

Flight International

17-23 October 2017

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Big move

Garuda 747 retirement sees upstart A380 take ultra-large crown from aged jumbo **9**

Fuel duel

Why Air Canada crew made four Mayday calls as Dreamliner's passage to India went awry **18**

Build wait

Slowing sales make BAE throttle back on production rate for weakening Typhoon **23**

NBAA SHOW REPORT

Taking on the world

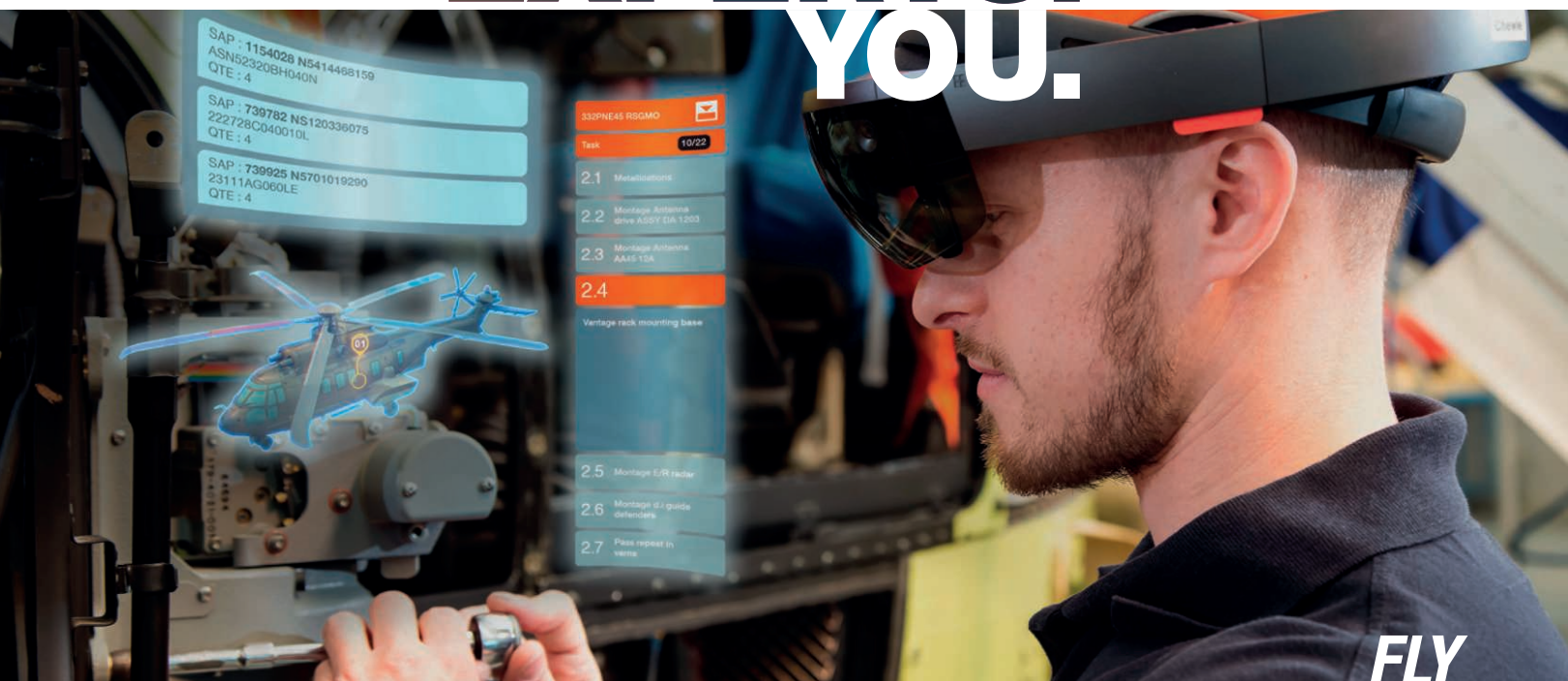
How Global 7000's arrival will shake up top end of the market



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COVER IMAGE

Bombardier provided this shot of its Global 7000 touching down at Henderson Executive airport near Las Vegas, where it was part of the NBAA static exhibit **P10**



BEHIND THE HEADLINES

Our *Flight Evening News* team delivered the goods at the NBAA convention in Las Vegas, producing three bumper issues and a show report from the undisputed main event for the business aviation sector (**P10**)



NEXT WEEK AIRLINERS

Our essential, two-part World Airliner Directory starts with mainliner types, including the 737 Max 8

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With its distinctive shape, Boeing's jumbo jet is one of the most-recognised airliners of all time, but the 747's size and natural flagship status also made it a perfect vehicle for showing off its operators' branding

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Gulfstream considers stretch version of G600 **P11**. 787 made four Mayday calls as it ran low on fuel **P18**



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CAE offers training centres, training services, and simulation products for maritime patrol aircraft.

Image of the week

Rich Cooper took this dramatic shot of an avian encounter involving one of the US Navy P-8A maritime patrol aircraft taking part in the Formidable Shield and Joint Warrior multinational exercises in the UK early this month. The Poseidon was operating from RAF Lossiemouth in Scotland

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

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Rich Cooper

The week in numbers

98%

Flight Dashboard

Czech Airlines rival Travel Service will soon own virtually all of the flag carrier; main shareholder Korean Air will sell its 44%

\$2.6m

AeroVironment

The US Navy has contracted AeroVironment to update and expand its arsenal of Blackwing submarine-launched UAVs

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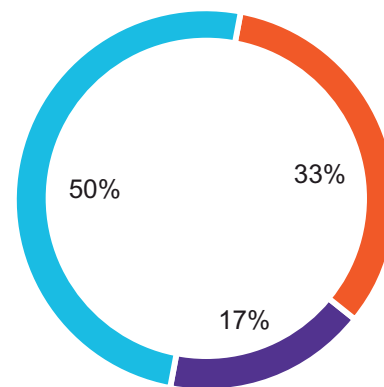
Flight Dashboard

By June 2018 Air New Zealand's seven 777-300ERs will have in-flight wi-fi; its eight -200ERs will be upgraded from April

Question of the week

Last week, we asked: **CR 929?**
You said:

Total votes: 2,294



Modest domestic appeal
1,148 votes

Doomed collaboration
764 votes

Widebody contender
382 votes

This week, we ask: **Boeing 747?**

☐ Still queen of the skies ☐ Tarnished crown

☐ Overthrown by A380

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Half-full or half-empty?

Business aviation has been stumbling along for several years, despite manufacturers' efforts to stimulate the market. Is this a new long-term norm, or is a renaissance just around the corner?

Two of aviation's three economies are growing: military aircraft sales are slowly and steadily on the rise, while Airbus's and Boeing's biggest problem is ramping up output without breaking the supply chain.

And then there is business aviation, which has been sputtering along since 2011. Any real growth in deliveries over the past seven years has later been revealed to be the product of unsustainably low pricing, which, when corrected, drags the figure back to a weak annual average of between 650-700 jets a year.

Is there a path to a healthy, sustainable growth rate, or is the business aviation sector locked into a Sisyphean cycle of oversupply and low demand?

Depending on where you looked in Las Vegas during NBAA, there were reasons for both optimism and doubt.

Despite the market weakness, the industry continues to invest heavily in new products, with several major aircraft types nearing service entry and rumours of more on the way. In addition, a three-year delivery

At some point a new recognition of the likely return on investment could drive a rethink of strategy

binge between 2007 and 2009 is approaching a 10th anniversary, which is historically the age when used jets lose their attraction to the industry's prime buyers. In the longer term, new innovations emerging in electric propulsion and artificial intelligence promise a revolution in the economics of business travel, potentially pushing customers out of cars and into small aircraft for short trips within, and between, cities.

So that is the good news. The inevitable counter-



Time for another gamble?

arguments seem at least as persuasive. It is great that the industry continues to invest in new products, but the introduction of several new aircraft types over the past few years has not led to an increase in overall deliveries. The 10-year mark seems helpful, but a consumer shift from private owners to lessors could mitigate the effect on demand. Electric propulsion and greater cockpit autonomy could change the economics of air travel, but current infrastructure and regulations may need a radical shift to create meaningful growth.

It remains possible – perhaps even likely – that the last six years represent the long-term “normal” for business aviation, with deliveries and pricing ticking up and down around an anaemic annual average not far from the current levels. That is not a disastrous scenario. After the consolidation of Hawker Beechcraft into Textron Aviation, the industry's largest players have shown remarkable resilience. At some point, however, a new recognition of the likely return on investment could drive a rethink of product strategy. ■

See Show Report P10

A changing game

News that the Airbus A380 fleet now exceeds that of the Boeing 747 will have been met with mixed emotions in Seattle.

The decline of the original “queen of the skies” – as a passenger airliner at least – relative to its nemesis is not a milestone that Boeing will have been savouring. But the circumstances in which it has happened certainly vindicates the US manufacturer's long-held pessimism about the size of the ultra-large airliner (ULA) market.

When Airbus launched the A380 in 2000 as a game-changing double-decker to usurp the 747, the jumbo passenger fleet totalled around 740 aircraft, but production of the passenger 747-400 was already in decline.

Based on its assessment of market dynamics, Boeing

told Airbus it needed its eyes tested if it truly believed there was sufficient market to invest in the launch of an all-new ULA. Airbus was convinced that congestion and infrastructure constraints would force the sector to shift upwards to cater for growth.

By the time the A380 made its service debut in 2007, the 747 passenger fleet had declined to 550 units. Even Airbus must be disappointed that it has taken the A380 10 years to overhaul its rival – especially given how slow sales of the 747-8I airliner version have been. With the entire “big-jet” A380/747 passenger fleet now standing at a little over 400 aircraft, the market has indeed shifted – but the wrong way for Airbus. ■

See This Week P9



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BRIEFING

FIRST FLIGHT FOR CHINESE-BUILT A320NEO

PROGRAMME Airbus on 11 October conducted the maiden flight with the first A320neo to be produced at its Chinese plant in Tianjin. The aircraft is due to be delivered to AirAsia, with the carrier having selected CFM International Leap-1A engines. AirAsia has ordered a combined total of 404 A320neo and A321neo twinjets, Flight Fleets Analyzer shows. See Air Transport P19

AIR BALTIC RESUMES C-SERIES SERVICES

INSPECTIONS Air Baltic temporarily halted operations with its fleet of seven Bombardier CS300s on 11 October, amid checks relating to the type's Pratt & Whitney PW1500G engines. The Latvia-based carrier – which began returning its regional jets to use the following day – has not disclosed the nature of the checks, but notes that it co-operates with Bombardier and P&W to “ensure the safety” of its CS300s and to enable them to “perform the necessary upgrades to the aircraft”.

BOOM SUCCESS BOOSTS KC-46A TANKER

TESTING The US Air Force and Boeing have for the first time passed fuel between a pair of KC-46A tankers, with 17,300kg (38,100lb) of fuel transferred by the 767-based type's boom during a 4h test flight. “The milestone flight helps pave the way for the next phases of certification and specification compliance testing,” says Boeing.

RYANAIR OPERATIONS CHIEF OFF THE ROSTER

MANAGEMENT Ryanair has disclosed the resignation of its chief operations officer Michael Hickey, who will leave the Irish carrier at the end of October. The airline has faced significant adverse publicity in recent weeks, after cancelling hundreds of flights amid rostering issues relating to pilots. Hickey is the first senior executive at Ryanair to resign since the scale of the flight-crew staffing issues became apparent.

