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Gulfstream

COVER IMAGE
Gulfstream supplied this stunning image of its first production example of the G500. We put the new business jet through its paces as part of our EBACE preview P24

Gulfstream

BEHIND THE HEADLINES
Michael Gerzanics was in **Savannah**, Georgia, as we got the chance to try out **Gulfstream**'s new **G500** for our **flight test** report (**P24**). **Stephen Trimble** visited **Greensboro** for our **HondaJet** update (**P34**)

Boeing

NEXT WEEK ENGINES
We check out GE Aviation's progress with the GE9X for Boeing's 777X, and analyse full delivery data from 2017

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cfm
The Power of Flight

Image of the week

Six Su-25 ground-attack aircraft made a colourful contribution during Russia's annual Victory Day Parade in Moscow's Red Square on 9 May. Flight Fleets Analyzer records the Russian air force as operating 196 of the Sukhoi type: 40% of a global inventory which it shows totals 494 units

View more great aviation shots online and in our weekly tablet edition:

flightglobal.com/flight-international

Kremlin Pool/Planet Pix via Zuma Wire/REX/Shutterstock

The week in numbers

6.1%

SIA Engineering

In its year to end-March, MRO group SIA Engineering lifted operating profit to $76.4m; revenue held steady at $1.09bn

$116m

Flight Dashboard

Q1 revenue was up 9.3% at Garuda Indonesia maintenance arm GMF AeroAsia; operating profit gained 2.2% to $12.8m

1,000

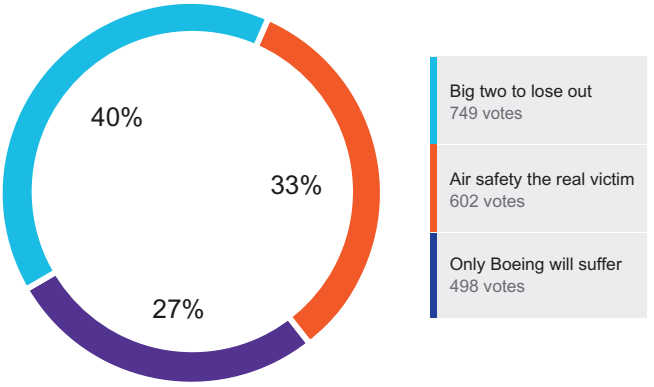
GKN Fokker Services

GKN Fokker Services sold its 1,000th iPad electronic flight bag to wet lessor Hi Fly, one the device's first buyers in 2012

Question of the week

Last week, we asked: **US exit from Iran nuclear deal?**
You said:

Total votes: 1,849



This week, we ask: **World Trade Organization ruling?**
❑ Boeing victory ❑ Airbus the winner ❑ Everyone loses

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CAE

Start talking

For Europe and the USA – and their respective aerospace champions – the latest WTO ruling should be a catalyst to agree changes on the trade in civil aircraft. Sadly, this will not happen

In an increasingly imaginary ideal world filled with rational attorneys, reasonable industry leaders and responsible politicians, the entire dispute between Airbus and Boeing at the World Trade Organization that has dragged on for 14 years and now threatens to further expand a growing rift between the EU and USA could be resolved with a handshake over a nice lunch.

Okay, maybe a few lunches.

The original point of this entire dispute – now buried beneath an A380-sized mountain of legal documents and absurdly contradictory press releases from both sides – really is not that complicated.

The EU provided below-market interest rates on repayable loans that Airbus used to help finance the A380 and A350, and Boeing, with the support of three successive US administrations, wants that to stop. Strip away all of the legal technicalities and political grandstanding, and that forms the specific cause of Boeing's 2004 decision to urge the US government to file a trade case at the WTO.

The record shows that the WTO fundamentally agrees with Boeing's position on launch aid

If all of the secondary issues and retaliatory complaints are set aside, the record shows that the WTO fundamentally agrees with Boeing's position.

So set up a lunch meeting: the EU has said already that it is willing to negotiate a solution to this dispute. Have the EU and Airbus agree to set market rates as the benchmark for financing any future commercial aircraft development. Tell Boeing to drop the lesser subsidies from the Washington state government that the WTO has also consistently opposed. Accept the ill-gotten benefits accrued by the A350 and 777X as sunk costs, and let the industry move on to more important matters.

REX/Shutterstock

Protectionist measure

Of course, no such lunch meeting is going to happen. No "grand bargain" on Airbus launch aid will ever be discussed by the two sides.

With the rise of the Trump administration, Boeing's quest to make Airbus pay a financial penalty for past launch aid infractions has gained a friendly and powerful ear. Canada and Bombardier have already felt the brunt of US trade aggression, with a subsidy complaint last year ultimately gifting the CSeries to Airbus.

Meanwhile, the game of trade policy brinkmanship between Washington DC and Beijing could lead to full-scale economic war, with Boeing at risk of significant financial injury. In this new reality, Boeing now has much more to lose from its government's aggressive trade stance than any Airbus below-market interest rate loan. ■

See This Week P7

And now, back to normal

Finally, it seems, some good news in business jets; a decade on from the financial crisis, sales look to be firming up. It is of course no surprise that the most severe economic downturn since the Great Depression should have wiped out a nascent air taxi industry. Nor is it any real surprise that the sales slump did not spare larger aircraft models – volume is small and it did not take many distressed sales to flood the market with too-good-to-miss second-hand deals.

But now, conditions look very good. A generation of global capitalism has generated a huge pool of stunningly wealthy individuals. Years of central bank quantitative easing – that is, money-printing – have given them mountains of cash. And, today's economy offers few profitable investments, so vast sums are pouring into super-high-risk ventures like spaceflight, artifical intelligence and genetic engineering. What money is left over – a lot – might as well be spent on private jets.

But for those slightly down the chain – who aspire to private air travel – wealth is relative and feels fragile. It is widely expected that the next financial crisis is coming, and that it might be a really big one. The Middle East looks increasingly like war ready to happen. An Asian arms race rings alarm bells.

The take-away? Enjoy an upturn, but do not compare sales and backlog figures to the high times pre-2008 – that was not a boom but a bubble. Normal is now. ■

See EBACE preview P23

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For the full analysis of airline safety and losses in 2017, go to: flightglobal.com/safety2017

BRIEFING

CFO WILHELM LATEST TO QUIT AIRBUS

MANAGEMENT Airbus chief financial officer Harald Wilhelm is to step down next year, becoming the latest senior departure at the airframer. He has held the post at Airbus's commercial aircraft division for 10 years, and also been group chief financial officer for six. Wilhelm says that 2019 will be the "right time" to move on. Chief executive Tom Enders is set to retire in spring next year, while commercial aircraft president Fabrice Brégier and chief salesman John Leahy have already left their posts.

UK SIGNS NEW GAZELLE SUPPORT DEAL

ROTORCRAFT Airbus Helicopters UK has been awarded £15 million ($20.3 million) to support the British Army's Aérospatiale Gazelle AH1 reconnaissance and battlefield liaison rotorcraft until 2022. The deal contains a three-year option, but the 22-strong fleet could retire earlier than a current plan of 2025.

FRESH GOVERNMENT BAILOUT FOR SAA

AIRLINE South African Airways (SAA) is to receive a fresh R5 billion ($407 million) bailout from the nation's government. The sum will partly be used to repay creditors and suppliers, with the rest to serve as working capital until October-November. SAA has previously received state guarantees worth R20 billion. The Star Alliance carrier made a R5.67 billion net loss in its 2016-2017 financial year, and aims to break even by 2020.

SWEDEN'S NEXTJET CEASES OPERATIONS

BANKRUPTCY Swedish regional carrier Nextjet has cancelled all flights and disclosed plans to file for bankruptcy. Sweden's transport agency, Transportstyrelsen, has permanently revoked Nextjet's operating licence. Flight Fleets Analyzer lists 15 aircraft in the Nextjet fleet: nine Saab 340s, three British Aerospace ATPs, two Bombardier CRJ200s and a BAe 146.

DARK LIVERIES MAY POSE PARKING RISK

HAZARD The European Aviation Safety Agency has warned that advanced docking and guidance systems could fail to identify an arriving aircraft if it has a dark paintscheme. Its advisory follows a recent probe into a collision in which a parking aircraft's engine struck the passenger airbridge. The carrier involved in the collision – not named by EASA – had encountered similar problems owing to the "dark colour" of the aircraft.

US COAST GUARD SEEKS MARITIME UAV

SURVEILLANCE The US Coast Guard wants to demonstrate the ability of long-endurance unmanned air vehicles to conduct intelligence, surveillance and reconnaissance missions against illegal drug and migrant smugglers. Such a UAV should be land-based, able to fly for more than 24h at up to 15,000ft, and have a patrol speed of at least 50kt (93km/h).

TECHNODINAMIKA LANDS CR929 GEAR WORK

PROGRAMME Technodinamika will carry out undercarriage modelling work for the Sino-Russian CRAIC CR929 long-haul twinjet. The Rostec-owned company says it has concluded a pact with Sukhoi's civil aircraft division for the effort, which will be completed by October this year. Under the agreement, it will conduct initial calculations on criteria for shock absorber assemblies on the nose and main landing-gear.

NTSB

Changes come in the wake of 17 April fatal accident involving 737

SAFETY **GHIM-LAY YEO** WASHINGTON DC

Southwest to track fan serial numbers

Airline institutes new regime for blades on CFM56 engines, as regulator steps up urgency of high-cycle part inspections

Southwest Airlines will launch an internal system to track all of its engine fan blades by serial number, following the inflight failure of a CFM International CFM56-7B engine in April.

The Dallas-based airline says there was no previous requirement to track fan blades that precisely, but it is rolling out the initiative to prevent a repeat of the blade fatigue issue that caused a 17 April engine failure which killed one passenger.

Southwest aims to have the internal tracking system set up shortly, chief operating officer Mike Van de Ven told FlightGlobal at the airline's shareholders meeting in Annapolis, Maryland.

In early May, the airline completed inspections on more than 35,000 fan blades – an effort that began in 2016 after a blade-loss incident that August. The carrier accelerated inspections following the April accident.

Chief executive Gary Kelly says there were "zero findings" from the completed inspections, but says the airline removed 20-30 blades which showed coating anomalies. These were sent back to CFM for further checks that will be more in-depth than the airline's ultrasonic inspections, he adds.

"There is a more precise and more invasive step that can be taken if you have some indeterminate results from that [ultrasonic] inspection," says Kelly.

The airline is also completing an audit of its records to ensure that it has inspected every fan blade that requires the checks.

Meanwhile, the US Federal Aviation Administration has issued a new airworthiness directive requiring more-urgent inspections of highest-cycle blades in CFM56-7B engines.

When the directive takes effect, carriers will have 30 days to perform eddy current or ultrasonic inspections of blades identified in a service bulletin issued by CFM.

That bulletin recommends that airlines, by 30 June, inspect blades with more than 20,000 cycles, and some engines with 20,000 cycles, according to GE Aviation, which co-owns CFM with Safran. GE says some 5,400 engines fall within that category, though many have already been inspected.

CFM is to institute a system of full accounting and tracking of all 356,000 CFM56-7B fan blades, says GE, with around 77,000 inspected to date. ■

Additional reporting by Jon Hemmerdinger in Boston

TAP jet helps hunt out Neo nasties
This Week P8

TRADE **JON HEMMERDINGER** BOSTON & **DOMINIC PERRY** LONDON

Boeing claims victory in subsidy ruling

WTO broadly upholds decision that EU support for Airbus harmed US interests, as industry braces for likely retaliation

A World Trade Organization (WTO) appeals panel has completed its review of alleged government subsidies provided to Airbus for the A350 and A380, largely siding with Boeing and mostly upholding the body's 2016 conclusions.

With the Chicago-headquartered airframer hailing the decision as a victory, and given the current protectionist climate in Washington DC, there are fears that the ruling could simply touch off a new EU-US trade war.

"There were things that the US didn't get and things that Airbus might get in the future, but in the here and now, Boeing got something," says Richard Aboulafia, vice-president of analysis at US-based Teal group. "But rather than use this as the way to a negotiated settlement, the Trump administration might shoot from the hip. It risks throwing a wrench into the industry."

The 15 May appellate report may mark the final act in the USA's long-running subsidy dispute against Airbus and several European governments. However, a separate WTO investigation against Boeing remains open and is expected to rule later this year.

With the WTO dispute having run since at least 2005, industry observers may feel they have seen this all before, not least that both airframers conformed to type and claimed that the latest verdict proves they were in the right.

The WTO "found that the European Union has failed to honour multiple previous rulings and has provided more than $22 billion in illegal subsidies" to Airbus, says Boeing. "Today's decision ends the dispute and clears the way for the United States Trade Representative to seek remedies in the form of tariffs against European imports."

IMPORT TARIFFS

What may be different this time is the Trump administration's more protectionist stance. It is already threatening the EU with tariffs on imports of steel and aluminium, and the WTO ruling provides it with further ammunition.

"President Trump has been clear that we will use every available tool to ensure free and fair trade benefits American workers," says US trade representative Robert Lighthizer. "This report confirms once and for all that the EU has long ignored WTO rules, and even worse, EU aircraft subsidies have cost American aerospace companies tens of billions of dollars in lost revenue."

Panel ruled that launch aid for A350 was against rules

Airbus

"Unless the EU finally takes action to stop breaking the rules and harming US interests, the United States will have to move forward with countermeasures on EU products."

WTO rules mean that retaliatory measures do not have to be targeted at aircraft imports.

While the WTO found Boeing had lost sales of the 787 and 747-8 as a result of subsidies – notably loans at lower-than-market rates of interest – to the A350 and A380, it rejected accusations of harm caused by the A320 and A330.

Airbus says the ruling "confirms the legality of the loan partnership approach between Airbus and European governments". Only "minor" elements related to A380 and A350 financing "remain to be addressed", it adds.

"Airbus is currently implementing changes to respond to these findings," the airframer says, noting that the "only real solution to [the] 15-year-long dispute remains a negotiated deal."

Recent concessions by Trump to Chinese telecommunications firm ZTE have given some observers hope that a deal can be done, but Aboulafia is not convinced. "The WTO [civil aircraft] dispute still has me concerned, as both sides are going to continue to see what they want to see," he says.

If "reasonable people" were in place there would be a "wonderful path" to a negotiated settlement, he says, potentially putting new binding rules in place for the sector, "but that's not the case right now".

"Both sides need to sit down and establish a new set of rules or go back to living in a reality where economic nationalism has made an ugly comeback." ■

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PROGRAMME **DAVID KAMINSKI-MORROW** LONDON

TAP jet helps hunt out Neo nasties

Airbus has embarked on a cabin-test programme for its A330neo with the maiden flight of the first customer aircraft, bound for Portuguese carrier TAP.

The A330-900, MSN1819, departed Toulouse on 15 May for a flight lasting 4h 32min. Two other -900s are already involved in certification flight tests.

Airbus had disclosed last year the TAP aircraft would be used to supplement the certification campaign. The twinjet is being used to validate the interior "Airspace" cabin, and examine the cabin environment, ventilation systems and crew rest area.

Airbus aims to deliver the TAP aircraft, powered by Rolls-Royce Trent 7000 engines, this summer.

Meanwhile, AirAsia Group says it may convert its order for 10 A350-900s to the higher-gross weight variant of the A330neo.

Group chief executive Tony Fernandes says he is "most interested" in the 251t maximum take-off weight model, which has sufficient range for AirAsia X group carriers to reach Europe.

"When the [251t] A330neo… is flight tested, we want to make sure that the performance is going to do what it's got to do," says Fernandes. "If the 251t performs... we won't keep the A350s."

Flight Fleets Analyzer shows that AirAsia already has orders for 66 A330neos, all of which are for the 242t variant; the aircraft are due to arrive from late-2019. ■

Additional reporting by Mavis Toh in Bangkok

Handover of first example is due this summer

Airbus

Lockheed Martin

ROTORCRAFT

King Stallion clears delivery hurdle

Sikorsky delivered its first of an expected 200 CH-53K heavy-lift helicopters to the US Marine Corps on 16 May, with the King Stallion due to achieve initial operational capability next year. To be stationed at MCAS New River, North Carolina, the lead example of the three-engined rotorcraft will be used during an activity to test supportability. Sikorsky says there are "18 additional aircraft in various stages of production already", with a second CH-53K due to be delivered in early 2019. Production is due to commence at its Stratford, Connecticut site "this summer". The King Stallion fleet will replace the USMC's 142 CH-53Es, which have been in service since 1981, Flight Fleets Analyzer shows.

