	300 nm	\$688	\$816	\$536
	600 nm	\$1,346	\$1,597	\$967
	1,000 nm	NP	NP	\$1,620
	3,000 nm	—	—	—
	6,000 nm	—	—	—
	Captain Salary	\$88,358	\$88,358	\$88,358
	First Officer Salary	SP*	SP*	SP*
	Cabin Crew Salary	NA	NA	NA
	Director of Maintenance Salary	NA	NA	NA
	Flight Crew Recurrent Training	\$4,500	\$4,500	\$4,500
FIXED COSTS	Cabin Crew Recurrent Training	NA	NA	NA
	Maintenance Training	NA	NA	NA
	Hull Insurance per \$100	\$10,710	\$12,600	\$14,175
	Liability Insurance per \$M	\$7,500	\$7,750	\$7,500
	Hangar/Office	\$16,391	\$16,391	\$16,391
	Maint. Software Programs	NA	\$1,523	NA
	Airframe Sys. Parts & Labor	\$71	\$125	\$98
	Engine Reserves	\$100	\$123	\$120
	APU Reserves	NA	NA	NA
	Avionics Reserves	NA	NA	NA
VARIABLE COSTS	Propeller Reserves	\$6	\$6	\$6
	Nav Database	\$924	\$1,000	\$1,000
	EGPWS/TAWS Database	\$150	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	NA	NA	NA
	Wx Services	NA	NA	NA
ANNUAL CAFIN SERVICES COSTS	Charts & Maps	NA	NA	NA
	Swift Broadband	NA	NA	NA
	Ka/Ku	NA	NA	NA
	Air to Ground	NA	NA	NA
	SatTV	NA	NA	NA
ANNUAL TRIP SUPPORT COSTS	Cabin/Iridium Phone	NA	\$2,150	\$2,150
	Catering Service	NA	\$3,121	\$3,121
	Flight Crew Travel	NA	\$2,050	\$2,050
	International Trip Support	NA	NA	NA
	Concierge	NA	NA	NA
	Ground Handling	NA	\$2,030	\$2,030
Landing/Parking Fees	NA	\$1,010	\$1,010	\$1,010

*FAA certified for single-pilot operations

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

Manufacturer	Daher	Cirrus Design	Nextant Aerospace	Vulcanair SpA
Aircraft Model	Kodiak	Vision G2**	G90XT	A-Viator
Category (1-6)	1	1	1	1
BCA Equipped Price	\$2,454,800	\$2,480,000	\$2,750,000	\$2,965,000
DIRECT COSTS	300 nm	\$844	\$601	\$867
	600 nm	\$1,650	\$1,266	\$1,730
	1,000 nm	\$2,723	\$2,027	\$2,877
	3,000 nm	—	—	—
	6,000 nm	—	—	—
FIXED COSTS	Captain Salary	\$88,358	\$88,358	\$108,980
	First Officer Salary	SP*	SP*	SP*
	Cabin Crew Salary	NA	NA	NA
	Director of Maintenance Salary	NA	NA	NA
	Flight Crew Recurrent Training	\$4,500	\$14,000	\$8,000
	Cabin Crew Recurrent Training	NA	NA	NA
	Maintenance Training	NA	NA	NA
	Hull Insurance per \$100	\$15,465	\$19,840	\$17,325
	Liability Insurance per \$M	\$7,500	\$7,750	\$7,500
	Hangar/Office	\$16,391	\$16,391	\$16,391
VARIABLE COSTS	Maint. Software Programs	NA	NA	NA
	Airframe Sys. Parts & Labor	\$107	\$137	\$225
	Engine Reserves	\$154	\$137	\$224
	APU Reserves	NA	NA	NA
	Avionics Reserves	NA	NA	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Propeller Reserves	\$8	NA	\$18
	Nav Database	\$1,000	\$1,200	\$1,500
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	NA	NA	NA
	Wx Services	NA	\$1,200	NA
ANNUAL CAFIN SERVICES COSTS	Charts & Maps	NA	\$1,200	NA
	Swift Broadband	NA	NA	NA
	Ka/Ku	NA	NA	NA
	Air To Ground	NA	NA	NA
	SatTV	NA	NA	NA
ANNUAL TRIP SUPPORT COSTS	Cabin/Iridium Phone	\$2,150	\$2,150	\$2,150
	Catering Service	\$3,121	\$3,121	\$6,151
	Flight Crew Travel	NA	\$2,050	\$4,101
	International Trip Support	NA	NA	NA
	Concierge	NA	NA	NA
	Ground Handling	\$2,030	\$2,030	\$2,050
	Landing/Parking Fees	\$1,010	\$1,010	\$4,101

*FAA certified for single-pilot operations

**See footnote in "How to Use the 2020 Operations Planning Guide"

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

	Manufacturer	Epic Aircraft	Piper Aircraft	Daher
Aircraft Model	Epic*	M600		TBM 910
Category (1-6)	1	1		1
BCA Equipped Price	\$3,250,000	\$3,261,955		\$4,162,365
DIRECT COSTS	300 nm	\$527	\$566	\$508
	600 nm	\$1,001	\$1,013	\$965
	1,000 nm	\$1,623	\$1,715	\$1,563
	3,000 nm	—	—	—
	6,000 nm	—	—	—
	Captain Salary	\$88,358	\$88,358	\$88,358
	First Officer Salary	SP**	SP**	SP**
	Cabin Crew Salary	NA	NA	NA
	Director of Maintenance Salary	NA	NA	NA
	Flight Crew Recurrent Training	\$4,500	\$4,500	\$4,500
FIXED COSTS	Cabin Crew Recurrent Training	NA	NA	NA
	Maintenance Training	NA	NA	NA
	Hull Insurance per \$100	\$22,750	\$20,550	\$29,137
	Liability Insurance per \$M	\$7,500	\$7,500	\$7,500
	Hangar/Office	\$16,391	\$16,391	\$16,391
	Maint. Software Programs	NA	NA	\$1,523
	Airframe Sys. Parts & Labor	\$109	\$98	\$81
	Engine Reserves	\$143	\$120	\$152
	APU Reserves	NA	NA	NA
	Avionics Reserves	NA	NA	NA
VARIABLE COSTS	Propeller Reserves	\$8	\$6	\$8
	Nav Database	\$1,000	\$1,200	\$1,300
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	NA	NA	NA
	Wx Services	NA	NA	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	NA	NA	NA
	Swift Broadband	NA	NA	NA
	Ka/Ku	NA	NA	NA
	Air to Ground	NA	NA	NA
	SatTV	NA	NA	NA
ANNUAL CABIN SERVICES COSTS	Cabin/Iridium Phone	NA	\$2,150	\$2,150
	Catering Service	NA	\$3,121	\$3,121
	Flight Crew Travel	NA	\$2,050	\$2,050
	International Trip Support	NA	NA	NA
	Concierge	NA	NA	NA
	Ground Handling	NA	\$2,030	\$2,030
ANNUAL TRIP SUPPORT COSTS	Landing/Parking Fees	NA	\$1,010	\$1,010

*Direct Costs estimated by AirPower Software

**FAA certified for single-pilot operations

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

Manufacturer	Textron Aviation	Daher	Pilatus Aircraft
Aircraft Model	Beechcraft King Air C90GTx	TBM 940	PC-12 NGX
Category (1-6)	1	1	1
BCA Equipped Price	\$4,200,000	\$4,504,654	\$5,353,000
DIRECT COSTS	300 nm	\$1,027	\$796
	600 nm	\$1,935	\$1,466
	1,000 nm	\$3,079	\$2,380
	3,000 nm	—	—
	6,000 nm	—	—
	Captain Salary	\$108,980	\$88,358
	First Officer Salary	SP*	SP*
	Cabin Crew Salary	NA	NA
	Director of Maintenance Salary	NA	NA
	Flight Crew Recurrent Training	\$8,000	\$4,500
FIXED COSTS	Cabin Crew Recurrent Training	NA	NA
	Maintenance Training	NA	NA
	Hull Insurance per \$100	\$26,460	\$33,724
	Liability Insurance per \$M	\$7,750	\$7,500
	Hangar/Office	\$16,391	\$20,822
	Maint. Software Programs	\$1,523	NA
	Airframe Sys. Parts & Labor	\$211	\$248
	Engine Reserves	\$247	\$143
	APU Reserves	NA	NA
	Avionics Reserves	NA	NA
VARIABLE COSTS	Propeller Reserves	\$14	\$6
	Nav Database	\$12,000	\$7,406
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	NA	NA
	Wx Services	NA	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	NA	NA
	Swift Broadband	NA	NA
	Ka/Ku	NA	NA
	Air to Ground	NA	NA
	SatTV	NA	NA
ANNUAL CABIN SERVICES COSTS	Cabin/Iridium Phone	\$2,150	\$2,150
	Catering Service	\$6,151	\$3,121
	Flight Crew Travel	\$4,101	\$2,050
	International Trip Support	NA	NA
	Concierge	NA	NA
	Ground Handling	\$2,050	\$2,030
ANNUAL TRIP SUPPORT COSTS	Landing/Parking Fees	\$4,101	\$1,010
	*FAA certified for single-pilot operations		

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

Manufacturer	Textron Aviation	Viking Air	Piaggio
Aircraft Model	Beechcraft King Air 250	400 Series	Avanti Evo
Category (1-6)	1	1	1
BCA Equipped Price	\$6,390,000	\$6,500,000	\$7,695,000
DIRECT COSTS	300 nm	\$1,048	NA
	600 nm	\$1,924	NA
	1,000 nm	\$3,024	NA
	3,000 nm	—	—
	6,000 nm	—	—
	Captain Salary	\$118,029	NA
	First Officer Salary	SP*	SP*
	Cabin Crew Salary	NA	NA
	Director of Maintenance Salary	NA	NA
	Flight Crew Recurrent Training	\$16,000	NA
FIXED COSTS	Cabin Crew Recurrent Training	NA	NA
	Maintenance Training	NA	NA
	Hull Insurance per \$100	\$40,257	\$40,950
	Liability Insurance per \$M	\$7,750	\$7,750
	Hangar/Office	\$16,391	\$16,391
	Maint. Software Programs	\$1,523	NA
	Airframe Sys. Parts & Labor	\$211	NA
	Engine Reserves	\$270	NA
	APU Reserves	NA	NA
	Avionics Reserves	NA	NA
VARIABLE COSTS	Propeller Reserves	\$16	NA
	Nav Database	\$12,000	NA
	EGPWS/TAWS Database	Incl. in Nav Database	NA
	Flight Planning	NA	NA
	Wx Services	NA	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	NA	NA
	Swift Broadband	NA	NA
	Ka/Ku	NA	NA
	Air to Ground	NA	NA
	SatTV	NA	NA
ANNUAL CABIN SERVICES COSTS	Cabin/Iridium Phone	\$2,150	NA
	Catering Service	\$6,270	NA
	Flight Crew Travel	\$4,045	NA
	International Trip Support	NA	NA
	Concierge	NA	NA
ANNUAL TRIP SUPPORT COSTS	Ground Handling	\$2,023	NA
	Landing/Parking Fees	\$4,101	NA
			\$4,101

*FAA certified for single-pilot operations

Production Aircraft – Category 2 – Turboprops ≥12,500 lb. – Jets <20,000 lb.

Manufacturer	Embraer	Nextant Aerospace	Honda Aircraft Co.	Textron Aviation
Aircraft Model	Phenom 100EV	Nextant 400 XTi	HondaJet Elite**	Cessna Citation M2
Category (1-6)	2	2	2	2
BCA Equipped Price	\$4,250,000	\$4,650,000	\$5,300,000	\$5,305,000
DIRECT COSTS	300 nm	\$937	\$946	\$903
	600 nm	\$1,701	\$1,682	\$1,603
	1,000 nm	\$2,741	\$2,748	\$2,580
	3,000 nm	—	—	—
	6,000 nm	—	—	—
FIXED COSTS	Captain Salary	\$118,029	\$118,029	\$118,029
	First Officer Salary	SP*	SP*	SP*
	Cabin Crew Salary	NA	NA	NA
	Director of Maintenance Salary	NA	NA	NA
	Flight Crew Recurrent Training	\$14,000	\$14,000	\$14,000
	Cabin Crew Recurrent Training	NA	NA	NA
	Maintenance Training	NA	NA	NA
	Hull Insurance per \$100	\$16,150	\$17,670	\$13,250
	Liability Insurance per \$M	\$7,500	\$7,000	\$7,500
	Hangar/Office	\$20,822	\$20,822	\$20,822
VARIABLE COSTS	Maint. Software Programs	\$3,355	NA	NA
	Airframe Sys. Parts & Labor	\$146	\$241	\$202
	Engine Reserves	\$398	\$318	\$300
	APU Reserves	NA	NA	NA
	Avionics Reserves	NA	NA	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Propeller Reserves	NA	NA	NA
	Nav Database	\$1,400	\$5,917	\$1,810
	EGPWS/TAWS Database	\$550	Incl. in Nav Database	\$350
	Flight Planning	NA	NA	NA
	Wx Services	NA	NA	NA
ANNUAL CAFIN SERVICES COSTS	Charts & Maps	NA	NA	NA
	Swift Broadband	NA	NA	NA
	Ka/Ku	NA	NA	NA
	Air to Ground	NA	NA	NA
	SatTV	NA	NA	NA
ANNUAL TRIP SUPPORT COSTS	Cabin/Iridium Phone	\$2,150	\$2,150	\$2,150
	Catering Service	\$8,652	\$8,652	\$8,652
	Flight Crew Travel	\$5,767	\$5,767	\$5,767
	International Trip Support	NA	NA	NA
	Concierge	NA	NA	NA
	Ground Handling	\$2,884	\$2,884	\$2,884
	Landing/Parking Fees	\$5,767	\$5,767	\$5,767

*FAA certified for single-pilot operations

**Variable Costs estimated by AirPower Software

Production Aircraft – Category 2 – Turboprops ≥12,500 lb. – Jets <20,000 lb.

Manufacturer	Textron Aviation	Syberjet	Textron Aviation	Textron Aviation
Aircraft Model	King Air 350i	SJ30i	King Air 350iER	Citation CJ3+
Category (1-6)	2	2	2	2
BCA Equipped Price	\$7,755,000	\$8,306,452	\$8,795,400	\$8,990,000
DIRECT COSTS	300 nm	\$1,049	\$849	\$1,097
	600 nm	\$1,905	\$1,438	\$1,983
	1,000 nm	\$2,995	\$2,253	\$3,118
	3,000 nm	—	—	—
	6,000 nm	—	—	—
	Captain Salary	\$118,029	\$118,029	\$118,029
FIXED COSTS	First Officer Salary	SP*	SP*	SP*
	Cabin Crew Salary	NA	NA	NA
	Director of Maintenance Salary	NA	NA	NA
	Flight Crew Recurrent Training	\$13,500	\$14,000	\$14,000
	Cabin Crew Recurrent Training	NA	NA	NA
	Maintenance Training	NA	NA	NA
	Hull Insurance per \$100	\$29,469	\$31,565	\$33,423
	Liability Insurance per \$M	\$7,500	\$7,500	\$7,000
	Hangar/Office	\$20,822	\$20,822	\$20,822
	Maint. Software Programs	\$1,523	\$1,755	\$1,523
VARIABLE COSTS	Airframe Sys. Parts & Labor	\$211	\$217	\$211
	Engine Reserves	\$270	\$231	\$270
	APU Reserves	NA	NA	NA
	Avionics Reserves	NA	NA	NA
	Propeller Reserves	\$18	NA	\$18
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Nav Database	\$12,000	NA	\$12,000
	EGPWS/TAWS Database	Incl. in Nav Database	NA	Incl. in Nav Database
	Flight Planning	NA	NA	NA
	Wx Services	NA	NA	NA
	Charts & Maps	NA	NA	NA
ANNUAL CAFIN SERVICES COSTS	Swift Broadband	NA	NA	NA
	Ka/Ku	NA	NA	NA
	Air to Ground	NA	NA	NA
	SatTV	NA	NA	NA
	Cabin/Iridium Phone	\$2,150	\$2,150	\$2,150
ANNUAL TRIP SUPPORT COSTS	Catering Service	\$8,652	\$8,652	\$8,652
	Flight Crew Travel	\$5,767	\$5,767	\$5,767
	International Trip Support	NA	NA	NA
	Concierge	NA	NA	NA
	Ground Handling	\$2,884	\$2,884	\$2,884
	Landing/Parking Fees	\$5,767	\$5,767	\$5,767

*FAA certified for single-pilot operations

Production Aircraft – Category 2 – Turboprops ≥12,500 lb. – Jets <20,000 lb.