HAITEC PARTNERS ON SUPERJET OVERHAULS

MAINTENANCE Haitec has become an aftermarket support partner for Sukhoi's Superjet programme. The German company will provide line and base maintenance services for the regional jet, initially at its Erfurt facility, along with select line-maintenance stations, and later at its Hahn headquarters. Venice-based SuperJet International has made the appointment.

RUAG ADDS TO BANGLADESH BACKLOG

ACQUISITION Bangladesh's navy has ordered two additional RUAG Dornier 228NG maritime patrol aircraft, in a move that will increase its fleet of the twin-engined type to four. Flight Fleets Analyzer shows its current assets were ordered in 2011 and delivered during 2013.

TAXIBOT GAINS US 737 APPROVAL

OPERATIONS The US Federal Aviation Administration has approved the Israel Aerospace Industries TaxiBot pilot-controlled tow tractor for use with Boeing 737s. The supplemental type certificate, which covers the full range of 737 Classics and NGs, joins those issued by the European Aviation Safety Agency and Israel's civil aviation authority. EASA and the FAA had previously approved the TaxiBot's use with Airbus A320-family jets.



Aaron Cassebeer/Scaled Composites

P&W JT15D-powered prototype can fly up to 30,000ft and Mach 0.6

DEVELOPMENT STEPHEN TRIMBLE WASHINGTON DC

Rutan clan unveils a well-kept secret

Scaled Composites' latest experimental aircraft, the Model 401, is the first of two vehicles to be built under contract

Northrop Grumman subsidiary Scaled Composites has unveiled and flown a new experimental aircraft, called Model 401.

“Scaled worked with a proprietary customer to build two vehicles to demonstrate advanced, low-cost manufacturing techniques and to provide aircraft for research flight services to industry partners and the United States government,” the company says.

The Mojave, California-based rapid prototyping specialist developed and flew the single-engined, single-seat Model 401 in secret, revealing the first flight milestone with a press release and an announcement on Facebook on 11 October.

“We had a great flight and we are looking forward to the future test programme,” Scaled Composites' project engineer Aaron Cassebeer says in a Facebook post.

The 3,630kg (8,000lb) maximum take-off weight aircraft, featuring a 3,050lb-thrust (13.5kN) Pratt & Whitney Canada JT15D-5D turbofan mounted atop the fuselage behind the cockpit, is capable of flying at up to 30,000ft and Mach 0.6, Scaled Composites says. It cites a flight endurance of up to 3h.

“The Scaled team plans to continue envelope expansion on the

first aircraft as they move toward first flight of the second Model 401 vehicle,” the company says.

The design's 11.6m (38ft) wingspan, resembling the wing planform of the General Atomics Aeronautical Systems Avenger unmanned air vehicle, has a highly swept leading edge with a straight inboard trailing edge and a swept outboard trailing edge.

The aircraft continues a long line of experimental types from Scaled Composites, a company founded by maverick design guru Burt Rutan, who retired after selling the company to Northrop.

In the last decade, Scaled Composites has unveiled several new research programmes, including the BiPod and Firebird aircraft. The company is also known for coming up with groundbreaking designs such as SpaceShipOne, SpaceShipTwo, Proteus, Voyager and WhiteKnight.

Additionally, the company is currently producing the world's largest aircraft, Stratolaunch, with funding from Microsoft co-founder Paul Allen. Powered by six Pratt & Whitney PW4056 turbofan engines, the twin-hulled type will have a payload capacity of more than 227,000kg and a range of around 2,000nm (3,700km). ■



Hybrid Zunum
targets regional
market
This Week P8

INVESTIGATION DAVID KAMINSKI-MORROW LONDON & JON HEMMERDINGER WASHINGTON DC

Bombardier subsidy dispute intensifies

Canadian and British governments urge Boeing to withdraw complaint as USA seeks to increase import duty on CS100s

The swirling trade row between Boeing and Bombardier, their respective government backers and CSeries customer Delta Air Lines has deepened, with all sides adopting increasingly entrenched positions.

Already reeling from a US Department of Commerce decision to impose subsidy-related import duties of 220% on CSeries aircraft sold into the USA, Bombardier was dealt a fresh blow on 6 October, when another 80% duty was added to the total, based on findings that it “dumped” the CS100s.

Both decisions remain subject to final rulings and to findings of concurrent investigations conducted by the US International Trade Commission.

“The United States is committed to free, fair and reciprocal trade with Canada, but this is not our idea of a properly functioning trading relationship,” says US commerce secretary Wilbur Ross.

Bombardier repeats its defence of the subsidies paid by the Canadian and UK governments and notes that the Department of Commerce’s approach to the investigation “completely ignored aerospace industry realities”. Boeing has sold aircraft “below production costs for years after launching a programme”, it says.

“This hypocrisy is appalling, and it should be deeply troubling to any importer of large, complex and highly-engineered products,” says Bombardier.



Justin Trudeau (left) told Donald Trump the tax is “not warranted”

Boeing, however, says the ruling “confirms that, as Boeing alleged in its petition, Bombardier dumped its aircraft into the US market at absurdly low prices”.

The Department of Commerce intends to announce the final determinations from both the subsidy and dumping investigations on 19 December.

However, Bombardier’s governmental cheerleaders have upped their defence of the embattled airframer, and, by extension, the subsidies they provided. Following a meeting with the US President on 11 October, Canadian Prime Minister Justin Trudeau said he told Donald Trump that the decision to impose the 300% import tax was “not something that is warranted and something we look very negatively upon”.

He reiterated his government’s position that it would no longer consider Boeing for future defence orders.

Meanwhile, Boeing’s case has been categorically rejected as having no merit by the UK government, which has urged the US airframer to immediately withdraw the complaint, noting that it was “unjustified and unwarranted” and “incompatible” with a long-term partner of the country.

The UK’s provision of £113 million (\$150 million) in repayable launch investment, made in 2009, forms part of Boeing’s argument. But business secretary Greg Clark told parliament on 10 October that the government firmly refutes the allegation and is “totally confident” that the funding complied with international rules. ■

ORDER EDWARD RUSSELL WASHINGTON DC

Delta stands by commitment to CSeries

Delta Air Lines chief executive Ed Bastian is confident that the carrier will take delivery of the 75 Bombardier CS100s it has on order without paying a proposed 300% tariff on the aircraft.

“There may be a delay... but we do not expect to pay any tariffs and we do expect to take the planes,” he said in a third-quarter earnings call on 11 October.

However, he admits that the carrier has “various other plans and alternatives” should delivery be delayed beyond 2018, but declines to elaborate.

Bastian maintains Delta’s view that Boeing has not made a comparable aircraft to the CSeries since the 717-200, which the airframer discontinued in 2006.

“It’s very hard for Boeing, or any US manufacturer, to claim harm from a product they don’t produce,” he says, pointing out that Boeing proposed used Embraer 190s in the campaign won by the CSeries.

Delta plans to configure its CS100s with 110 seats, the same number as on its 717-200s, while its 737-700s have 124 seats. ■



Carrier’s CEO says Boeing’s discontinued 717-200 was its last comparable product

Ottawa ups interest in surplus Hornets

Canada has expressed formal interest in acquiring some of Australia’s legacy Boeing F/A-18A/Bs, marking a significant development in its air force’s search for fighters that could temporarily fill its current CF-18 fleet’s mission.

Last month, Canadian defence minister Harjit Sajjan expressed interest in Australia’s in-service Hornets, and on 29 September, Ottawa submitted a formal expression of interest to Canberra. Its government expects to receive a response by the end of 2017

with details on pricing and availability, it announced on 9 October.

After Lockheed Martin’s F-35 fell out of favour with the ruling Liberal Party and Canadian Prime Minister Justin Trudeau, Ottawa identified an interim batch of F/A-18E/F Super Hornets as a potential solution.

But the nation’s government suspended talks with Boeing following the eruption of the trade row centred on government subsidies and the sale of Bombardier CS100s to Delta Air Lines.



ASSESSMENT DOMINIC PERRY LONDON

Airbus powers on with electric flight system tests

Airbus Helicopters has completed the first full-scale tests for the electric-powered propulsion system on its City Airbus demonstrator, ahead of a planned maiden flight next year.

Conducted at the manufacturer's facility in Donauwörth, Germany, the trials assessed the performance of the individual ducted fans. In addition, checks were carried out on the integration of a full-scale propulsion unit with two fans, a 100kW electric motor and all electrical systems.

Designed to perform vertical take-offs and landings with four people on board, the City Airbus concept is aimed at improving

urban mobility in congested mega-cities, says the manufacturer.

Power on of the first full-scale demonstrator aircraft is planned in early 2018, to be followed by a series of ground tests which will culminate in an unmanned first flight before year-end. The airframer has already accumulated around 200h of flight time using a scaled mock-up of the design.

Airbus Helicopters anticipates achieving service entry for the 2t maximum take-off weight platform in 2023.

It will initially be a piloted aircraft "to ease certification and public acceptance" before fully autonomous operations are introduced later in the next decade.

Meanwhile, Airbus Helicopters has started trials of a new internally-developed advanced sensor-fusion package linked to a rotorcraft's flight-control computers.

AUTONOMOUS FLIGHT

Initially designed to automate and stabilise approaches, take-offs and landings, it will ultimately pave the way for autonomous flights. Called Eagle – or Eye for Autonomous Guidance and Landing Extension – it combines a gyro-stabilised optronics package with on-board video analytics.

Future versions of the Eagle package will gain a Lidar system to allow object detection and 3D terrain reconstruction.

Airbus Helicopters believes the system will increase situational awareness and cut pilot workload during approaches, as well as addressing "future requirements for operations in urban environments", says Tomasz Kryszinski, its vice-president for research and technology.

"Ultimately, Eagle will also contribute to improve the safety, autonomy and performance of future unmanned vehicles."

Ground tests of Eagle began in May, with flights now taking place aboard an H225M testbed.

"The value we can add is coupling [the sensors] with the autopilot. It is the first step to full autonomy," says Kryszinski. ■

DEVELOPMENT STEPHEN TRIMBLE WASHINGTON DC

Hybrid Zunum targets regional market

Seattle-based start-up launches highly efficient battery and turbine-powered design with backing of Boeing and JetBlue

Seeking to serve a neglected market for inexpensive, short-range air transport, Zunum Aero formally launched development of a six- to 12-seat hybrid-electric design on 5 October, promising to deliver the aircraft within five years.

The low-wing, V-tailed aircraft is aimed at providing air transport on routes up to 700nm (1,300km) for seat-mile economics equivalent to a 78-seat Bombardier Q400 turboprop, says company founder Ashish Kumar.

However, he notes that the automotive industry has more to worry about from its planned development than manufacturers of regional turboprops or small regional jets, as cars, not aircraft, account for the vast majority of all travel under 300nm. "The people that should be afraid are the guys that make cars," he says.

But the regional aircraft market is also ripe for disruption, he says. "From our standpoint, it has a lot to do with cost," he says. "The



Company says it will deliver a six- to 12-seat aircraft within five years

regional market is largely flying 1960s, 1970s, 1980s technology."

With the financial backing of Boeing HorizonX, JetBlue Technology Ventures and Washington state's Green Energy Fund, Zunum seeks to modernise the regional aircraft by inserting a hybrid-electric propulsion system to lower operating costs by 40-80%.

The aircraft is designed to carry batteries in wing compartments for normal power, then use a gas turbine engine to generate electric

power to extend the aircraft's range. Despite a design that still requires a gas turbine engine, two 500kW generators and batteries, Zunum believes the acquisition cost of the aircraft can be kept below the list price of a \$4.5 million single-engined turboprop, such as the Cessna Denali or Pilatus PC-12.