SAFETY **MAVIS TOH** SINGAPORE

Detached A319 windshield was original

CAAC finds no record of cockpit pane on Sichuan Airlines twinjet being replaced or repaired before 14 May incident

China's civil aviation regulator has disclosed that the right cockpit windshield that separated from a Sichuan Airlines Airbus A319 was an original part that had not been replaced since the aircraft entered service in July 2011.

The Civil Aviation Administration of China (CAAC) says preliminary information shows that until the incident on 14 May, there was no record of the right-hand windshield malfunctioning, nor had it been replaced or undergone any maintenance.

It adds that the aircraft had climbed away from Chongqing normally to a cruising altitude of 32,000ft and was within the Chengdu air traffic control zone, en route to Lhasa, when the right cockpit windshield suddenly cracked and detached.

This resulted in a loss of cabin pressure, damaging some equipment in the cockpit and injuring the co-pilot – local media describe him as being "sucked halfway" out of the cockpit – and a flight attendant.

The jet, operating flight 3U8633, eventually diverted to Chengdu Shuangliu International airport, where it landed safely. Investigations are ongoing, says the CAAC.

Registered as B-6419, the twinjet was built in 2011 and delivered to Sichuan Airlines in July that year. It had accumulated 19,942h to date, says Airbus.

FlightGlobal understands that the aircraft was assembled at Airbus's Tianjin plant in China.

Airbus declines to comment on the nature of the windshield failure or its origins, citing the ongoing investigation, but adds that it will provide all necessary support to the CAAC and French investigation authority BEA. Sichuan Airlines has so far only said that the jet suffered a "mechanical failure".

Flight Fleets Analyzer shows that the International Aero Engines V2500-powered aircraft is owned and managed by Sichuan Airlines.

While the jet touched down safely the first officer suffered injuries during the incident, says the CAAC. A flight attendant was also slightly injured during the descent. ■

Additional reporting by David Kaminski-Morrow in London

Silk Way West grows with 747 pair
Air Transport P10

VENTURE STEPHEN TRIMBLE SEATTLE

Aviation Partners sees beyond winglets

Pioneering Seattle company joins forces with data analytics provider to offer carriers fuel-saving flight optimisation service

After almost single-handedly making winglets standard equipment across the industry, Seattle-based Aviation Partners has diversified by entering the market for data analytics services for airlines.

The announced acquisition of iJET Technologies – and formation of Seattle-based APiJET – comes six months after launch customer Icelandair began to use the new analytics service for its small, but diverse, fleet.

APiJET's strategy is focused on using a stream of real-time data to help make small improvements to aircraft fuel efficiency during a flight, and also during ground and airport operations. The improvements add up over time, and APiJET wants the savings for the airline to offset the cost of the monthly per-aircraft service fee.

Aviation Partners considers the move into data analytics an extension of the company's core mission, which led to a successful – albeit sometimes awkward – collaboration with Boeing to develop and produce blended and split-tip scimitar winglets for thousands of 737NGs.

However, Joe Clark, the outspoken founder of Aviation Partners, has little interest in seeing APiJET follow a similar route, even if

APiJet

Icelandair has been evaluating APiJET system over six-month period

Boeing Global Services approaches it to offer a partnership.

"I don't think I have the energy to do anything like that," says Clark. "When we negotiated our winglet joint venture it took one year to negotiate. It took us a year to certify the airplane and one year to negotiate the deal!"

But the expectations for APiJET's business growth are no less ambitious than for the company's blended winglets. For Clark, that means providing the service to 10,000-20,000 aircraft, he says.

The rate of growth is expected to be slow, which is also not unlike the firm's experience in the winglet market. There it went from installing blended winglets on certain business jets in 1999 to forming the Aviation Partners Boeing joint venture, which eventually developed the winglet modification for 737NGs, as well as other Boeing models.

NEW CUSTOMERS

APiJET has launched its data analytics service with Icelandair and hopes to add two or three more small or mid-size airline fleets by the end of the year, says Tom Gibbons, president of the Aviation Partners 2 innovation group and chief commercial officer of APiJET.

Gibbons, a former Microsoft executive, joined Aviation Partners in 2016 to launch a digital services business. After quickly identifying iJET as a potential partner, Gibbons spent months on a due diligence review before Aviation Partners formed APiJET, with the former iJET now a minority shareholder.

Over a five-year period, iJET developed a digital product that differs from the majority of data analytic services offered to airlines. Instead of using algorithms and machine-learning tools to diagnose long-term maintenance needs, iJET developed a toolset that harvests and displays raw operational data in real time, says John Schramm, chief executive of APiJET. It is also quick and simple to deploy, even on older aircraft.

By tapping various databuses on an aircraft, APiJET's "Smart Aircraft" system can relay information about which aircraft doors are open or closed at the gate, Schramm says. For Icelandair, that information tells it which aircraft have received a load of catering supplies, for example. In flight, real-time data can be fed into a flight optimisation tool, allowing the flightcrew to adjust altitude to slightly reduce fuel consumption, he says.

"It's all about efficiency with the airlines," Clark says. "We think they'll save a lot of fuel with this programme. We think they'll save in a lot of ways they don't even know about yet." ■

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Silk Way West Airlines

FLEET

Silk Way West grows with 747 pair

Azerbaijan's Silk Way West Airlines is introducing another pair of Boeing 747-400Fs to its cargo fleet, as it expands its freight network. The Baku-based airline says it brought in one of the freighters in early May, and a second will arrive in June. Silk Way West has introduced new services at Budapest and, during April, opened a twice-weekly link between Baku and Liège in Belgium. "The two long-expected additional aircraft will further support the growth of the network," says chief executive Wolfgang Meier. Silk Way West says the additional freighters will complement its fleet of "more than 10" 747s, which includes the -8F version.

PROGRAMME **DAVID KAMINSKI-MORROW** LONDON

Sukhoi seeks 'Russified' engine for Superjet 100

Sukhoi's civil aircraft division has yet to decide on the crucial powerplant issue for its proposed "Russified" Superjet 100.

The current Superjet fleet is powered by the Franco-Russian PowerJet SaM146, with Safran as Sukhoi's Western partner in the venture. But the airframer is pursuing a substitution programme to create a version of the aircraft, the SSJ100R, with greater domestic content. Sukhoi Civil Aircraft says it is "still analysing the options available" for the engine, without specifying further.

Aviadvigatel has been developing the PD-14 engine family and has proposed a smaller model, designated the PD-10, aimed at aircraft such as the Superjet.

Sukhoi says other components to be replaced for the SSJ100R include the inertial navigation system and auxiliary power unit – both provided by Honeywell – and parts for the interior.

Honeywell is a strong supplier to the Superjet programme, producing several parts of the twinjet's avionics suite. The aircraft features structures from a number of other Western companies: Safran manufactures the jet's undercarriage assemblies, for example.

"Russian companies are already invited for participation in the [SSJ100R] programme," says the airframer, adding that first deliveries are scheduled for 2020.

Two Iranian airlines have signed preliminary agreements to take the Russified aircraft. The US government's withdrawal from a pact lifting nuclear-related sanctions will re-impose restrictions on supplying aircraft to Iran featuring significant US content. ■

STRATEGY **OLIVER CLARK** LONDON

EasyJet reassured on post-Brexit status

Government promises low-cost carrier will be treated as UK operator even if it becomes majority owned by EU nationals

Low-cost carrier EasyJet has received government assurances that it will continue to be treated as a UK operator after Brexit, even if it is EU majority-owned.

Speaking on a 15 May half-year earnings call, EasyJet finance chief Andrew Findlay said the budget carrier had secured an "agreement" from the relevant UK secretary of state to this effect, despite having plans to ensure that more than 51% of shares are owned by EU nationals after Brexit.

Findlay says EasyJet has been in talks with investors in Europe and is now close to achieving the 51% EU ownership it requires to ensure it does not breach the bloc's ownership and control rules.

The carrier changed its articles of association in February to ensure it would stay EU-owned and controlled.

EasyJet says it was on 14 May awarded a UK air operator certificate (AOC), to which it plans a transfer of its UK-based fleet in June 2018. Findlay describes the UK AOC as a mirror of the Austrian permit the carrier is using for its intra-European operation.

Operationally, he says, EasyJet plans to continue to run its business centrally from its Luton headquarters. The carrier also has a Swiss AOC.

For the six months ended 31 March, EasyJet was dragged to a £68 million ($92 million) pre-tax loss by the financial impact of its expansion into the Berlin Tegel market and integration of former Air Berlin assets.

The carrier says it would have achieved a headline pre-tax profit of £8 million for the period without the negative cost impact of its Tegel operation, which included a £19 million non-cash charge as a result of the sale-and-leaseback of 10 Airbus A319s, plus £24 million in integration costs. Nevertheless, EasyJet cut its pre-tax loss from the £212 million of 2017's first half, on revenue which was up by one-fifth, to £2.18 billion. ■

EasyJet

Airline will transfer its domestic fleet to new air operator certificate

US unions fail to overturn NAI permit
Air Transport P12

DEVELOPMENT **DAVID KAMINSKI-MORROW** LONDON

MC-21 lifted by second aircraft's flight

Latest test vehicle incorporates changes over initial example, as airframer gears up for serial production of narrowbody

Irkut's second flight-test MC-21 has conducted its maiden sortie, almost a year since the type's first test airframe initially became airborne.

The second aircraft – MC0003, numbered 73053 – took off from the airframer's facility at Irkutsk on 12 May for a relatively short flight lasting 1h 7min.

Irkut says the aircraft underwent basic stability checks, undercarriage retraction, and wing configuration tests.

The aircraft reached an altitude of 3,000m (9,840ft) and speeds of up to 215kt (400km/h).

It behaved normally and the intended testing was completed, the airframer says.

The manufacturer points out that development of the second MC-21-300, which was moved from assembly to the flight-test division on 25 March, has taken into account the findings of the trials performed with the first aircraft. That MC-21 initially flew on 28 May last year.

"Flight of the second aircraft is a significant event that will ensure timely conduct of flight certification tests," says Russian trade and industry minister Denis Manturov.

Two flight-test MC-21s, powered by Pratt & Whitney PW1400G engines, are currently complemented by a third airframe which is undergoing static tests. Three additional flight-test vehicles are being assembled by Irkut.

The airframer is also carrying out "active preparations" for serial production of the twinjet, says Manturov; supplier Aviastar has already begun manufacture of composite fuselage panels for the first customer aircraft at its Ulyanovsk facility.

Irkut

Twinjet behaved normally in 1h 7min sortie from Irkutsk on 12 May

Irkut

Initial prototypes are powered by Pratt & Whitney PW1400G engines

Yuri Slyusar, president of Irkut parent United Aircraft, says that a "profound modernisation" of Russia's aerospace industry has taken place in recent years, including the creation of modern assembly lines and the development of competencies in high-tech materials.

> "The new high-tech production will ensure development of the MC-21 programme"
>
> **Yuri Slyusar**
> President, United Aircraft

"The new high-tech production will ensure the development of the MC-21 programme and other prospective aviation projects," he says.

The first test MC-21, which is stationed at the Gromov institute in Moscow, has been performing a range of certification activities, including single-engined operations, take-off and landing stability, and handling at extreme attitudes.

Irkut carried out crucial wing-strength testing last year which led to reinforcement of the MC-21's structure. ■

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REGULATION **STEPHEN TRIMBLE** WASHINGTON DC

US unions fail to overturn NAI permit

Battle over so-called "flag of convenience" model now heads for Congress, after appeal court rules in carrier's favour

A US appeals court has rejected an attempt by four employee unions to overturn the award of a foreign air carrier permit to Norwegian Air International (NAI), dealing a severe blow to an 18-month-long campaign to block the low cost-carrier's so-called "flag of convenience" business model.

However, the 11 May decision by the US Court of Appeals shifts the unions' legal battle to Congress.

The US House of Representatives has proposed, in a reauthorisation bill for the Federal Aviation Administration, to make foreign air carrier permits contingent on proving they would serve the public interest.

The Air Line Pilots Association, International, one of four unions that challenged Norwegian's permit, is now calling on the Senate to insert the same provision in their version of the FAA reauthorisation bill.

"While we are disappointed, ALPA is no less determined in calling for the United States to enforce its trade agreements and ensure US workers have a fair opportunity to compete internationally," says Tim Cannoll, the union's president.

Airteamimages

Airline has been operating transatlantic flights using fleet of Max 8s

ALPA's opposition to NAI's operations in the USA dates back more than five years, when, in December 2013, the operator applied to the Department of Transportation (DoT) for a foreign carrier permit.

Its parent company, Norwegian Air Shuttle, is based in Norway, but the application revealed that NAI would be based in Ireland, a member of the EU with lower social taxes, and with crews sourced by an agency in Singapore.

Three years later, in December 2016, NAI gained approval for its permit to operate scheduled passenger flights to the USA.

But a trio of employee unions – the Association of Flight Attendants-CWA, Allied Pilots Association and Southwest Airlines Pilots Association – joined with ALPA to challenge the DoT's decision.

The Court of Appeals rejected both of the unions' arguments, pointing to the precise wording of the statute used by the DoT to evaluate applications for foreign air carrier permits.

The unions argued that NAI's application could only be approved if it serves the public interest, but the Court of Appeals noted that the statute plainly says that in addition to that criterion, the DoT is allowed to approve applications from carriers designated by their national governments to provide public transportation.

"Attempting to convince us that 'or' really means 'and', the unions point to the statute's history," says the court's ruling. "In doing so, however, the unions run afoul of a fundamental principle of statutory interpretation: where the text is unambiguous, as it is here, courts may not look to history."

The court also rejected the union's second argument, which stated that the DoT is required to comply with a provision in the air transport agreement with the EU that certain principles "shall guide" decisions, including an appreciation of the "benefits that arise when open markets are accompanied by high labour standards".

But that statement of principle "imposes no specific obligations on the [DoT] when considering a permit application", says the ruling. ■

OPERATIONS **GHIM-LAY YEO** WASHINGTON DC

Negotiated settlement bridges Gulf of suspicion

Officials from the USA and the United Arab Emirates have reached an agreement to settle a long-running dispute over alleged government subsidies for Emirates and Etihad Airways, mirroring a similar agreement struck in January with Qatar regarding its flag carrier.

The UAE embassy in Washington DC says the pact has "reaffirmed" the "strong support" between the two parties over air transport issues.

It adds that all rights under the bilateral agreement remain in place, including fifth freedom flights, which had provoked the ire of US carriers in the dispute, which has been running since at least March 2015.

However, the UAE's position has been contradicted by the Partnership for Open and Fair Skies coalition, which says that the deal reached between the two countries will prevent Emirates and Etihad from adding nonstop flights to the USA from Europe and Asia. The coalition comprises American Airlines, Delta Air Lines and United Airlines and their employee groups.

The UAE embassy disputes the coalition's claim, saying that "the information released by three US airlines is not correct".

It adds that the talks between the two governments have noted that the "UAE and its designated carriers are and have been at all times in full compliance with the agreement". Emirates and Etihad decline to comment.

The Associated Press reports that as part of the agreement, the two UAE carriers have agreed to disclose their accounts and release financial statements in line with international accounting standards.

While Etihad does not operate any US flights from locations other than Abu Dhabi, Emirates flies from Athens and Milan to Newark and New York JFK, respectively. ■

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ANNIVERSARY **MAVIS TOH** SINGAPORE

Low-key celebrations show Comac is set for next decade's long march

Chinese airframer does little to mark first 10 years, as it focuses on programme execution

When China declared its ambition to develop a large passenger aircraft and become a world-class player in civil aircraft manufacturing, it established the Commercial Aircraft Corporation of China (Comac) as the vehicle by which it would realise this vision.

The significance of Comac to China was obvious from the start: key businesses were stripped from AVIC to form its foundations, and political heavyweights were placed at its helm.

This month marks the Shanghai-based manufacturer's 10th anniversary, but it appears that Comac has chosen to let the occasion pass with little or no fanfare: high-profile, government-graced celebrations have been non-existent, with the only sign of the occasion a dedicated page on the company's website.

The reserved attitude could stem from Chinese President Xi Jinping's austerity measures for state-owned enterprises, which have ended the once-common practice of elaborate banquets laid on at taxpayers' expense. Equally, Comac's lack of celebration could simply reflect a desire to focus on the plateful of projects it is currently working through.

Comac was launched specifically to build a narrowbody jet – now known as the C919 – but it also inherited, for better or worse, AVIC's ARJ21 regional jet programme.