Manufacturer	Embraer	Textron Aviation	Pilatus Aircraft
Aircraft Model	Phenom 300E	Cessna Citation CJ4	PC-24
Category (1-6)	2	2	2
BCA Equipped Price	\$9,650,000	\$10,095,000	\$11,134,900
DIRECT COSTS	300 nm	\$1,138	\$1,041
	600 nm	\$1,970	\$1,911
	1,000 nm	\$3,102	\$2,948
	3,000 nm	—	—
	6,000 nm	—	—
FIXED COSTS	Captain Salary	\$118,029	\$118,029
	First Officer Salary	\$70,304	\$70,304
	Cabin Crew Salary	NA	NA
	Director of Maintenance Salary	NA	NA
	Flight Crew Recurrent Training	\$14,000	\$14,000
	Cabin Crew Recurrent Training	NA	NA
	Maintenance Training	NA	NA
	Hull Insurance per \$100	\$22,488	\$25,238
	Liability Insurance per \$M	\$7,500	\$7,500
	Hangar/Office	\$20,822	\$20,822
VARIABLE COSTS	Maint. Software Programs	\$3,355	\$1,755
	Airframe Sys. Parts & Labor	\$168	\$197
	Engine Reserves	\$484	\$342
	APU Reserves	NA	NA
	Avionics Reserves	NA	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Propeller Reserves	NA	NA
	Nav Database	\$1,400	\$7,325
	EGPWS/TAWS Database	\$550	Incl. in Nav Database
	Flight Planning	NA	NA
	Wx Services	NA	NA
ANNUAL CABIN SERVICES COSTS	Charts & Maps	NA	NA
	Swift Broadband	NA	NA
	Ka/Ku	NA	NA
	Air to Ground	NA	NA
	SatTV	NA	NA
ANNUAL TRIP SUPPORT COSTS	Cabin/Iridium Phone	\$2,150	\$2,150
	Catering Service	\$8,652	\$8,652
	Flight Crew Travel	\$5,767	\$5,767
	International Trip Support	NA	NA
	Concierge	NA	NA
	Ground Handling	\$2,884	\$2,884
	Landing/Parking Fees	\$5,767	\$5,767

Production Aircraft – Category 3 – Jets 20,000 lb. to 29,999 lb.

Manufacturer	Bombardier	Bombardier	Textron Aviation
Aircraft Model	Learjet 75 Liberty*	Learjet 75*	Cessna Citation XLS+
Category (1-6)	3	3	3
BCA Equipped Price	\$9,900,000	\$13,800,000	\$13,940,000
DIRECT COSTS	300 nm	\$1,164	\$1,201
	600 nm	\$2,090	\$2,155
	1,000 nm	\$3,339	\$3,440
	3,000 nm	—	—
	6,000 nm	—	—
	Captain Salary	\$153,426	\$153,426
	First Officer Salary	\$88,173	\$88,173
	Cabin Crew Salary	NA	NA
	Director of Maintenance Salary	NA	NA
	Flight Crew Recurrent Training	\$58,000	\$58,000
FIXED COSTS	Cabin Crew Recurrent Training	NA	NA
	Maintenance Training	NA	NA
	Hull Insurance per \$100	\$22,770	\$31,740
	Liability Insurance per \$M	\$13,300	\$13,300
	Hangar/Office	\$36,062	\$36,062
	Maint. Software Programs	\$1,736	\$1,755
	Airframe Sys. Parts & Labor	\$107	\$107
	Engine Reserves	\$634	\$634
	APU Reserves	NA	\$40
	Avionics Reserves	NA	NA
VARIABLE COSTS	Propeller Reserves	NA	NA
	Nav Database	\$7,325	\$7,325
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	NA	\$3,500
	Wx Services	NA	\$1,400
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	NA	\$2,450
	Swift Broadband	NA	NA
	Ka/Ku	NA	NA
	Air to Ground	NA	\$22,740
	SatTV	NA	NA
ANNUAL CABIN SERVICES COSTS	Cabin/Iridium Phone	\$2,150	\$2,150
	Catering Service	\$8,652	\$24,501
	Flight Crew Travel	\$5,767	\$16,334
	International Trip Support	NA	NA
	Concierge	NA	NA
ANNUAL TRIP SUPPORT COSTS	Ground Handling	\$2,884	\$8,167
	Landing/Parking Fees	\$5,767	\$16,334

*Mission Fuel estimate from BCA Purchase Planning Handbook;

Variable Costs estimated by AirPower Software

Production Aircraft – Category 4 – Jets 30,000 lb. to 40,999 lb.

Manufacturer	Embraer	Embraer	Textron Aviation
Aircraft Model	Legacy 450	Praetor 500	Cessna Citation Latitude
Category (1-6)	4	4	4
BCA Equipped Price	\$16,570,000	\$16,995,000	\$18,195,000
DIRECT COSTS	300 nm	\$1,583	\$1,609
	600 nm	\$2,741	\$2,785
	1,000 nm	\$4,280	\$4,414
	3,000 nm	—	—
	6,000 nm	—	—
	Captain Salary	\$178,393	\$178,393
	First Officer Salary	\$99,094	\$99,094
	Cabin Crew Salary	NA	NA
	Director of Maintenance Salary	\$127,306	\$127,306
	Flight Crew Recurrent Training	\$58,000	\$58,000
FIXED COSTS	Cabin Crew Recurrent Training	NA	\$3,545
	Maintenance Training	\$10,600	\$10,600
	Hull Insurance per \$100	\$29,826	\$32,751
	Liability Insurance per \$M	\$22,400	\$22,400
	Hangar/Office	\$60,704	\$60,704
	Maint. Software Programs	NA	\$1,755
	Airframe Sys. Parts & Labor	\$158	\$186
	Engine Reserves	\$661	\$600
	APU Reserves	\$45	\$40
	Avionics Reserves	NA	NA
VARIABLE COSTS	Propeller Reserves	NA	NA
	Nav Database	\$33,500	\$15,295
	EGPWS/TAWS Database	Incl. in Nav Database	\$1,050
	Flight Planning	\$3,500	\$3,500
	Wx Services	\$1,400	\$1,400
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	\$2,450	\$2,450
	Swift Broadband	\$68,000	\$68,000
	Ka/Ku	NA	NA
	Air to Ground	\$22,740	\$22,740
	SatTV	NA	NA
ANNUAL CABIN SERVICES COSTS	Cabin/Iridium Phone	\$2,150	\$2,150
	Catering Service	\$44,313	\$44,313
	Flight Crew Travel	\$29,543	\$29,543
	International Trip Support	\$22,156	\$22,156
	Concierge	\$7,385	\$7,385
	Ground Handling	\$14,771	\$14,771
ANNUAL TRIP SUPPORT COSTS	Landing/Parking Fees	\$29,543	\$29,543

Production Aircraft – Category 4 – Jets 30,000 lb. to 40,999 lb.

Manufacturer	Textron Aviation	Embraer	Embraer
Aircraft Model	Citation Sovereign+	Legacy 500	Praetor 600
Category (1-6)	4	4	4
BCA Equipped Price	\$19,730,000	\$19,995,000	\$20,995,000
DIRECT COSTS	300 nm	\$1,529	\$2,279
	600 nm	\$2,634	\$4,058
	1,000 nm	\$4,202	\$6,408
	3,000 nm	—	—
	6,000 nm	—	—
	Captain Salary	\$178,393	\$178,393
	First Officer Salary	\$99,094	\$99,094
	Cabin Crew Salary	NA	NA
	Director of Maintenance Salary	\$127,306	\$127,306
	Flight Crew Recurrent Training	\$58,000	\$58,000
FIXED COSTS	Cabin Crew Recurrent Training	NA	NA
	Maintenance Training	\$10,600	\$10,600
	Hull Insurance per \$100	\$35,514	\$37,791
	Liability Insurance per \$M	\$22,400	\$22,400
	Hangar/Office	\$60,704	\$60,704
	Maint. Software Programs	\$1,755	NA
	Airframe Sys. Parts & Labor	\$187	\$155
	Engine Reserves	\$594	\$674
	APU Reserves	\$40	\$45
	Avionics Reserves	NA	NA
VARIABLE COSTS	Propeller Reserves	NA	NA
	Nav Database	\$15,295	\$33,500
	EGPWS/TAWS Database	\$1,050	Incl. in Nav Database
	Flight Planning	\$3,500	\$3,500
	Wx Services	\$1,400	\$1,400
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	\$2,450	\$2,450
	Swift Broadband	\$68,000	\$68,000
	Ka/Ku	NA	NA
	Air to Ground	\$22,740	\$22,740
	SatTV	NA	NA
ANNUAL CABIN SERVICES COSTS	Cabin/Iridium Phone	\$2,150	\$2,150
	Catering Service	\$44,313	\$44,313
	Flight Crew Travel	\$29,543	\$29,543
	International Trip Support	\$22,156	\$22,156
	Concierge	\$7,385	\$7,385
ANNUAL TRIP SUPPORT COSTS	Ground Handling	\$14,771	\$14,771
	Landing/Parking Fees	\$29,543	\$29,543

Production Aircraft – Category 4 – Jets 30,000 lb. to 40,999 lb.

Manufacturer	Gulfstream Aerospace	Bombardier	Textron Aviation
Aircraft Model	G280	Challenger 350*	Cessna Citation Longitude
Category (1-6)	4	4	4
BCA Equipped Price	\$24,500,000	\$26,673,000	\$28,345,000
DIRECT COSTS	300 nm	\$1,767	\$1,623
	600 nm	\$3,026	\$2,777
	1,000 nm	\$4,720	\$4,328
	3,000 nm	—	—
	6,000 nm	—	—
	Captain Salary	\$178,393	\$178,393
	First Officer Salary	\$99,094	\$99,094
	Cabin Crew Salary	NA	\$98,753
	Director of Maintenance Salary	\$127,306	\$127,306
	Flight Crew Recurrent Training	\$58,000	\$58,000
FIXED COSTS	Cabin Crew Recurrent Training	NA	\$3,545
	Maintenance Training	\$10,600	\$12,237
	Hull Insurance per \$100	\$31,850	\$34,675
	Liability Insurance per \$M	\$22,400	\$22,400
	Hangar/Office	\$60,704	\$60,704
	Maint. Software Programs	\$11,501	\$8,142
	Airframe Sys. Parts & Labor	\$285	\$132
	Engine Reserves	\$762	\$676
	APU Reserves	\$45	\$40
	Avionics Reserves	NA	NA
VARIABLE COSTS	Propeller Reserves	NA	NA
	Nav Database	\$33,500	\$48,500
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	\$3,500	\$3,500
	Wx Services	\$1,400	\$1,400
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	\$2,450	\$2,450
	Swift Broadband	\$68,000	\$68,000
	Ka/Ku	NA	NA
	Air to Ground	\$22,740	\$22,740
	SatTV	NA	NA
ANNUAL CAFIN SERVICES COSTS	Cabin/Iridium Phone	\$2,150	\$2,150
	Catering Service	\$44,313	\$44,313
	Flight Crew Travel	\$29,543	\$29,543
	International Trip Support	\$22,156	\$22,156
	Concierge	\$7,385	\$7,385
	Ground Handling	\$14,771	\$14,771
ANNUAL TRIP SUPPORT COSTS	Landing/Parking Fees	\$29,543	\$29,543

*Mission Fuel estimate from BCA Purchase Planning Handbook;

Variable Costs estimated by AirPower Software

Production Aircraft – Category 5 – Jets ≥41,000 lb.

Manufacturer	Dassault	Bombardier	Dassault	Dassault
Aircraft Model	Falcon 2000S	Challenger 650*	Falcon 2000LXS	Falcon 900LX
Category (1-6)	5	5	5	5
BCA Equipped Price	\$29,950,000	\$32,350,000	\$35,100,000	\$44,800,000
DIRECT COSTS	300 nm	\$1,649	\$1,728	\$1,649
	600 nm	\$2,836	\$3,128	\$2,836
	1,000 nm	\$4,436	\$5,000	\$4,435
	3,000 nm	—	—	—
	6,000 nm	—	—	—
FIXED COSTS	Captain Salary	\$215,531	\$215,531	\$215,531
	First Officer Salary	\$132,068	\$132,068	\$132,068
	Cabin Crew Salary	\$98,753	\$98,753	\$98,753
	Director of Maintenance Salary	\$165,957	\$165,957	\$165,957
	Flight Crew Recurrent Training	\$94,589	\$94,589	\$94,589
	Cabin Crew Recurrent Training	\$3,545	\$3,545	\$3,545
	Maintenance Training	\$10,037	\$8,574	\$11,301
	Hull Insurance per \$100	\$38,935	\$42,055	\$45,630
	Liability Insurance per \$M	\$22,400	\$22,400	\$22,400
	Hangar/Office	\$103,196	\$103,196	\$103,196
VARIABLE COSTS	Maint. Software Programs	\$8,362	\$8,142	\$8,362
	Airframe Sys. Parts & Labor	\$342	\$150	\$342
	Engine Reserves	\$560	\$783	\$559
	APU Reserves	\$24	\$40	\$24
	Avionics Reserves	NA	NA	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Propeller Reserves	NA	NA	NA
	Nav Database	\$44,500	\$48,500	\$44,500
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	\$3,500	\$3,500	\$3,500
	Wx Services	\$1,400	\$1,400	\$1,400
ANNUAL CAFIN SERVICES COSTS	Charts & Maps	\$2,450	\$2,450	\$2,450
	Swift Broadband	\$78,000	NA	\$78,000
	Ka/Ku	NA	\$125,000	NA
	Air to Ground	\$22,740	\$22,740	\$22,740
	SatTV	\$11,652	\$11,652	\$11,652
ANNUAL TRIP SUPPORT COSTS	Cabin/Iridium Phone	\$2,150	\$2,150	\$2,150
	Catering Service	\$55,446	\$56,000	\$56,000
	Flight Crew Travel	\$36,964	\$37,296	\$37,296
	International Trip Support	\$27,723	\$27,972	\$27,972
	Concierge	\$9,241	\$9,324	\$9,324
	Ground Handling	\$18,482	\$18,649	\$18,649
	Landing/Parking Fees	\$36,964	\$37,296	\$37,296

*Mission Fuel estimate from BCA Purchase Planning Handbook;

Variable Costs estimated by AirPower Software

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Production Aircraft – Category 5 – Jets ≥41,000 lb.