In addition to saving on fuel, the operating costs for the Zunum aircraft should be kept low by using Part 23 airworthiness certification requirements, says Kumar.

If operated with an all-premium, nine-seat cabin, the Zunum aircraft can be operated by only a single pilot, versus a crew of two pilots and a flight attendant for the Q400, Kumar says. Zunum also is designing the fly-by-wire aircraft to be able to operate without a pilot on board, he adds.

SURROGATE AIRCRAFT

Zunum has started surveying four potential vendors – GE Aviation, Honeywell, Rolls-Royce and United Technology Aerospace Systems – to supply the 500kW-class electric generators. The powertrain rig will begin flight testing on a surrogate aircraft in 2019 from the company's facilities near Chicago, he says.

Maiden sortie of the Zunum aircraft will follow a year later, followed by first delivery in 2022.

UK airline EasyJet recently announced a partnership with Los Angeles start-up Wright Electric, with the aim of bringing to market an electric-powered 180-seat airliner by 2027. ■



Bombardier blasts
back at the big boys
[Show Report P10](#)

ANALYSIS MAX KINGSLEY-JONES LONDON

A380 finally eclipses waning monarch

With latest retirements, operational superjumbo fleet now outstrips that of 747, but is Airbus's victory just a Pyrrhic one?

When Garuda Indonesia retired its final Boeing 747-400 on 9 October, it marked an inevitable milestone for the original queen of the skies as the 747 passenger in-service fleet declined below that of the Airbus A380.

It is now 10 years since the A380 entered service, and over that decade Airbus has shipped 216 A380s to 13 customers. Of these, 213 are currently operational, Flight Fleets Analyzer shows (two Singapore Airlines A380s are grounded as they are being returned off lease, while an Air France A380 is in Goose Bay after its recent engine problem).

When the A380 arrived in ser-

vice in 2007, the 747 passenger fleet totalled around 550 units. As the A380 fleet has expanded, the numbers of the original jumbo jet have declined every year – despite production of the type continuing.

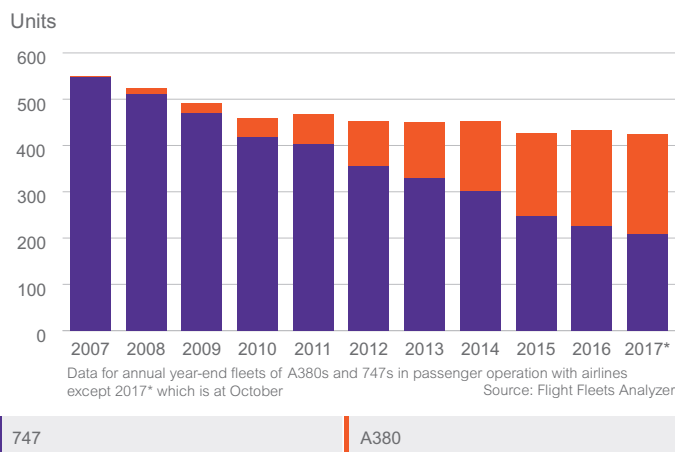
Flight Fleets Analyzer shows that with the Garuda retirement, there are 209 747s in passenger operation with airlines, while a further 326 aircraft are in service in freight, VIP and other non-passenger-airline roles. The combined A380/747 airline passenger fleet stands at 423 aircraft, meaning that the worldwide fleet of ultra-large airliners has declined by over a fifth during the last decade.

“Airbus has succeeded in



British Airways is one of a handful of carriers still operating both types

A380/747 fleet evolution



removing the 747 as a competing aircraft,” says Richard Evans, senior consultant at Flight Ascend Consultancy. “However, the future market-share battle seems to have shifted to large single-aisles and 300-seat twin-aisles.”

Boeing has delivered a total of 118 of its re-engined 747-8 family since 2011, but the majority – 74 aircraft – are of the -8F cargo variant. Just three airline customers have taken the -8I passenger version: Air China, Korean Air and Lufthansa.

The last 747-8I on order by an airline was delivered to Korean Air (HL7644) on 31 July; the backlog currently stands at 17 aircraft, including three for VIP customers. It remains to be seen if Boeing can secure any additional airline orders

for the passenger 747, however.

“The market has spoken,” says Flight Ascend Consultancy’s head of market analysis, Chris Seymour. “Instead of the 747-8I (or indeed A380) being the natural replacement for 747-400s, most airlines have downsized to twin-engined types to be able to offer higher frequencies and more routes. Focus is now on the 777X and A350-1000 for the 2020s. Boeing’s decision to reduce 747 production to six units a year is effectively to meet freighter demand.”

The 747 passenger fleet is poised to shrink further in the coming months, as the two major US operators – Delta Air Lines and United Airlines – end their operations of the type. ■

See Feature P26

PilotView

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NBAA 2017

The NBAA Business Aviation Convention and Exhibition, from 10-12 October, was the first major event to take place in a Las Vegas shaken by a 1 October mass shooting. City representatives thanked NBAA for "being here with us". Despite the sombre mood, it was an upbeat industry that arrived for the world's biggest business aviation show. Jon Hemmerdinger, Murdo Morrison, Alan Peaford, Kate Sarsfield and Stephen Trimble report. Images by BillyPix



PROGRAMME

Bombardier blasts back at the big boys

Global 7000 makes its show debut, with Canadian airframer now planning to take on Airbus and Boeing executive jets

Bombardier's Global 7000 made its NBAA show debut, in the process creating waves among potential competitors.

The 33.9m (111ft)-long business jet pushes the Canadian aircraft into a size class normally reserved for derivatives of commercial aircraft, such as the 33.9m-long Airbus ACJ319neo and the 33.7m-long Boeing Business Jet (BBJ).

"It's 111ft 2in from tip to tail. It has an impressive wingspan of over 104ft and it has four dedicated living spaces," Bombardier Business Aircraft president David Coleal says. "No other business jet rivals the Global 7000 aircraft. It is redefining the segment in performance, smooth ride and interior comfort."

Those characteristics have al-

ready captured the industry's attention. Airbus Corporate Jets redirected its traditional criticism of the BBJ towards private jets, noting what it considers the ACJ319neo's advantages over other ultra-long-range, large-cabin products.

The fresh attacks from Airbus recall the company's commercial confrontation with the Bombardier CSeries since 2008. In 2015, Airbus chief operating officer, customers John Leahy attacked the CSeries as an "orphan".

Boeing has been even more aggressive on the legal front, launching a trade case at the US Department of Commerce against a deal to sell CSeries aircraft to Delta Air Lines.

Unlike the commercial scenario, Bombardier Business Aircraft is one of the dominant players in



Fuselage length is comparable to that of rivals' converted airliners

the large-cabin market, with deliveries of 50 Global 5000/6000 business jets annually.

The backlog for the Global 7000 is sold out until 2021, after

deliveries begin by the end of 2018, Coleal says.

"Tests are showing an exceptionally high level of system reliability," he says. ■



Apollo 13 commander Jim Lovell voices his support for NBAA

CAMPAIGN

Legends line up against ATC sell-off

National Business Aviation Association chief executive Ed Bolen says airline-backed moves to privatise the US air traffic control (ATC) system are "The biggest threat to the future of our industry we have ever seen."

The organisation has launched a television campaign themed "ATC not for sale" and fronted by "leaders and legends" of aviation, including Apollo 13 commander

Jim Lovell, Miracle on the Hudson pilot Capt Chesley Sullenberger, and retired US Air Force Gen Lloyd Newton.

The adverts are running on cable stations watched by politicians and their advisers.

Both Lovell and Sullenberger appeared at NBAA to urge attendees to sign a petition opposing any moves, proposed by the Trump administration, to transfer ATC from

the control of the Federal Aviation Administration.

The effort is intended to counter a well-funded campaign by the major airlines that portrays business aviation users as privileged abusers of the ATC system, who, it argues, want unfettered access to the detriment of ordinary airline passengers.

Bolen describes it as "an ugly caricature of what we do". ■



New delay creates crisis for Silvercrest
Show Report P12

NBAA 2017 Show report



WE HAD IT COVERED

Flight Evening News – the industry's only same-day show newspaper – produced three packed and lively editions during the event. You can read them on our show landing page flightglobal.com/nbaa



OVERVIEW

Questions remain on industry's plans but hints are there

Despite continued market stagnation, manufacturers are striving to achieve service entry for a host of new aircraft

NBAA passed without answers emerging to the business aviation industry's burning questions, but clues about the next moves of several busy manufacturers abounded.

The lack of new product announcements and the anemic state of sales activity combine to offer a strong impression of a business aviation industry slogging lazily through an extended period of stagnation.

But nothing is further from the truth. It is true that business jet deliveries have flat-lined to around 700 units since 2011, after recovering from a three-year freefall from 1,120 aircraft in 2008. Still, four of the industry's five largest manufacturers – with Embraer as the only exception – have never seemed more active, with seven new business jets combined in development and expected to enter service over the next four years. And that is not counting announced new offerings from Pilatus and Chinese airframer AVIC.

Amid the acknowledged development commitments are hints of still more new product activity

that remain undisclosed and range from light turboprops to ultra-long-range, large-cabin jets.

Pratt & Whitney Canada's disclosure, in a press conference on the eve of NBAA on 9 October, illustrates one of the intriguing mysteries across the industry right now. For several years, P&WC has teased interest in developing a new 2,000shp (1,490kW)-class turboprop engine. At this event, the company went a step further, saying that component-level demonstrator tests have begun.

The company is on a pace to have a new engine ready within a few years, yet so far there are no declared platforms that can use it. Textron Aviation selected the GE Aviation advanced turboprop for the Cessna Denali. The single-engined Denali poses a formidable competitive challenge to the Pila-

As Gulfstream has no answer to the Global 7000, JetCraft thinks a "G750" will enter service in 2020



Gulfstream is reported to be contemplating a stretch of the G600

tus PC-12NG, yet so far the Swiss manufacturer has announced no plans to launch a response. If the P&WC engine finds a home anywhere, however, it would likely be with the Swiss airframer.

Similar hints of intrigue could be found in JetCraft's 10-year forecast of the industry, which was also released on the eve of the NBAA convention.

Although the forecast claims no privileged insight into manufacturers' future product plans, it reflects the industry's assumptions about the next major moves by several key players.

For example, Gulfstream currently has no answer for the Bombardier Global 7000, which is scheduled to enter service with a longer cabin and a similar range to the G650ER. So JetCraft anticipates a "G750" from Gulfstream to enter service in 2020, possibly as a new stretch of the G600, which is scheduled to enter service in 2019.

As the third manufacturer of ultra-long-range business jets, Dassault may want to enter the same market, so JetCraft anticipates a Falcon "9X" model to enter service by 2023.

Gulfstream has also stopped production of the super-large G450, with the far more capable G500 on track to enter service later this year. But that still leaves a yawning gap in its range between the super midsize G280 and G500, so JetCraft expects the Savannah-based manufacturer to field a new "G400" by 2023.

Finally, Embraer has invested billions over the last decade to field four clean-sheet business jets and two major derivatives of commercial aircraft for the segment, so is currently taking a pause. But JetCraft does not expect the Brazilian company to wait long. A large-cabin Legacy 7000 is projected to enter service in 2023, replacing the ERJ-135-derived Legacy 650. ■



PROPULSION

New delay creates crisis for Silvercrest

Dassault chief executive refuses to commit to in-development engine, after Falcon 5X schedule is knocked further back

A “serious” new problem discovered five years into testing the Safran Silvercrest engine has shaken Dassault Aviation’s confidence and raised questions about the future of France’s only hope to remain one of the world’s few designers of turbofan propulsion systems.