Having begun to build a presence in the regional and narrowbody markets, Comac is also working with Russia's United Aircraft on a 6,480nm (12,000km)-range widebody, the CR929, for the 2025-2028 timeframe.

With these three programmes, the manufacturer will have a range of aircraft covering the space from 90 to 280 seats.

Comac's expansion has not all been plain sailing, however; bringing a complete aircraft from the drawing board to certification has proved challenging. That inexperience was arguably most keenly felt on the ARJ21, which was eight years behind schedule when it entered service in 2016.

LIMITED CAPACITY

Looking at that history, industry observers have raised questions about the airframer's ability and resources to deliver on its strategy of developing, producing and researching three generations of aircraft simultaneously.

Comac has certainly invested in the infrastructural trappings of a modern manufacturer: aside from its main office and laboratory complex in Shanghai, it boasts an advanced technology research centre in Beijing and a major production centre – with five assembly lines – near Shanghai's Pudong International airport.

Despite this, critics have repeatedly hit out at what they perceive as a lack of innovation on Comac's part. The ARJ21, they argue, features old Western technology: its GE Aviation CF34 engines date from the early 1980s, for example.

While that is true, it probably misses the point: the ARJ21 and C919 were never meant as game-changers, but as a means of learning for future programmes.

SELF-AWARENESS

The Chinese airframer has no delusions about its deficiencies either. Before the ARJ21, China had never taken a civil aircraft programme all the way from design to delivery. Every stage in the regional jet's development, it tells FlightGlobal, was a step into the unknown. Comac's biggest challenge was having to start from scratch: from programme management to the infrastructure required, to recruitment and training, all had to be built up, virtually overnight. For example, in 10 years, its workforce has grown from 2,800 to 11,000.

"Our foundation was weak, lacking experience in civil aircraft development, and also development capability and little technological reserves in that area. In addition, the development of civil aircraft is a highly complex systems project," says Comac.

"We went through many difficulties and challenges in terms of manpower, programme management, key technology research, systems integration and also building customer support."

The ARJ21 was launched in 2002, but received Chinese type certification only 12 years later. It took another two years for the aircraft to enter service, and a further 12 months passed before a production certificate was awarded.

Even now, the aircraft is still being optimised. Only in March did it complete crosswind validation tests, finally allowing the jet to operate in all weather conditions. Western approval has also not been forthcoming, despite the US Federal Aviation Administration having shadowed the certification process.

With the C919, Comac wants to achieve certification and bring the aircraft into service between 2020-2021, more than 12 years after its launch. The Chinese narrowbody programme began before Airbus and Boeing even decided to re-engine their competing A320 and 737 families, but both the Neo and Max variants are already in operation.

GROWING PAINS

Western suppliers that worked on the ARJ21 say that before the regional jet, Comac did not even know how to provide suppliers with basic quotations and defined specifications, nor understand the complexities of aircraft integration, as well as certification. Experienced suppliers had to step in and guide the programme along.

In addition to the political task of developing a technologically advanced aircraft, and

KEY MILESTONES

- 2007 – C919 programme launched
- 2008 – Comac established
- 2008 – ARJ21 first flight
- 2014 – ARJ21 receives CAAC type certification
- 2015 – C919 roll-out
- 2015 – First ARJ21 delivered to launch customer Chengdu Airlines
- 2016 – ARJ21 service entry
- 2017 – C919 first flight
- 2017 – Comac, United Aircraft launch joint widebody programme
- 2017 – Project named CR929

Remanufacturing programme will keep Dutch fleet on target
Defence P16

A pair of C919 prototypes are now in certification testing

ImagineChina/REX/Shutterstock

> "For at least the next 10 years, Comac's aircraft are going to be limited to service in China and its satellite states"
>
> **Richard Pettibone**
> Aerospace analyst, Forecast International

dealing with its own steep learning curve, Comac has seen that process mirrored at inexperienced local suppliers.

Today, Comac says it has strung together a domestic and international aerospace supply chain comprising over 200 companies, 36 universities and a combined workforce of millions. It is also proud of the growth it has brought to Shanghai's commercial aerospace sector, quoting statistics that show total output value grew over six-fold to CNY7.96 billion ($1.28 billion) in the 2007-2015 period.

Richard Aboulafia, vice-president of analysis at Teal Group, says the main differences between Comac's first 10 years and those of Airbus and Boeing are the modest goals and freedom to choose the best technology available to the West's big two.

The high levels of government control at Comac, coupled with demands for replicating all parts of the supply chain domestically with no intellectual property protection for vendors, also hints at trouble ahead, he adds.

Corrine Png, chief executive of transport equity research firm Crucial Perspective, offers a more positive outlook, however. She believes Comac's acquisition of technology and know-how from world-class OEMs via joint ventures is a "clever strategy". Without foreign help, it would have taken far, far longer to develop the necessary expertise, she says.

Forecast International's defence and aerospace companies analyst Richard Pettibone points to the public perception of a "made in China" label in the West as Comac's biggest weakness.

"Even with FAA certification, it is unlikely that any major [Western] carrier would opt for Chinese aircraft due to public perception of inferior quality. Further complicating matters would be the lack of a global support network.

"For at least the next 10 years, Comac's aircraft are going to be limited to service in China and its satellite states," he says.

Analysts agree that with the world's largest jetliner market in its backyard, and the immense government support insulating it from financial pressures, Comac has the ingredients necessary for success.

STRONG BACKLOG

Indeed, despite being nowhere near certification, the airframer already holds commitments for 815 C919s from 28 customers. There are also orders for 453 ARJ21s, although it is unclear how many of these will actually be delivered.

Still, Comac wants to be internationally recognised. It has made a point of being present at major air shows such as Paris and Farnborough, where it displays models of its aircraft at large and strategically located stands. All this will count for little, however, if it is unable to gain Western certification for the C919, a necessity to show China's ability to build a safe aircraft, and not merely by its own standards.

Png estimates that Comac could eventually account for 19% of the country's owned aircraft fleet. The C919 and later improved variants will have no lack of orders from Chinese airlines, lessors and emerging markets, with deals sweetened by favourable financing from Chinese financial institutions and the country's export-import bank.

The key, however, is preventing production and delivery delays, which would make its aircraft less competitive.

Despite its potential, Comac remains decades behind competitors, and the country still has a long road ahead to realise its aerospace dreams.

The in-service performance and reliability of its aircraft, and the support the company provides, will be key indicators of progress in the coming years.

That will ensure it wins over airlines and passengers – both at home and abroad – who remain sceptical about the quality of Chinese-built aircraft.

GRAND AMBITION

To its credit, Comac agrees: "We're like a 10-year-old child who still needs to continue to grow and improve. What we need to do now is to be focused and to put one foot in front of the other, follow the developmental rules of aircraft manufacturing, insist on prioritising safety, be open to co-operation, and build products that pilots love to fly, airlines love to buy and passengers love to travel on."

No small ambition, then; Comac's next decade will demonstrate whether or not the company has managed to achieve those lofty goals. ■

ImagineChina/REX/Shutterstock

ARJ21 regional jet programme, launched in 2002, was beset by delays

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DEVELOPMENT **GARRETT REIM** PHOENIX

Valor hits stride as it aces initial cruise mode test

Bell's experimental V-280 tiltrotor angled its proprotors horizontally and flew for the first time in cruise mode on 11 May near the company's assembly facility in Amarillo, Texas.

The company says the vertical take-off and landing aircraft achieved a speed of 190kt (352km/h) and that at a later, unspecified date it will aim to increase this to 280kt.

"This is a product that will fly twice as fast as the aircraft in the theatre today; twice as far; for the same cost," Glenn Isbell, vice-president of rapid prototyping and manufacturing innovation with Bell, said at AHS International's Annual Forum & Technology Display conference in Phoenix, Arizona.

V-280 achieved 190kt in forward flight

Bell

Bell markets the V-280 Valor as having a 500-800nm (925-1,480km) combat range, capacity for four crew and 14 troops, and a useful load of 5,450kg (12,000lb).

The V-280 is being used as a demonstrator in support of the US Army's Future Vertical Lift programme's Capability Set Three element, which aims to replace the Sikorsky UH-60 Black Hawk transport and Boeing AH-64 Apache attack helicopter. The service is aiming to field its Capability Set Three-class aircraft beginning in 2030.

Bell flew its Valor platform for the first time in December 2017. ■

TECHNOLOGY **GARRETT REIM** PHOENIX

US Army has exotic updates for Apache in sight

With replacement attack helicopter not due until at least 2030, service eyes structural updates and extra armaments

The US Army is eyeing futuristic weapons and other upgrades for the Boeing AH-64 Apache attack helicopter, such as directed energy weapons and a compound wing, as it believes a replacement aircraft is not expected within the next decade.

Its ambitious plans are aimed at keeping the Apache relevant for decades to come as the Future Vertical Lift (FVL) programme's replacement for the attack helicopter – dubbed Capability Set Three – is not due to be fielded until at least 2030.

Potential Apache upgrades include the use of a composite tail boom, vertical stabiliser and tail rotor blades, while possible changes to the design of the aircraft include the addition of a compound wing and propulsor.

The army is also keen on updating the AH-64's arsenal through the addition of small guided munitions and directed energy weapons.

"You're not going to replace 791 Apaches overnight," Richard Tyler, the army's deputy project manager, Apache attack helicopter programme, told AHS International's Annual Forum & Technology Display conference in Phoenix, Arizona. "We see the Apache going forward for quite a number of years. We want to keep it relevant.

"We are going to leverage the work being done in FVL and in ITEP," he adds, referring to the ongoing improved turbine engine programme, which is seeking to deliver a 3,000shp (2,240kW)-class turboshaft as a drop-in replacement for the army's Apache and Sikorsky UH-60 Black Hawk fleets.

Tyler believes there is likely to be more than a 20-year transition period while a new-generation rotorcraft comes online. "That is driven by economics," he says. "You can't do a straight, full-up replacement. Over time, yes, but not right out of the gate." ■

UPGRADE **ANNO GRAVEMAKER** ARNHEM

Remanufacturing programme will keep Dutch fleet on target

Seeking to continue operations with the Apache attack helicopter until 2050, the Netherlands' defence ministry has outlined plans to remanufacture the nation's current fleet of 28 Boeing AH-64Ds.

Fielded from 1997, the Dutch aircraft have been heavily used, including during missions in Afghanistan and Mali. According to the defence ministry, the fleet is already starting to encounter technical shortcomings, resulting in "operational restrictions in circumstances with a high threat".


Dutch defence ministry

The Netherlands' D-model rotorcraft face operational restrictions

The US Army's decision to stop supporting the D-model Apache as it transitions to the AH-64E is another factor driving the decision "to join the USA in the remanufacturing programme", it adds.

Modifications will include more powerful engines and new transmissions and rotor blades. The estimated budget for the project is between €250 million ($298 million) and €1 billion, with work to run between 2021 and 2025.

The Netherlands notes that the UK is also advancing with a remanufacturing effort for the British Army's Boeing/Westland Apache AH1s. Fifty of the service's current aircraft will be updated to the enhanced AH-64E standard under the activity. ■

Indonesia could eject from K-FX pact
Defence P18

ASSESSMENT **STEPHEN TRIMBLE** WASHINGTON DC

Laser weapon ambitions are energised by demonstration

Prototype funding edges AFSOC closer to future combat use of high-energy payload

The US Air Force has started preparing to rapidly stage a demonstration of a highly mature laser weapon system (LWS) for an unspecified "airborne vehicle", with the potential for a follow-on production programme.

Plans for the near-term demonstration of a "High Energy Laser [HEL] flexible prototype" programme were revealed by the Air Force Life Cycle Management Center (AFLCMC) in an 11 May notice to potential suppliers. This outlines a plan to pay a supplier to deliver a prototype and perform a system-level ground verification test of a LWS within 12 months of contract award.

"The success of meeting this milestone is the primary factor for continued work toward the flying prototype and the possibility of future LWS production," the AFLCMC says. Its request for information was disclosed around one year after Eglin AFB issued a call for "Airborne Tactical Laser Technology", soliciting information about various subsystems that would be needed for an HEL. "Those responses have been reviewed," the AFLCMC confirms.

US Air Force

New AC-130J Ghostrider gunship is viewed as ideal host platform

Nearly a decade ago, the US Air Force Research Laboratory ended testing of a 100kW-class chemical oxygen-iodine laser on a Lockheed Martin C-130, after an Air Force Scientific Advisory Board report determined the weapon had "no tactical utility".

But interest in such a weapon has never waned – particularly at the Air Force Special Operations Command (AFSOC). Since the late 1990s, the organisation has lobbied for funding to develop a laser weapon for its C-130 gunships.

Following the demise of the Advanced Tactical Laser programme in 2009, AFSOC's interested shifted to solid-state laser technology. Last month, its commander, Lt Gen Marshall Webb, complained in Senate testimony that a programme to install a 60kW-class laser weapon on an AC-130J Ghostrider gunship by 2022 is advancing, but with a $58 million funding shortfall. ■

MODERNISATION
GARRETT REIM PHOENIX

Gray Eagle UAV facing essential system overhaul

An effort by the US Army to modernise its General Atomics Aeronautical Systems MQ-1C Gray Eagle unmanned air vehicle fleet has grown to encompass almost all of the aircraft's systems, with a focus given to redundancy and improving reliability.

The reassessment is the result of a reduced tempo of operations, says Dennis Sparks, chief of the technical management division in the US Army's unmanned aircraft systems project office.

"We are modernising pretty much every element of that system," he told AHS International's Annual Forum & Technology Display conference in Phoenix, Arizona. "There wasn't a lot thought given to redundancy, sensor management, signal management – stuff that on the manned aviation side we take for granted."

The US Army has also invested in improving the Gray Eagle's engine, which Sparks says is another problem area. The MQ-1C uses a Thielert Centurion diesel based on a Mercedes-Benz automotive engine. When Thielert was bought in 2013 by Aviation Industry Corporation of China, General Atomics bought the rights to produce the engine itself. ■

ACQUISITION **ARIE EGOZI** TEL AVIV

Israel launches $4bn bid to boost F-15I inventory

Israel Défence Force

Air force's current examples would receive major enhancements

Israel has proposed a deal to purchase additional Boeing F-15s, in a package that would also include upgrading its air force's existing I-model examples to the same standard.

Worth almost $4 billion, the potential purchase would include 25 twin-engined F-15Is in an advanced configuration. The new version's airframe would have an extended lifespan and enhanced features including a large-area cockpit display.

The purchase of additional F-15s has gained priority for the Israeli air force's high command over ordering a third squadron of Lockheed Martin F-35Is. The rationale is that while the F-35's stealth features are essential at the start of a conflict, later combat sorties will require assets capable of carrying a heavier weapons load.

Flight Fleets Analyzer records the Israeli air force as currently operating 25 F-15Is, aged between 18 and 20 years. ■

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DEVELOPMENT **GREG WALDRON** SINGAPORE

Indonesia could eject from K-FX pact

Jakarta misses scheduled $100m payment, as government reviews commitment to bilateral fighter deal with Seoul

Indonesia wants to review its involvement in the Korea Aerospace Industries (KAI) K-FX fighter programme, defence minister Ryamizard Ryacudu confirms.

Explaining Jakarta's position during a television interview, Ryacudu said the development contract for the advanced fighter – signed by KAI and Indonesian Aerospace (IAe) in early 2016 – was "incomplete", without providing further details.

One industry source confirms that KAI is unsure of its partner's continued backing. Jakarta has already invested $200 million in the K-FX programme, but recently missed making a further $100 million payment, part of which was intended to pay Indonesian researchers already on the payroll at the South Korean company's factory in Sacheon.

Korea Aerospace Industries

Korea Aerospace Industries is expecting to fly its twin-engined design for the first time during 2022

DEVELOPMENT COSTS

In 2016, Jakarta committed to pay $1.6 billion toward the fighter's development costs: about 20% of an estimated $8.5 billion total. Ryacudu says he believes it should remain in the programme, due to the money that it has already invested.

According to an industry source, the prevailing view is that Jakarta is using K-FX to obtain more concessions from Seoul, such as an order for additional IAe-built CN235 maritime patrol aircraft; four of which are in service with South Korea's coastguard, with two more as options. IAe declines to comment, but the topic is likely to be an issue when Indonesian president Joko Widodo visits South Korea in July.