Manufacturer	Bombardier	Gulfstream Aero.	Bombardier	Dassault
Aircraft Model	Global 5500*	G500	Global 5000*	Falcon 7X
Category (1-6)	5	5	5	5
BCA Equipped Price	\$46,000,000	\$48,500,000	\$50,441,000	\$53,800,000
DIRECT COSTS	300 nm	\$2,540	\$1,722	\$2,814
	600 nm	\$4,361	\$2,720	\$4,739
	1,000 nm	\$6,835	\$4,088	\$7,369
	3,000 nm	—	—	—
	6,000 nm	—	—	—
FIXED COSTS	Captain Salary	\$215,531	\$215,531	\$215,531
	First Officer Salary	\$132,068	\$132,068	\$132,068
	Cabin Crew Salary	\$98,753	\$98,753	\$98,753
	Director of Maintenance Salary	\$165,957	\$165,957	\$165,957
	Flight Crew Recurrent Training	\$94,589	\$94,589	\$94,589
	Cabin Crew Recurrent Training	\$3,545	\$3,545	\$3,545
	Maintenance Training	\$10,621	\$10,621	\$13,611
	Hull Insurance per \$100	\$64,400	\$67,900	\$70,617
	Liability Insurance per \$M	\$22,400	\$22,400	\$22,400
	Hangar/Office	\$108,110	\$108,110	\$103,196
VARIABLE COSTS	Maint. Software Programs	\$8,142	\$8,142	\$8,362
	Airframe Sys. Parts & Labor	\$188	\$482	\$188
	Engine Reserves	\$1,238	\$927	\$1,238
	APU Reserves	\$52	\$52	\$52
	Avionics Reserves	NA	NA	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Propeller Reserves	NA	NA	NA
	Nav Database	\$54,500	\$37,980	\$54,500
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	\$3,500	NA	\$3,500
	Wx Services	\$1,400	NA	\$1,400
ANNUAL CAFIN SERVICES COSTS	Charts & Maps	\$2,450	NA	\$2,450
	Swift Broadband	NA	NA	NA
	Ka/Ku	\$125,000	\$125,000	\$125,000
	Air to Ground	\$22,740	\$22,740	\$22,740
	SatTV	\$11,652	\$11,652	\$11,652
ANNUAL TRIP SUPPORT COSTS	Cabin/Iridium Phone	\$2,150	\$2,150	\$2,150
	Catering Service	\$56,000	\$56,000	\$56,000
	Flight Crew Travel	\$37,296	\$37,296	\$37,296
	International Trip Support	\$27,972	\$27,972	\$27,972
	Concierge	\$9,324	\$9,324	\$9,324
	Ground Handling	\$18,649	\$18,649	\$18,649
	Landing/Parking Fees	\$37,296	\$37,296	\$37,296

*Mission Fuel estimate from BCA Purchase Planning Handbook;

Variable Costs estimated by AirPower Software

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Production Aircraft – Category 6 – Ultra-Long-Range Jets

Manufacturer	Gulfstream Aero.	Bombardier	Gulfstream Aero.	Dassault
Aircraft Model	G550	Global 6500*	G600	Falcon 8X
Category (1-6)	6	6	6	6
BCA Equipped Price	\$54,500,000	\$56,000,000	\$58,500,000	\$59,300,000
DIRECT COSTS	300 nm	—	—	—
	600 nm	—	—	—
	1,000 nm	\$7,204	\$6,900	\$6,766
	3,000 nm	\$16,761	\$19,826	\$13,216
	6,000 nm	\$34,859	\$41,014	\$27,860
	Captain Salary	\$244,697	\$244,697	\$244,697
	First Officer Salary	\$137,631	\$137,631	\$137,631
	Cabin Crew Salary	\$120,000	\$120,000	\$120,000
	Director of Maintenance Salary	\$199,948	\$199,948	\$199,948
	Flight Crew Recurrent Training	\$102,900	\$102,900	\$98,000
FIXED COSTS	Cabin Crew Recurrent Training	\$3,545	\$3,545	\$3,545
	Maintenance Training	\$12,880	\$20,505	\$20,260
	Hull Insurance per \$100	\$81,750	\$89,600	\$87,750
	Liability Insurance per \$M	\$22,400	\$22,400	\$22,400
	Hangar/Office	\$109,266	\$114,469	\$109,266
	Maint. Software Programs	\$9,395	NA	NA
	Airframe Sys. Parts & Labor	\$360	\$187	\$438
	Engine Reserves	\$1,222	\$1,238	\$1,018
	APU Reserves	\$52	\$52	\$52
	Avionics Reserves	NA	NA	NA
VARIABLE COSTS	Propeller Reserves	NA	NA	NA
	Nav Database	\$37,980	\$54,500	\$37,980
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	\$3,500	\$3,500	NA
	Wx Services	\$1,400	\$1,400	NA
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	\$2,450	\$2,450	NA
	Swift Broadband	NA	NA	NA
	Ka/Ku	\$125,000	\$125,000	\$125,000
	Air to Ground	\$22,740	\$22,740	\$22,740
	SatTV	\$11,652	\$11,652	\$11,652
ANNUAL CABIN SERVICES COSTS	Cabin/Iridium Phone	\$2,150	\$2,150	\$2,150
	Catering Service	\$62,049	\$62,049	\$62,049
	Flight Crew Travel	\$41,367	\$41,367	\$41,367
	International Trip Support	\$31,025	\$31,025	\$31,025
	Concierge	\$10,341	\$10,341	\$10,341
	Ground Handling	\$20,683	\$20,683	\$20,683
ANNUAL TRIP SUPPORT COSTS	Landing/Parking Fees	\$41,367	\$41,367	\$41,367

*Mission Fuel estimate from BCA Purchase Planning Handbook;

Variable Costs estimated by AirPower Software

Production Aircraft – Category 6 – Ultra-Long-Range Jets

Manufacturer	Bombardier	Gulfstream Aero.	Gulfstream Aero.	Bombardier
Aircraft Model	Global 6000*	G650	G650ER	Global 7500*
Category (1-6)	6	6	6	6
BCA Equipped Price	\$62,310,000	\$68,500,000	\$70,500,000	\$75,000,000
DIRECT COSTS	300 nm	—	—	—
	600 nm	—	—	—
	1,000 nm	\$7,420	\$7,372	\$6,770
	3,000 nm	\$17,954	\$19,145	\$19,298
	6,000 nm	\$37,089	\$39,391	\$39,668
	Captain Salary	\$244,697	\$285,332	\$285,332
	First Officer Salary	\$137,631	\$137,631	\$147,000
	Cabin Crew Salary	\$120,000	\$120,000	\$120,000
	Director of Maintenance Salary	\$199,948	\$199,948	\$199,948
	Flight Crew Recurrent Training	\$102,900	\$102,900	\$120,000
FIXED COSTS	Cabin Crew Recurrent Training	\$3,545	\$3,545	\$3,545
	Maintenance Training	\$20,505	\$12,880	\$24,186
	Hull Insurance per \$100	\$93,465	\$109,600	\$120,000
	Liability Insurance per \$M	\$22,400	\$22,400	\$44,800
	Hangar/Office	\$114,469	\$109,266	\$114,469
	Maint. Software Programs	\$9,395	\$9,395	\$9,395
	Airframe Sys. Parts & Labor	\$187	\$437	\$231
	Engine Reserves	\$1,238	\$1,251	\$1,153
	APU Reserves	\$52	\$52	\$52
	Avionics Reserves	NA	NA	NA
VARIABLE COSTS	Propeller Reserves	NA	NA	NA
	Nav Database	\$54,500	\$37,980	\$54,500
	EGPWS/TAWS Database	Incl. in Nav Database	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	\$3,500	\$3,500	\$3,500
	Wx Services	\$1,400	\$1,400	\$1,400
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	\$2,450	\$2,450	\$2,450
	Swift Broadband	NA	NA	NA
	Ka/Ku	\$125,000	\$125,000	\$125,000
	Air to Ground	\$22,740	\$22,740	\$22,740
	SatTV	\$11,652	\$11,652	\$11,652
ANNUAL CABIN SERVICES COSTS	Cabin/Iridium Phone	\$2,150	\$2,150	\$2,150
	Catering Service	\$62,049	\$62,049	\$62,049
	Flight Crew Travel	\$41,367	\$41,367	\$41,367
	International Trip Support	\$31,025	\$31,025	\$31,025
	Concierge	\$10,341	\$10,341	\$10,341
	Ground Handling	\$20,683	\$20,683	\$20,683
ANNUAL TRIP SUPPORT COSTS	Landing/Parking Fees	\$41,367	\$41,367	\$41,367

*Mission Fuel estimate from BCA Purchase Planning Handbook;

Variable Costs estimated by AirPower Software

Production Aircraft – Category 6 – Ultra-Long-Range Jets

Manufacturer	Boeing	Boeing	Airbus	Boeing
Aircraft Model	BBJ MAX7	BBJ MAX8*	ACJ319neo*	BBJ MAX9*
Category (1-6)	6	6	6	6
BCA Equipped Price	\$91,200,000	\$99,000,000	\$105,000,000	\$107,900,000
DIRECT COSTS	300 nm	—	—	—
	600 nm	—	—	—
	1,000 nm	NA	\$9,606	\$7,721
	3,000 nm	NA	\$28,035	\$26,035
	6,000 nm	NA	\$57,915	\$54,589
	Captain Salary	NA	\$285,332	\$285,332
	First Officer Salary	NA	\$147,000	\$147,000
	Cabin Crew Salary	NA	\$120,000	\$120,000
	Director of Maintenance Salary	NA	\$199,948	\$199,948
	Flight Crew Recurrent Training	NA	\$120,000	\$120,000
FIXED COSTS	Cabin Crew Recurrent Training	NA	\$3,545	\$3,545
	Maintenance Training	NA	\$24,186	\$24,186
	Hull Insurance per \$100	NA	\$158,400	\$168,000
	Liability Insurance per \$M	NA	\$56,000	\$56,000
	Hangar/Office	NA	\$133,410	\$133,410
	Maint. Software Programs	NA	\$12,389	\$12,389
	Airframe Sys. Parts & Labor	NA	\$377	\$928
	Engine Reserves	NA	OC	OC
	APU Reserves	NA	OC	OC
	Avionics Reserves	NA	NA	NA
VARIABLE COSTS	Propeller Reserves	NA	NA	NA
	Nav Database	NA	\$55,300	\$55,300
	EGPWS/TAWS Database	NA	Incl. in Nav Database	Incl. in Nav Database
	Flight Planning	NA	\$3,500	\$3,500
	Wx Services	NA	\$1,400	\$1,400
ANNUAL COCKPIT SUBSCRIPTION SERVICES COSTS	Charts & Maps	NA	\$2,450	\$2,450
	Swift Broadband	NA	NA	NA
	Ka/Ku	NA	\$175,000	\$175,000
	Air to Ground	NA	\$22,740	\$22,740
	SatTV	NA	\$11,652	\$11,652
ANNUAL CAFIN SERVICES COSTS	Cabin/Iridium Phone	NA	\$2,150	\$2,150
	Catering Service	NA	\$62,049	\$62,049
	Flight Crew Travel	NA	\$41,367	\$41,367
	International Trip Support	NA	\$31,025	\$31,025
	Concierge	NA	\$10,341	\$10,341
	Ground Handling	NA	\$20,683	\$20,683
ANNUAL TRIP SUPPORT COSTS	Landing/Parking Fees	NA	\$41,367	\$41,367

*Mission Fuel estimate from BCA Purchase Planning Handbook;

Variable Costs estimated by AirPower Software



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A Descent Too Late

And the red flags colored green

BY ROGER COX rogerdodger62@gmail.com

On a dark and foggy night in 2017 the crew of a Turkish freighter came to grief in an autoland that touched down off the airport in Kyrgyzstan, killing themselves, two relief crewmembers and 35 area residents.

After a three-year effort, Russian investigators have released their final report on the accident. In addition to a catalogue of human errors and missed opportunities to avoid the catastrophe, the report revealed a new twist on an automatic system involving the color green.

The all-cargo Turkish Airlines Boeing 747-412F flew a fully automated descent and executed a perfect autoland, including flare, but did so 3,050 ft. beyond the far end of the intended runway. The airplane touched down at 165 kt., smashed through an airport barrier wall and disintegrated along a 1,800-ft. path.

The Flight

Turkish Airlines Flight 6491 originated in Hong Kong (VHHH) and was destined for Istanbul (LTBA), with an intermediate stop at Manas Airport (UCFM) near Bishkek, the capital and largest city of Kyrgyzstan (Kyrgyz Republic). The cargo flight was operated on behalf of Turkish Airlines by ACT Airlines on Jan. 16, 2017. The planned time en route was 6 hr., 3 min. The crew conducted a preflight briefing beginning at 2130 Hong Kong time but did not depart until 0312, a delay of 2 hr., 2 min. from the scheduled departure. According to the accident report, the destination weather, although foggy, was "within limits to depart." Two alternates, Astana (UACC) and Karaganda (UAKK), Kazakhstan, were filed.

The flight cruised at 34,000 ft. using the separation system of the People's Republic of China and entered the Bishkek ATC Area Control Center at 0641 local time. (There is a 2-hr. time difference between Hong Kong and Bishkek.)



RUSSIAN IAC REPORT

The fin and the horizontal stabilizer (Figure 4) have been found attached to the tail fuselage section, extending from the aft pressure bulkhead to the tail cone.

Ten minutes later, the flight was cleared to descend to FL 220 (using the Kyrgyz Republic system) and shortly thereafter was advised that Manas Airport Runway 26 RVR was 1,300 ft. at the threshold and 1,000 ft. at midpoint and end, with vertical visibility of 130 ft.

The flight was handed off to Bishkek Approach Control at 0705 and cleared for the TOPKA 1 arrival and descent to FL 060 for an intended ILS approach to Runway 26. The controller reported the winds were calm, the visibility was 165 ft., the RVR was 1,000 ft., there was freezing fog and the vertical visibility was 160 ft. Asked by the controller if they wanted to continue the approach, the crew confirmed that they did. The airline's operating manual allowed pilots to continue an approach up to 1,000 ft. above the runway threshold altitude regardless of provided RVR data.

At 0711:45, the flight was reminded of the transition level FL 060, given the QNH, 1023 hectopascals, and cleared for the ILS RWY 26. The approach controller added, "call me on localizer." At 0714:05, the flight captured the localizer and 3 sec. later the glideslope

mode armed. The pitch mode was flight level change and the selected altitude was set to 3,400 ft., the depicted glideslope altitude.

At 0715:13, the approach controller asked, "Turkish six four nine one, are you established?" and when the crew confirmed they were, handed them off to the tower. Bishkek Tower cleared the flight to land at 0715:38. The RVR had improved slightly to 1,300 ft. at the approach end, 1,065 ft. at the midpoint and 1,300 ft. at the runway end.

There was just one problem. The flight was too high to capture the normal glideslope. In fact, throughout the entire descent the airplane had been high on profile, and the crew knew it.

Kyrgyzstan is one of the most mountainous countries in the world; 94% of its lies above 1,000 meters (3,280 ft.), and peaks range up to 24,406 ft. MSL. Bishkek is in the far north and lies in one of the country's few plains. The Manas Airport elevation is 2,090 ft. The depicted minimum safe altitude to the south of Manas is 13,000 ft. and 5,900 ft. to the east.

The TOPKA 1 arrival requires

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Cause & Circumstance

crossing 43 nm southeast of Manas (MNS) VOR/DME (RAXALT) at or above FL 170 and 16.2 DME southeast (TOPKA) at or above FL 060. These restrictions can be met if the crew makes prudent use of drag devices. But the flight remained high on profile throughout the descent and the captain can be heard on the cockpit voice recorder (CVR) complaining about ATC. While still at FL 220, the captain says, "We are starting to be high." Leaving FL 180 with clearance to cross TOPKA at FL 060, the captain says, "They left us high again." The flight crossed TOPKA at 9,200 ft. and 270 kt. Crossing a waypoint (MNS 090/8) with a recommended altitude of 4,400 ft., the flight was at 6,500 ft. and had an airspeed of 220 kt.

At 0714:18, when the airplane was over the Manas VOR/DME 5.4 DME, it was supposed to be at the glideslope intercept altitude of 3,400 ft., but the crew were at 5,300 ft. When they intercepted the localizer, they continued descent to the glideslope intercept altitude, but they were already past the 3.2 DME where the glideslope began. They flew level at 3,400 ft. until 0.4 DME, just 1.15 nm from the runway threshold, before commencing their final descent. The Runway 26 threshold was 2,055 ft. MSL, and they were at 3,400 ft. just over a mile away.

The glidepath deviation indicator descended from its position at the top of

the primary flight display, but the angle of the captured glideslope signal was not 3 deg.; it was 9 deg.

Six seconds after the (false) glideslope capture, the green "LAND 3" annunciation was recorded, indicating the autoland system was engaged in a triple redundant, fail-operative configuration, suitable for use in ICAO CAT III conditions. The captain called out, "Glideslope capture," the first officer (F/O) responded, "Check. Four thousand four hundred," and the captain said, "Land three."

But then, 15 sec. after the glideslope signal capture, there was an autopilot caution, an amber line drawn through the glideslope mode annunciation, and the beginning of a "four beep" audio alert that lasted until the flare.

The autopilot continued to function. The pitch control channel maintained an inertially derived 3-deg. descent track, a descent designed to continue until either a valid glideslope signal reappeared, the crew disconnected the autopilot or the crew commenced a go-around. (This inertial path feature is common to Boeing 747-400/-8, 757, 767, 777, 787 and some 737 aircraft).

At 0716:18, the autoland mode changed from LAND 3 to LAND 2. The crew checked the altitude, which was 800 ft., and continued the approach. At a height of 300 ft., the EGPWS Mode 5 "glideslope" aural warning began to sound and continued until the flight

passed 200 ft. At 0717:04, the 100-ft. aural warning sounded and the F/O called out, "MinIMUMS." At 0717:07, the captain commanded, "Negative, go around."