A clearly displeased Dassault chief executive, Éric Trappier, declined to offer an explicit commitment to remaining with the Silvercrest for the large-cabin Falcon 5X when asked during a 9 October news conference if he would start considering other engine suppliers.

“It’s too early to say. We are trying to fix the problem with Safran. We are trying to keep all options open,” he says.

As more questions were raised about details of the new problem, Trappier called on Safran vice-president of commercial engines Cédric Goubet, who was seated among a standing-room only press conference audience, to come to the front of the room and respond.

POSITIVE STEPS

At first, Goubet attempted to emphasise the positive. The fixes put in place to resolve a previous two-year delay with the Silvercrest – involving oil-fuel heat exchanger problems and clearance controls in the high-pressure core of the engine – appeared to be working as the Falcon 5X passed 50h in flight test since a debut sortie on 5 July, he said.

But Safran has discovered a new problem in data from the company’s San Antonio-based flying testbed and in simulations on the ground, he says. The data reveals new problems with acceleration and deceleration of the engine at high altitude and low-speeds, he says.

The cause of the problem, discovered five years after Safran delivered the first Silvercrest engine to test in September 2012,



Maiden sortie of ultra-wide-cabin aircraft was performed with preliminary version of Safran powerplant

remains under investigation. As that evaluation continues, Trappier says, the impact on the programme is not clear, but Dassault expects 5X service entry to slip even further beyond 2020.

“We’re very confident in Safran as a partner. A lot of the problems should soon be well behind them”

Brad Thress
Textron Aviation

Despite Dassault’s clear frustration over the new setback, Safran’s other customer for the Silvercrest engine remains supportive. Textron Aviation selected the Silvercrest to power the original version of the Citation Longitude, which was launched with a 4,000nm (7,400km)-range goal. But Textron dropped the Silvercrest two years ago when it redesigned the Longitude to fly up to 3,500nm. Instead, the company selected Safran’s turbofan to power the new Citation Hemisphere, which is scheduled to achieve a first flight in 2019 with a range goal of up to 4,500nm.

“We’re very confident in [Sa-

fran] as a partner,” says Textron Aviation senior vice-president of engineering Brad Thress. “A lot of that should be well behind them before we get to that point of our programme.”

But the Silvercrest’s development problems plague Safran’s plans to remain a full-service developer of modern turbofan engines. The company last designed a full engine, for the Dassault Rafale, about 20 years ago. Its largest business involves supplying the low-pressure sections of the CFM International CFM56 and Leap powerplants. But the Silvercrest represents the first engine to feature Safran-designed low- and high-pressure sections since the Rafale’s M88.

Safran approached the design of the Silvercrest with a unique architecture for a turbofan engine in the 10,000-12,000lb-thrust (44.5-53.4kN) class. Such powerplants usually feature a compressor design with axial airflow, meaning the air passes in a straight line through the compressor.

Smaller engines ranging up to about 7,000lb-thrust often use a different architecture, with the airflow passing axially through the first several stages of compression and then passing

around – or centrifugally – over the last stage. Despite the size of the Silvercrest, Safran selected an axial-centrifugal architecture.

Company officials have explained the decision as a chance to make a breakthrough in propulsion efficiency in the 10,000-12,000lb-thrust power category.

If an axial-centrifugal architecture can be made to work at such thrust levels with the Silvercrest, Safran could deliver a step-change in fuel efficiency to a segment of the market that currently has no other modern alternatives.

COMPLEX ARCHITECTURE

But it is becoming increasingly clear that such an architecture is more complex to achieve than Safran expected. The Silvercrest design can still deliver a breakthrough, but it must overcome the latest setback.

Safran’s rivals may not wait for that moment, however. Pratt & Whitney Canada chief executive John Saabas acknowledges the firm currently does not have an engine to offer Dassault as an alternative, but that could change. It may be able to adapt the core of the currently 15,000lb-thrust PW800 to the 10,000-12,000lb-thrust category. ■

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INTERIOR

Full cabin upgrade gives Phenom 300 Enhanced appeal

Alterations include new seats and entertainment system, as airframer brings first major changes to light jet since launch

Embraer unveiled a new version of its Phenom 300 at the show, designed to boost the appeal and value proposition of its best-selling light business jet. The Phenom 300E – or Enhanced – marks the first major upgrade to the seven-seat twin since its introduction in 2009.

The new model has a completely redesigned cabin, with the aim of the modifications – which include new side-walls and restyled seats – to create a much roomier interior.

The new seats feature broader backs for better support, extendable

ble headrests with bolsters, and extendable leg rests for improved passenger ergonomics.

The aircraft's seats – which are available in a choice of four designs – were created by the Brazilian airframer and will be manufactured at its Aero Seating Technologies subsidiary in Titusville, Florida.

The Phenom 300E will also feature Lufthansa Technik's Nice cabin management and in-flight entertainment system. The controls are incorporated into what Embraer describes as "an industry-exclusive upper technology



The 300E will feature Lufthansa Technik's Nice IFE and cabin system

panel" situated along the centreline of the aircraft's ceiling, to "significantly improve passenger ergonomics".

Audio and video on demand are accessible via two "slender" swing-down 7in (17.7cm) displays, says Embraer. The unit also offers an enhanced cabin lighting scheme, with a broad range of ambient mood selections. Bluetooth connectivity also allows passengers to view in-flight information on their per-

sonal devices.

Embraer Executive Jets chief executive Michael Amalfitano says the Phenom 300E "sets a new standard in value and customer experience [and] reflects our commitment to fascinate our customers".

The Phenom 300 was launched in 2005 along with the smaller Phenom 100 – which was raised to the E standard in 2013, followed by the launch of the EV variant in 2016. ■

REMANUFACTURING

Nextant pushes Challenger 604XT to next stage

Nextant Aerospace has embarked on the second phase of its Challenger 604XT remanufacturing programme, which will include a performance enhancement to the existing airframe and an entirely new cabin design.

The announcement comes five months after Nextant launched the project – a revamped Bombardier Challenger 604 – which introduces a Rockwell Collins Pro Line Fusion flightdeck in place of the legacy Pro Line 4 suite.

Flight testing of the Fusion avionics on a Challenger 604 began in September. Nextant's executive vice-president Jay Heublein describes the response to the 604XT as "exceptional". The company has secured a launch customer for the aircraft and plans to deliver the first example shortly after certification in mid-2018.

"With a large portion of the



Tests of single-lever power control system in G90XT are complete

certification effort for the cockpit behind us, we will embark on phase two of our overall solution for this airframe," he says.

Improvements include a "radically new cabin" – renderings for which were shown for the first time at NBAA. It features a redesigned entryway, including a door between the air stair and

galley, designed to help reduce exterior wind noise.

The front half of the cabin is designed as an "all-new, ultra-modern media room hosting the latest in connectivity technology", says Heublein. The rear is separated from the forward half and features VIP seating with a full-width conference/dining

table. Phase two changes also include an increase in the aircraft's range of up to 500nm (925km), which is described by fellow Nextant executive vice-president Mark O'Donnell as "a true game-changer for consumers".

"We will now be able to link New York with London on a non-stop basis, or Boston with western Europe in both directions," he says. Nextant projects an 18- to 24-month certification timeframe for the range and interior enhancements, but expects some customers to opt for the cockpit upgrade initially and then add the other features at a later date.

Meanwhile, Nextant has wound up certification testing for the integrated single-lever power control system in the G90XT and expects to secure US airworthiness approval for the twin-engined turboprop within the next 30 days. ■



Honda Aircraft plans output increase, with China in sights
Show Report P17

START-UP

Stratos seeks \$200 million to fund personal jet ambitions

Oregon-based developer says four financiers are interested in backing 714 programme

Stratos Aircraft is seeking about \$200 million to bring its Stratos 714 personal jet to market, and is in discussions with four potential investors who have expressed a keen interest in the high-performance single, which was making its NBAA debut.

Michael Lemaire, chief executive of the Oregon company, says that “while there has been strong investor interest in the programme” Stratos will not open formal discussions until it has pinned down the aircraft’s performance numbers. “This could be as early as next year,” he says.

The Stratos 714 was launched in 2008 and the proof-of-concept aircraft made its first flight in November 2016. To date it has logged 80h across 44 sorties, reaching speeds of 320kt (590km/h) and an altitude of 18,000ft.

The second proof-of-concept



Initial proof-of-concept prototype has logged 80h across 44 sorties

prototype will enter flight testing in mid-2018.

The 714 programme has been funded internally so far, Lemaire says. “We have enough money to complete testing of the proof-of-concept aircraft, but will need the investment when we launch the certification campaign.”

The current aircraft is powered by a 2,900lb-thrust (12.9kN) Pratt & Whitney Canada JT15D-5 tur-

bofan, but the certificated aircraft will feature a 3,400lb-thrust PW535E, says Lemaire.

The 714 is projected to have a cruise speed of 400kt and a range of 1,500nm (2,780km). It is pitched against the Cirrus Vision Jet – the only Part 23 certificated single-engined jet on the market – the Embraer Phenom 100, and Daher TBM 910/930 and Piper M600 turboprop singles. ■

ORDER

Learjet will stay on the Wichita line as Zenith signs for 75s, doubling fleet

Bombardier has announced an order for two Learjet 75s from UK charter company Zenith Aviation, and stressed its continued commitment to the super-light jet.

Zenith’s order doubles its Learjet 75 fleet and comes on the back of growing demand for charter within the UK and Europe.

The deal also helps increase

the backlog for the Learjet 75, which remains sold out until mid-2018, Bombardier says.

The airframer believes the sole remaining Learjet type can stay in production for several years at a rate of one aircraft per month.

The Wichita site was built to produce several dozen Learjets each year, but Bombardier says the line can remain economical because the location has since been diversified.

In addition to producing new Learjets, the Wichita complex is maintenance base for the worldwide fleet and for Global jets. Bombardier also uses the site to operate flight-test missions. ■



Bombardier intends to keep producing twinjet for foreseeable future

CHARTER

VistaJet sizes up on back of booming USA

Three years after launching in the USA, VistaJet – one of the world’s largest charter operators – plans to increase its N-registered fleet of 11 to at least 16 aircraft in the “next months” to reflect demand in North America.

The company says it tripled US customers and increased new programme hours by 150% in the third quarter, compared with the same period in 2016.

US-originated flights now represent around a quarter of all VistaJet departures, says Ron Silverman, president of VistaJet’s US operation.

However, the additional aircraft will be “reallocated” from the rest of the VistaJet inventory. The Malta-headquartered company has no plans to add to its overall fleet of 72 Bombardier Global and Challenger aircraft until at least 2019.

In September, VistaJet boosted its balance sheet by raising \$200 million from private equity firm Rhône Capital. While the investment – made in return for a roughly 7.5% stake in the company – will not be used for new aircraft, Silverman says that “it gives us ready capital if a situation advantageous to the VistaJet model arises”.

VistaJet’s Maltese-registered aircraft can operate international flights to and from the USA, but its N-registered aircraft are required for domestic journeys.

The company, founded in 2004, is taking a Global 5000 on a marketing tour of six US cities between 16-23 October.

VistaJet says its liveried fleet and its business model, where customers pay only for the hours they fly, sets it apart from rivals.