The same source downplays suggestions that the USA is concerned about the sharing of sensitive technologies with Indonesia. Lockheed Martin, as part of offsets associated with Seoul's order for 40 F-35As, is also helping with development of the K-FX.

"Export licences are of secondary concern, because South Korea is developing some of these technologies on its own," the source notes. Hanwha Systems is developing the aircraft's active electronically scanned array (AESA) radar, with Israel's Elta Systems providing assistance.

In 2015, the K-FX programme suffered a major setback, when it emerged that Washington was unwilling to provide export licences for four core key technologies: AESA radars, infrared search and track sensors, electro-optical target tracking devices and jammers.

The worst-case scenario for KAI would be a complete withdrawal by Indonesia. If this were to occur, it would need to make up Jakarta's share of the development budget, or find another partner.

TWO VARIANTS

The joint programme envisages that 120 twin-engined fighters will be delivered to South Korea's air force, and 80 to Indonesia. Their fleets are likely to be different, with officials having previously said that Jakarta will field its examples in a Block I configuration without stealth coatings or the ability to carry weapons internally.

The Republic of Korea Air Force will introduce a Block II-standard model with both these features added. This is a source of concern to KAI, since developing two major variants will increase costs and complexity.

The K-FX will be powered by two GE Aviation F414 engines, and have a significant amount of other foreign content. United Technologies Aerospace Systems will provide its environmental control system, air turbine starters and flow control valves. Cobham will supply weapons carriage and release equipment, and Meggitt will furnish the aircraft's nose and main wheels, carbon brakes and brake control system.

The programme's design phase will run until late 2019, when the production of prototypes will begin. A first flight is planned in mid-2022, with testing and evaluation to continue until 2026. ■

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ANALYSIS **KATE SARSFIELD** LONDON

GAMA data shows sector still sluggish

First-quarter deliveries for fixed-wing aircraft reveal modest growth, but turboprop segment appears to be on rebound

Worldwide shipments of business and general aviation aircraft rose modestly in the first quarter, but performance across the sector was mixed.

In its latest quarterly review, released on 10 May, the General Aviation Manufacturers Association records total deliveries of 447 fixed-wing aircraft in the three months ended 31 March, compared with 435 aircraft in the same period last year. GAMA data, which details shipments of piston-, turboprop- and jet-powered aircraft, values total first-quarter shipments at $3.8 billion, an increase of $100 million on the first three months of last year.

The turboprop sector was the best performer during the period, GAMA data shows: deliveries rose by 12.7% year-on-year to 115 units, compared with 102 shipments in the first quarter of 2017.

Key to the increase was renewed interest in the Beechcraft King Air family following declining sales: demand for the Textron Aviation twin-turboprop increased, with the airframer shipping 17 units in the period, up on 12 examples a year earlier. The flagship 350 series led the way, with deliveries climbing by four units, to 10.

The Cessna Caravan single-engined turboprop range also performed well, with output rising to 12 aircraft, from eight in the first quarter of 2017.

The decision by Piaggio Aerospace last year to reinvigorate the sales and marketing effort for its P180 Avanti Evo as part of a new five-year strategic plan may finally be starting to bear fruit: the Italian airframer shipped three of the twin-pusher turboprops in the first quarter: one more than in the whole of 2017.

Output for the business jet sector grew by a modest 1.5% in the first quarter, with 132 aircraft delivered against 130 last year.

Pilatus made its sector debut, delivering the first two superlight PC-24s in February and March, from a planned output for 2018 of around 20 units.

Cessna delivered 36 Citation-series business jets, one more than the same period last year. Output was up for the four members of its seven-strong line-up, led by the CJ3+, which doubled from three to six units. However, deliveries of the entry-level M2 fell from eight to six aircraft and it failed to ship a single Sovereign+ in the first quarter.

The poor performance of the legacy midsize twin is a reflection of the increasing popularity of its cheaper and wider midsize stablemate, the Latitude, which has proved a consistently strong performer for Cessna since its introduction in mid-2015. Latitude shipments rose by two units in the first quarter, to 12 aircraft.

CLOUD NINE

Cirrus delivered 10 SF50 Vision Jets in the three-month period, compared with no output for the single-engined personal jet during the same period last year, the report shows. Although the six-seat type entered service in December 2016, teething problems with the production process delayed further shipments until the second quarter of 2017.

Embraer was one of the worst performers in the business jet sector in the first quarter. Strong competition in the crowded light and midsize markets led to a 27% fall in shipments for the Brazilian airframer, from 15 in the first three months of 2017 to 11 aircraft in the same quarter this year.

Dassault has also had a poor start to 2018. Although GAMA's quarterly report does not include shipments of Falcon business jets – the French airframer releases its deliveries and earnings at six-monthly intervals – Flight Fleets Analyzer records five Falcon deliveries for the period: four flagship 8Xs and a large-cabin 900LX. This compares with nine shipments during the same period last year, consisting of the same number of 8X and 900LX trijets as well as four twin-engined 2000LXS/S.

Elsewhere in the business jet sector, Bombardier shipped 31 Learjets, Challengers and Globals – a year-on-year increase of two units. Gulfstream saw its output of large-cabin G550s and G650s slide by four units, to 19, although shipments of its super-midsize G280 remained unchanged at seven.

TOP-END TROUBLES

Airbus delivered no VIP airliners for the fifth consecutive quarter, GAMA data shows, as consistently weak demand from the traditionally strong markets of China and the Middle East continued to hit sales of its ACJ family.

The airframer has an order backlog for only one widebody – an ACJ350-900 – and 11 ACJ319/320neos. The first example from the re-engined single-aisle family, an ACJ320neo, is scheduled for delivery to Swiss completion house AMAC Aerospace in the fourth quarter of 2018.

Boeing fared better between January and March, shipping two green BBJ 777-300ER widebodies and a pair of 737-derived BBJs. This compares with three widebody deliveries during the same period last year. As with rival Airbus, demand in the narrowbody segment is shifting to the re-engined option, with over 20 orders for its BBJ Max trio secured to date. Boeing is now preparing its first example – a BBJ Max 8 – for delivery to Comlux Completions in late 2018.

PISTON PRESSURE

It was a lacklustre first quarter for the piston-engined sector, meanwhile. Deliveries dipped by 1.5%, from 203 to 200 aircraft, with the slide due almost entirely to Textron Aviation's poor performance. Soft demand from the owner-flyer market led to a fall in shipments of Cessna's family of high-end piston singles from 40 to 21, while output for Beechcraft's Baron and Bonanza fell from eight to two units.

GAMA president Peter Bunce describes the industry's first-quarter performance as "trending positively". He says the "stabilising" used aircraft market, global economic growth, and the introduction of new programmes will help to stimulate the market. ■

See Feature P23

Paul Cordwell/Piaggio Aerospace

Piaggio shipped three P180 Avanti Evos in the period to 31 March

Fixed-wing shipments, first quarter

	2017	2018
Business jets	130	132
Pistons	203	200
Turboprops	102	115
Total	435	447
Total billings (bn)	**$3.7**	**$3.8**

Source: GAMA

New jets make way
Special Report P23

STRATEGY **DOMINIC PERRY** LONDON

Dedicated division pays off for Airbus Helicopters

Airbus Helicopters believes its decision last year to launch a dedicated business aviation operation – mirroring the approach of its fixed-wing sister company – is already paying dividends.

The airframer in May 2017 unveiled Airbus Corporate Helicopters (ACH) to handle all its offerings in the segment and provide customers with an "end-to-end" experience.

"One year after the launch of Airbus Corporate Helicopters we can say it was a success for us," says the division's chief executive Frédéric Lemos. "We are grabbing market share from the competition, particularly in the light-twin segment."

In 2017, ACH had a claimed 70% share of the market for corporate or VIP-roled turbine helicopters over 1.3t maximum take-off weight.

Airframer wants to turn interest in ACH160 into firm orders

Airbus Helicopters

Lemos says that ACH took in 58 gross orders last year, or 54 net, with around 70% of commitments from new customers. The bulk of orders were for the ACH125 and ACH130 light-singles, but also included 13 light- or medium-twins – the German-built ACH135 and ACH145 – as well as a single ACH175 super-medium.

Key for 2018 will be converting the "huge interest" from the market in the developmental ACH160 into firm orders.

ACH earlier this year signed two separate deals for the medium-twin: totalling five aircraft, these are the type's sole firm orders so far. "It is very important for us this year. The ACH160 is a game-changer in the small medium category. We have started the process of submitting offers to the clients," says Lemos.

Certification for the baseline version of the Safran Helicopter Engines Arrano-powered twin is anticipated in 2019, with the Stylence corporate aviation model to arrive in 2020.

A more exclusive VIP variant – which requires exterior modifications, including hinged doors and an electrically-actuated footstep – is scheduled for 2021. ■

DEVELOPMENT **KATE SARSFIELD** LONDON

Stratos plans roomier 714 personal jet

US start-up will stretch composite single in response to market feedback requesting more space for six passengers

Stratos Aircraft will stretch its 714 personal jet, following market feedback requesting a "roomier" design that can easily accommodate six passengers and crew, plus baggage.

The start-up, based in Redmond, Oregon, had designed the high-performance composite single to seat up to six people, but concedes it is too small in its current form to comfortably hold that number.

"Many people have told us that the 714 is too tight for six adults with bags," says Stratos chief technical officer Carsten Sundin. "So we are lengthening the pressure vessel by 31in [77.5cm], which will give the occupants more room."

The aircraft is also likely to undergo a rebrand to reflect its larger proportions, says Sundin.

He suggests the 714, like most business aircraft, is typically flown with an average of two passengers on board, "but owners and operators like the option of being able to carry more".

Stratos Aircraft

Proof-of-concept model has logged 170h since first flight in 2016

Sundin says Stratos "will get the design absolutely right" before it embarks on the next stage of the flight-test campaign and production. "We are never going to change the outside of the aircraft. This will be the production model for years to come," he says.

Stratos is mirroring Daher's "successful" strategy with the 28-year-old TBM single-engined turboprop series. "Daher – and Socata before it – have stuck with the same basic design, but to keep the product fresh, they have added new features with each generation of aircraft," says Sundin.

The 714 was launched in 2008, and the proof-of-concept model made its maiden flight in November 2016. To date, the Pratt & Whitney Canada JT15D-5-powered jet has logged 170h, says Sundin.

Stratos projects the 714 as having a cruise speed of 400kt (740km/h), and a range of 1,500nm (2,780km) with four occupants, or 1,200nm with six.

It is pitched against the Cirrus Vision Jet – currently the only Part 23-certificated single-engined jet on the market – and the Embraer Phenom 100EV entry-level twin.

Construction of a first prototype is now under way, and the remodelled aircraft is expected to be unveiled in the third quarter. No date has been set for first flight, but it is likely to be in 2019, Sundin says.

Stratos is considering producing the first batch of aircraft as kit planes. This approach, Sundin argues, "will allow us to fine-tune the product" before embarking on a "very expensive" Federal Aviation Administration Part 23 type certification campaign.

"If we do decide to take kit orders, we could start delivering next year, as the regulations for this sector are far less onerous and costly," he notes. ■

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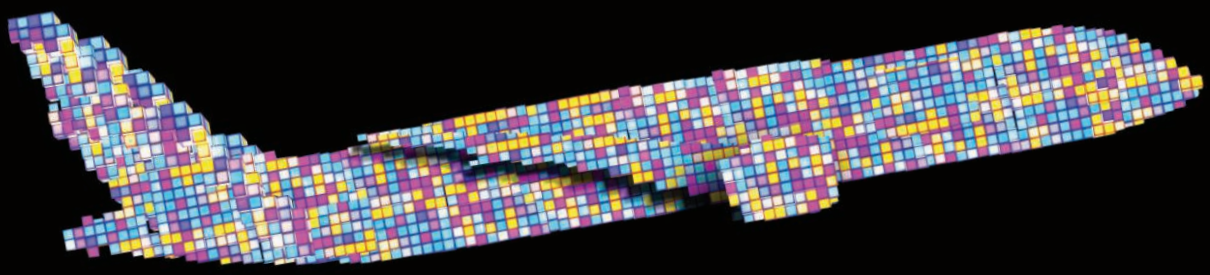

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ROLLS ROYCE

NEW JETS MAKE WAY

To say that business aviation was hammered by the 2008 financial crisis would be an understatement; economic turmoil and public outcry at the sight of US corporate bosses arriving in Washington DC by private jet to beg for handouts pulled the rug from under the small-cabin sector, and the sales slowdown eventually caught up with makers of larger, more lucrative models. But finally, after a decade in the doldrums, there are signs of recovery. On the eve of the EBACE industry gathering in Geneva, we look at the arriving models which are powering this revival, and try out one of the most ambitious: Gulfstream's all-new G500

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Gulfstream's new G500 stakes several claims to large-cabin sector leadership – not least through its first civil use of active sidesticks

Actively advanced

Gulfstream's replacement for its G450 boasts improvements in range, cabin size and comfort, along with the industry's first use of active sidesticks in a civil aircraft – we try it for size

MICHAEL GERZANICS SAVANNAH

Several years ago, I had the pleasure of flying what was then Gulfstream's latest offering, the G650ER. The ultra-long-range G650 family was a step-change improvement over its very capable predecessor, the G550. While its performance advantages over the G550 are notable, I was more interested in its fly-by-wire (FBW) flight-control system.

FBW systems have matured and are now state of the art, employed in nearly every new transport category and clean-sheet business jet offering. While I found the G650 a joy to fly, I was puzzled by one seeming omission – a sidestick. Gulfstream had elected to put a yoke in the G650. It felt a passive sidestick, a current industry standard, would not provide the feel and situational awareness enhancements that would come with active sidesticks, which electronically connect both sides, so each pilot can feel the other's inputs.

More than five years have elapsed since the successful launch of the G650 and Gulfstream has used the interval to incorporate an active sidestick, developed by BAE Systems, into its FBW flight-control scheme. So, the world's first civil aircraft to fly with active sidesticks is the new G500/G600.

Other than its Gulfstream moniker and accommodation for up to 19 passengers, the G500 has little in common with the G450 it replaces. The clean-sheet G500 cruises further and faster, with a range of 5,200nm (9,630km) at Mach 0.85, besting the G450's 4,350nm at M0.80. Besides that, it does so while burning less fuel and providing a more spacious cabin; the G500's cabin size is slotted between the G450/550 and the G650.

While its cabin may be slightly smaller than the G650's, the G500 does share a lot of characteristics with the type. It features the same signature oval-shaped windows, as well as the same empennage. Both aircraft have FBW control systems, sharing the same basic architecture and similar control law logic.

The G500 comes equipped with Gulfstream's new Symmetry flightdeck, based on Honeywell's Primus Epic. What sets Symmetry apart are its displays and pilot interface. It features four large (13 x 10in) LCD displays, two wide-format standby displays, as well as four sizeable (10in) touchscreen controllers which allow the pilot to set up the avionics-related systems for flight management, communications and navigation. The G500 features two Lockheed Martin F-16 fighter-style cursor control devices (CCD) similar to those in the G650, but mounted on the central pedestal rather than outboard on the sidewalls.

With nearly 40 years of flying under my belt I can say that an overhead panel rarely warrants a shout-out, but the G500's does. As with other aircraft, the panel hosts system control panels, as well as light switches. What is different is how it is done. There are only four traditional panels: engine start, electrical power control, bleed air and cabin pressure control. Added to these are three overhead panel touchscreens, the innovative element of the panel. Each can control any one of 13 aircraft and cabin systems, as well as six test and maintenance functions.

These flexible displays can also show information more commonly presented on instrument panel multifunction display synoptic pages. Other standout features are a LCD head-up display (HUD), enhanced vision system and synthetic vision primary flight display (SV-PFD). Like the G650, the G500's cockpit is paperless, with JeppView charts and an electronic checklist.

Clear underside makes G500 wing 'a marvel to behold in its simplicity'

Gerzanics (*left*) was accompanied by Gulfstream experimental test pilot Kevin Claffy

Gulfstream

MOTIVE FORCE

Another first for Gulfstream is the choice of Pratt & Whitney PW800-series turbofans: PW-814GAs on the G500 and PW815GAs for the G600. The engine features a high-efficiency single-piece fan, as well as stainless steel fan case with a Kevlar wrap.