At 0717:09, the autopilot FLARE mode engaged, then, at 58 ft., the go-around push button was pressed. Engine thrust began to increase, there was a control column pitch-up input, and vertical load increased to 1.4 G. However, 3 sec. after the go-around button activation, the jumbo made ground contact.

The Investigation

The investigation was conducted by the Russian Interstate Aviation Committee (IAC) Air Accident Aviation Commission as the State of Occurrence by treaty agreement with Kyrgyzstan. Also participating was Turkey as the State of Registry and Operator and the U.S. as the State of Aircraft Design and Manufacture. The NTSB, FAA and Boeing represented the U.S. The IAC issued its final report this past February and provided a courtesy English translation.

Examination of the accident site showed the 747's right wing and engines impacted buildings about 525 ft. beyond the touchdown point, and the aircraft began to turn right while still moving forward. At 1,450 ft. beyond touchdown, the cockpit impacted a brick house and turned more than 90 deg. to the right. Parts of the left wing and empennage traveled about 100 ft. beyond the

Accidents in Brief

Compiled by Jessica A. Salerno

Selected accidents and incidents in June 2020. The following NTSB information is preliminary.

► **June 27 — About 0153 CDT, a Piper PA-32R airplane (N315AM) was destroyed when it was involved in an accident at a private airstrip near Zavalla, Texas. The non-certificated pilot was killed. The airplane was operated as a Part 91 personal flight. According to ATC information, the airplane departed David Wayne Hooks Memorial Airport (DWH), Spring Texas, at 0023 and arrived overhead the airstrip at 0059. During the**

next 54 minutes, the airplane maneuvered near the airstrip between 350-1,300 ft. AGL, with a groundspeed ranging from 65-143 kt. The airplane was last recorded at 350 ft. AGL and 94 kt. ground speed. The airplane impacted trees 670 ft. north of the southwest oriented runway threshold and came to rest 375 ft. southeast of the initial impact. A post-crash fire ensued. Examination of the airframe and engine revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

► **June 16 — About 0730 CDT, an Air Tractor AT-502B (N879JA) was substantially damaged when it was involved in an accident near Atmore, Alabama. The pilot was killed in the**

accident. The airplane was operated as an FAR Part 137 aerial application flight. According to the pilot's spouse, he departed earlier on the morning of the accident to dispense two small "loads." On his return home he called and asked her to come outside of their residence to watch the airplane fly over. She said that the airplane flew over the house before making a climb straight up. The airplane then banked to the left, rolled right, descended straight down, and she heard a loud "boom" shortly thereafter. Two witnesses that were fishing on a nearby lake saw the airplane flying below the tree line before it climbed straight up. They said the airplane rolled and descended straight down nose first. They heard a "loud thud" and then silence. The witnesses contacted emergency services



RUSSIAN IAC REPORT

cockpit. Fuel spillage fed a fire that destroyed most of the aircraft.

The aircraft flight data recorder (FDR) and CVR were recovered, as was one of the three flight control computer (FCC) circuit boards. The FCC unit was sent to the NTSB and examined by Rockwell Collins, the manufacturer. The non-volatile memory data was successfully downloaded and used in the investigation. A recording of air traffic control transmissions was also obtained.

The captain, 59, had 10,808 hr. of flight time, including 820 hr. on the 747. His training records and medical certification were complete. He had a previous accident, a runway excursion and gear collapse at Bagram Airport while

serving as an F/O in 2010.

The F/O, also 59, had 5,894 hr. total flight time and 1,758 hr. in the 747, and his training records and medical certification also were normal. Both pilots had been off duty in Hong Kong for 69 hr. before the flight, and both were on duty 11 hr., 47 min. at the time of the accident. The two had flown into Bishkek together the month before the accident. Both pilots were graduates of the Turkish Air Force Academy.

The airplane was manufactured in February 2003 and operated by Singapore Airlines from then until December 2015. Turkey's ACT Airlines began operating the four-engine Boeing the following October. The airplane had

Main fire bed indicated in yellow dashed line.

logged 46,820 hr. and 8,308 cycles at the time of the accident. Its oldest engine was manufactured in 1991 and had over 90,000 total hours and had undergone three overhauls. Examination of maintenance records revealed no faults or areas of concern. A fuel sample taken from the left wing was found to be normal.

The freighter's takeoff weight of 755,055 lb. and 213,055-lb. fuel weight were found to be in limits, as was the takeoff center of gravity of 23% of MAC. The landing weight of 614,649 lb. and 151-kt. Vref also were within limits and appropriate.

The weather at the Chuya lowland and Manas Airport on Jan. 15-16 was affected by a slow-moving cold front with a wide area of frontal fog and consecutive forecasts for fog, visibility 650 ft. and vertical visibility 100 ft. Investigators found the forecasts had been accurate and the meteorological equipment and support had been in compliance with requirements. The airfield lighting was checked and found to be functioning normally.

A Diamond DA-42 flying laboratory was used to fly the accident aircraft's profile along the ILS and all parameters checked. The false glideslope was found, with an angle of about 8.8 deg., at 1.2 nm from the end of Runway 26 at 3,400 ft.

and assisted local responders in finding the wreckage. An FAA inspector examined the airframe prior to its recovery from the accident site, and noted that the nose, cockpit, and empennage area were crushed aft. Both wings displayed crush damage along their entire leading edges. The inspector confirmed flight control continuity from the elevator and rudder to the cockpit area. He also noted aileron cables extending from the cockpit area to their respective wing.

► June 15 — About 1045 Alaska

daylight time, a Cessna 180 (N3186D) was heavily damaged when it was involved in an accident near Fairbanks, Alaska. The pilot and two passengers were not injured. The Cessna 180 was operated as a Part 91 personal flight. The pilot of the float-

equipped airplane reported that while on final approach to the float-pond at the Fairbanks International Airport (PAFA), Fairbanks, Alaska, all engine power was lost. He added that the propeller continued to windmill and that there were no unusual noises or notable changes. Subsequently, the floatplane landed short of the float-pond and all occupants were able to egress with no further incident. A review of PAFA Federal Aviation Administration ATC recordings revealed that the pilot was inbound from the north, requested to land on Waterway 2, and never made a distress call or any other indication that something was wrong.

► June 10 — About 1630 CDT, a Piper PA-32RT-300T (N543GS) was destroyed when it was involved in an accident near

Selma, Alabama. The commercial pilot and pilot-rated passenger were fatally injured. The airplane was operated as a Part 91 business flight. According to the FBO, the airplane was fueled with 55 gal. of fuel prior to departure from Walker County Airport – Bevill Field (JFX), Jasper, Alabama. According to preliminary FAA air traffic control communications and radar data, the airplane departed JFX at 1543 with the intended destination of Pensacola International Airport (PNS), Pensacola, Florida. After departure, the airplane climbed and leveled off at a cruise altitude of 15,000 ft. MSL. Shortly thereafter, the pilot reported an engine "fluctuation" to the controller and requested to divert to Craig Field Airport (SEM), Selma, Alabama. The controller cleared the airplane to SEM,

Cause & Circumstance

Analysis and Causes

The IAC's lengthy analysis can be divided into four main areas:

(1) Conduct of the descent. The crew did not take the appropriate actions to get the airplane down to the required approach altitude. In particular, the descent between RAXALT and TOPKA, a distance of 27 nm, required the use of speed brakes and possibly lowering of the gear and possibly even the first notch of flaps in order to lose the depicted 12,000 ft. of altitude.

(2) Lack of assistance from ATC. Both the approach controller and the tower controller had radar with altitude capability, but the former was not required to notify the crew of their abnormal altitude and the latter had not been trained to use the radar for this purpose.

(3) The crew's "psycho-emotional condition." The captain displayed anxiety and even intemperance about the steep descent and the F/O's efforts to calm him were not successful. The crew began to blame the controller for their own errors, stopped monitoring approach indications and narrowed their focus to only two objects — altitude and the autoland objective — all of which resulted in "tunnel effect." In addition to violating their own airline flight operations

manual guidance and mandatory call-outs, they ignored the "AUTOPilot" and "FMA FAULT 2" cautions, the audio beeper alert, the flight director pitch bars removed from the PFDs, the "G/S" indication with a crossed amber line, and the two "MASTER CAUTION" lights and audio alert. The crew was not psychologically prepared to go around.

(4) Boeing guidance and systems operation logic. The manufacturer's flight crew operating manual (FCOM) and flight crew training manual (FCTM) do not provide a complete description of pitch mode failure or direct instructions for pilot actions in this case. There was some conflict between the FCTM and training manual guidance as to exactly when a go-around is required. Most significantly, the airplane's system operation may not be in compliance with the FAA's certification requirements.

The 14 CFR Part 25.1322 document "Flightcrew Alerting" requires red for warning alerts and amber or yellow for caution alerts. The green LAND 3 and LAND 2 annunciations are used for advisory purposes and informing the crew on safe operational conditions. The descent beyond the runway area in IFR ICAO II conditions was certainly not safe. The crew probably relied on the green advisory display. The IAC gave as a contrary

example the red warning "APPROACH LOST" in the Sukhoi RRJ-95 when the glideslope signal is lost.

The FAA Advisory Circular on automatic landing systems that was in effect when the Boeing 747-400F was certified (AC 20-57A) set prescribed dispersion areas on the landing surface, and the accident landing was well outside those limits. The most recent update of that AC requires the probability of touchdown within that area of 1×10^{-6} .

The false glideslope capture that took place and the followed inertial path with only an amber annunciation does not seem to be in full compliance with the established requirements.

The IAC found the cause of the accident was "the missing control of the crew over the aircraft position in relation to the glideslope during the automatic approach, conducted at night in the weather conditions, suitable for ICAO CAT II landing, and as a result, the measures to perform a go-around, not taken in due time with the aircraft, having a significant deviation from the established approach chart, which led to the controlled flight impact with terrain (CFIT) at the distance of $\times 930$ meters beyond the end of the active RWY."

There were six contributing factors, paraphrased here:

Accidents in Brief

and the pilot indicated that the propeller was turning; however, the airplane had experienced a total loss of engine power. Soon after, while in the descent to SEM, the pilot stated that there was a "fire as well." When the airplane was about 3 mi. from SEM and about 3,100 ft. MSL, radar and voice communications were lost. According to an FAA inspector, the airplane crashed in a field and all components of the airplane were within the vicinity of the main wreckage. The initial impact crater was about 4.5 ft. deep and the debris field was about 225 ft. long by 120 ft. wide oriented on a 125-deg. heading.

► June 7 — About 0425 CDT, a

Mitsubishi MU-2B (N44MX) was destroyed when it was involved in an accident near

Sioux Falls, South Dakota. The pilot was fatally injured. The airplane was operated as a Title 14 Code of Federal Regulations (CFR) Part 135 cargo flight. The flight originated at Snohomish County Airport (Paine Field)(PAE), Everett, Washington, about 2115, and was originally destined for Huron Regional Airport (HON), Huron, South Dakota, for a fuel stop. However, preliminary ATC information and weather data was consistent with the pilot diverting to Joe Foss Field Airport (FSD), Sioux Falls, South Dakota, due to weather at HON at the time of intended arrival. The flight landed at FSD at 0140. The final destination was Kokomo Municipal Airport (OKK), Kokomo, Indiana.

According to dispatch records and statements from the fixed-base operator (FBO) personnel, the pilot had misplaced his cell phone and was unable to contact the on-call line service technician (LST) at the FBO for fuel. The operator's dispatcher was unable to get in contact with the pilot and, about 0310, called the FBO for verification the airplane

had made it to FSD. The LST responded to the airport and confirmed that the airplane and pilot were on their ramp. The LST gave his phone to the pilot so that the pilot could speak to the operator's dispatcher while the LST retrieved the fuel truck. When the pilot spoke to the operator's dispatcher, he advised that he would be departing FSD enroute to OKK about 0400. The pilot requested the LST fill the tip tanks on the airplane wings with fuel. Preliminary radar data indicated that the airplane departed FSD from Runway 15 at 0426.

According to video recordings captured from various facilities at FSD, the airplane appeared to have a normal takeoff roll. After rotation, a high pitch angle was established for initial climb out and the right wing began to dip. As the airplane climbed, the right wing continued to drop with the airplane rolling over to the right side. The airplane nosed-over on the right side and continued in a nose down attitude and impacted the ground. Radar track data for the flight began when the



The peculiarity of Manas International Airport is that the ILS systems on both RWY approach courses have the same frequency (111.7 MHz) while their letter-codes are different. According to the available information, the system is configured in such a way that when the ILS for one approach heading is engaged, the ILS for the other approach heading disengages automatically.

- The flight crew's poor briefing and descent planning.
- The flight crew's poor execution of the descent, leaving them too high.
- The lack of the tower controller's requirements to monitor aircraft deviations.
- The excessive psycho-emotional stress of the crewmembers.
- The flight crew's lack of monitoring crossing reference points.
- The flight crew's failure to verify altitude at the FAF/FAP and the lack of a depicted FAF on the Jeppesen chart.

Recommendations

The IAC wrote 13 recommendations, directed variously to airline

managements, ATC personnel, airports, Boeing and the FAA. Several involved improved procedures and training at airlines, and ACT airlines has taken steps to address these concerns.

Four recommendations pertain to the airplane's design and operational guidance. Paraphrased, they are:

- Improve glideslope capture logic and false glideslope warning.
- Change the inertial glideslope descent logic.
- Provide a better description of the inertial path flight mode.
- Eliminate guidance discrepancies for "autopilot caution."

In its earlier preliminary report, the IAC had urged the FAA to reevaluate the Boeing 747's compliance with

airplane reached about 45 ft. AGL and was limited to 3 radar hits in 3 seconds until the airplane impacted. The airplane wreckage was located in the infield area north of taxiway B3 between taxiway B and Runway 3-21. All four corners of the airplane (both wings, and the nose and tail sections), as well as both engines, were accounted for in the airplane wreckage.

► June 5 — About 0801 PDT, a Cessna

175 (N9217B) was heavily damaged when it was involved in an accident near Redlands, California. The pilot and two passengers were killed. The airplane was operated as a Part 91 personal flight. Recorded Automatic Dependent Surveillance-Broadcast (ADS-B) data provided by the FAA showed that the airplane departed Big Bear City Airport (L35), Big Bear City, California at 0745, and proceeded southwesterly as it ascended to 9,300 ft. MSL.

At 0751:36, the airplane began a descent followed by a left turn to a southeasterly heading; about 3 min.,

12 sec. later, the airplane descended through 7,200 ft. MSL. About 3 min. later, a right turn to a southerly heading was observed about 5,150 ft. MSL. At 0758:29, a left 270-deg. turn was observed at 5,125 ft. MSL. The data showed that the airplane completed the turn at 0759:15, on a west-northwesterly heading at 5,275 ft. MSL. About one minute later, a left turn to a southwesterly heading at 3,975 ft. MSL was observed. The airplane remained on a southwesterly heading and continued to descend until ADS-B contact was lost at 0800:58, at an altitude of 2,775 ft., about 436 ft. northeast of the accident site. There are no known witnesses to the accident sequence.

San Bernardino County Sheriff Air Units located the wreckage at 1630. Examination of the accident site by an FAA inspector revealed that the airplane impacted terrain on a southwesterly heading. The wreckage debris path was about 80 ft. long and contained all major structural components of the airplane.

certification requirements. The FAA replied that they believed the aircraft met all requirements and did not envisage any reasons for changing the logic of the automatic flight system.

While I have great respect for the millions of successful ILS and auto-land approaches the Boeing fleet has made over the years, I think this accident points up a discrepancy in the Boeing approach display that should be addressed. The color green has universally meant "normal" in aircraft displays. In addition, green has a broader meaning in everyday life. When you see a green traffic light, it means one thing: Go! When a crew is missing their marks, green is not the color they should be seeing when danger lurks. The color green just has too much power for that. **BCA**

The wreckage was recovered to a secure location.