To help fill empty legs, the company has launched an app-based booking platform, where members, in exchange for a fee, can book rides at discount rates on positioning flights or when an aircraft is idle for several days at an airport. ■



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made four
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Light jet – which appeared on static display in Las Vegas – is powered by twin GE Honda HF120 engines

RAMP-UP

Honda Aircraft plans output increase, with China in sights

US-based manufacturer examines means of raising production while keeping costs steady

After hitting a production rate for the HondaJet of four-a-month only a year after entering service, Honda Aircraft is looking at ways to increase production by 25% as it launches a sales campaign in China.

The Greensboro, North Carolina-based manufacturer ramped up to four HondaJet deliveries a month last January, enabling the company to ship 24 of the 422kt

(780km/h)-capable light business jets up to 1 July. The HondaJet entered service in December 2015.

Now, Honda executives are considering how to raise production to five aircraft per month, chief executive Michimasa Fujino says.

The goal is to achieve the rate target, while holding assembly labour costs steady by reducing

the number of hours it takes to build each aircraft, he says. Honda does not disclose how many orders are in the company's backlog, but Fujino says the company is trying to sell 1-1.5 aircraft for every HondaJet delivered.

As the company looks to boost production, Honda has launched plans to enter the Chinese market, and has appointed a dealer, Honsan General Aviation. ■

TECHNOLOGY

Stellar believes industry lags in the internet era

Business aviation has failed to grasp the benefits of the internet age and is ripe for a technological revolution that will change the industry forever.

That is the view of Stellar Labs, the Silicon Valley technology company that has just picked up \$26.3 million of investment from AE Industrial Partners, Carlyle Group, Columbia Equity Partners, Global Jet Capital, Blackstone unit GSO Capital Partners, and Garrett Camp, the founder and chairman of Uber.

The investors are backing Stellar's belief that, along with partner Rockwell Collins, it can develop technology that will remove the manual inefficiencies that hinder the backroom and booking practices of charter operations.

"There are lessons to be learned from commercial aviation," says Paul Touw, Stellar's founder. "The great expansion in commercial aviation happened after the advent of the computer, not the airplane." Stellar is investing more than \$50 million in its next-generation technology platform. ■

PROGRAMME

PC-24 makes a return as entry into service nears

Pilatus's PC-24 returned to NBAA, as the superlight business jet reaches the final stages of its certification campaign.

The clean-sheet programme was launched in May 2013 and flight testing began two years later. To date, the three PC-24 prototypes have flown 2,000h across 2,000 flights, the Swiss airframer says. The seven-seat twin is scheduled to receive European and US type certification in December.

The official handover of the first aircraft to US fractional ownership company PlaneSense – Pilatus's oldest and largest custom-

er with a fleet of 35 PC-12 single-engined turboprops – will follow shortly after. PlaneSense has an order for six PC-24s.

"I'm very pleased with the progress of the development programme and am looking forward to the moment when we are awarded the type certificate and can hand over the PC-24 to our first customer," says Pilatus chairman Oscar Schwenk.

Pilatus has secured 84 orders for the Williams International FJ44-4A-powered PC-24 – equivalent to three years of production – and plans to reopen the order-book following certification. ■



Swiss manufacturer has secured 84 orders for clean-sheet twinjet



INCIDENT DAVID KAMINSKI-MORROW LONDON

Low-fuel 787-9 made four Mayday calls

Air Canada crew forced to repeatedly declare emergency before being cleared for straight-in approach at Hyderabad

Investigators have disclosed that a diverted Air Canada Boeing 787-9's crew had to declare a Mayday four times over a low-fuel situation before being given approach clearance to Hyderabad.

The aircraft was originally bound for Mumbai but was shuttled between alternate airports because of capacity problems.

Canada's Transportation Safety Board states in a bulletin that it is "in contact" with the Indian accident investigation authority over the 19 September incident.

The aircraft (C-FGEI) departed Toronto on 18 September, operating as flight AC46 to Mumbai with 177 passengers and 14 crew members on board.

But Mumbai air traffic controllers cancelled the approach after a runway mishap involving another aircraft. The bulletin does not specifically identify this incident, but a SpiceJet 737-800 suffered an excursion shortly before the 787's arrival.



Flight AC46 had been operating for 17h at time of arrival

The Canadian bulletin says the 787 entered a hold for 1h but its crew then opted to divert to their alternate. It does not identify the location, but states that air traffic control informed the crew that they could not be accommodated owing to the airport reaching maximum capacity.

The crew then chose to divert a second time to Hyderabad, after

consulting with the carrier's operations centre, only to be informed by air traffic control en route that Hyderabad had also already reached maximum capacity and could not handle the flight.

According to the bulletin, Air Canada informed investigators that air traffic control "continued trying to divert the flight or attempted to place it in another

hold", adding that the crew had to declare a Mayday over the aircraft's low-fuel situation four times before being cleared for a straight-in approach to Hyderabad's runway 09L.

Flight AC46, which has a scheduled duration of around 14h 30min, had been operating for around 17h at the time of arrival. The aircraft landed safely. ■



CONVERSION

EFW's first A330-300P2F takes off

German modification and maintenance specialist Elbe Flugzeugwerke (EFW) has started test flights of the first Airbus A330 it has converted from passenger to freighter configuration. EFW says the A330-300P2F made its first flight on 4 October. It lasted only "several minutes" due to stormy weather, but three further flights – including a 6h second sortie – have since been completed. Dresden-based EFW expects to gain European approval for the modification by year-end, ahead of delivery to launch customer DHL Express. In parallel, an initial A330-200 is undergoing the P2F conversion at EFW's Dresden site, but the company has yet to disclose a schedule for first flight.

FLEET EDWARD RUSSELL WASHINGTON DC

United will divide loyalties in future

Chicago-headquartered United Airlines no longer pledges allegiance to any particular airframer, despite a fleet and orderbook dominated by Boeing.

"We, as a company, are going to be completely agnostic about airplanes," said Scott Kirby, president of United, speaking to an employee meeting in late September. "We're not going to be a Boeing airline or an Airbus airline, we're going to [buy from] whoever gives us the best deal."

However, United's orderbook remains heavily stacked towards Boeing, with nearly 78% of the 202 aircraft it has committed to coming from the US airframer, with the remainder from Airbus, Flight Fleets Analyzer shows.

The disparity is largely driven by the over-100 737 narrowbod-

ies United has on order, as well as 777s and 787s, while the only Airbus model it has signed for is the A350-900.

Kirby attributes the tilt towards Boeing to a "most favoured customer clause" provided by Airbus to American Airlines for its 2011 order of 260 A320-family aircraft. Airbus has to refund any difference in price to American if it sells an aircraft to another airline at a lower rate, he says.

"Airbus just can't give us a competitive price today," says Kirby, who was president of American from December 2013 to August 2016.

United operates 749 mainline aircraft, of which nearly 79% are Boeing models and only 21% are from its European rival, Fleets Analyzer shows. ■



A330's Swiss near-miss shows UAV risk
Air Transport P20

ANALYSIS DAVID KAMINSKI-MORROW & DOMINIC PERRY LONDON

Boeing flies ahead of Toulouse rival in the delivery stakes

Worries for Airbus, in both wide- and narrowbody markets, as Seattle ships 100 more units in first nine months of year

Airbus and Boeing collectively handed over 1,008 commercial aircraft in the first nine months of the year, with the US manufacturer streaking ahead of its European rival, beating it by exactly 100 units.

In all, Airbus delivered 454 jets in the three quarters ended 30

September, while Boeing's shipments amounted to 554 aircraft, according to the airframers' most recent delivery data.

Although headlines this year have largely focused on problems with the ramp-up on the A320neo, the delivery deficit is arguably more keenly felt on the



All Nippon Airways has received first PW1100G-powered A321neo

lucrative widebody side, where Boeing handed over 69 more aircraft – including 100 787s.

Output on the A350-900 is rising, however, with early production problems largely ironed out; Airbus handed over 50 of the Rolls-Royce Trent XWB-powered jets in the nine-month period.

A weakness in the single-aisle market will be a worry for Toulouse, however. Airbus trailed Boeing by 31 units at the end of September – 350 aircraft against 381 in Seattle – also lagging its corresponding figure last year by 30.

Of the 350 narrowbodies delivered, just 90 were the re-engined variant, the order data indicates: still less than halfway to Airbus's original target of around 200 by year-end. However, September saw the highest monthly total for the re-engined family, with 14 aircraft handed over – 12 A320neos and a pair of A321neos.

Boeing, by contrast, has now delivered 30 737 Max 8s, to a total of six carriers.

While all 737-8s are powered by

Airbus and Boeing nine-month deliveries

Type	Deliveries
Airbus	
A320	350
A330	45
A350	50
A380	9
Total	454
Boeing	
737	381
747	8
767	7
777	58
787	100
Total	554

Source: Manufacturers

CFM International Leap-1B engines, Neo operators have a choice between the Leap-1A and Pratt & Whitney's PW1100G. Despite being the first variant into service, the P&W-equipped model is trailing: just 30 of the 90 A320neo-family aircraft delivered this year have PW1100G powerplants. ■

BACKLOG

LATAM the latest to trim A350-1000 order

Latin American operator LATAM has converted two Airbus A350-1000s back to the smaller -900 variant, Airbus's latest backlog data confirms.

The company becomes the third high-profile operator, after Cathay Pacific and United Airlines, to switch away from the larger version of the A350 over the past month.

LATAM had 14 A350-1000s on order but the switch, disclosed in the airframer's backlog data for September, shows it has now cut this to 12.

The change raises its -900 commitment from 13 to 15. Seven of these aircraft have already been delivered.

LATAM's A350-1000s had all been the result of upward conversions from original orders for the -900, with the most recent, for two aircraft, revealed in August last year.

LATAM's conversion leaves Airbus with a total of 169 A350-1000s on order; the first aircraft is due to be delivered to Qatar Airways before the end of this year. ■



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INVESTIGATION DAVID KAMINSKI-MORROW LONDON

A330's Swiss near-miss shows UAV risk

Investigators suspect that drone was positioned over navigation waypoint on Zurich approach for photography purposes

An unmanned air vehicle might have been deliberately positioned above a navigation waypoint for photography purposes before an airprox incident involving an Airbus A330-300, Swiss investigators believe.

Despite the good visibility, says Swiss investigation authority SUST, the crew could not detect the UAV's presence in time for evasive action.

The Swiss International Air Lines aircraft had been conducting an instrument landing system (ILS) approach to Zurich following a service from Dar es Salaam in Tanzania on 6 May.

SUST says the UAV had been positioned about 5,000ft above the MILNI final approach point – some 10.3nm (19km) from the



Flightcrew did not detect air vehicle in time to take evasive action

airport. This coincides with the height an aircraft would expect to reach upon crossing the waypoint during an ILS descent to runway 34.

The inquiry states: "It is conceivable that the position and height of the [UAV] was deliberately chosen, with the

intention of making close-ups of commercial aircraft."

The UAV was a multi-rotor craft about 1m (3ft) in diameter and the A330 passed 10m underneath, it adds. None of the 185 passengers and 12 crew members was injured and the aircraft was undamaged. SUST says a "simi-

lar situation" occurred in the approach path to Basel's runway 33 on 14 July last year.

The inquiry states that a collision with an aircraft is "only a question of time", given the prevalence of remotely-piloted drones.

It has detailed the A330 encounter as the Single European Sky collaborative research organisation SESAR embarks on a two-year series of projects to investigate various safety and security aspects of UAV technology.

Tasks will include exploring geo-fencing capabilities and the resistance of UAVs to unlawful interference, as well as the tracking and surveillance of operations to protect restricted areas such as airports. ■

See Feature P30

INCIDENT DAVID KAMINSKI-MORROW LONDON

Ice caused ATR 72 stall after departing Alicante

Spanish investigators are probing an incident in which an ATR 72-500 suffered a stall while climbing through icing conditions.