That the engine is controlled by a dual-channel FADEC is unremarkable. What is remarkable is that thrust-reverser control is an integral function of the FADEC, not a stan-

Gulfstream

Gulfstream G500 specifications

Accommodation	
Crew	3 (2 pilots min, 1 cabin attendant)
Passengers	Up to 19 (sleeps 8)
Dimensions	
Wingspan	26.30m
Length	27.79m
Height	7.77m
Passenger cabin (finished internal dimensions)	
Length	12.65m*
Width	2.31m
Height	1.88m
Weights	
Maximum take-off weight	36,106kg
Maximum landing weight	29,189kg
Std basic operating weight	21,251kg**
Engines	2 x Pratt & Whitney Canada PW814GA
Thrust	15,200lb, ISA std day
Baggage stowage	
Tail cone	4.96m^3
Performance	
Take-off distance***	1,646m
Operating ceiling	51,000ft
Initial cruise altitude	41,000ft
Long-range cruise speed	M0.85
Range @ M0.85****	5,205nm
High-speed cruise	M0.90
Maximum operating speed	M0.925
Landing distance*****	945m

Source: Gulfstream *excl baggage compartment **unusable fuel and oil, 3 crew, std avionics and interior ***MTOW, SL, ISA ****MTOW, 3 crew + 8 pax, NBAA IFR *****MLW, SL, ISA

dalone system like on other engines. Like the earlier G650, the G500's quadruplex digital flight-control system controls all three axes, with three flight-control computers (two primary and one back-up). Each primary flight-control surface has two hydraulic actuators, powered by the aircraft's left and right hydraulic systems.

For the G650, Gulfstream had developed a set of bespoke flight control laws (FCL), which were the basis for those deployed on the G500. In the pitch axis, the G650's control scheme changed, dependent on whether it was in a take-off and landing or up and away clean configuration. The G500 employs a single pitch-axis control scheme irrespective of configuration. Like the G650's up and away laws, it is *g*-command with apparent speed stability.

FBW systems offer an opportunity to enhance safety in several ways. One is when control laws ensure that the aircraft's response to control input is normalised throughout the flight envelope, yielding consistent and predictable handling qualities. Another is automated protection from flight-envelope exceedances. Finally, they are also used to mitigate the adverse effects of asymmetric thrust caused by an engine failure.

The G650 flight test showed that Gulfstream had fielded FCL that, on a spectrum from "highly protective" to totally "hands off", leaned towards the "hands-off" end. In the G650 I found their proportional control scheme (in all three axes) provided crisp and predictable handling qualities, a major boon to flight safety.

As to envelope protections, they were limited to the pitch axis with limited overspeed and robust stall protections. In the engine failure case, Gulfstream opted for a total hands-off approach. An engine loss requires timely and correct pilot intervention to ensure a safe outcome. As I would find out during my preview flight from Savannah/Hilton Head International airport, near Gulfstream's headquarters in Georgia, this control scheme philosophy has been carried over to the G500.

ENHANCED CABIN AND COCKPIT

Our aircraft for the preview flight was serial number 72005 (registration N505GD), the first production G500. I accompanied Gulfstream experimental test pilot Kevin Claffy as he performed the pre-flight walk-around inspection. The G500's large supercritical wing is based on the G650's and was a marvel to behold in its simplicity, with fixed leading edge and large single-panel barn-door trailing-edge flaps.

Besides the flap size, the clean underside of the wing was notable. All of the flap tracks, actuators and hinges are internal, with nothing protruding below the lower wing skin.

Entry into the aircraft was via the large electrically actuated main cabin entry door, which, like the wing, is based on the G650's. Once on board I turned right to survey the large passenger cabin. The 12 oval cabin windows let in a large amount of ambient light and gave the cabin an airy feel as I walked its length. In response to customer feedback, Gulfstream has elected to add an additional cabin window on each side of the G500 for aircraft number 7 onward.

Helping me get settled in the left seat was another Gulfstream test pilot, Todd Abler, who would act as an additional safety pilot during the flight. I slid the manual seat forward so that my left hand reached the sidestick and raised it to the design eye position by referencing the centre pillar alignment balls.

The spring-loaded rudder pedals were easily adjusted to comfortably allow for full displacement. As a final check of my seating position, I lowered the standard Rockwell Collins HUD to ensure I could see its entire presentation. Finally, I raised the console-mounted arm support so that my hand rested comfortably on the sidestick.

Meanwhile, Claffy had completed most of the pre-start setup. Once the auxiliary power »

» unit was started, its generator automatically came online. Claffy next pointed out that the bottom row of overhead panel switches support initial power-up/engine start. This was done, he says, to create a simple left-to-right flow for the pilots. A simple push of the APU bleed pushbutton was the final step needed to prepare for engine start.

Once cleared for engine start I placed the right engine's quadrant-mounted fuel control lever to the run position. That single switch action also turned on the rotating beacons as well as starting the respective fuel boost pump. A push to the overhead panel-mounted engine button allowed the FADEC to start the engine, which reached idle in less than 30sec. Start of the left engine mirrored the right with no pilot action required. With both engines running, the APU bleed was turned off to complete the start sequence. One design goal was that a cold/power-off G500 could be ready for taxi in less than 10min; the overhead panel layout certainly helps.

While the G500 was still in the chocks, Claffy showed me some of the unique features of the Symmetry flightdeck. The touchscreen control interface is a pressure-based one with no audible feedback. Pushing a virtual switch causes it to "bloom", indicating it has been selected. Lifting off the glass completes the switch action. If your finger moves off the target switch before lifting from the glass, the switch action is not executed.

One thing I did notice about the flightdeck was that it was almost devoid of "guarded" switches. Guarded virtual switch functions on the touch-screens are indicated by a box around their label. Traditional guarded switch action is replicated on the overhead panel touchscreen via a two-step process. First, the switch is pressed and released. Then, a second dialogue box appears asking to confirm the switch action. Overall, I found this mechanisation a good digital substitute for legacy, guarded switches.

Gulfstream G500 versus competitors

	G500	Bombardier Global 5000	Dassault Falcon 6X*
Take-off distance	1,646m	1,689m	1,670m
Basic operating weight	21,251kg	23,070kg	18,543kg
Range (M0.85, 8 pax/3 crew)	5,205nm	5,205nm	5,505nm**
Cabin cross section (H x W x L)	1.88 x 2.31 x 12.65m	1.88 x 2.41 x 12.41m	1.98 x 2.58 x 12.3m
Passengers	Up to 19	Up to 16***	Up to 19
Landing distance (SL, ISA, MLW)	945m	814m	942m
Initial cruise (ISA+10°C)	41,000ft	41,000ft	40,000ft
High-speed cruise	M0.90	M0.88	M0.88
Maximum operating speed	M0.925	M0.89	M0.90
Maximum operating altitude	51,000ft	51,000ft	51,000ft
Thrust-to-weight ratio	0.381	0.319	0.336-0.361
Wing loading (kg/m^2)	409.1	442.6	485.5
@ maximum take-off weight			

Source: Manufacturers *projected **M0.80 ***19 with custom floorplan

Gulfstream cabins compared

	G450/550	G500	G650
Height	1.83m	1.88m	1.91m
Length	12.29/13.39m	12.65m	14.27m
Width	2.13m	2.31m	2.49m

Source: Gulfstream

SIDESTICK HIGHLIGHTS

Prior to taxi, I familiarised myself with the sidestick. Both Gulfstream and Embraer sourced their active sidesticks from BAE, and I had been fortunate to sample Embraer's during an earlier KC-390 flight (*Flight International*, 14-20 November 2017). Unlike Embraer's sidestick installation, where the pitch axis parallels the aircraft longitudinal axis, Gulfstream's rotates the pitch axis outboard by about 3° to more closely reflect actual arm movement.

While stick forces in the KC-390 were symmetrical in both pitch and roll, Gulfstream has opted to tailor them to mimic real-world exertion requirements. During my initial full-range control sweep I told Claffy that control forces seemed excessive, but he recommended we reserve judgement until airborne.

With the G500 still in the chocks, Claffy demonstrated the interconnection feature of the sidesticks. He had me displace my stick, with him putting a minor input in the opposite and then same directions. I could feel even the most minor of his inputs, making an "audible dual input" warning redundant.

During our taxi to runway 28 for take-off, I had a chance to evaluate Honeywell's SmartView synthetic vision system. It combines synthetic vision and moving maps to enhance situational awareness. Moving maps can be presented in a typical 2D or a newer 3D format. While on the ground and at speeds below 60kt (111km/h), the 3D presentation can be viewed from either an egocentric (out of the windscreen) or exocentric (above and behind the aircraft) perspective. At faster speeds and while airborne, only the egocentric view is available. During the taxi, I found airport signage displayed by the synthetic vision system helped maintain positional awareness on what was for me an unfamiliar airfield.

PATH-BASED GUIDANCE

Once on runway 28 and cleared for take-off, I advanced the thrust levers and engaged the auto-throttle. For our 20° flaps configuration, computed V speeds (V1/VR/V2) were 115/120/136kt. As this was my first time in

Evaluation flight was made from Savannah using the first production aircraft, N505GD

Gulfstream

the G500, Claffy would call out speeds 10kt faster than book to provide a little margin should I be overly aggressive in rotation. The engines advanced and stabilised at 91.2%N1.

Acceleration was brisk for the light aircraft, our fuel load of 6,710kg (14,800lb) less than half the maximum of 13,720kg. When Claffy called "rotate" at 130kt indicated air speed (KIAS), my initial pull was indeed a bit too much, an action primed by what I had perceived to be high forces needed during the post-start control sweep. I immediately relaxed the back pressure with the G500 lifting of the runway in an 8° nose-high attitude.

Once airborne with the gear and flaps retracted, I followed the flight-director guidance in the HUD for the 200KIAS climb. The flight-director guidance cue is "winged diamond" in both the HUD and on the panel-mounted PFD. Flight-director guidance is intuitive where one places the "winged circle" flight-path marker over the flight-director cue. Once above 3,000ft, I lowered the nose and accelerated the G500 to 250KIAS in a left-hand turn towards the Atlantic Ocean, where we would work in one of the charted warning areas.

In the climb to flight level 400 (40,000ft), I hand-flew the aircraft and would periodically execute bank-to-bank turns at speeds from 250 to 300KIAS, with my feet on the floor and at bank angles of 30° to 45°. Aircraft response in roll was crisp and predictable, with desired bank angles easily captured. During the higher bank-angle turns I found I needed to add back pressure to keep the nose from dropping; the G500's flight-control scheme does not include pitch compensation for banked turns, a feature found in other FBW control schemes.

HIGH-SPEED CRUISER

After levelling at flight level 400 the G500 accelerated to and stabilised at M0.90, its high-speed cruise condition. A total fuel flow of 2,920lb/h held M0.90 and an indicated airspeed of 274kt. Static air temperature was -61°C, about 5°C colder than standard, with a resultant true airspeed of 510kt. Gulfstream's published NBAA IFR range is 4,400nm at this speed.

Next, I slowed the G500 to M0.85 for a long-range cruise condition. At an indicated airspeed of 258kt, total fuel flow dropped to 2,400lb/h. On the cool test day, resultant true airspeed was 476kt with a book range of 5,200nm. These are impressive figures; the G450 had a maximum range of only 4,350nm at M0.80. While this performance is a marked improvement, it does just bring the G500 in line with the capabilities of the Bombardier Global 5000, one of its major competitors.

Once level at flight level 400, I noted a differential pressure of 0.719bar (10.4psi) with a cabin altitude of only 3,020ft. It is well-proven that lower cabin altitudes are less fatiguing. The G500 shares the G650's 0.74bar maximum differential-pressure cabin pressurisation schedule, which yields a remarkably low cabin altitude of 4,850ft at 51,000ft.

For the flight test, I borrowed a lightweight active noise-reduction headset from Gulfstream. The headset is the same one I use flying the Boeing 737NG. While it provides some relief from the Boeing's loud cockpit it is by no means as effective as more expensive ear-cupping models I have worn on other business jet test flights.

What I noticed while setting up for upcoming cruise performance points was how quiet the cockpit was. I could have a conversation »

Gulfstream

Safety pilot Todd Abler joined Gerzanics and Claffy for pre-flight walkaround

» with Claffy without using the aircraft's inter-phone.

PITCH ENVELOPE PROTECTIONS

With the high-altitude work complete, we started a descent towards a medium-altitude block for some low-speed handling evaluations. In the descent, I accelerated the G500 to its maximum operating speed (MMO) of M0.925 and, once lower, its 340KIAS VMO.

Ample warnings are provided of the high-speed condition both on the PFD and calibrate air speed (CAS). At the limit speed/Mach the FCL raise the nose to slow the aircraft, as well as prohibiting further pitch trim. At MMO a "high speed protect active" (advisory) CAS message alerted me that the FBW protections had kicked in. Additional forward sidestick pressure had no effect, the G500 could not be oversped. While not active on our aircraft, the latest software loads will also use the auto-throttle to reduce thrust and further slow the aircraft. At both MMO and VMO I put in a number of sharp small-amplitude control inputs in each axis. As expected, the aircraft's response to these was deadbeat, with no residual oscillations. Speed brake extension at these high speeds caused a minor nose-up pitching moment, easily countered by forward pressure on the sidestick.

After our speedy descent from altitude, we levelled at 15,000ft, where I again used the speed brakes to slow the aircraft, retracting them before extending the landing gear at just below its limit speed of 225KIAS. The flaps were then extended to 20°, a typical configuration for just after take-off. With the power set to 81%N1, the G500 slowed in level flight. For test day conditions the top of the slow speed amber band in the PFD was 132KIAS. Slowing further sounded an audible "airspeed low" warning.

These cautions were purposely ignored as I applied full aft sidestick, slowing the G500 to its alpha limit of 110KIAS for our conditions. At the limit, a "FCS AOA limiting" (advisory) CAS message was displayed. In the G650 this slow speed would have triggered the slow-speed stick-shaker. For the G500, Gulfstream has made significant improvements to the slow-speed protection scheme, fielding a robust system that allows the stick-shaker to trigger at speeds below the red band.

Satisfied with the G500's slow-speed handling and warnings, I advanced the thrust levers to power out of the slow-speed condition in level flight. As the G500 has apparent speed stability built into it, I used the sidestick's trim button to relieve stick forces as we cleaned up and accelerated to 250KIAS for our transit back. During the transit, I lowered the HUD and turned on the enhanced vision system. After a short cooling period I found the dual infrared-band cameras presented a crisp view of the low-country marshes and sloughs as we manoeuvred towards Savannah/Hilton Head International.

While at altitude I had familiarised myself with Symmetry's flight management system (FMS), using the CCD to graphically select and define a number of waypoints in our working area. I had found its operation to be straightforward and quite powerful. Returning to Savannah/Hilton Head International, Claffy helped me install our planned ap-

Supercritical wing features large single-panel barn-door trailing-edge flaps

Gulfstream

proach, the ILS or LOC runway 1.

The localiser frequency and final approach course were automatically loaded by the FMS: a handy feature. I engaged the autopilot and used its HDG mode to follow air-traffic control vectors to intercept the localiser. Once tracking the LOC inbound, I disengaged the autopilot and hand-flew the approach. While slowing and configuring, rather than using the sidestick trim switch to null forces, I used a neat feature resident in the FCL architecture. The sidestick autopilot disconnect button has another function: it is also a "trim speed sync" button. Pushing the button, regardless of speed or configuration, sets pitch trim to the current condition.

Thrust-reverser control is an integral function of the FADEC, not a standalone system like on other engines

This feature is similar to the trim control switch found on Embraer's Legacy 450/500 and KC-390. It should be noted that the Embraers only exhibit speed stability in landing configurations, while the Gulfstream does so in any configuration. In the G500 the trim reference speed is displayed to the pilot on the "FLT CTRLS" 1/6 synoptic display to the left of the PFD. In the Embraers, it is displayed directly on the PFD speed tape, a location I preferred. During the approach I found flight-director guidance and precise aircraft response to sidestick inputs allowed me to accurately track both the LOC and ground speed. Engine response to thrust lever inputs allowed me to easily maintain our approach speed of 135KIAS with flaps set to 39° (full).

V2 CUT

At minimums, Claffy directed a go-around. I advanced both thrust levers and selected take-off/go-around for the flight director mode. As I raised the nose and called for the landing gear to be retracted, Claffy retarded the right thrust lever to idle to simulate an engine failure. With the flaps set to 20° and 92%N1 on the left engine, approximately 25kg of pedal force was required to maintain co-ordinated flight in the 160KIAS climb to pattern altitude.