► June 2 — At 1327 PDT, a Bell 206L3

helicopter (N65PJ) was destroyed when it was involved in an accident near Fairfield, California. The pilot and 2 passengers were killed. The helicopter was operated as a Part 133, rotorcraft external load (Human External Cargo (HEC)) operation. The helicopter was operated by PJ Helicopters under contract from Pacific Gas and Electric (PG&E) to perform power line repair work. According to PG&E, the linemen had completed work for the day and had been picked up by the pilot. The lineman would have been connected to an external cable and airlifted back to the landing zone (LZ). During transition to forward flight, the helicopter contacted the lower power line, and impacted the ground. A witness to the accident reported that after the helicopter impacted the power line, it impacted the ground and rolled downhill. The helicopter came to rest in a ravine. **BCA**

Pilatus PC-24



Maturing is an ongoing process

Operators laud large-cabin volume, short-field performance and approval for unimproved runway operations.

BY FRED GEORGE fred.george@informa.com

There are more than 80 Pilatus PC-24s now in service and operators say the twin jet is an ideal step up from the Swiss manufacturer's popular PC-12 single-engine turboprop. Compared to that sibling, the jet flies 50% faster, 50% higher and it offers 50% more cabin volume. The PC-24 is the only current production business jet that is purpose-built for combination passenger and freight missions, having both a 17-sq.-ft. cargo door and approval for unimproved runway operations. It's positioned as a light jet, but it offers a midsize cabin with a flat floor. Operators say it has no direct competitors.

The Embraer Phenom 300E, Bombardier Learjet 75 Liberty and Cessna Citation CJ4 are three closely priced rivals. The three have higher cruise speeds and greater tanks-full payloads. But the PC-24 boasts better runway performance, lower V speeds, greater cabin volume and larger baggage capacity. And its quick-change interior enables operators to configure the cabin for four, six or eight passengers, as needed, to accommodate

between 90 and 200 cu. ft. of cargo.

Australia's Royal Flying Doctor Service (RFDS) has its PC-24s configured as "emergency wards in the skies," complete with three litters and seats for four doctors and nurses. The RFDS says its three PC-24s can slash aero-medical transport times by nearly half, compared to its single- and twin-engine turboprops.

The PC-24 has proven popular with the two biggest PC-12 fleet operators. PlaneSense, the fractional ownership operation based in Portsmouth, New Hampshire, took delivery of the first production aircraft in February 2018. JetFly Aviation SA, a charter operator and management company in Leudelange, Luxembourg, launched the aircraft in Europe a few months later.

"The PC-24 is a special value proposition," says George Antoniadis, CEO and president of PlaneSense, which now operates six of the Pilatus jets. "It's a light jet, but the cabin is a lot more than that [size]." He adds that its runway performance puts it into a class of its own as it's able to use 392 more airports in

PlaneSense's operating area than competitive light jets. It's one of the few jets that can operate out of Staniel Cay, Bahamas, with its 3,030-ft. runway, Chatham Municipal in Massachusetts (3,001-ft. runway) and Banner Elk, North Carolina (3,468-ft. elevation, 4,600-ft. runway). When departing such airports, the PC-24 can fly more than 1,000 nm.

JetFly CEO Cédric Lescop also lauds the aircraft's short-field performance, saying he can fly clients between Paris-Le Bourget and La Mole (3,514-ft. runway), the airport nearest St. Tropez. He also says he's able to use the grass strips at Goodwood Airport (EGHR), West Sussex, England. The famous British aerodrome is in the middle of the vintage Goodwood automobile race-track and a 5-min. drive from the polo matches at Goodwood Racecourse.

Antoniadis notes that the PC-24 has more modern design features than its competitors, including standard Honeywell Laseref VI IRS, an FMS that uses both GPS and DME for position sensing, a main engine Quiet Power Mode (QPM) that provides APU-like

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ground power and a utility management system that integrates control and monitoring of aircraft systems through the avionics system. The QPM provides ample power for both electrical heat and the electrically powered vapor-cycle system air-conditioner, thus providing APU-like functionality.

"It just punches every other OEM in the face," says Scott Marshall, who flies serial number 0103, based mainly in Boise, Idaho.

Overcoming Teething Pains

Pilatus R&D chief Bruno Cervia endeavored to perfect the aircraft before the first deliveries, but as with most clean-sheet designs, there have been some snags. Pilatus worked with Swiss firm Mecaplex to develop new-generation, lighter weight, glass-faced, stretched acrylic transparencies for the windshields and cockpit side windows. Comining supplies Mecaplex with its ultra-thin and tough-tempered "Gorilla Glass" for the outer windshield plies.

But several operators report cracking or crazing of the Gorilla Glass outer layer that requires windshield replacement. They say that it takes 24 hr. to remove and replace the windshield and that some aircraft have had multiple replacements. A series of upgrades to the

assembly and coating processes have yet to solve the problem, so Pilatus now is eying other vendors to provide a more permanent solution.

Some operators report that the hydraulic power pack, used for the anti-skid brakes, is problematic. A sticky valve in the brake fluid reservoir can cause loss of fluid and/or cause the pump motor to run excessively long, leading to premature wear or failure. A Service Bulletin addresses this issue and apparently has solved the problem.

A few serial numbers have required wire bundle repairs, an upgrade that can keep an aircraft grounded for up to two weeks. Some early aircraft also were delivered with defective NiCad batteries that needed replacement under warranty.

Most of the afflicted aircraft are early serial numbers. Pilatus bundled several Service Bulletins into the Big Aircraft Modification (BAM) program, including: (1) SB42-004, a major software update for the advanced cockpit environment with avionics powered by Honeywell; (2) SB24-001, which upgrades the software for the four electrical power distribution units; (3) SB42-006, which enhances the electronic checklist function; (4) SB45-002, which upgrades the loadable diagnostic information database interface; (5) SB42-005, which updates the utility

management system software to Build 7.2; (6) SB21-003, which provides more cooling air to the avionics rack behind the copilot; (7) SB32-004, which checks the nose gear for excessive free play; and (8) SB21-004, which improves moisture sealing of the environmental control system.

A few pilots remarked that SB21-003 reduces cooling air flow to the flight deck while improving ventilation to the avionics rack. The result is an uncomfortably warm flight deck on hot days. And many operators say the passenger seats in early aircraft are uncomfortable, armrests wobble and the seats don't track or swivel properly. Pilatus has developed Service Bulletins to remedy those issues.

Some operators also said the adhesives used to attach upholstered panels get soft in warm weather and that fit and finish of interior bits and pieces weren't up to the standards set by the Phenom 300 or Citation CJ4. However, newer aircraft destined for the North American market are being completed at Pilatus Business Aircraft Ltd. in Broomfield, Colorado, and are much improved, operators say.

Starting at s.n. 0131, Pilatus wrapped

PC-24 is approved for single-pilot operations, but most operators we contacted fly it with two pilots.

PILATUS



Forward lav received mix reviews, but it's a necessity, considering PC-24's aft cargo door. However, it's full width, amply sized, and it features an externally service toilet.



Operators Survey

PILATUS



Advanced Cockpit Environment [ACE], powered by Honeywell Apex, is quite similar to the flight deck of PC-12NG. Standard are autothrottles, LASEREF VI IRS, multi-sensor FMS and easy access to quick donning oxygen masks.

all these Service Bulletins and many production line upgrades into a block point production change. Aircraft delivered after mid-2019 appear to more reliable. However, until Pilatus solves the PC-24's chronic windshield cracking problems, it's likely to be an ongoing issue.

On balance, though, the PC-24 has proved to be remarkably reliable, considering that it incorporates some of the most advanced design features of any aircraft in its class. It's the only business jet to feature brushless AC starter/generators, plus electrically actuated multifunction spoilers, distributive data processing and electrical power architectures. It's also one of the few aircraft in its class to feature a fully interactive electronic checklist that ties into system synoptic diagrams and sensors and autothrottles.

Operator Demographics

Almost half of the PC-24 fleet is based in the U.S. PlaneSense in New Hampshire is the largest single fleet operator. While the aircraft is designed with the owner-pilot market in mind, there are fewer than a half dozen people in this segment, a considerably smaller fraction compared to the PC-12. The large majority of single aircraft operators employ professional pilots. High-net-worth entrepreneurs in oil and gas exploration, real estate development, high tech and music production are among the single aircraft operators in the U.S.

Most aircraft in fleets are professionally crewed by two pilots employed by business flight departments, management companies or charter operators.

PC-24, approved for steep approach operations, making possible use of London City airport.



Many of these firms either currently operate, or formerly operated, PC-12s.

Cox Aviation in Atlanta, U-Haul Business Consultants in Phoenix and Gulf States Toyota in Houston, plus Steelman Aviation in Las Vegas, North Slope Borough in Barrow, Alaska, and Bloomberg in New York are the largest mixed-fleet operators, outside of PlaneSense.

In Europe, the aircraft is popular with air charter operators, most of whom also fly PC-12s. JetFly, European Aircraft Private Club near Brussels, Amac Aerospace and Premium Jet AG in Zurich, plus Blackbird Air Charter in the heart of Denmark and Comlux in Malta have PC-24s in their charter fleets. Volkswagen AG in Wolfsburg, Germany, is one of the largest corporate flight departments, with two PC-24s, four Dassault Falcon 7X and two Falcon 8X jets in its fleet.

Its PC-24 trio makes Australia's RFDS the type's largest operator in the Asia-Pacific region. Other aircraft are scattered throughout the U.K., Canada, Chile, Malta, Mexico, Botswana, San Marino and South Africa.

Non-commercial single aircraft operators predictably fly the fewest hours, averaging 100 to 200 hr. annually among survey participants. Business flight departments fly the aircraft 200 to 400 hr. per year. And air charter/fractional ownership firms typically average 400 to 800 hr. per year.

Most operators report average stage lengths of 1.5 to 2.0 hr. with block speeds close to 400 kt. They plan on climbing directly in the low to mid-forties and cruising at Mach 0.69 to Mach 0.72, equivalent to 398 to 413 KTAS in ISA conditions. First-hour fuel flow is 1,100 to 1,200 pph, dropping to 900 to 1,000 pph the second and subsequent hours.

While the aircraft can fly as far as 2,000 nm when slowed to Mach 0.65, most operators plan on limiting missions to 1,700 to 1,800 nm. Antoniadis uses even more conservative flight planning, usually capping missions at 1,400 to 1,500 nm. The consensus is that the PC-24 is a good 1,500-nm workhorse.

A few operators say they seldom push the aircraft to its maximum range limits because their passengers feel self-conscious using the forward lavatory with its multi-section folding forward and aft doors. Pilatus is evaluating an optional aft lavatory configuration. But such a design change would substantially reduce baggage capacity. And, when Pilatus offered the option to PC-12 operators, it never proved popular.

Congratulations to Our Very Own William Garvey!

On his induction into the
“Living Legends of Aviation”



BCA Editor-In-Chief William Garvey has been inducted into the Living Legends of Aviation.

Garvey is part of the Class of 2020 inductees, which includes Apollo 13 Commander Jim Lovell, Gulfstream's Larry Flynn and Sergei Sikorsky. Past inductee recipients include more than 100 men and women from every corner of aerospace.

During a career that has already spanned 50 years, Garvey has established himself as a well-known, highly respected ambassador for aviation and shaped **BCA** into the leading, essential “how-to” business aviation publication within the industry.

Photo: *Business & Commercial Aviation (BCA)* Editor-In-Chief William Garvey is introduced by Living Legends of Aviation host, actor/pilot John Travolta. ©2020 Larry Grace Photography / Living Legends of Aviation (LLoA)

“For the past five years, I have been honored to work alongside Bill. His writing never fails to amaze me, and his knowledge and innate understanding of our industry is unparalleled. He is simply the best story teller I know. Congratulations to Bill on this outstanding recognition.”

— Frank Craven,
Managing Director
Business Aviation

Operators Survey

Five Favorite Features and Opportunities for Improvement

Operators found it difficult to limit themselves to only five favorite features of what Pilatus calls its "Super Versatile Jet." Cabin environment topped the list, not only because of its 500-cu.-ft. volume, but also due to its flat floor and impressively low interior sound levels in cruise.

"The aircraft is very, very comfortable," says Steve Cirino, U-Haul's aviation department manager. The PC-24 is the firm's largest aircraft; it also flies three Eclipse 500s and two PC-12s.

The capacious baggage compartment, which is easy to load because of the aft cargo door and low floor level, is another favorite feature among operators. And passengers appreciate unrestricted access to their belongings. Operators say that while the aircraft comes with an aft tail stand, it has a wide CG range that allows them to carry heavy items in the aft bay. They also say it's easy to load because of the relatively low baggage door sill height and the door's large size.

Runway and climb performance are two more favorite features. As noted by Antoniadis of PlaneSense, this enables them to use runways that are too short for other light and medium jets and then climb to the aircraft's 45,000-ft. certified ceiling on most missions, even on warm days.

New optional forward, left-side galley has available coffee maker, AC power outlet and microwave oven, along with standard ice chest and storage compartments.

Docile handling is yet one more favorite feature. "There's no 'coffin corner,'" the top point in the flight envelope where critical Mach number and stalling angle of attack might converge, says Tommy Suell, chief pilot for Steeleman Aviation in Las Vegas. "It's a forgiving aircraft; it handles a lot like a PC-12. But thrust-wise,



Flat floor, large cabin volume, full-time access to the aft baggage compartment and very low interior sound levels are some of operators' favorite features.

it's a bit of a pig at [FL] 450." Still, he loves the ability to use unpaved runways. He's flown charters with the PC-24 between Las Vegas and the Burning Man festival in Nevada's Black Rock Desert north of Reno, just as he does using the firm's PC-12 aircraft.

The Advanced Cockpit Environment (ACE) flight deck, powered by Honeywell Epic 2 avionics, received praise, mostly from crews making the transition from the PC-12NG, which features Honeywell Apex equipment. The user interface is quite similar to that on Dassault's EASy models, relying extensively on point, type and click entry conventions.

"It's user friendly and it's robust," says Todd Hotes, who flies s.n. 112 based at Oxford, Connecticut. Some operators commented that the Apex and

ACE interfaces are quite different from Garmin designs and that it's not easy making the transition between Honeywell and Garmin flight decks. However, as almost all ACE menus only are two layers deep, some operators be-

lieve that the Honeywell system is easier to use in everyday operations.

The quiet power mode (QPM) on the Williams International FJ44-4 turbofans enables one engine to function as an APU and is a well-received feature.



In QPM, ground idle rpm is reduced by 8%, thereby reducing exterior sound levels significantly.

As is often the case with an all-new design, operators say that the PC-24 has opportunities for improvement. Besides the BAM Service Bulletins and recurring windshield problems, operators say the single-point pressure refueling (SPPR) system doesn't accurately refill the tanks to the selected fuel quantity. It can be off by as much as 300 lb. In addition, they cannot preselect the refuel quantity from the flight deck; it only can be done from the outside refueling panel, forward of the right wing root. They would like the option to use either location.

Pilatus officials say SPPR will fill the aircraft within 1110 lb. of the preselected quantity, but line service technicians must follow published procedures and allow sufficient time for the fuel to settle in the tanks. Engineers in Stans, Switzerland, are "investigating software improvements to avoid such issues," says Tom Aniello, vice president of marketing for Pilatus Business Aircraft.

The autothrottle system needs fine-tuning, according to operators. While it precisely holds programmed indicated airspeed at lower altitudes, it wanders off the preselected or programmed Mach speed by as much as Mach 0.03 at cruise altitude. This can result in the autothrottles pushing the aircraft over its Mach 0.74 redline.

"We have successfully tested autothrottle system improvements that will be announced soon," Aniello responds.

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Operators Survey

including V speeds, runway requirements and close-in climb performance, currently is computed using Pilatus' proprietary Guru tablet computer app. Operators say they want the ACE FMS upgraded to support TOLD computations, freeing them of dependence on their tablet computers. Pilatus is evaluating the change.

The aircraft needs a full-service galley, some operators remarked. At last year's NBAA annual convention, Pilatus Business Aircraft showed off a prototype forward galley that would replace the coat closet behind the pilot's seat. It would be a 54.9-lb. option, priced at \$59,750, and include an ice chest and storage compartments. A coffee maker or pull-out tray with 115-volt AC power outlet will be optional. A microwave oven also will be offered as an option.