The Swiftair turboprop, with 26 occupants, had departed Alicante for Madrid on 9 September, operating a service on behalf of Air Europa.

It followed the CATON3A departure pattern – involving a take-off from runway 10, towards the sea, before turning right to head inland – and was cleared to climb to 17,000ft.

Spanish investigation authority CIAIAC says moderate icing conditions had been expected at 15,000ft.

Upon reaching 13,000ft the ATR's crew engaged icing protection. But 7min later, as the aircraft reached 17,000ft, it entered a stall from which the crew quickly recovered.

CIAIAC says the autopilot disconnected, as a result, and the aircraft suffered a significant loss of altitude as well as pronounced roll.

The crew declared an emergency and was granted priority for a landing at Madrid.

Investigators state that yaw control problems experienced en route were traced to issues with the rudder travel limiter.

The aircraft (EC-KKQ) landed without further incident and none of those on board was injured.

Investigators have yet to reach any conclusions regarding the circumstances of the event.

Flight Fleets Analyzer lists the aircraft as a 10-year-old airframe.

Three years ago Swiftair was involved in a fatal stall accident triggered by icing, involving a Boeing MD-83 over Mali. ■



Pilots of Air Greenland helicopter spotted the fragments lying in snow

SAFETY STEPHEN TRIMBLE WASHINGTON DC

Dispersed GP7200 parts located

French investigators have recovered pieces of the engine fan module that disintegrated aboard an Air France Airbus A380 over Greenland on 30 September.

The crew of an Airbus Helicopters H125 operated by Air Greenland spotted several pieces of the Engine Alliance GP7200 lying atop the snow in Greenland's interior, says French accident investigation bureau BEA.

Air Greenland handed over the engine fragments to the Danish accident investigation board,

which has jurisdiction over Greenland. It will subsequently forward them to the BEA, which is the lead agency on the probe.

Pictures released by the BEA show that the pieces include fragments of the fan case and perhaps a fan blade of the GP7200.

The A380 (F-HPJE) was en route to Los Angeles from Paris when its number 4 engine failed, causing the fan module to disintegrate, releasing the disc and fan case. The crew landed in Goose Bay, Canada, hours later. ■



Control software glitch brought down first Raider
Defence P22

RECRUITMENT JON HEMMERDINGER PALM BEACH

US regionals warn over looming mechanic crisis

Though a pilot shortage has gained more recent headlines, regional airline executives warn that the industry faces a looming lack of another critical employee group: mechanics.

Nearly all the airline executives who spoke at the recent Regional Airline Association (RAA) annual convention, held in Palm Beach, Florida, cited a dearth of technicians as a growing issue, with many already

struggling to fill vacancies.

PSA Airlines president Dion Flannery told the meeting: "There are not as many qualified technicians coming out of schools today. We think the mechanic shortage is systemic to the industry."

These comments were underlined by Piedmont Airlines president Lyle Hogg: "We talk a lot about pilot shortage, but keep in mind that this industry is fore-

casting a maintenance technician shortage as well," he says. "We have begun really scouring the earth for maintenance technicians who are coming out of school."

Richard Leach, president of Trans States Holdings, states that the problem "is not the flavour of the day [or] making headlines, but it is very real".

According to a 2017 aviation maintenance survey from consultancy Oliver Wyman, 78% of

maintenance executives are having more trouble hiring new mechanics and increasingly rely on existing employees to work overtime.

Retirements are partly driving the shortage, the report says, noting that US aircraft mechanics have a median age of 51 years.

Executives also say wages and benefits, plus high living costs near maintenance facilities, are other factors. ■

MAINTENANCE MICHAEL GUBISCH LONDON

Collapsing clients fail to dent dreams of repair providers

Atitech and SR Technics refuse to see insolvency of Alitalia and Air Berlin as big setbacks, with expansion plans in train

Two maintenance, repair and overhaul providers are staying confident about the future and their expansion plans, despite the insolvency of major clients Air Berlin and Alitalia.

SR Technics handled engine overhauls of the German carrier's Airbus A320 and A330 fleets at its Zurich facility, while Naples-based Atitech carried out airframe checks on the troubled Italian flag carrier's short-haul fleet.

Speaking at the recent MRO Europe event in London, Atitech marketing and sales director Salvatore Russo said that uncertainty surrounding Alitalia's future has created a situation that is "not easy" for the business.

Russo acknowledges that a loss of work from the Italian airline would have "an impact" on Atitech's business, which is focused on supporting single-aisle types. But he says the MRO provider will be able to continue operating "for sure".

He notes that customers beyond Alitalia account for more

than half of Atitech's business, and argues that "we are on the way to recovery".

For SR Technics, meanwhile, Klaus-Peter Leinauer, the Swiss MRO provider's vice-president for sales in Europe and the CIS, acknowledges that Air Berlin's insolvency filing represents a "big problem".

Under a long-term deal, SR Technics services Air Berlin's CFM International CFM56-5B and Pratt & Whitney PW4168 engines, which power the carrier's respective A320-family and A330 twinjets.

Air Berlin will cease long-haul flights this month. EasyJet and Lufthansa Group are looking to acquire parts of its short-haul operations.

However, Leinauer says a likely loss of the Air Berlin engine-support business is no reason to halt the expansion of the MRO provider's overhaul capacity.

Its Zurich facility is currently "full", driven by increasing shop



Naples-based MRO firm has secured new work on Italian ACJ319s

visits for CFM56 powerplants. The site can handle around 200 engines per year, but capacity is being expanded to reach 280-300, says Leinauer.

He does not disclose a timeline, but says that efforts to raise productivity and to recruit staff – from other divisions as well as from outside the organisation – are under way.

He says that the in-service PW4000 fleet still represents a sizeable market and, more importantly, overhaul demand for CFM56-5Bs and -7Bs – the latter of which equip Boeing 737NGs – will increase, as the majority of those aircraft have not yet undergone a first shop visit. "The [CFM56 overhaul] wave is coming," he says.

Atitech, too, is growing both its footprint and capabilities. In 2015, the company – which has its base on the south side of Naples airport – acquired hangar facilities from Leonardo on the

gateway's north side to add wide-body maintenance to its portfolio. Leonardo has a 25% shareholding in the MRO firm.

Private equity fund Meridie is the majority shareholder with a 60% stake, held by an entity named Manutenzioni Aeronautiche, while the remaining shares are owned by Alitalia.

Russo insists the MRO provider will need hangars on both sides of the airport. Without the former Leonardo facility it would be "impossible" to serve Atitech's customers, he says.

Atitech has recently won a deal from NATO's Support and Procurement Agency to maintain three Airbus ACJ319 VVIP airliners for the Italian air force. The three-year contract covers scheduled and unscheduled maintenance, continued airworthiness management services, and pool access for equipment including engines, auxiliary power units and landing gears. ■



DEVELOPMENT LEIGH GIANGRECO WASHINGTON DC

Control software glitch brought down first Raider

Sikorsky has traced the cause of a 2 August crash involving its first S-97 prototype, and is now preparing its second Raider for a flight debut early next year.

Following an analysis made with the US National Transportation Safety Board, the company identified the cause of the crash as a software issue, which has

since been corrected and checked in a simulator, Sikorsky Innovations vice-president Chris Van Buiten tells FlightGlobal.

"It's a very sophisticated fly-by-wire flight-control issue," Van Buiten says. "We've worked through it, corrected it and we're moving on. We don't see any hardware changes."

Neither crew member was injured in the accident at Sikorsky's flight-test centre in West Palm Beach, Florida.

"We were delighted with how all the systems behaved in the hard landing, including the fuselage, landing gear, seats and fuel

systems," Van Buiten notes. Sikorsky does not plan to change the outer-mould line or materials used on the Raider, but is performing detailed analysis on how its composite structure behaved in the crash. There are no plans to replace the first prototype, he adds.

Sikorsky is now preparing the second Raider for flight, including finishing its gearbox. It is also experimenting with weapons integration. The company aims to test Lockheed Martin AGM-114 Hellfire air-to-surface missiles, precision-guided rockets and guns on the demonstrator, potentially during 2019. ■



Lockheed Martin

Lead prototype of S-97 was heavily damaged in 2 August accident

ROTORCRAFT LEIGH GIANGRECO WASHINGTON DC

FVL remains a priority, US Army insists

Service includes Future Vertical Lift programme in updated plans, but schedule slip would drive upgrades to current fleet

US Army leaders including chief of staff Gen Mark Milley used the AUSA convention to reaffirm the service's commitment to the Future Vertical Lift (FVL) programme instead of pursuing incremental block upgrades for existing types.

Support for the FVL programme came a week after the US Army announced plans to reorganise its modernisation efforts. This identifies six priorities, including "Future of Vertical Lift platforms".

Conspicuously missing from the update was any reference to the Improved Turbine Engine Program (ITEP), leading to speculation that an effort to replace the GE Aviation T700s powering Boeing AH-64 Apaches and Sikorsky UH-60 Black Hawks could be at risk.

Col Erskine Bentley, capability manager for FVL and ITEP at the US Army Training and Doctrine Command, notes that the engine replacement programme will play a crucial role in maintaining the current types' relevance, and also would

power the next generation of light-attack and reconnaissance rotorcraft under FVL.

"ITEP is important to FVL, because it is a capability set 1 and 2 powerplant," he says. "I think the ITEP will be brought along with that."

Apache programme manager Col Joe Hoecherl, meanwhile, plays down the prospects of an upgrade from the E-model to an F-variant – a suggestion that was made by Boeing last year. Instead, the parties are analysing options to bridge the gap between the Apache and FVL, potentially via sensor and laser upgrades.

"That could very easily end up being a new model of aircraft, but at this point it's premature to say that," Hoecherl says. "Right now we're not talking about a new model, partly because the priority is FVL."

However, Hoecherl acknowledges that the FVL activity's procurement timeline could potentially be extended, requiring some aircraft to remain in service longer than expected, prompting block upgrades. ■



US Army

Apache could receive enhanced capability

TECHNOLOGY

Raytheon unleashes HEL from above

The US Army is pursuing a high-energy laser (HEL) capability for its rotorcraft and fixed-wing assets, after a successful test performed using a Boeing AH-64 Apache attack helicopter.

The experiment marked the first time a laser has hit a target from a rotary-wing aircraft, says Raytheon. The activity combined a laser pod with a modified version of its multi-spectral targeting system, which directed the beam and engaged the target.

Raytheon – which previously worked on a separate HEL effort

led by the US Special Operations Command – is looking to meet the army's specifications for an airborne laser capability, says HEL product lead Ben Allison.

An operational airborne laser may not be a near-term possibility, however, according to Apache programme manager Col Joe Hoecherl.

"It's a capability we're interested in," he says. "But it's still very early from a policy [view] in how we use lasers properly, legally. How do you do it in a safe manner?" ■



Japanese Global Hawks receive funding boost
Defence P24

PRODUCTION DOMINIC PERRY LONDON

BAE slows output to sustain assembly

Almost 1,400 employees to be made redundant as manufacturer looks to extend life of Typhoon and Hawk programmes

BAE Systems is slowing its production rate on the Eurofighter Typhoon and Hawk advanced jet trainer, in a bid to extend final assembly work on both types into next decade while it pursues fresh sales opportunities.

While it points to potential near-term export deals for both models, including a recent statement of intent with Qatar, BAE says: "The timing of future orders is always uncertain. To ensure production continuity and competitive costs between the completion of current contracts and anticipated new orders, we plan to reduce Typhoon final assembly and Hawk production rates."