I used rudder trim to reduce pedal forces during the climb-out. Forces were just about nulled out when I ran out of trim authority. Once level on a downwind, with a reduced power setting on the good engine, I centred rudder trim for the approach. As I hand-flew the pattern, Claffy loaded the RNAV (GPS) Z runway 28 approach. I planned on using its guidance for the final segment of the simulated single engine approach. Target speed was again 135KIAS as the approach was flown with flaps 39°. As with the prior approach, the G500 was stable and responsive on final. At 100ft Claffy called for a go-around, both engines used for the climb-out to enter a visual left-hand circuit.

Proportional control schemes and limited envelope protections make new type rewarding to fly

Gulfstream

My last approach in the G500 was a visual to a full stop on runway 28. As with the prior two approaches it was flown at flaps 39°. I flew the entire circuit without reference to any charted approaches, the precision approach path indicators providing a good reference for a 3° glidepath. Had path indicators not been available, the pitch ladder in the HUD would have provided a handy reference for a 3° glidepath.

At about 40ft radio altitude I retarded the thrust levers to idle, and started the flare manoeuvre passing through 30ft radio altitude. I said to myself: "Swing and a miss," as we were several feet too high. I then milked the G500 to the runway. Had I dropped it in, the trailing link main gear most likely would have absorbed any untold sink rate and made me look like a seasoned Gulfstream pilot. After flying the nose to the runway, I deployed the thrust reversers and applied moderate toe braking, which rapidly slowed the G500 to a safe taxi speed. The taxi back to Gulfstream's ramp was uneventful with the shutdown and post-flight checks easily accomplished.

When I had approached my G650 flight several years ago I was interested in how Gulfstream would implement its first full FBW control system. As I detailed in that test, I found its proportional control schemes and limited envelope protections made it a joy to fly.

With the G500 they have taken the flight controls a step further. The active sidestick allows for accurate and precise control inputs, while freeing up valuable real estate on the flightdeck. Electronically tied together, the sidesticks enhance situational awareness by keeping the other pilot in the loop.

I found the Symmetry flightdeck a marked improvement over the very capable PlaneView II in the G650. The passenger experience has also been upgraded with a larger cabin. After what can be a 5,200nm flight, passengers will no doubt arrive more refreshed owing to the G500's quiet cabin, low cabin altitude and M0.85 cruise speed.

With US Federal Aviation Administration certification on the horizon, it looks certain that the G500 will be pleasing passengers and pilots alike, Gulfstream having raised the bar for the super-large segment. ■

All-new Pilatus PC-24 superlight jet will enter service in Europe imminently

Pilatus Aircraft

Cautious optimism

Europe's business aircraft market took a hammering from the financial crisis, but rising wealth, innovative ownership plans and new models are finally heralding a sales rebound

KATE SARSFIELD LONDON

Europe's business aviation industry is finally emerging from one of the gloomiest periods in its history, and its rebirth is being greeted with a mixture of relief, optimism and, perhaps understandably, a little caution.

The region is a significant market. Flight Fleets Analyzer data shows that Europe has accounted for some 20% of global business jet shipments worldwide over the past decade and 13% of turboprop deliveries. It is also home to the world's second-largest installed base of business jets, with around 2,700 units, and the third-largest inventory of turboprops, with 900 examples.

But sales in Europe of new turbine aircraft have slowed considerably over the past decade. The financial crisis of 2008-2009 was crippling, with business jet deliveries plummeting from a market peak of 339 aircraft in 2008 to just 121 in 2017. Shipments of business turboprops more than halved during the same period, from 76 to 37 aircraft.

Cost-conscious buyers still maintained a relatively healthy appetite for pre-owned models during this challenging time – and there were rich pickings because of a huge oversupply of aircraft being sold at historically low prices. This activity has helped to keep Europe's installed base of jets and turboprops relatively stable over the past 10 years.

Richard Aboulafia, aerospace analyst at the Teal Group, describes European buyers as "value shoppers". He says they have "little problem buying used aircraft, and therefore may act as canaries in the coal mine in reverse". Now that this market has "passed the bottom, in terms of pricing", he says, "demand is starting to shift to new aircraft".

His view is supported by European Business Aviation Association (EBAA) chair Juergen Wiese, who pitches the inventory of used aircraft for sale at a "healthy" level of around 10% of the global fleet, helping to "firm up" prices and stimulate demand for new models.

> **"There is a good balance [in the used aircraft sector] of supply and demand"**
>
> **Juergen Wiese**
> Chair, European Business Aviation Association

"People ask me if the industry is over the hump, and I say: 'I think it is'," says Wiese, who also heads BMW's corporate flight department. "We are certainly in a sweet spot now. The economy is doing well, and there is a good balance [in the used aircraft sector] of supply and demand."

FLYING SOARS

Aerospace analyst Rolland Vincent agrees. He describes the market as "bullish", and notes that relative to the rate of economic growth over the past decade, Europe's business jet fleet has performed well. "Just imagine the fleet growth we might see if Europe can sustain the current GDP growth momentum," he says.

According to EU statistical office Eurostat, during 2017 GDP rose by 2.3% in the euro area, compared with 1.8% in 2016. The 28 EU member states registered growth of 2.4% in 2017, versus 2% in the previous year.

While aircraft sales are on the rise, so too is flying activity; European travellers are turning to business aircraft in increasing numbers to meet their transport needs. "There has been 16 months of sustained growth in charter sales and movements across Europe's airports," says Wiese. "It's been over 10 years since such a long spell of uninterrupted growth was recorded."

Dassault Aviation

Dassault recently launched the wide-cabin Falcon 6X, due to enter service around 2023

Adam Twidell, chief executive of PrivateFly, one of the continent's largest and oldest online charter platforms, believes a range of innovative, affordable programmes are helping to sustain this growth.

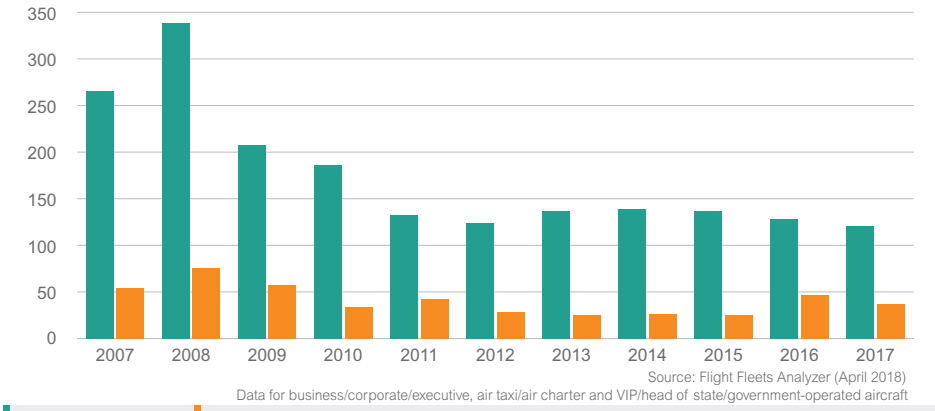
Programmes such as members-only venture Surf Air and scheduled business jet shuttle JetSmarter are lowering the bar to entry and encouraging a new generation of European travellers to sample private aviation: "The charter industry is benefiting from their high-profile, multimillion-dollar marketing campaigns. Once people have experienced the convenience and flexibility of flying by private jet – compared with the headache of travelling on a commercial airline – they don't look back."

And, says Twidell, Europe's new wave of high-tech, user-friendly booking platforms such as Stratajet are attracting a younger, "digitally literate clientele who want the power to access various services at the touch of a button – from taxis through to Uber to seats on a private jet".

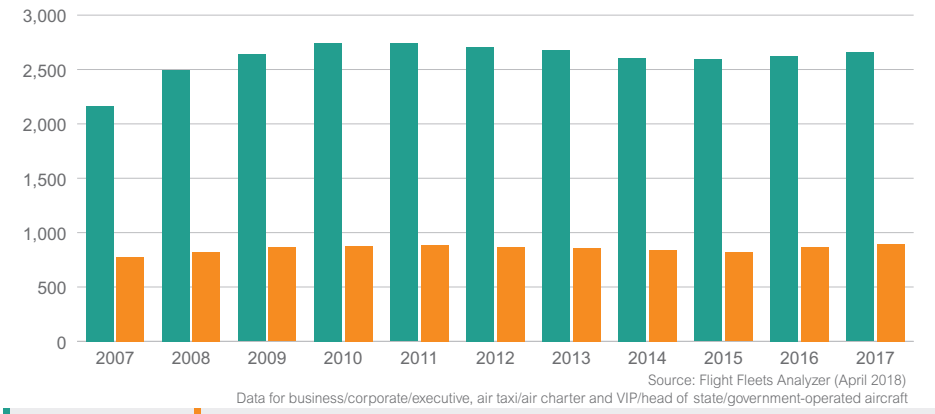
PrivateFly figures support this assessment, showing a fall in the average age of the typical European business aircraft user, from 41 years in 2016, to 38 today. "As millennials continue to enter the workforce, this younger generation will become the next private jet audience – demanding more choice, customisation and personalisation," says Twidell.

Bombardier is upbeat about Europe's business aviation market – the Canadian airframer's largest territory outside North America, with a 25% share of its annual deliveries. "The key drivers – economic health, strong aircraft activity, and a low used aircraft inventory – are boosting buyer confidence, persuading previously indecisive consumers to come off the fence, and helping to expand our »

European business jet and turboprop deliveries 2007-2017



European business jet and turboprop fleet growth 2007-2017



» pool of potential customers," says the company's director for market analytics and customer insight, Thomas Fissellier.

This "pool" includes the growing population of ultra-high-net-worth individuals. He points to recent research by wealth information services company Wealth-X, which records a 9% hike in the number of Europe-based billionaires between 2016 and 2017 to 650 – with the UK, France and Germany home to the largest concentrations.

"We are seeing a pretty nice increase in order activity this year, and expect that momentum to continue," says Fissellier.

SALES BOOST

Bombardier's most popular model in Europe is the Challenger 300/350, followed closely by the Global 6000. "There is a healthy appetite for aircraft with large cabins and long ranges," says Fissellier, adding that he expects the 7,700nm (14,200km)-range Global 7000 to be "very popular", when it enters service in the second half of 2018.

> **"Customers want their aircraft to be an extension of their home and office"**
>
> **Robert Baltus**
> Chief operating officer, European Business Aviation Association

Bombardier's ultra-long-range flagship is one of a host of new designs entering the market over the next few years, which EBAA chief operating officer Robert Baltus believes will help stimulate buyer interest.

Europe is not short of new product. Pilatus Aircraft's PC-24 superlight business jet will enter service in Europe in the coming weeks, and Gulfstream's super-large G500 and G600 are expected to follow later in 2018 and in 2019, respectively. From Textron Aviation, the super-midsize Cessna Citation Longitude will arrive late this year; its Denali single-engined turboprop is due in 2020. By 2023, Dassault's recently launched wide-cabin, long-range Falcon 6X should be gracing Europe's skies. "Innovation is the key," says Baltus. "Customers want their aircraft to be an extension of their home and office, and these technologically advanced cabins do all that and more."


VistaJet

Global 6000 helps drive Bombardier sales in Europe, which takes a quarter of its deliveries

Textron Aviation's vice-president of sales for Europe, Tom Perry, says that while the Longitude has only performed a handful of demonstration flights on the continent so far, the reception for the 10-seat business jet has been "fantastic".

He describes Europe as Textron Aviation's "second-strongest market" for its Citation jet family, noting that the company completed "a great first quarter" for new orders. For the Beechcraft King Air and Cessna Caravan turboprop series, Europe ranks fourth for new aircraft sales and deliveries. Perry says the continent has taken "relatively few" commercial turboprop deliveries in recent years, but orders for its special mission variants have been strong. Perry points to a 2017 order from Norway's Babcock Scandinavian Air Ambulance for 10 King Air 250s and a single Latitude jet. Deliveries are scheduled to begin this year.

GOOD PROSPECTS

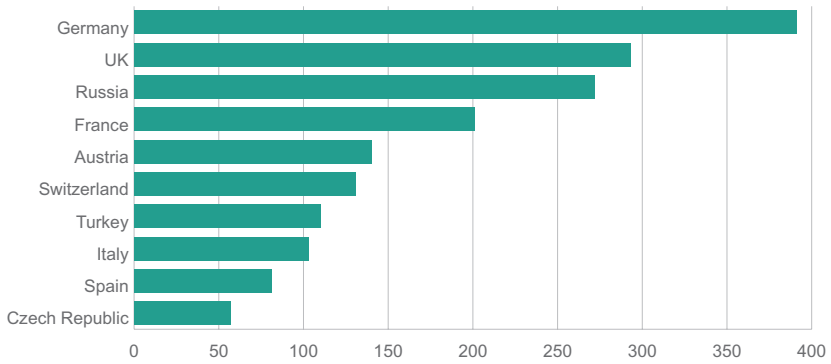
While European business aviation continues to recover and evolve, EBAA's focus is to create a thriving market and an unfettered operating environment for its 750-plus members and supporters. Baltus believes the "true value" of the industry is not recognised by many regulators and key decision-makers, so the needs of the community are often overlooked. He says an EBAA-sponsored study by Booz Allen Hamilton and the German aerospace research centre DLR is helping to change perceptions and bolster its profile.

The report, published in March, presents business aviation as a bulwark of Europe's economy, supporting 374,000 jobs and contributing €32 billion ($40 billion) – or just under 0.2% – of the total value of goods and services produced in the region each year.

This influence is becoming more important. Baltus notes that the latest report follows a similar survey in 2016 of the 28 EU countries plus the Channel Islands, Iceland, the Isle of Man, Monaco, Norway, San Marino and Switzerland, which concluded business aviation was behind 371,000 jobs and boosted the continent's economy by €27 billion.

The report also claims business aviation vastly improves connectivity within Europe, serving more than 25,000 city or area pairs not linked by direct airline flights – or almost

Europe's top 10 countries by business jet fleet size



Source: Flight Fleets Analyzer (April 2018)
Note: information for base location of business jets


Textron Aviation

Cessna Citation Longitude will be entrant to bouyant super-midsize market late this year

one in three of all air connections.

France, Germany, Switzerland and the UK are the four countries with the largest business aviation sectors, contributing 76% of the industry's "gross value added", or its value to the economy each year.

The EBAA report also makes the case for the increased productivity business aviation offers companies and their executives, allowing them to devote time to working that would otherwise be unproductively spent transiting through commercial airports and flying in cramped airline cabins.

Using a complex formula that takes into account flying times and an assumption that it is easier to work on a private aircraft, the study maintains that business aviation users generate an average 153min of productive time by taking a business, rather than commercial flight. "Without business aviation in some regions, business connectivity would simply not be possible, and new ventures and opportunities would never be realised," says Baltus.

IMPROVING ACCESS

The study seeks to demystify the image of business aviation as a preserve of the wealthy and privileged. "We want to grow this market by making it more accessible to the wider community," says Wiese. "Our job is to get out there and help make a compelling case for business aviation with lawmakers and company decision-makers."

As part of the initiative, the Brussels-based trade association is rolling out in the next few weeks an online comparison tool that allows users to assess the productivity and time savings of using business aircraft to fulfil a travel requirement, comparing it with other options such as commercial flights.

While refining the public image of business aviation is an imperative for the industry's long-term prosperity, so, too, is securing enough airport capacity. Wiese notes that for major hubs such as Berlin, Frankfurt, Geneva and London's Heathrow and Gatwick, commercial airlines are typically more lucrative than business jet operators, which thus struggle for access.

This pattern is repeated at small regional airports such as London Luton – the top destination in the UK for business aircraft traffic in 2017, with over 30,000 movements – thanks to a rise in low-cost carriers at the site. The UK capital is, however, one of the few cities in Europe with a variety of airports – including Biggin Hill, Farnborough, London City and Northolt – serving the sector outside the major slot-controlled hubs.

"With increasing pressure placed upon business aviation from regional airlines and feeders of all sorts at major hubs, Europe must find alternative solutions to avoid aggravating the current gridlock," EBAA says.

The answer lies in Europe's vast network of secondary airports. EBAA is calling for the wider and faster adoption of satellite-based approaches for business aircraft, which will open up more tertiary airports. It says procedures such as localiser performance with vertical guidance allow operators to fly precision approaches using EGNOS, the European geostationary navigation overlay service, down to a 200ft decision height and 800m (2,600ft) visibility.

"A quicker adoption of EGNOS-based technology will enable regional airports to be part of the network that could accommodate all types of aircraft," says EBAA.

LOOMING BREXIT

While airport access is a key priority for the region's operators, avoiding any detrimental impact from the UK's exit from the EU – set for 29 March 2019 – is a priority for the industry.