Many operators praise Pilatus for its tip-to-tail Crystal Care maintenance and support program, which covers both engines and consumables. Some say they wouldn't own the aircraft without it. But others complain that it's too expensive. Pilatus officials counter that Crystal Care is the most comprehensive customer care program in business aviation and that's why it's pricey. It even pays for consumables, such as O-rings, LEDs and lubricants, along with AOG support and freight costs.

Crystal Care has both fixed and direct costs. An operator who flies 300 hr. per year, for instance, would pay

Overhead panel is a model of Swiss simplicity. Switches up, knobs 12 o'clock, lights out and you're ready for takeoff.

\$10,800 per month plus \$550 per hour, according to Aniello. Notably, the hourly rate includes \$353.26 for Williams TAP Blue engine maintenance, Aniello notes. Overall, the hourly cost for Crystal Care ranges from \$1,300 per hour for low utilization operators to \$828 per hour for high-time users.

"Crystal Care is really good and Pilatus has been very supportive in building up its support network," says PlaneSense's Antoniadis. Some other operators, though, say they've waited 48 to 72 hr. for replacement parts if they must be shipped from Switzerland. However, Pilatus Business Aircraft in Colorado now has considerably more complete spare inventories, officials say.

Operators also say they need a higher tanks-full payload. Typically equipped

with stores and supplies and when flown with two pilots, the aircraft only can carry two passengers with full tanks. However, with a single pilot and BCA-spec equipment, it has a 715-lb. tanks-full payload. Aniello says Pilatus is evaluating several measures to increase tanks-full payload.

On Balance

Operators understand that all aircraft designs involve inevitable tradeoffs. The PC-24's sweet spots are its spacious cabin, quiet interior and exceptional short-field performance, including approval to operate from unimproved runways. In exchange, it's not the fastest cruising, longest range or highest payload aircraft in its class.

"At first, I was turned off by its slow speed. If you want high cruise speed, it's not for you," says U-Haul's Cirino. "But it's also the safest airplane I've ever flown, a dandy machine for owner/operators."

"The PC-24 is the value driver in its class," says Hotes.

Growing pains notwithstanding, operators say dispatch reliability has been quite satisfactory. Steeleman's Suell, for instance, says he's only lost two charter flights in 18 months. That's quite impressive, considering the PC-24 is the most sophisticated light to medium jet yet to enter service, considering its fully integrated ACE flight deck and utility management system, distributive data processing and electrical distribution networks, QPM and virtually all-electric systems architecture.

Customer loyalty is reflecting operator sentiment, Aniello says. Despite the plunge in sales suffered by other business aircraft manufacturers this year, the Pilatus PC-24 order book for 2020-2021 has remained intact, he says.

The Swiss specialty aircraft company never has been one to accept the status quo. Most likely, PC-24 development and refinement will be an ongoing program at Pilatus, much the same as with the PC-12, which is now in its fourth generation. The PC-12NGX is a far more capable machine than the original model introduced in the mid-1990s and was also an unprecedented design.

As with the PC-12, operators say they expect the PC-24 to become considerably more capable as post-certification development continues. It's off to a strong start and it can only get better. **BCA**



Overhead panel is a model of Swiss simplicity. Switches up, knobs 12 o'clock, lights out and you're ready for takeoff.

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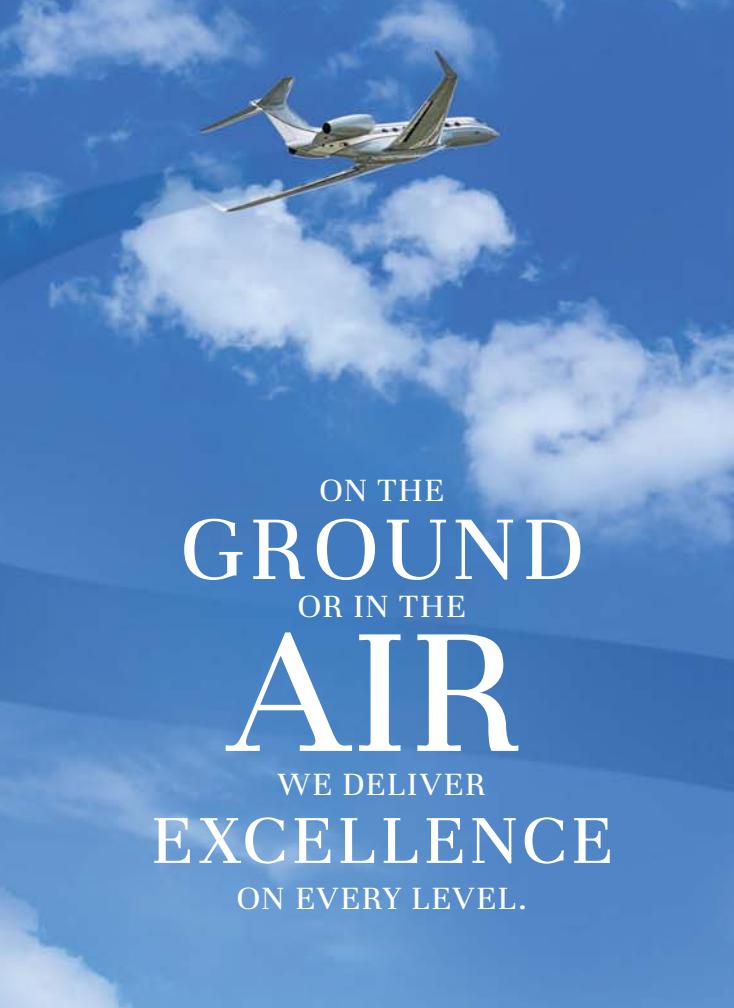
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Operators also say they need a higher tanks-full payload. Typically equipped



Standard configuration features a four-chair club section up front and either two or four, forward facing chairs in the aft cabin. Alternatively, some operators have chosen a double-club layout.

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The Human-Engine Interface

Many problems, one easy solution

BY JAMES ALBRIGHT james@code7700.com

My first piece of aircraft automation was a flight director in the Northrop T-38. It was pure magic: Two mechanical needles came into view, one for course and another for glidepath, and you simply flew the airplane so as to center them. Over the next few years the crossbars turned to vee bars, but there was nothing earthshaking until one of my airplanes allowed us to couple those bars to the autopilot. Now, that was neat.

Then came an autothrottle system that was good for an ILS approach and autoland, but not much else. (It could not be trusted for takeoff or climb.)

It wasn't until I got to the Gulfstream GV that I had an airplane that allowed

you to engage the autothrottles for takeoff and then simply forget about them until after landing. And, I must admit, sometimes I forget about them. But these days, I mostly don't trust them during the climb because with the wrong mode of the autopilot they can result in a stall. Oh yes, I don't trust them en route because changing environmental conditions can leave us short of thrust. And then there is the descent. And don't get me started about the approach phase! OK, OK. I guess I just don't trust them. But I do use them from takeoff to landing; they free up my brain for other things.

Why so paranoid? There have been a lot of accidents over the years in which

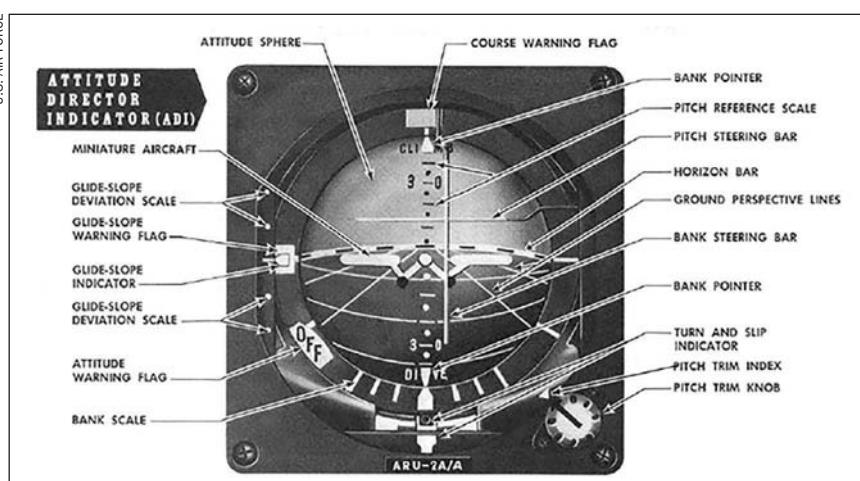
autothrottles had a role to play leading up to the scene of the accident. Four follow — each with an autothrottle problem. Let's see if we can come up with a solution.

Case Study: Gulfstream GIV, G-GMAC

Problem: There has been a divergence of opinion in the Gulfstream world on the proper way to engage and disengage the autothrottles. There are two sets of switches, forward and aft of what are called throttles, power levers or thrust levers. The type of switches used has changed but their locations remain the same. The forward switches will only disengage and the aft switches will engage or disengage. You can only engage with the switches aft of the throttle stems, so no debate there. I believe you should only disengage using the forward switches, since there is no chance you will engage the autothrottles with a "double click." But Gulfstream gives us the option and it seems many pilots use the aft switches for everything.

On Dec. 1, 2004, a crew destroyed a perfectly good airplane while landing at Teterboro Airport (KTEB), New Jersey. The pilot disengaged the autothrottles at 570 ft. AGL. It is unclear as to who or why, but the autothrottles were re-engaged at 38 ft. The GIV cannot be landed with the autothrottles engaged and I speculate that the pilot hit the aft engage/disengage switches at

U.S. AIR FORCE



Northrop T-38 attitude director indicator, circa 1979



Gulfstream GIV autothrottle switches

the last moment to ensure they were disengaged. Of course, that caused them to re-engage.

After landing when the speed decayed below the target approach speed, the autothrottles pushed the thrust levers forward, making it impossible for the pilot to lift the reverse levers out of their stowed detent.

With available runway disappearing, the pilot activated the emergency brake, which does not have anti-skid protection, and the airplane departed the runway. All survived the landing except the airplane.

The NTSB blames the crew's inadvertent engagement of the autothrottles and failure to recognize that during landing. The Safety Board also notes the lack of autothrottle switch guards and a lack of an audible engagement tone. But all of that misses the point.

Once the airplane had been landed the pilot should have noticed the throttles moving forward and he should have slapped them back. I am speculating that the pilot's right hand was not on the throttles during the final phase of the approach and landing until he wanted the reversers.

Solution: Keep your hands on the



Gulfstream GIV G-GMAC

throttles during approach and landing, and mentally connect what they are doing against what you want them to do. If there is a disagreement, put the throttles where you want them.

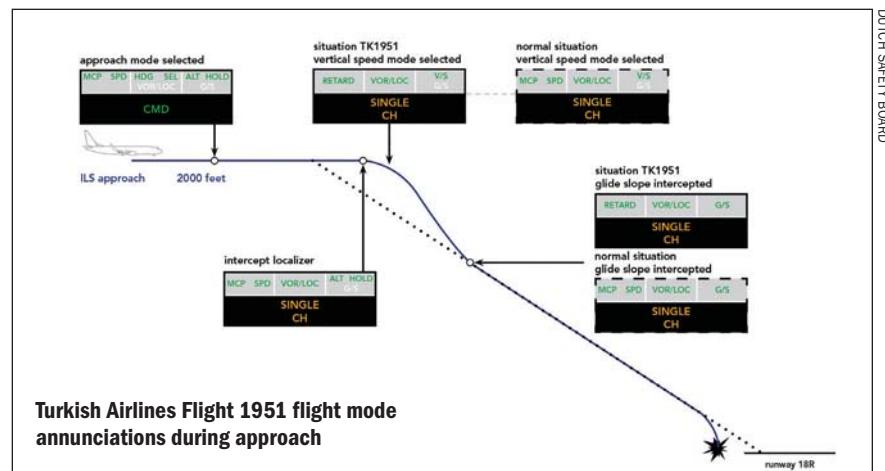
Case Study: Turkish Airlines Flight 1951

Problem: Does this sound topical? A Boeing 737 equipped with two sensors used by the automated flight system was designed to use only one of those sensors at a time, ignoring the opposite sensor. Then one day the sensor being used went bad and the airplane crashed, even though the opposite sensor could have saved the day. It has nothing to do with the 737 MAX of the Lion Air Flight 610 era; this was 10 years ago.

In a nutshell, here is what happened to Turkish Airlines Flight 1951 on Feb. 25, 2009: The captain's radio altimeter malfunctioned to read -8 ft. in flight.

Well, maybe they were. Here's my take: The radio altimeter system was one of the leading maintenance squawks for the Boeing 737-800 of the time — in fact, it was the top squawk at Turkish Airlines. Boeing knew a faulty radio altimeter could cause an autothrottle "retard" mode while in flight but reasoned that the cockpit had more than enough warning systems to alert the crew.

Actually, the very airplane involved in this crash had the "retard" mode occur in two previous flights in the previous 48 hr. But each crew noticed the "RETARD" annunciation, the decaying airspeed, the low-speed cue and the higher than usual deck angle. Each crew disconnected the autothrottles and flew the jet to a successful landing. This crew did not. Rather, the captain was busy training a new first officer, but there



Turkish Airlines Flight 1951 flight mode annunciations during approach

The crew were slam-dunked into Schiphol Airport, a common occurrence. A poor design allowed the autothrottles to use the left radio altimeter while the first officer flew the ILS with the autopilot coupled to the right autopilot. As the aircraft intercepted the ILS from above, the autothrottles had all they needed to go into "retard" mode. Neither pilot seemed to correlate a cascading series of warnings, including one for low airspeed, and the resulting high deck angle, with the radio altimeter failure.

The 737 ran itself out of speed at about 500 ft., at which time it stalled. The airplane impacted short of the runway. Nine of the 135 people on board were killed. The airplane was destroyed.

The Dutch accident investigators placed the blame on Boeing for the design of the radio altimeter/autothrottle interface while giving the crew an additional mention, as if they were bystanders to the crash.

was a third pilot on the flight deck as a safety pilot. Nevertheless, they got rushed with the slam dunk and nobody noticed the visual cues and five audible warnings until the stick shaker alerted them, too late.

Solution: Keep your hands on the throttles during approach and landing,



Turkish Airlines Flight 1951 wreckage

and mentally connect what they are doing against what you want them to do. If there is a disagreement, put the throttles where you want them.

Safety

Case Study: Asiana Airlines Flight 214

Problem: Airlines in South Korea have a long history of crashing airplanes because their pilots had difficulty when they were deprived of an ILS signal and their crews were unwilling to challenge the most senior pilot on the flight deck. This particular crash fits that mold, but the design of the autothrottle system combined with poor pilot technique was certainly a factor.

On July 6, 2013, Asiana Flight 214, a Boeing 777, was on approach to San Francisco International Airport (KSFO) on a clear day with no real challenges to speak of, except maybe one. The ILS glideslope was out of service. While many U.S. pilots prefer visual approaches, many Korean airline pilots seem to fear them. The crew started the approach too high, made a few automation mistakes that caused them to get even higher, and then as they were plummeting down to briefly pass through the correct glidepath (at a very high descent rate), they ended up with the autothrottles in a mode that would not correct their speed. They got too low and slow to safely recover and impacted short of the runway.

There is much to unpack from this accident and I encourage you to do that. But for our purposes here, let's look at the Boeing 777 autothrottle system.

The autothrottles have several modes that should be familiar to most autothrottle users:

► Thrust reference (THR REF) — Thrust set to the reference thrust limit displayed on EICAS.
► Speed (SPD) — Thrust applied to maintain target airspeed set using the

mode control panel or flight management computer.

- Thrust (THR) — Thrust applied to maintain the climb/descent rate required by AFDS (autopilot flight director system) pitch mode.
- Idle (IDLE) — Occurs when A/T (autothrottle) controls the thrust levers to the aft stop.
- Hold (HOLD) — Occurs when A/T removes power from the servo motors. In this mode, A/T will not move the thrust levers.
- Flight level change (FLCH) — A mode on many autopilots that holds speed by either bringing the throttles to idle or climb thrust while controlling speed with the elevator.

I am familiar with all of these modes except the HOLD mode, but more on that later. Airplane speed can be controlled by the AFDS or the A/T. When the AFDS is controlling speed, this is informally called "speed-on-elevator," as the speed is controlled by modifying the pitch of the airplane through elevator movement. This is typically during a climb when the thrust is set at an upper limit, or during a descent when the thrust is set to idle. When the A/T is controlling speed, this is informally called "speed-on-throttle," as the speed is controlled by movement of the thrust levers. The A/T controls speed only when it is in SPD mode. This is typically at times other than a climb or descent, such as in cruise or on an approach.