Qatar in late September signalled its intention to order 24 Typhoons, and BAE on 10 October disclosed that the deal could also contain six Hawks.

BAE is currently assembling the trainer at its Warton site in Lancashire under contracts with Oman and Saudi Arabia, and says production is secure until 2019.



Warton-built types are now being delivered to export buyer Oman

With the planned slowdown, and the addition of the Qatari aircraft to the backlog, BAE says it will be able to maintain its final assembly activities until 2021. However, the company says it needs to receive a firm order from the Gulf state next year to avoid a break in production.

It also is pursuing other sales opportunities with the Hawk, including an expected further batch for the Indian air force.

BAE is in a slightly stronger position on the Typhoon, where it is

assembling aircraft for the UK Royal Air Force and the remaining 10 examples for Oman to complete its 12-strong order.

It is also building forward fuselage sections for Eurofighters to be completed for programme partners Germany, Italy and Spain, plus 28 examples ordered by Kuwait. These will undergo final assembly by Leonardo in Italy.

Flight Fleets Analyzer records the current Typhoon backlog for the programme's four European partner nations as 36 aircraft.

BAE says it is actively competing for additional orders, with a follow-on deal with existing Typhoon operator Saudi Arabia still thought to be likely. Riyadh has already received the last of the 72 aircraft contained in its initial Project Salam acquisition.

Other UK-led sales campaigns include opportunities in Indonesia and Malaysia.

As part of the production slowdown, BAE's Military Air & Information business unit will make almost 1,400 employees redundant, with 1,150 of these positions to go at Warton, plus sites in Samlesbury, Lancashire and Brough, East Yorkshire. The rest of the cuts will be made as the Royal Air Force draws down its remaining fleet of Panavia Tornado GR4s by March 2019.

The company also has announced plans to reorganise its Military Air & Information, international and MBDA business interests under a new Air sector division from 1 January 2018. ■

DEVELOPMENT LEIGH GIANGRECO WASHINGTON DC

LANCE thrusts USAF towards offensive laser use

The US Air Force has awarded a \$26 million contract to Lockheed Martin to develop a high-powered laser source as part of the Air Force Research Laboratory's (AFRL) podded

electric laser concept for fifth- and sixth-generation fighters.

The laser advancements for next-generation compact environments – or LANCE – contract marks the second award under the



Podded energy weapon could eventually be integrated with F-35

AFRL's self-protect high-energy laser demonstrator (SHIELD) effort. In mid-2016, Northrop Grumman was awarded \$39 million to develop a laser beam control capability under the SHIELD turret research in aero-effects programme.

The USAF is expected to award another contract for the laser pod research and development activity, which will also develop its thermal management, battery and cooling systems.

LANCE will develop a compact, ruggedised high-powered laser for a tactical jet, with an event scheduled for 2021 to demonstrate a fighter with a low-powered laser against flying targets.

Although previous documents have indicated that a high-

powered laser would be used for self-defence, AFRL officials have characterised the SHIELD effort as both offensive and defensive.

It has also begun exploring a defensive laser capability for the service's tanker fleet as a separate effort for the Air Force Materiel Command, Jack Blackhurst, executive director at the AFRL, tells FlightGlobal.

"For years we've been talking about putting it on a fighter," Blackhurst says. "The tanker thing is relatively new and we're looking at it from a technology perspective. Could we do it faster? Would the actual pod look different? That's all part of the different technologies that we need to look at." ■



REQUIREMENT LEIGH GIANGRECO WASHINGTON DC

Decision looms over future of JSTARS

Suggestion that US Air Force could defer replacement programme for E-8C fleet faces staunch opposition from Congress

The US Air Force could reach a decision on its recapitalisation strategy for the Northrop Grumman E-8C Joint Surveillance Target Attack Radar System (JSTARS) fleet by the end of this month, with the issue causing controversy on Capitol Hill.

Speaking at the Center for Strategic and International Studies in Washington DC on 5 October, USAF secretary Heather Wilson said the service's engineers are examining whether there is technology mature enough to step in for the JSTARS mission. This followed a letter sent to US defense secretary James Mattis early last month, which disclosed that it was exploring alternative means of performing airborne intelligence, surveillance and reconnaissance duties, riling supporters of Northrop in Congress.

"We should be able to make a rapid assessment and decision so we can explain to the secretary of



Current system's use of the 707 platform is a technology mismatch

defense, as well as the other branch of government, what we think is the best thing to do," Wilson says of the USAF's evaluation of the JSTARS Recap effort.

Wilson intimates that a replacement programme could fall out of the air force's budget, as a trade-off measure. Candidates include a modified Gulfstream G550 or G650 being pro-

moted by Northrop, plus rival offers based on the 737 and Bombardier Global 5000 or 6000, respectively tabled by Boeing and Lockheed Martin-led teams.

Asked about the USAF's ability to balance aircraft modernisation priorities and space-based programmes, Wilson points to its advanced battle management system analysis of alternatives activity.

This will, from next year, assess its command and control priorities, including options such as networking sensors that could perform such key surveillance functions in contested environments.

"It's a great aircraft, but technology has moved on," she says of the 707-based E-8C. "Everything now is a sensor. If a [Lockheed] F-35 can send its picture and radar on an image to another aircraft and we're pulling that down to a battle station in the Middle East, why can't we distribute it? We can do better than this with a network. That means moving money among programmes to try to do more priorities."

Any threat to the E-8C fleet faces opposition from supporters on Capitol Hill. The House of Representatives' version of the 2018 National Defense Authorization Act has an amendment to prevent funds from being used to retire the current aircraft. ■

UNMANNED SYSTEMS GREG WALDRON SINGAPORE

Japanese Global Hawks receive funding boost

Northrop Grumman has been awarded a \$130 million contract to enable long-lead work related to Japan's acquisition of three RQ-4 Global Hawk Block 30(I) unmanned air vehicles.

Placed via the US Air Force, the transaction was detailed in a 5 October contract notification by the US Department of Defense.

In addition to the trio of UAVs, Tokyo's Global Hawk acquisition also will include enhanced sensor suites and two ground control

elements, the DoD says. The long-lead funding – which covers the period to July 2018 – will enable the provision of initial spare parts, and a site survey to support future operations.

The US Congress gave its approval to Japan's Global Hawk acquisition in November 2015, at which point the US Defense Security Cooperation Agency valued the deal at \$1.2 billion. Tokyo selected the high-altitude, long-endurance type in 2014. ■



Tokyo will field three of the high-altitude, long-endurance aircraft

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United, which will retire its last 747-400 in November, started with the -100 variant in 1970



United Airlines

Passenger services nearing extinction on US jumbo jets

Having been a mainstay of carriers' fleets for almost 50 years, iconic 747 faces retirement

EDWARD RUSSELL WASHINGTON DC

An era in commercial aviation will come to an end this December, when the last Delta Air Lines Boeing 747 flies into the sunset, ending a nearly half-century run for the iconic jumbo jet in US fleets.

The 747, launched by Boeing and Pan Am in 1966, flew at just about every major US carrier since its introduction in 1970. Long departed names, from Northwest Airlines to Pan Am and TWA, used the 747 to open markets and extend their networks around the world.

The in-service fleet of commercial passenger 747s in the USA peaked at 130 in 1990, Flight Fleet Analyzer shows. American Airlines, Continental Airlines, Northwest, Pan Am, TWA and United Airlines all operated the type, including the then-new 747-400, at the time.

That number had dwindled to just 27 last year, as Delta and United – the last two US passenger operators of the jumbo – gradually retired their 747 fleets.

As with any aircraft type, the gains from the 747-400 when it was introduced in 1989 have

been superseded by newer widebodies that boast better efficiency and range.

Delta is replacing its 747-400s with Airbus A350-900s and United, which retires its last 747 on a recreation of its first jumbo jet flight from San Francisco to Honolulu in November, with 777-300ERs. To date, neither has used these newer models to open routes, although both tout significant cost savings and benefits to their bottom lines.

"It's a bittersweet milestone – [the 747] with its unmistakable silhouette once represented the state of the art in air travel," said Scott Kirby, president of United, in a January letter to employees announcing the retirement plans. "Today, there are more fuel-efficient, cost-effective and reliable widebody aircraft."

When Northwest introduced the 747-400 in early 1989, its then chief executive Steven Rothmeier, in an interview with *Flight International* that June, touted the 17% lower operating costs than the 747-200 and improved capabilities that would allow it to fly in strong headwinds from New York to Tokyo with a full load of passengers and freight.

"That aircraft will set the economic pace

till the end of the century," he said, a prescient view of the type that did set the standard for widebody travel into the 2000s.

"The 747-400... was instrumental in making Asia more accessible to the flying public in the US"

Bob Cortelyou

Senior vice-president of network planning, Delta Air Lines

Northwest was the launch customer for the 747-400, placing an order for 10 in October 1985, and United followed suit with an order for four that November, the *Flight International* archive shows.

Northwest would ultimately take delivery of 16 747-400s and United 44, Boeing's orders and deliveries database shows.

The 747-400 has a range of 7,200nm (13,300km) – making it the longest-range commercial airliner when it was introduced – and a maximum take-off weight of 397,000kg (875,000lb). This compares with

6,560nm and up to 378,000kg on the 747-200.

In addition, the -400 was the first 747 with a two-crew cockpit. Boeing eliminated the need for a flight engineer with its engine indicating and crew alerting system (Eicas), a technology pioneered on the 757 and 767, as well as other automation improvements.

In its 747-400 flight test report in November 1988, *Flight International* called the move to two crew a “quantum leap” in technological advancement representing a significant cost saving for airlines.

Bob Cortelyou, senior vice-president of network planning at Delta, says: “The 747, especially the -400 series, gave Northwest at the time... an aircraft with range and scale that hadn’t been possible before and was instrumental in making Asia more accessible to the flying public in the US.” For example, the Detroit-Nagoya route launched by Northwest in 1998 was made possible by the 747-400, he says.

NEW ROUTES

Delta acquired Northwest, along with its 16 747-400s, in 2009. The Atlanta-based carrier also operated the 747-100 between 1970 and 1976, Fleets Analyzer shows.

United similarly used the 747-400 for performance gains and to open long-haul markets. By 1993, the capabilities of the -400 allowed it to replace the smaller 747SP, 11 of which were acquired from Pan Am along with the latter’s Pacific routes in 1986, and open new markets such as the Chicago-Hong Kong route that began in 1996.

The Chicago-based carrier also has the distinction of having operated every 747 variant with the exception of the 747-300, which no US airline flew. It took its first 747-100 in June 1970 and has operated the jumbo ever since.

“The 747 is a wonderful, wonderful airplane to fly,” says Gerry Laderman, treasurer of United. “It’s just not the best airplane to operate [in 2017] because the operating economics are just not as attractive as current generation widebody aircraft.”

Both Delta and United expect significant gains from their respective transitions to the



A commemorative lei marked Delta’s final Tokyo Narita-Honolulu service with type last month

A350 and 777-300ER. Airline executives tout cost savings, as well as operational and passenger benefits, from the shift.

RAISING REVENUE

The A350 will be “immediately accretive into the Pacific operations with much, much better efficiency and much better revenue performance” than the 747, Delta chief financial officer Paul Jacobson said in May. He even attributed the majority of a forecast 1.5% improvement in fuel efficiency across the airline’s 865 aircraft-strong mainline fleet in 2017 to the widebody transition.