The UK is an important market. Fleets Analyzer records a based fleet of over 400 business jets and turboprops, making it the second-largest inventory after Germany. The country accounted for around 100,000 business aircraft departures in 2017, according to EBAA. This represents the third-highest tally within the EU's 28 states, with Luton to Paris and Nice the most flown city pairs in 2017.

EBAA also shows that the UK industry supports more than 41,000 jobs and contributes €8.3 billion to the nation's economy.

The association points to uncertainty surrounding the post-Brexit aviation relationship between the UK and the EU. So, it reckons, the challenges for business aviation, in particular its 155 UK-based members, lie in four key areas: traffic rights for commercial flights; ownership and control of operators providing commercial air transport services; VAT and customs; and the UK's membership of the European Aviation Safety Agency.

An EBAA report analysing the possible effects on Europe's business aviation community of different Brexit scenarios is intended to be "almost like a toolbox for the people at the table", Baltus says. "For our members, the most important thing is that we retain a high level of flexibility across Europe." ■

Textron Aviation

Textron Aviation's clean-sheet Denali single-engined turboprop is set for service in 2020

No design committee

The HondaJet's parent company is an automotive industry giant – so its creator is steeped in a tradition that places as much emphasis on customer delight as pure engineering

STEPHEN TRIMBLE GREENSBORO

A carefully choreographed and staged ritual begins every time a customer parks in front of the HondaJet delivery centre to accept handover of a new aircraft.

It will start with a personal greeting by Honda Aircraft chief executive Michimasa Fujino, who also happens to be the designer of the HondaJet and master of its several innovations.

The customer then steps into the delivery hangar itself. It is common for such a facility to be a manufacturer's most well-appointed hangar, but Honda Aircraft takes that idea to a new level. Standing before the customer is their completed aircraft, theatrically displayed on a platform that rotates under a surgically bright lighting display. The HondaJet in the centre of the room is ringed by three walls, each covered in white panels crafted to accentuate the aircraft's proportions from the perspective of the viewer. Finally, the fourth wall would normally be the hangar door, but it is covered up by a 20m (66ft)-tall, white cloth curtain.

This experience was presented by Fujino during a recent, exclusive tour of the facility. If the guest of the tour had been a paying customer instead of a journalist, the delivery ceremony would be attended by a crowd of HondaJet employees, celebrating the customer with a chorus of applause and cheers.

It is a ceremony as unique in the industry as Fujino himself. First assigned by Honda's research and development branch to experiment with aircraft designs in 1986, he sketched the distinctive shape of what became the HondaJet configuration in 1997. A prototype flew for the first time in 2003, and certification finally came 12 years later.

Few chief executives in any industry have had such a long and detailed association with a single project as Fujino. He is credited with inventing several of the HondaJet's most important innovations, including a natural laminar flow profile and over-the-wing engine mounting.

AESTHETIC SENSE

During the tour, however, it is clear he takes as much pride in the aesthetic features of the HondaJet as he does in its aerodynamic qualities. Fujino famously devoted six months to shaping the control columns in the HondaJet cockpit. He also designed the ceiling lights in the delivery hangar, he says.

In the years between his 1997 sketch and the 2015 certification, Fujino also personally directed the automotive-style design of the HondaJet's exterior and interior. Again, his approach broke with business jet industry tradition. For the exterior, he allowed customers to choose between several bold colours – but like a car manufacturer, he standardised the livery design.

HondaJet is infused with Michimasa Fujino's automotive-inspired design philosophy

A Fujino-guided tour of the interior reveals similar automotive touches. Although he earned an aeronautical engineering degree, Fujino began his career at Honda Motors in the automotive division. The influence of Honda's vast automotive operations runs deep in the HondaJet. The lavatory of the HondaJet cabin, for example, features a small skylight. Fujino acknowledges that such a design feature is anathema to structural engineers, but he insists it is central to his own – and Honda's – consumer-oriented design philosophy.

As he sees it, the aircraft manufacturing business too often prioritises the preferences of engineers over those of customers: "I really want to change [the aircraft field]. The automobile thought process is not just about [saving] weight."

Of course, weight savings are still important in aircraft design. That is why the HondaJet is designed with unique aerodynamic features, such as over-wing engine mounts. It also boasts a natural laminar-flow wing and

Honda Aircraft

Greensboro output is now at four aircraft per month, with room for a second assembly line

BillyPix

nose section. Combined, those features improve fuel efficiency by at least 10%, Fujino claims. But they also complicated the development and certification process, which was further held up by challenges with validating the aircraft's GE Honda Aero Engines HF120 turbofans. However, additional fuel efficiency gave Fujino more flexibility to incorporate customer-friendly interior design features such as the lavatory skylight.

In Fujino's view, HondaJet's unconventional configuration normally would be impossible in the aviation industry's product development culture. He criticises the committee-based approach to decision-making in aircraft design, with the need to balance the demands of various engineering teams – wings, fuselage, systems, or empennage – prioritised over the customer's interest. At Honda Aircraft, much of the fundamental design and decision-making falls to Fujino, who is also chief executive of the company.

So far, that approach seems to be working for HondaJet. Customers are now flying 84 aircraft delivered from the factory, making the HondaJet last year's top seller in its light or entry-level jets category.

HondaJet's early success has inspired imitators. In the last few years, other business jet manufacturers have spoken of a new appreciation for automotive-style design features. Some have even incorporated certain features, such as skylights and standardised livery schemes, that Fujino claims as his intellectual property. After noting that he holds a patent for integrating a skylight in a business jet cabin, he avoids answering a question about whether he would take legal action against infringement.

GAINING TRACTION

For Honda Aircraft, there are other priorities at the moment. The HondaJet has gained momentum after 18 months of customer deliveries. The Greensboro, North Carolina factory is building new aircraft at a rate of four per month. During a tour of the final assembly line, nine aircraft were in various stages of completion. In the hall, there is room for a second assembly line.

To expand production, HondaJet must find a way to increase sales. Signs suggest the market is heading in the right direction. During the first quarter of this year, the inventory of used business jets of all sizes dropped below 10% for the first time since before the 2008 recession, according to figures released by JetSmart on 9 May. Tight supply of used jets usually indicates higher demand for new aircraft – which gives manufacturers additional pricing power.

However, Fujino again diverges from business jet industry convention. "My viewpoint of the business jet industry is a little different. Many people treat the business jet market with macroeconomics, like GDP," he says. "But the business jet industry is not like automobiles or houses. The population of products is much less than the automobile or housing market."

He acknowledges "some correlation" between GDP and sales, but stresses that a "hit" product has an impact: "If HondaJet sold 50, the market will increase 5% or 6%. It's very different [in the automotive market]. Even if [Honda] has one big hit in automobiles, it doesn't affect the percentage. Of course, I'm looking at the macroeconomic statistics. But what I'm looking at more is how the business jet market can be expanded instead of looking at GDP or the gross economy."

> **"I really want to change the aircraft field – the automotive thought process is not just about saving weight"**
>
> **Michimasa Fujino**
> Chief executive, Honda Aircraft

For a clue about Honda Aircraft's strategy for broadening the base of business jet users, Fujino points to a recent partnership formed between All Nippon Airways (ANA) and HondaJet in Japan. "We provide a feeder service using HondaJets. Not many people know business jets or even how to charter business jets in Japan, because there is no culture to use business jets. Only a few people use them. But if we have a partnership with ANA, probably many people start to notice how business jets can be used," he says.

Such an agreement potentially offers a new route to market for business jet manufacturers. In the entry-level jet category, a vast experiment in jet-powered air taxis fell apart because certain operators, such as Florida-based DayJet, tried to grow too quickly.

"I understand the DayJet concept. It was very attractive in the beginning, but a little bit too far from reality. You have to take really small steps. My first step is to increase the fleet of HondaJets to a certain level," Fujino says.

"If we could estimate how many hours are available from those aircraft, probably, I think we can arrange a time-sharing type business because airplanes are available," he continues. "What we are doing now is we try to achieve that fleet size. That's why we do not »

Natural laminar-flow shape and over-wing engine mounting are HondaJet trademarks

Honda Aircraft

» only track just the people who own business jets, but the people who have never used business jets before. We're not only tracking the aircraft buyer, but also the aircraft user.

"That's why I brought up the example of ANA. Many airline passengers never think of using business jets, but if demand is expanded maybe even… from 1% to 10%? And, if demand is there, then charter operators have to increase [their] fleet," he says.

Having outlined his long-term strategy, Fujino is asked to share his short-term plans. The business jet market typically rolls out a major refresh within about five to seven years after each new model is introduced. The goal is to stimulate new demand with product improvements after the manufacturer has had a chance to maximise the return on the initial investment in a clean-sheet aircraft.

Again, Honda Aircraft is considering taking a different approach, with its reference point being the consumer-oriented automotive culture of its parent. "I work from the automotive industry. So, the [market] cycle is not as long as aviation people think. Hondajet now has good momentum. But now I want more momentum," says Fujino; he declines to elaborate.

Such comments also reveal Honda Aircraft's unique position in the aviation industry. Aviation start-ups normally enter the market on a shoestring budget, but the HondaJet is backed by a parent company that records $140 billion in sales each year. It has waited a long time for its investment in the aviation market to pay off, but that has been the strategy all along, Fujino says.

"The reason why Honda entered a business like aviation is we see ourselves as a mobility company," he says. "We really want to be a leading mobility company. The definition of mobility includes aviation. We are looking at this business segment as not just one year or two, it's very long-term."

In the long term, Honda hopes to reap a synergistic effect from pooling ideas and lessons from its wide array of product lines, ranging from cars and motorcycles to lawnmowers and business jets.

"We cannot use the shape of an aircraft for an automobile, but the technology can be applied to how to validate and verify the reliability of a product," he says. "So, I think it is probably a very big strength of Honda to have diverse viewpoints and diverse technology which can resonate and produce a synergy effect as an entire company."

In the latest year for which figures are available, the fiscal year ending 31 March 2017, Honda Aircraft and GE Honda Aero Engines reported a combined operating loss of ¥43.8 billion ($401 million), an inauspicious beginning for the first full fiscal year of production.

But despite the early losses, Honda remains committed to the HondaJet programme, Fujino says.

"We have a very tight and stringent target, so each year we are striving to meet that business target. The business target of course starts from a profit or loss, so a financial target," Fujino says. "Many business goals are set and we have to strive to meet those business goals. So far, we are kind of meeting those expectations so we have strong support from Honda Motors. And that's why we keep investing for the future as well." ■


Honda Aircraft

Fujino spent six months on control column design in a clearly automotive-influenced cockpit

Smooth operator

Bombardier's new flagship vies for leadership of an emerging class of ultra-long-range jets for which cabin noise, comfort and ride quality are critical performance features

Global 7000 is capable of flying from Hong Kong to New York non-stop

Bombardier

STEPHEN TRIMBLE LOS ANGELES

A Global 7000 does not look out of place on the lawn of the Beverly Hills Hilton at the Milken Institute's annual global conference, a $50,000-a-ticket venue for the world's rich and powerful. It is the kind of event where you see US Treasury Secretary Steven Mnuchin chatting up a group of seated bankers at the coffee bar in the lobby.

So Bombardier brought the 33.9m (111ft)-long cabin mock-up of its $75 million business jet to the 2016 conference, allowing a host of potential future customers an up-close look at the aircraft long before its scheduled entry into service later this year.

Last year, a mock-up of the smaller Challenger 350 adorned the conference's entrance. This year, with the Global 7000's first delivery drawing nearer, Bombardier returned to the Hilton. But instead of bringing a mock-up of its new flagship, Bombardier chose to showcase its latest entry in a product category that is becoming a major marketing focus across the business jet industry. As Brad Nolen, Bombardier's vice-president of marketing, puts it: "You'll find that we'll have more real owners today at Milken than even at NBAA or EBACE, so it's the perfect place to launch a new aircraft seat."

COMFORT OFFERING

The new seat unveiled on the sidelines of the conference on 29 April is branded Nuage, the French word for cloud. As a marketing term, it sounds as if Bombardier is entering the remote data storage business, but in this case it is a reference to the floating, visible mass of tiny liquid droplets – and the intent is to evoke the cloud's airy weightlessness.

"We're really pleased with the result. The comfort we'll be able to deliver to our customers is amazing," says Tim Fagan, manager of industrial design for Bombardier Business Aircraft.

Some customers, such as former Formula One driver Niki Lauda, have been waiting for that experience for a long time. Bombardier launched the Global 7000 at the NBAA convention in Atlanta in 2010. Entry into service was originally scheduled for 2016, but that was before the company's CSeries programme fell more than two years behind schedule. In 2015, it announced that the new model would enter service in 2018.

Three years after that announcement, Bombardier has logged 1,800 flight hours on four test aircraft since achieving first flight in November 2016. The programme remains on track to obtain airworthiness certification later this year, with the first production aircraft delivered to a production customer before 2019 begins.

"The certification is progressing extremely well. We're really entering the final phase before final [certification]," says chief executive Alain Bellemare, speaking to analysts on a first-quarter earnings call on 3 May.

As the flagship of Bombardier Business Aircraft, the Global 7000 has played a significant role in the company's corporate strategy since it was unveiled eight years ago. But the »

» programme assumed a new importance for the Canadian manufacturer last October, when Airbus and Bombardier announced a plan to create a joint company with the Quebec government on the CSeries programme. When the deal closes, Airbus will become the majority shareholder in the CSeries programme.

ELEVATED PROFILE

As Bombardier becomes a minority shareholder in the CSeries, the Global 7000 will become the largest aircraft under the company's control. It strikes a similar profile on the flight line, with a fuselage length only 1m shorter than the CSeries family's CS100 variant and a 3.4m narrower wingspan.

The Global 7000 also shares the CS100's Rockwell Collins ProLine Fusion cockpit and fly-by-wire flight control architecture. The two differ in power, with Pratt & Whitney PW1500G geared turbofan engines on the CSeries family and a pair of aft-mounted GE Aviation Passports for the Global 7000.

With no new aircraft development programmes in the pipeline, the Global 7000 becomes an even more critical piece of Bombardier's future. But company executives have played down expectations for the production ramp-up.

The combined family of the smaller Global 5000 and 6000 jets exceeded 80 aircraft deliveries a year until 2016, but have since declined to about 50. The Global 7000 is not expected to approach even the smaller number as Bombardier hits full-rate production in two or three years.

Between 2020 and 2021, "you'll see the mature level of production, and we think it's going to be something that will contribute up to $3 billion of revenue to the top line at BBA", Bellemare says. "So if you do some quick math, that will give you about 40 aircraft [deliveries] or so when we're pumping out normal production. We'll go with market demand. If there's more, we'll take it from that point."

The Global 7000 is scheduled to enter the market as signs point to a rebound in demand for ultra-long-range, large-cabin jets. Bombardier's fiercest rival, Gulfstream, has reported that sales of the G650 and G650ER rose dramatically in the fourth quarter of 2017 and have not abated so far this year. The G650ER's range is 200nm (370km) shy of the Global 7000's 7,700nm. It is now possible to fly from Hong Kong to New York in a Bombardier jet without a refuelling stop.


Bombardier

Long-endurance flights call for extreme comfort; Bombardier's answer is the Nuage seat

ENDURANCE TEST

That emphasis on extreme endurance has been driving manufacturers to focus more closely on ride quality and interior design. Last November, Bombardier's marketing campaign at the NBAA convention concentrated on the aircraft's flexing wings. Visitors to the flight-test aircraft on the static display were invited to stand beneath the wing and push it as their strength would allow. The point, according to Bombardier, is that such flexibility in wings dampens the vertical gusts that make flying through turbulence so uncomfortable.

Six months later, Bombardier's message to future customers attending the Milken Institute conference focused on the qualities of the aircraft's newly branded seat.

"It's becoming more and more important as time goes on. The whole experience of flying in a business jet is evolving," Nolen says. "As you have more and more competitors entering the field and airplanes are flying further and further and you have more choices, people are moving away from range and speed and more to things like the level of noise in the aircraft. The ride quality, in particular. Is it a bumpy airplane or a smooth airplane? More and more, you're getting into the area of seat comfort over the last 10 years, progressively toward: 'Yes, I'm going to look at the seat and I'm going to make a decision on the seat'."

It is an emphasis that challenges how performance is defined. Typical marketing data for business jets focuses on objective criteria, such as the range and speed of comparable aircraft, or advanced features, including the avionics and engines. As the focus turns more towards the cabin environment, the industry must develop a new lexicon for making objective comparisons between different products.