In FLCH SPD mode, A/T is limited by the thrust limit at the forward range of thrust lever travel and by idle at the aft range of travel. During a FLCH descent, HOLD mode will engage when the thrust levers reach the aft stop or if the pilot manually overrides the

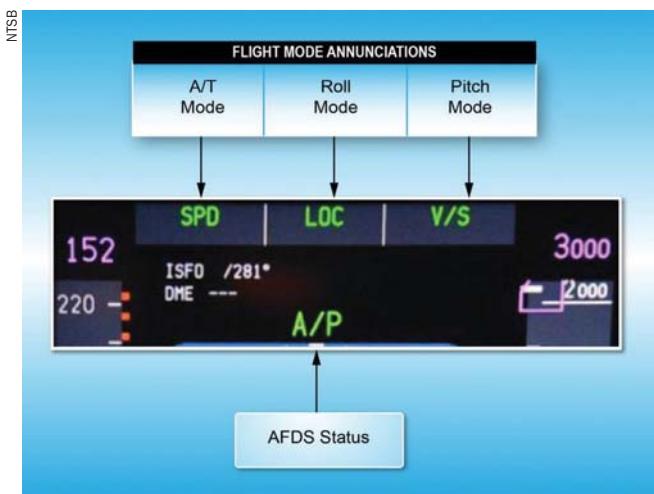
will be surrounded by a green box for 10 sec. The A/T will remain in HOLD mode until one of the following conditions is met:

- (1) The airplane reaches the MCP target altitude.
- (2) The pilot engages a new AFDS pitch mode or new A/T mode.
- (3) The A/T arm switches are turned off.
- (4) The thrust is manually commanded to increase past the thrust limit.
- (5) The A/P is disconnected, and both F/D switches are turned off.

This seems nonsensical at first. If you are in an idle descent why do you want the autothrottles to essentially stop moving once they hit idle? To rationalize a reason, visualize a typical descent with autothrottles that don't do this. You start down and the autothrottles go to idle. As you descend the speed target will eventually change from Mach to Indicated or Calibrated and that could cause the throttles to come up momentarily. Environmental conditions can change so the speed is suddenly too low and the autothrottles will move forward only to move back again. This back and forth makes it harder to descend quickly and can be annoying in the cabin as the power comes up and back again. So, I guess, there is a reason for this behavior.

But isn't it dangerous? Typically, you are descending to a target altitude on the mode control panel (MCP) at which point the HOLD mode is released. But the sequence of events for Asiana Flight 214 left the throttles in HOLD until it was too late. They were too high coming down rapidly. Their MCP target was set to 3,000 ft., which was the missed approach altitude for the ILS. The pilot wanted to increase his descent rate and selected the FLCH mode, wanting the autothrottles to command an idle descent. But the autothrottles increased thrust for a climb, because the MCP target altitude was above them. The pilot manually overrode the autothrottles, pulling them to idle and placing them into the HOLD mode, where they would stay until one of the conditions noted above was met.

But most of those were unlikely to happen: The MCP target altitude was above their actual altitude, they were flying a visual approach and were unlikely to change that, and they normally left the A/T arm switches on. Interestingly, Asiana standard operating



Boeing 777 mode annunciator

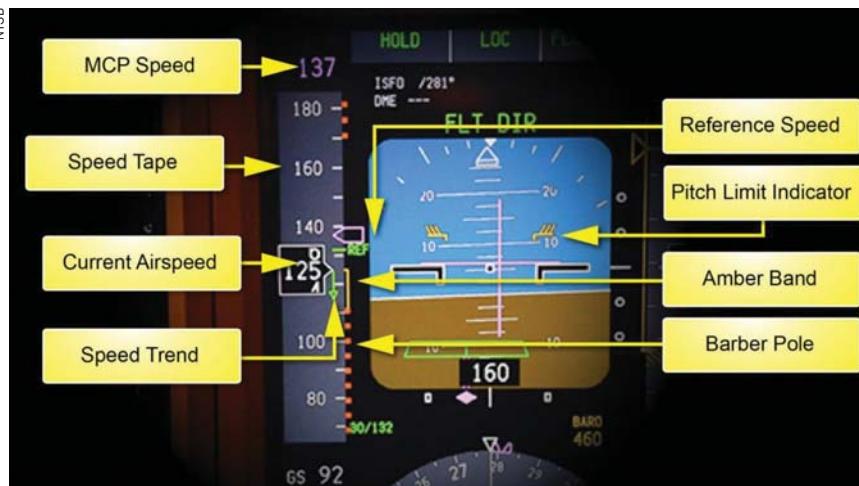
A/T. During a FLCH climb, HOLD mode will engage only if the pilot manually overrides the A/T. When the HOLD mode engages, the annunciation for the A/T mode will change from "THR" to "HOLD," and the annunciation

procedures called for the PM to turn both F/D switches to off and then his own on to during a visual approach. Had the PM done this, the A/T would have released the HOLD mode, but the PM simply turned the PF's F/D switch off and left his own on, and the HOLD mode persisted as a result. By the time the PF realized he needed more thrust, it was too late.

Note that in many accidents where automation is a factor, the investigators never fail to point out that the mode in question is clearly shown to the pilot. An important factor in this case was that the pilots failed to realize the autothrottles were in HOLD mode when it was clearly annunciated at the top of their pilot flight displays.

I'm not so sure. There is a lot of information on that display and the "HOLD" is tucked away on top with other things that compete for attention. Of course, the pilot should have spent some time looking at the airspeed indicator and the approaching amber band and barber pole. There is a trend vector forecasting what is to come. But there was an even better predictor of what was to come in this Boeing: the throttles that move even when being manipulated by the autothrottle system.

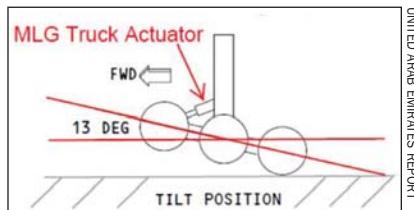
Solution: Keep your hands on the throttles during approach and landing, and mentally connect what they are doing against what you want them to do. If there is a disagreement, put the throttles where you want them.



Boeing 777 indicated speed display

Case Study: Emirates Flight 521

Problem: This was a surprising accident on many fronts. First, Emirates has a sterling safety record and the carrier's record was perfect with the Boeing 777. Second, from what I've heard about



Boeing 777 main landing gear tilt position

Emirates, they take all of this very seriously. And finally, the incident itself seemed at first to be one of those cases of a perfectly good airplane destroyed for reasons unknown.

On Aug. 3, 2016, this Emirates Boeing 777 appeared to be coming off a stable approach into gusty winds and a hot runway with thermals. Everything appeared normal into the flare. While the touchdown was a little late, it wasn't too bad. The airplane appeared to go around, climb briefly and then fall to the runway. Passengers evacuated (some with their carry-ons in hand) and the airplane was engulfed in flames. The captain initiated the flare 15 ft. earlier than he should have. (As someone I used to fly with on the Boeing 707 often said, "I've done worse and bragged about it.") The combination of shifting winds (headwinds to tailwinds) and hot runway thermals made it difficult to touch down in the touchdown zone, so the captain elected to go around.

The captain wasn't aware that the aft set of wheels on the trucks of his main landing gear were going in and out of ground mode, which made the airplane think it was on the ground for a second. When the captain pressed the Take-off/Go-Around (TO/GA) button, the go-around thrust mode of the autothrottles was disabled because they were "on the ground." The captain did not realize he was at idle thrust as he pitched up for the go-around. The airplane ran out of speed. As the airplane began to sink, the captain realized his power state and manually advanced the power, but it was too late.

It appears to me that the crew did everything right all the way to the flare. Briefs, callouts, crew coordination. Very good.



The airplane survived the initial impact but not the ensuing fire. Incredibly, the only fatality was a firefighter. It was a tremendous loss, especially considering two things. First, had the captain simply flown the airplane onto the runway, none of this would have happened.

REUTERS



Emirates Flight 521 wreckage

Second, the go-around was only missing one thing: Somebody should have pushed the throttles forward when the autothrottles didn't.

Solution: Keep your hands on the throttles during approach and landing, as well as the go-around, and mentally connect what they are doing against what you want them to do. If there is a disagreement, put the throttles where you want them.

Fixing What Is Broken

In my current aircraft, the autothrottles come on when you engage the autopilot; the two are linked. While you can use

one without the other, that is not its modus operandi. I find it helpful to think of the autothrottles as an extension of the autopilot, which we know bears considerable watching. A common theme to many autothrottle accidents is that pilots simply stopped thinking about the throttles at all.

In the case of the Teterboro Gulfstream GIV, the pilot disengaged the autothrottles, pulled them to idle and assumed they would stay there until it was time to pull on the reverse levers.

In the case of the Turkish Airlines flight, once the airplane was on the approach the pilots

busied themselves with helping the auto-pilot catch up with their "slam dunk" and assumed the autothrottles would take care of airspeed until the "RETARD" message appeared, which ironically is exactly what happened.

In the case of the Asiana Airlines flight, the autothrottles behaved as designed, but not as expected. Here again the pilots were provided the information they needed to survive, but the information wasn't in a place they could receive it because their eyes were not on their instruments during the visual approach and the pilot's right hand was not in "receive mode" for the one critical piece of missing information.

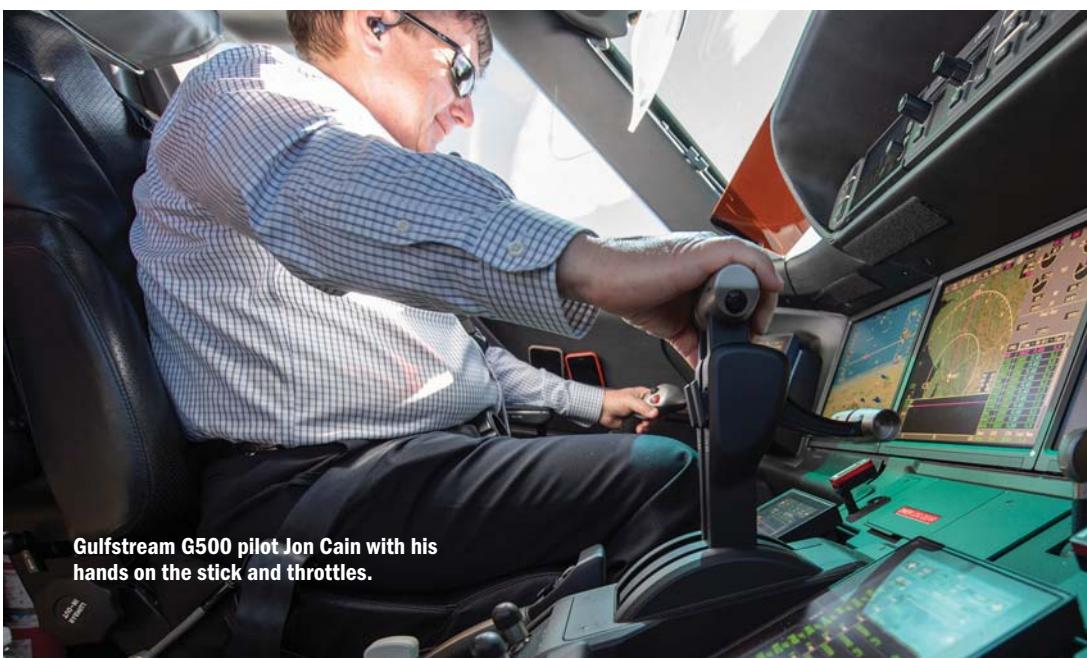
Finally, in the case of Emirates Flight 521, the crew did just about everything right but failed to realize the engines were not doing what they expected because their human-to-engine interface was disconnected.

Years ago I had a mechanic complain that one of our pilots was putting too much wear and tear on the throttle quadrant. This was in a Gulfstream GV where the throttle quadrant is not much more than two thrust levers connected to a rotary variable displacement transducer (RVDT) that translated the physical movement of the levers into digital signals for the engine's full authority digital engine control (FADEC). The throttle quadrant was a \$300,000 item and we had already broken two of them. You couldn't simply replace the RVDT — the entire unit had to be swapped. This caused me to think about my usual hand-on-throttle technique.

I place my hands on the throttles for takeoff; I remove them at V1. I'll watch them closely during the climb, cruise and descent. But I typically don't rest my hands on them until the gear is down again on approach. And I keep them there during the approach, landing and rollout. I've done a few go-arounds over the years and my hand will stay on the throttles until we are at our missed approach or pattern altitude again.

Is my technique right or wrong? I will leave that to you, but I encourage you to read each of these four case studies and the recommended solution to each. **BCA**

JAMES ALBRIGHT



Gulfstream G500 pilot Jon Cain with his hands on the stick and throttles.

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Strategy → Program Updates → Supplier Opportunities

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Strategy, Program Updates and Supplier Opportunities. Knowledge gained from each pillar is actionable — enabling delegates to effectively secure significant and sustainable growth opportunities.

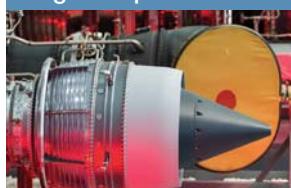
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Kent S. Jackson

Contributing Editor

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Sharing Aircraft Under Part 91

When does “sharing” become illegal?

THE FAA REAUTHORIZATION ACT OF 2018 CONTAINED A SECTION titled “Report on Illegal Charter Flights,” which contained several requirements intended to help identify and combat such activities. The agency has since been revising inspector guidance and has even sent a letter to every pilot on record regarding the new emphasis on combating illegal charters.

But where is the line between legitimate FAR Part 91 business aviation operations and illicit ones?

The straightforward options for sharing aircraft under Part 91 are time sharing, joint ownership and interchange, which are defined in Part 91.501. The less-than-straightforward options are dry leasing your aircraft or “sharing the expenses” under Part 61.118.

Part 91.501 applies to large airplanes (over 12,500 lb. MGTOW) and turbojet-powered multiengine airplanes. However, there is an exemption for members of the NBAA who want to use the flexibility of Part 91.501 for a helicopter or small airplanes. The NBAA small-aircraft exemption, 7897K, has been around in various forms for decades. However, because of the FAA’s new focus on illegal charters, if a corporate operator wants to utilize the NBAA exemption, in addition to the numerous previous requirements (that already included contacting the nearest FSDO), the company must now go to <http://www.regulations.gov> and file a Notice of Joinder. No one may operate under the exemption after Sept. 27, 2020, without first filing such a Notice.

The easiest way to share a business jet with another company or individual is a “time-sharing agreement” under Part 91.501. Such an agreement is a lease of the aircraft with crew, but the reimbursement is limited to 2xfuel plus the flight-specific expenses, which means crew expenses but not crew salary. Maintenance programs cannot be charged as a flight-specific charge. If the 2xfuel plus flight-specific expenses is covering the entire cost of the flight, you are probably doing the math wrong. Because a time-sharing agreement is a lease, you must also comply with the “Truth in Leasing” notification requirements of Part 91.23 as explained in Advisory Circular 91-37B.

Although time-sharing flights are conducted under Part 91, they are “commercial” for Federal Excise Tax purposes. So, after the current COVID-inspired tax holiday (which ends on Dec. 31), you must collect and remit the 7.5% FET plus segment fees on all time-sharing flights.

If the new flying partner is going to be a regular user of the aircraft, and you want to avoid losing money and paying FET, you may want to consider a joint ownership agreement. Under Part 91.501 (c)(3), such an agreement means “an arrangement whereby one of the registered joint owners of an airplane employs

and furnishes the flight crew for that airplane and each of the registered joint owners pays a share of the charge specified in the agreement.”

“Registered” is the key to joint ownership. Sharing ownership of an LLC that in turn owns an aircraft is not registered joint ownership. Because of the simplicity of registered joint ownership from an FAA enforcement perspective (just look at the registration certificate), joint owners have great latitude in shaping the arrangement to meet their needs.

Part 91.501 also contains an interchange concept that is useful for some, but it comes with strings, and the FET. Interchange is an hour-for-hour swap of airplane and crew that is primarily useful for smoothing out the occasional maintenance problem by swapping time with another flight department. The swap is subject to Part 91.23 Truth in Leasing requirements, and after this year’s tax holiday, the arrangement is subject to the commercial FET even if no money actually changes hands.

Meanwhile, dry leasing is governed by Part 91, but it is not defined there. Rather, Part 110.2 defines “wet lease” as “any leasing arrangement whereby a person agrees to provide an entire aircraft and at least one crewmember.” The phrases “dry lease” and “wet lease” have nothing to do with fuel. If you lease your aircraft to another company and their pilots (not your pilots) fly the plane, then you have a dry lease and you can charge whatever the market will bear. However, to the extent that any pilots employed by the lessor end up flying for the lessee, you can expect immediate FAA scrutiny to determine if the lessee truly has operational control, and, next year, IRS scrutiny to assess the FET.

“Sharing expenses” is more of a myth than an option. Part 61.113(c) states that “A private pilot may not pay less than the pro rata share of the operating expenses of a flight with passengers, provided the expenses involve only fuel, oil, airport expenditures or rental fees.” Case law doctrine limits this even further, requiring that the pilot and passengers share a “common purpose” for the flight. Under this doctrine, if a pilot offers to fly passengers wherever they want to go, then the pilot cannot share the expenses of the flight.

If you do not like your Part 91 options, then explore your Part 135 options. Starting your own certificate may not be a timely solution, but there are always Part 135 operators who welcome business aircraft owned by others to their certificates. This is still the best option if the company wants its aircraft to earn income whenever it’s not in company use. Part 135 comes with FAA paperwork and oversight. But there is no unlimited option for charging for flights under Part 91. The upside to Part 135 is that the company aircraft can earn the going rate, flying for anyone, anytime. **BCA**

The phrases
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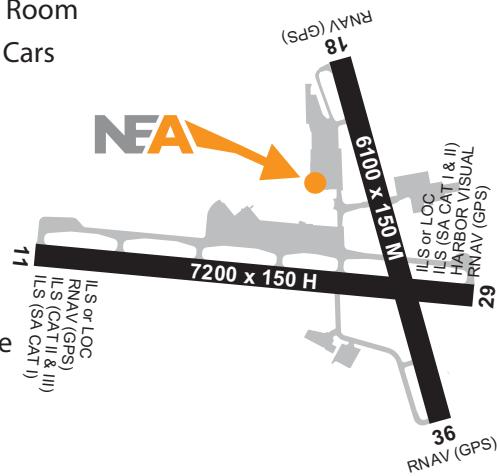


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Gulfstream G280

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G280 that can fly four passengers 3,600 nm in the largest and quietest cabin in its class. In keeping with large-cabin Gulfstreams of its vintage, it typically cruises at Mach 0.80 to 0.82. It also delivers better fuel economy than any direct competitor.

The G280's outward appearance indicates that it's related to the G200/Galaxy/Astra IV family, but it shares little in common other than its basic fuselage and a few systems. It has a scaled down G550 wing, best-in-class Honeywell HTF 7000-series engines, a proper Gulfstream T-tail, trimmable horizontal stab and hybrid flight control system. Autothrottles and auto-brakes are standard. Options include HUD with infrared EVS camera, SVS PFDs, dual Honeywell Laseref VI IRSes, GoGo Biz and Inmarsat Swift Broadband connectivity. Later serial numbers are available with VIASAT KA-band SATCOM.

Removing the G200's fuselage fuel tank made room in G280 to stretch the main cabin seating area by 8 in., widen the aft lavatory significantly and enlarge the aft baggage bay to 120 cu ft. Without that tank, the G280 provides full-time access to the baggage compartment through a door in the aft lavatory. The aircraft has a dropped aisle that increases overall cabin height in the center and widens available floor width. While the G280 is the only super midsize aircraft to have a dropped aisle, operators say their passengers don't object to it.



GULFSTREAM

The cabin has four more windows than the G200, now totaling 19 transparencies. There are four typical, two-zone factory floor plans, all of which feature a forward, four-seat club section. The aft cabin may be configured as a second four-seat club, a two-chair section with opposite side three-place divan, four-chair conference grouping with opposite side divan or four-chair conference grouping flanked by two lean-width facing chairs. Maximum seating capacity is limited to 10 passengers due to emergency exit access requirements. All models feature a high-capacity vacuum toilet and hot and cold fresh water systems.

But typical tanks-full payload is only 800 lb. to 950 lb. With all options, tanks-full payload can drop to 600 lb. to 750 lb. So, if you fill all ten seats, plan capping max range at 2,700 nm to 2,800 nm.

Runway performance is a strong suit. Typical 2-hr. trips require only 3,100 ft. of runway, assuming standard day conditions. Departing at MTOW, the G280 needs 4,750 ft. of pavement in ISA sea-level conditions. Flying out of BCA's 5,000-ft. elevation,

ISA+20C airport, it needs 7,320 ft. of runway. It's approved for London City operations, but it's slightly weight limited on takeoff due to noise abatement requirements. With full tanks, it will fly from northeast U.S. coastal cities to most airports in western Europe. Coming home, it can depart U.K. and Irish airports and fly to the northeast U.S. and beyond.

Climb performance is excellent, making possible an initial cruise altitude of FL 440. First hour fuel burn is 2,200 to 2,300 lb., dropping to 1,800 lb. to 1,900 lb. and down as low as 1,750 lb. per hour near the end of a 7-hr. flight. Most operators say they're comfortable flying the aircraft as far as 3,400 to 3,500 mi., depending weather at the destination, known ATC delays and available alternates.

They budget \$2,400 to \$2,500 for all-up hourly operating expenses, including \$620/hr. for Honeywell MSP. Basic maintenance intervals are 500 hr. or 12 months, whichever first occurs. Most of those inspections require less than 7 days in the shop. The most comprehensive 500-hr. inspections can be accomplished in 12 to 14 days.

Aircraft dispatch reliability has been excellent and Gulfstream's product support is second to none, operators say. However, some are concerned that the firm's recent reductions in workforce may have a negative impact on AOG support. Early aircraft suffered frequent incandescent exterior light bulb failures. Aftermarket LED replacement units solve the problem. Operators also say the galley is too small to serve 8 to 10 passengers on the longest missions and the microwave oven is tiny. They would also like to see a major mid-life operating system update for the PlaneView280 avionics. Some operators report excessive wear of the abradable lining of the engine intakes outside of the fan and chipping or peeling of the exterior coating of the thrust reversers. Gulfstream, they say, is addressing the nacelle issues and fixes are in the works.

Pilots love the aircraft's sporty performance, but they say that roll control forces are a little heavy at high indicated air speeds. They say they must take care not to use much wing down/top rudder technique when landing in a crosswind as the wingtips are comparatively low to the ground due to the short stance of the gear. They also remark that the short-travel, trailing link main gear is not forgiving of imperfect landing touchdown technique.

The G280, while being impressively capable, has been outsold by Bombardier Challenger 350 by a 2:1 margin, even though the Gulfstream's cabin volume is larger, it flies 400 nm farther and is more fuel efficient. Currently, there are about 15 of 193 G280s listed for resale, all 3 to 7 years old. And there are only 12 of 347 Challenger 350s for sale. Asking prices in the COVID-19 era are getting soft. So, potential buyers can afford to shop for deals. Patience and perseverance could make the G280 a best buy for bargain hunters. **BCA**



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News of promotions, appointments and honors involving professionals within the business aviation community

► **Air BP**, London, United Kingdom, named **Martin Thomsen** executive director, assuming the role from **Jon Platt**. Platt plans to retire later this year. Thomsen joined the company 15 years ago, most recently serving as retail director and fuels country integrator for Austria, Switzerland and Turkey.



AARON HIKEMANN

► **Aviation Personnel International**, San Francisco, California, promoted **Jennifer Pickerel** to vice president. Pickerel, who joined the company in 2015, will continue to serve as senior aviation recruiter. She previously served as director of client and candidate services.



CHAD DOEHRING

► **Business Air**, Seattle, Washington, announced that **Emily Morey**, the company's executive vice president, has accepted the position of president. In addition, she will maintain her position as executive vice president of High Plateau Capital LLC, a private equity investment fund and lead investor in Business Air.



BILL PROCHAZKA

► **Daher Group**, Paris, France, named **Pascal Laguerre** to replace **Nicolas Orance** as chief technology officer for the group. **Cedric Eloy** was appointed deputy chief technology officer. Orance has decided to become CEO of a midsize aerospace and defense firm.



JEFFREY LAKE

► **Deutsche Regional Aircraft**, Wessling, Germany, announced **Jose Costas** has joined Deutsche Regional Aircraft as vice president of aircraft sales. Most recently, Costas held senior positions with Embraer in its commercial and executive aircraft divisions.



MARTIN THOMSEN

► **Duncan Aviation**, Lincoln, Nebraska, has made the following changes to their leadership teams:

► **Jeff Lake** is the new president replacing **Aaron Hilkemann** who plans to semi-retire. **Mike Minchow**, vice president of Modification and Engineering has taken on the additional responsibilities of chief operations officer, Lincoln. **Chad Doehring**, formerly vice president of operations in Provo is replacing **Bill Prochazka** as COO. **Ryan Huss** is the new Director of Sales, a newly created position.

► **GlobalParts.aero** announced that **Scott Toom** has rejoined the company as its new director of business solutions. Toom joined the company in 2012. Most recently, he served as a sales engineer with Electromech Technologies.

► **Fargo Air Museum**, Fargo, North Dakota, named **Ryan Thayer** as executive director, replacing Jackie Williams, who left in January. Thayer, a private pilot, has more than 15 years of



MICHAEL MINCHOW



PASCAL LAGUERRE



RYAN HUSS



TONYA WOOD

business ownership, sales, marketing and managerial experience in the financial, insurance and real estate industries.

► **National Air Transportation Association (NATA)**, Washington, D.C., announced that **Curt Castagna**, president of Aeroplex/Aerolease Group, has been re-elected chairman of the National Air Transportation Association (NATA). His term was also extended by one year. **Larry Wade**, president of Golden Isles Aviation, was re-elected to the board for a second term. **Clive Lowe**, Atlantic Aviation senior vice president of business development, will continue his role as vice chair for one additional year. **David Best**, Jet Aviation senior vice president; **Joe Gibney**, TAC Air chief operating officer; **Josh Hochberg**, Sonoma Jet Center president; and **John King**, Solairus Aviation president; were newly appointed to the board for a term of three years.

► **Pentastar Aviation**, Watership Twp., Michigan, announced that **Bob Rufli**, vice president and director of flight operations has been named chairman of the Air Charter Safety Foundation. Rufli succeeds **Joshua Hebert**, CEO of Magellan Jets, whose term expired June 30.

► **JetHQ**, Kansas City, Kansas, announced that **Gabriela Perez de Leon** has joined the company as sales director based in Mexico. Most recently, Perez de Leon served as the principal of Mondo Aereo, an executive aviation services business in Toluca, Mexico.

► **Kansas State University's Polytechnic Campus**, Salina, Kansas, named **Kurt Carraway** department head of the unmanned aircraft systems flight and operations program at Kansas State University's Polytechnic Campus. Carraway joined the university in 2014 and currently serves as UAS executive director of K-State's Applied Aviation Research Center.

► **Twin Commander Aircraft**, Creedmoor, North Carolina, has hired **Andrew Wilson** as Technical service manager. He comes to the company from Dynamic Aviation.

► **Western Aircraft**, Boise, Idaho, has hired **Tonya Wood** as Interior manager, overseeing the removal, repair, modification, refurbishment and reinstallation of aircraft interiors according to customer specifications. **BCA**

If you would like to submit news of hires, promotions, appointments or awards for possible publication in *On Duty*, send email to jessica.salerno@informa.com or call (520) 638-8721

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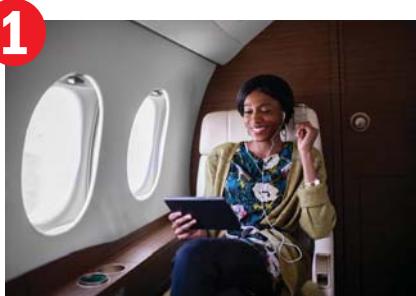
1. Duncan Completes STC for Gogo Installation

Duncan Aviation is pleased to announce that its Engineering and Certification Department has completed a full-equipment Supplemental Type Certificate (STC) for installation of the Gogo Business Aviation AVANCE L5 inflight Internet and Wi-Fi system in Cessna Citation 680 aircraft. This is the seventh STC Duncan Aviation has completed for the system, and it covers the Wi-Fi certification and full equipment and antenna installation required to provide inflight connectivity to the Gogo Biz 4G network. This latest STC, completed at the company's Battle Creek, Michigan, facility, adds the Citation 680 to the growing list of aircraft makes/models for which Duncan Aviation has created STCs.

Duncan Aviation

www.duncanaviation.aero

1



2



3



4



2. Avant Moves to St. Louis Downtown Airport

Avant Aerospace, a subsidiary of West Star Aviation and a supplier of aircraft parts, spares, equipment, and tooling, has relocated from Dallas to Hangar #12 at the St. Louis Downtown Airport. The new location is close to West Star's full-service maintenance, repair and overhaul facility in East Alton, Illinois. The company relocated its offices and inventory to the 20,000-sq.-ft. space to centralize its inventory and improve efficiency. Avant has expanded its services to include Bombardier, Textron, Piaggio and Gulfstream aircraft. All equipment and parts repairs are provided by OEMs or Authorized Repair Agents.

Avant Aerospace

[Email: info@avantaero.com](mailto:info@avantaero.com)

3. Duncan Aviation to Complete STC for ACA Air Purification System

Duncan Aviation an aircraft service provider, is set to complete and make available its first Supplemental Type

Certificate (STC) for the Aviation Clean Air (ACA) ionization system for a Global aircraft in late July. The ionized hydrogen molecules also deactivate other viral, bacterial, and fungal pathogens such as those that cause the common cold, flu

(swine, avian, etc.), MRSA (methicillin-resistant *Staphylococcus aureus*), C. diff (*Clostridium difficile*), E. coli (*Escherichia coli*), pneumonia, polio, and mold. In addition to pathogens, the ACA component neutralizes potentially harmful gasses caused by fuel emissions, other VOCs (volatile organic compounds), and offensive odors caused by cooking or cleaning, cigarette and cigar smoke, stagnant air, and lavatories. Pet odors are also neutralized. The system will also reduce the static electricity in aircraft that's caused by the low relative humidity of the cabin air. The company's Aviation Engineering & Certification Services team is developing the STC to cover the installation of the ionization system and is working towards certifying other aircraft makes and models, including a Challenger 300/350.

Duncan Aviation

www.duncanaviation.aero

4. FlightSafety Adds Maintenance Training at Australian Learning Center

FlightSafety International is now providing maintenance technician training at its new Learning Center at the Sunshine Coast Airport in Queensland, Australia. Students can receive classroom and hands-on training to develop and refine proficiencies. Technicians also receive interactive courseware, the use of full-scale systems trainers, major component cutaways, working models, and test equipment to demonstrate procedures and reinforce classroom instructions. The maintenance training and curriculum meet worldwide regulatory requirements.

FlightSafety International

www.flightsafety.com

5. West Star Perryville Gets Additional FAA Approvals

West Star's Perryville, MO (PCD) location has received FAA approval for four additional airframe capabilities within the Bombardier and Embraer series.

The additional series of capabilities include Bombardier Global BD-700, Embraer Phenom, Embraer Legacy 120 and Embraer Legacy 134/145. Currently, the PCD location is approved to perform service on a variety of aircraft models including Falcon, Gulfstream, Sabreliner and Textron series. These additional approvals reflect West Star's continual focus on the development of airframe-specific capabilities throughout the organization. "The addition of these capabilities will provide further service opportunities for our location, while also benefiting the West Star company as a whole," stated Kyle French, General Manager (PCD).

West Star Aviation

www.weststaraviation.com

6. Signature Launches **SignatureAssure**

Signature Flight Support has launched Signature-Assure, a comprehensive COVID-19 response that includes measures that encompass social distancing, employee readiness, facility cleanliness and aircraft safe standards. The roll-out coincides with a gradual increase in aircraft operations and includes the deployment of several technological advancements including electrostatic sprayers, pulse oximeters and touchless thermometers.

Signature Aviation plc

www.signatureaviation.com

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