"I wouldn't say it's terribly analytic" at the moment, Nolen says. "But if you look at the way the seat is manipulated and moving and the geometry, the geometry… is fundamentally different than a Gulfstream seat. Anyone who sits in this seat is going to tell us that rapidly."

Bombardier designed the Nuage with three main elements: a tilt-link system that enables full recline with a comfortable dip at the hips, a headrest that tilts forward in recline to cradle the head and neck and a new swivel mechanism with an axis of rotation that always remains below the passenger's centre of gravity. ■

Bombardier

Four test aircraft have so far amassed more than 1,800h aloft, with certification due this year

From yuckspeak to tales of yore, send your offcuts to murdo.morrison@flightglobal.com

Boeing puts America first

Not so long ago Boeing would bend over backward to stress its multinational credentials as a business that was investing and creating jobs around the world, rather than merely exporting its wares. It appointed "country presidents", or corporate ambassadors, in key markets, whose role was to help transform Boeing's image from "a US company selling abroad to one of a business with a true global footprint".

So what to make of its latest initiative – Watch U.S. Fly, a "community dedicated to keeping Boeing the world's best manufacturer of aircraft and spacecraft"?

An email from one Joel DiGrado, Watch U.S. Fly community manager, urges: "American workers make the best products in the world. In this age of global competition, we need a better way to voice our support for the policies and decisions that keep those jobs here in the U.S."

Wonder what all these Boeing workers outside the USA who aren't US citizens think of those Trumpian sentiments – not to mention the hundreds of thousands in the global supply chain who help make these "best products in the world"?

Return *Flight*

Your favourite weekly made an appearance in a documentary this month shown on the UK's Channel 5 about 100 years of British Airways (and its predecessors).

Channel 5

Pages through the ages

The vintage issue of *Flight*, from 1949, featured an interview with the by-then retired pilot of the first international scheduled service 30 years earlier – a Lt EH Lawford.

Celebrating centenaries, of course, is so last decade. We marked our 100th birthday in 2009.

Lufthansa

"Let's hope, Herr Flugkapitän, we make it to Toronto before they introduce any more branding changes"

CAT tales

Alan Ferguson – or as he signs himself, Acting Pilot Officer Alan Ferguson SUAS 1972-75 – responds to our review a few weeks back of *The CAT and the Hamsters*, a history of the College of Air Training in Hampshire.

The CAT, he points out, "was the junior flying training organisation at Hamble in the 1970s. Southampton University Air Squadron was undoubtedly the premier unit there."

He adds: "We had a song about CAT, sung to the tune of Monty Python's Flying Circus. It went:

"Golf Alpha Xray Mike Bravo;

"You're 21 to finals, so round you go;

"Flightplan your circuits and chatter on the R/T;

"But steer clear of Chipmunks and steer clear of me."

Ferguson concludes: "I think there were a number of other verses, but I've forgotten them over the years. Perhaps others can remember them?"

Tinge of regret

Lufthansa may be the latest victim of the curse of the high-profile rebrand. Three months after launching its new livery, the German flag-carrier is testing a different version on a Boeing 747-400, using an "optimised", or lighter blue than the controversial darker hue unveiled with much fanfare in February, together with a larger crane logo on the tail.

At least it appears Lufty has responded quickly to public criticism.

It was on an altogether different scale, admittedly, but it took British Airways three years to scrap the disastrous ethnic fins introduced in the Bob Ayling era and famously scorned by a handkerchief-wielding Lady Thatcher.

One-way ticker

No euphemistic messing around from the Chinese when it comes to branding "killer drones".

China Aerospace Long-March's CH-901 loitering munition – displayed at this month's SOFEX 2018 security show in Jordan – is marketed as a "suicide UAV".

Battling Zeppelins

100 YEARS AGO

After persisting in the attack for 35 minutes, the seaplane forced the Zeppelin to retreat. Five minutes afterwards, the oil pipe of the seaplane fractured. Attempts to repair it in the air failed, so the seaplane came down on the water, and the pipe was mended with tape.

Singles to twins

75 YEARS AGO

Basic training on Moths and more advanced flying instruction bring the young pilot up to single-engine Harvards. The pupil may then continue with single-engine aircraft or may pass to twin-engined aircraft preparatory to becoming pilots of the bigger aircraft of the bomber or reconnaissance types.

Apollo situation

50 YEARS AGO

"All three spacecraft sections have passed unmanned flight tests. The rest of 1968 will be devoted to testing them with men aboard." This is perhaps the key sentence summing up the Apollo situation in mid-May 1968.

Hercules upgrade

25 YEARS AGO

US Air Force Lockheed C-130 Hercules are to become the first military transports to be fitted with the traffic-alert and collision avoidance system (TCAS II). New C-130Hs, scheduled for delivery from 1994, will be equipped with the AlliedSignal Aerospace TCAS II units.

100-YEAR ARCHIVE
Every issue of *Flight* from 1909 onwards can be viewed online at flightglobal.com/archive

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A tale of vanity or pure insanity?

Frank Kristensen's letter: "Fond memories" (*Flight International*, 8-14 May), reminded me of an occasion in the early 1970s, on a flight from London Heathrow to Milan Linate in an Alitalia McDonnell Douglas DC-9.

From my starboard aisle seat, close to the front of the aircraft, I observed our gallant captain very shortly after take-off, and while still in the climb, calmly pick up his full-sized Italian newspaper.

He then calmly lit a cigarette and proceeded to read the fully opened newspaper while swivelling slightly to his right.

This was either to allow the pages to be fully extended – which now blocked all of his windshield – or, I suspect, to make him more on show to the passengers.

The stewardess then brought the captain a coffee, and the passengers watched him in semi-profile, in supreme command.

One assumed the co-pilot was monitoring our progress with the aircraft on autopilot.

What I witnessed that day was pure theatre for the benefit of the captain's vanity, in what today would be considered an act of pure insanity.

Perhaps over the course of his career, the open-cockpit-door routine did encourage youngsters to learn to fly; but I hope never with Alitalia, if that was their interpretation of crew resource management.

Richard Roller
via email

AIRPORTS

Solution to capacity constraints

Airbus

Airbus is still producing the A380 largely thanks to Emirates

I find it strange that European hubs are struggling to keep up with air travel demand (*Flight International*, 8-14 May) when there are Boeing 747s and Airbus A380s available.

Carriers in only four European nations have selected the A380; and it takes a Middle East airline to keep the manufacturing line in business. There's something wrong within the industry that created and continues capacity constraints.

European airports should be encouraged to help the airlines to devise their own schedules, enabling large aircraft to be used on at least mid-range routes, or the longer, short-haul operations such as those in Japan.

Peter Carey
Portchester, Hampshire, UK

No competition

Your comment: Out of order (*Flight International*, 17-23 April) about American Airlines' decision to opt for the Boeing 787 over the Airbus A330neo (one assumes the -900, since the -800 appears to be a dead letter), implies that the European airframer will have to work harder to win more US orders.

Surely the "elephant in the room" is cost, and that is never disclosed. The A330-900, at least on paper, really cannot compete against the 787-9.

First, the A330neo is a design dating back to the 1980s, with the only real change being more modern, fuel-efficient engines.

Second, the 787-9 has a greater range, and a lower operating empty weight than its rival, while boasting similar passenger carrying capacity and maximum gross take-off weight.

The only way Airbus will sell the -900 in the USA against the -9 is to sell it for substantially less money.

This isn't rocket science, and of course Toulouse knows the score. The real issue is why the -900 has not sold better worldwide – but see reasons above.

Airbus may also lose the Iran Air order because of US President Donald Trump's decision to nix the Iran nuclear agreement, which, after several years of sales effort, will yield an orderbook of less than 200. At this stage, that is a definite disappointment.

Chris Skillern
San Diego, California, USA

'Sophisticated' Sprite left out

Regarding your special report on unmanned systems (*Flight International*, 24-30 April), I am surprised no mention is made of the ML Aviation Sprite.

This was the most sophisticated of the vertical take-off and landing UAVs, with most systems duplex and fail-safe.

It had a range of interchangeable payloads, ranging from one that remotely detected buried landmines and destroyed them; to sniffing for anti-personnel gases.

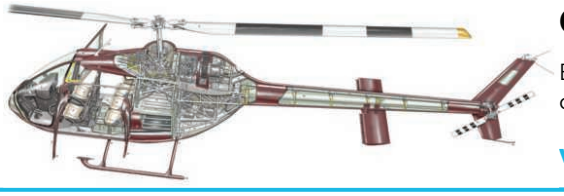
A total of 37 countries ordered the Sprite for both military and civilian operations.

Reg Austin
via email

Floating an idea

With most of the surface of the earth covered in oceans, why not develop a black box that floats?

Robert Freeman
Auckland, New Zealand



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airtattoo.com

16-22 July
Farnborough International Airshow
Farnborough, UK
farnboroughinternational.co.uk

23-29 July
EAA AirVenture
Oshkosh, Wisconsin, USA
eaa.org/en/airventure

15-18 September
World Routes
Guangzhou, China
routesonline.com/events

19-23 September
Africa Aerospace & Defence
Waterkloof, South Africa
aadexpo.co.za

16-18 October
Helitech
Amsterdam, the Netherlands
helitechinternational.com

16-18 October
NBAA
Orlando, Florida, USA
nbaa.org/events/bace/2018

6-11 November
Airshow China
Zhuhai, China
airshow.com.cn/en

14-16 November
Bahrain International Airshow
Sakhir air base, Bahrain
bahraininternationalairshow.com

28-29 November
Aerospace Big Data Summit
London, UK
flightglobal.com/bigdataemea

10-12 December
MEBAA
Dubai, United Arab Emirates
mebaa.aero

7-11 January 2019
AIAA Science and Technology Forum and Exposition
San Diego, California, USA
scitech.aiaa.org

26 February-3 March
Australian International Airshow
Avalon, Australia
airshow.com.au

5-7 March
HAI Heli-Expo
Atlanta, Georgia, USA
heliexpo.rotor.org

10-12 March
Routes Asia
Cebu, Philippines
routesonline.com/events/200/routes-asia-2019/

16-18 April
Aeromart Montreal
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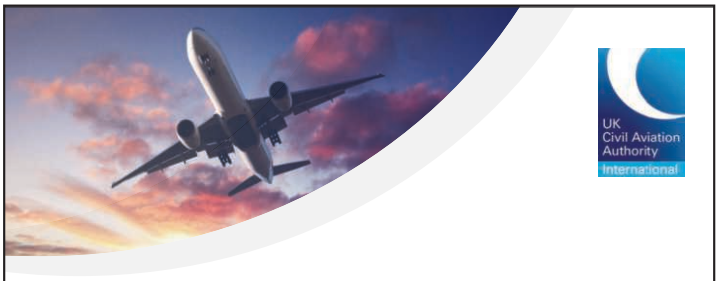

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Closing date for submissions: **Monday 4 June 2018 12:00 Geneva local time.**

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Meteorological Forecaster

DOI-007039

£35,537 to £41,507

A vacancy exists within the Ports Division of the Department of Infrastructure, Isle of Man Government. This post is for a Forecaster at Ronaldsway Meteorological Office, Isle of Man Airport.

Applicants must have completed the UK Met Office Professional Forecaster Training Programme (or equivalent) and have experience of aviation, marine and public weather forecasting and completion of SYNOP and METAR observations. Applicants must also have at least 3 years of experience as a forecaster in an operational environment.

The post is based on a conditioned working week of 37 hours as part of a 24 hour/365 day roster which attracts shift disturbance allowance (20%) and weekend premium pay.

More details of the duties of the post can be obtained from **Adrian Cowin on 01624 821640** or by e-mail: **adrian.cowin@gov.im**

Senior Air Traffic Engineer

DOI-007044

£61,230 to £74,411

A vacancy exists for a Senior Air Traffic Engineer at Isle of Man Airport to be responsible for the management of a team of Air Traffic Engineers, who in turn are responsible for the installation, alignment and maintenance of the Airport's communication and navigational facilities.

Applicants should have previous management experience, and be able to demonstrate a good understanding of the various regulatory and compliance issues associated with the role of Senior Air Traffic Engineer. The successful candidate will be required to work closely with other airport managers on wide ranging issues including Safety Management Systems.

More details of the duties of the post can be obtained from **Paul Clarkson on 01624 821601** or by e-mail: **paul.clarkson@gov.im** or **Ann Reynolds on 01624 81601** or by e-mail: **ann.reynolds@gov.im**

Deputy Airport Director

DOI-007021

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More details of the duties of the post can be obtained from **Ann Reynolds on 01624 821601** or by e-mail: **ann.reynolds@gov.im**

How to Apply

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WORK EXPERIENCE STEVE GRIMES

When business aviation is a passion

Steve Grimes' career has covered a variety of rewarding and challenging roles and his latest ambition, as managing director of Stobart Jet Centre, is to create a fixed-base operator network under the new brand

How did you get into aviation?
I was at university doing a degree in building surveying and found it boring. I applied to British Airways – my dad had regularly taken my brothers and me to watch the aircraft at Heathrow, which I was fascinated by. In those days, there was just a 3ft perimeter fence, which was broken in places.

How has your career progressed?
Eight years with British Airways was great fun and great training. I joined the worldwide operations control centre as an operations clerk. They put me in various departments: finance, catering, sales, operations control and load control. I emigrated to Australia and joined Lloyd Aviation Group as general manager, but had to return to the UK at the end of 1989 when my child became very ill. Luton airport paid for us to relocate, and I was appointed airside operations manager, before joining Servisair as head of commercial operations. After the company was floated in 1996, I was headhunted by Mohammed al Fayed – then co-owner of Harrods department store in London – to set up "the best business aviation services company in the world". He had acquired a venture called Hunting Business Aviation, which was losing £3 million a year. We started by rebranding as Metro Business Aviation. Once the company was performing well, we changed the name to Harrods Aviation. My baby! I spent 10 very happy years building it. After Harrods came Ocean Sky Aviation. It was certainly a challenge building a large group of aviation companies for Russian shareholders. I then worked for myself as an adviser to various aviation companies including the British Airports Authority, BBA Aviation and Inflite Engineering, before joining the Stobart Group in July 2017. Stobart asked me to bring business aviation to Southend airport, and hence the creation of the Stobart Jet Centre (SJC) fixed-base operation (FBO).


Stobart Jet Centre

Grimes says he loves every second of his role at London Southend

What have been your career highlights?
Concorde. Both as a passenger and working on the weight and balance and dispatch team. I enjoyed every minute. I still visit aircraft G-BOAE in its hangar in Barbados whenever I can. Australia was a great adventure too. Flying to places like Moomba and Jackson in the outback was an experience. Floating Servisair was a challenge. Building Harrods Aviation from the start was great fun, and again, a love-affair. The premiere of James Bond movie *Quantum of Solace,* with 12 different plugs for Ocean Sky in the film, was memorable. Our Bombardier Challenger 604 was used in some scenes. Now SJC is my passion, and I love every second. The best bit is building the team, and choosing and putting fantastic people together to create something special.

What were the low points?
Leaving Australia with a sick child, not knowing the future. Leaving Harrods Aviation after 10 years was hard too. Obviously 9/11 was dreadful, and had a terrible effect on business aviation. Worst of all was losing my dad; he taught me so much.

How has the FBO industry evolved since you entered it?
Back in 1997 when I joined Al Fayed and Metro Business Aviation, there was nothing to speak of in Europe and the UK. Luton was quiet, with Magec Aviation its only FBO, concentrating on Hawker business jets. We soon changed that. There are now multiple FBOs at Luton and across Europe, which just didn't exist 20 years ago.

Can you describe your current role?
As managing director of SJC, I am building a vibrant business aviation company at Southend. It is the only 24h airport in the London area that does not have any restrictions for operators this summer. My role is to build, drive and motivate.

What are the plans for SJC?
To grow business aircraft movements at Southend from 1,000 a year to 10,000 by 2022. I also plan to develop a chain of SJCs – probably five in western Europe – and establish Stobart as a major player in business aviation. ■

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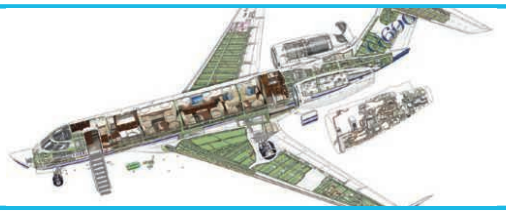

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