Delta’s A350s enter service with its latest business class product, Delta One suites, and new premium economy cabins on flights between Detroit and Tokyo Narita on 30 October. The aircraft will have 306 seats: 32 in business, 48 in premium economy and 226 in economy.

The carrier’s 747-400s have 376 seats, split between 48 in business and 328 in economy, including 42 with extra legroom.

Delta has not named any new routes for the A350, only replacement services, but executives have said that later deliveries of the 15

due by 2019 could be used for long-haul growth.

STREAMLINED FLEET

United sees similar benefits from its move to the 777-300ER. Kirby, in his January note, emphasised improved fuel efficiency, cost effectiveness and operational reliability from the transition.

The 777-300ER is about 20% more fuel efficient per seat than the 747-400, Boeing says.

The operational reliability of the 777 is about a percentage point or two better than the 747, says Laderman, adding that the type complements its existing fleet of 74 777-200s. “It’s always better to have fewer families of aircraft, so being able to add a 777-family aircraft and remove a fleet type will create greater efficiency [and] greater flexibility,” he says.

By the end of 2018 United will operate 18 777-300ERs, with the aircraft either directly replacing 747s or being used to upgauge existing 777-200 routes. As at Delta, the 777s are being line-fit with United’s latest premium product, Polaris, in a 366-seat configuration, with 60 in business and 306 in economy, including 102 extra-legroom seats.

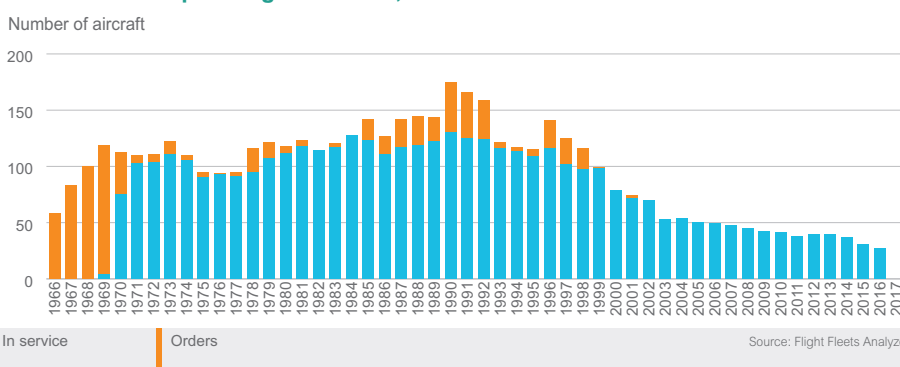
United’s departing 747-400s have 374 seats, including 12 in first, 52 in business and 310 in economy.

The airline is using its 787s, rather than 777-300ERs, for network growth. This includes new ultra-long-haul routes to Singapore from both Los Angeles and San Francisco, and Sydney from Houston, all on the -9.

American, the sole US legacy carrier without the 747-400 in its fleet, retired its last 747s – two SPs acquired in 1987 from TWA – in 1992, Fleets Analyzer shows. The airline operated up to 15 747-100s from 1970 until 1983. ■

See Picture retrospective, P28

US commercial passenger 747 fleet, 1966-2017



BOEING 747



(Clockwise from centre): United "tulip" livery flew 1975-1993; American 747s at JFK, 1970s; TWA in 1987; PanAm: "billboard" livery and homage to its own Juan Trippe, a key player in launching the type; Continental approaching London Gatwick, 1993; 747 assembly established Everett; tails show 747's global appeal; Northwest colours, 1989-2003

Aviation Images/Granger/Wil Blanche/REX/Shutterstock, Airframeimages, Mondadori Portfolio/Getty, Peter Ternuss/Alamy

BILLBOARD OF THE SKY

With its distinctive shape, Boeing's jumbo jet has been one of the most-recognised airliners of all time, but the 747's size and natural flagship status also made it a perfect vehicle for showing off its operators' branding



London police deployed small UAVs in the aftermath of the Grenfell Tower fire



Unmanned unlimited

With small, pilotless aircraft proving their worth in a growing range of civil applications, regulators and training providers find themselves scrambling to keep up with technology

BETH STEVENSON LONDON

Reactions to the proliferation of unmanned air vehicles are often emotional. This is hardly surprising for a disruptive technology making marks on civil society, and the language surrounding it gives a clue to its controversial nature; while the industry refers to “UAVs”, these aircraft are popularly known as “drones”, a term which carries negative connotations.

On one side, pilots, privacy pioneers and security promoters have raised concerns over flight safety and data protection as just some of the reasons why their use in civil ap-

plications must be controlled. On the other, advocates are often frustrated by what they deem to be a lack of progress, and are calling for more rapid allowances to be granted.

In the middle are regulators, struggling to protect public safety without needlessly holding back an industry whose early development leads many to anticipate a rapid flowering of commercial capability on a scale to match that of crewed aircraft. The European Aviation Safety Agency is introducing new, proportionate regulations for the operation of UAVs, which are expected to be introduced around 2019.

Meanwhile, US regulations have been

highly restrictive, but the Federal Aviation Administration now allows commercial UAV operations to be carried out under its so-called Part 107 exemption. That mechanism has been officially enforced since August 2016 and replaces the so-called 333 waiver system that had previously governed commercial operations.

While Part 107 marks progress in that it filled a gap in regulations that had previously hindered commercial use of unmanned systems in the USA, critics say there is still a long way to go to balance reasonable access with safety in US airspace. According to Paul Rigby, chief executive of UAV training and



Aner Ghazal/REUTERS/Shutterstock

weighing less than 7kg (15.4lb) to operate in Class A airspace without informing air traffic control. The result is that, generally, there are no airspace issues for commercial operators. “All the problems that make the press are from recreational flyers, which are more than likely consumers, and are not particularly hobby flyers that are part of a club, but they are rogue, lone-wolf types that have bought a drone off the internet and have gone and flown it,” he says.

Where the real test for these regulations will come will be in key areas such as beyond-

“The likes of the emergency services have had their budgets cut in recent times, and are subject to pay freezes, so they’re seeing UAVs as a way of saving money”

Paul Rigby
Chief executive, Consortiq

line-of-sight and higher-altitude operations, and with the use of heavier systems, says Rigby. “I think where there is still a lot of work to be done, in that entry-level permissions have got going in both the UK and USA, but what needs a lot more work now is how to start opening up to beyond-visual-line-of-sight, higher altitudes, heavier weights and so on, as a precursor to what we all know is coming, which is the heavier flying taxis that will operate at low levels.

consultancy company Consortiq: “The USA was crying out, waiting for some sort of regulatory framework to help them get above the 333 exemptions, and Part 107 went some way towards that.

“But there are still quite a lot of restrictions in terms of what airspace you can operate in, such as how far away from an airport you can operate. We don’t think we have such problems here in the UK.”

Rigby adds that there is a fair amount of commercial activity under way in the UK, and various organisations now have safe technology and inspection techniques – creating a far more flexible environment than in the USA. “If you are trying to do the same in the USA, there are still quite a lot of restrictions, and to get an exemption or waiver or permission to operate in certain areas, is sometimes going beyond 90 days. This really needs to be accelerated, because nobody can run a commercial organisation with that level of uncertainty as to whether or not they will be able to take a job.”

In Rigby’s view, the UK system has been particularly progressive in allowing systems

“There might be some sort of transition altitude where there is a mix of manned and unmanned aircraft, and at high altitudes there will be unmanned aircraft operating just as you’d expect any other aircraft to operate.”

In the USA, Part 107 permissions can be expanded if an operator has a strong safety and business case. One way to prove to the FAA that further authorisations should be granted is through advanced training, Rigby argues.

The number of National Qualified Entity (NQE) training companies that are certificated by the Civil Aviation Administration in the UK is on the rise, in large part based on the market potential from commercial users that are using training to both ensure they are safe, and to bolster the performance of their unmanned operations. “Outside aviation, it might not be so obvious as to why training is so key for preparing yourself for operating in the aviation environment,” Rigby notes.

“I think as the entry-level training got going, it was a case of what was the minimum viable training that had to be done to be competent, and that is what the UK CAA was dictating, but now as companies like ourselves are innovating with new products and the benefits are clear, they can send somebody on a course and after five days they’ve turned their cameraman into an aerial cameraman that can be very proficient at that job.”

He claims that various industries are starting to wake up to the benefits now, with the oil and gas sector being one that is gaining momentum. The media industry was the early adopter of UAVs to support operations – using them for newsgathering and getting aerial shots that would otherwise be difficult »



Consortiq

Successful commercial camera work demands safe flying and mission competence skills

» to obtain – and the emergency medical services (EMS) are now a significant user of UAVs as well.

“The likes of the emergency services have had their budgets cut in recent times, and are subject to pay freezes, so they’re seeing UAVs as a way of saving money or making the most of what they’ve got,” Rigby notes. “Police helicopters are not as freely available anymore, so if you can’t get one over to support going into a building, or maybe you’re looking for some aerial intelligence, there are certain divisions like Devon and Cornwall Police that are using drones now to get that extra information.”

The CAA recently lifted restrictions on EMS UAV use, allowing them to fly over public spaces that other users cannot, in order to benefit emergency operations.

“Because they are typically tackling situations where there is security or the public at risk, they are given a little bit more dispensation in the air navigation order by the CAA, and they can be doing things that probably aren’t available to the rest of the commercial industry at the moment without significant investment,” he adds.

The dispensation granted by the CAA does come with an extra requirement for responsibility, he adds: “If you are going to exercise the privilege of that information notice then you still need to understand what you are actually saying, and what you’re giving an authority to.”

To this end, training is key, and Consortiq

“We’re doing a lot more training for the emergency services, mainly the police and fire service, but because of the way they do their daily business, it doesn’t really lend itself to doing online training”

Mark Jones

Head of unmanned aviation services, Resource Group



UAVs have established a role as aerial camera platforms

is in the process of rolling out a new training course to police forces in Northern Ireland that are keen to exercise this dispensation.

“So at least when they are in a live situation, they will know what authority they are exercising,” Rigby says, noting that the new notice allows for a certain amount of beyond-line-of-sight operations.

“Beyond-visual-line-of-sight can be as simple as going behind a building and not being able to see it anymore, and you are not going to get into a conflict with any other air users,” he adds. “If you go beyond-line-of-sight in the broader sense, you can be operating up to 3km [2 miles] away.

“Suppose you go beyond-visual-line-of-sight, there are a few complications you open yourself up to. So, they’ve got to be sure that they are weighing that risk up against what the problem is that they are actually trying to solve.”

Consortiq is seeing more demand for training that goes beyond the three-day entry-level course that teaches clients how to operate a UAV, therefore, and customers are looking to take their training that bit further.

“The three days gets you to be safe, but the days after get you to be competent and proficient at your job, be that getting smooth aerial shots for media, or for using drones in hazardous situations by the fire service,” he adds.

“We’re finding that they are starting to extend those training courses, so we get requests for five- and six-day training courses now.”

Another NQE, Resource Group, has rolled out an online training element that replaces a ground school, which users can access in their own time. Mark Jones, its head of unmanned aviation services, claims this appeals to an increasing number of operators.

“We’ve rolled out online training, so looked at the demographic of the people coming through for training, and according to the feedback we were getting, they are of the ‘Playstation generation’, that would benefit from an online package, instead of having to turn up at one of our locations and do a face-to-face ground school,” Jones tells FlightGlobal.

“Instead, they can do an online package in their own time. When they are good and ready they will book with us to do a flight assessment.”

Resource Group is also seeing the EMS market as a significant one for its training courses, although the company has identified that the online training would not necessarily be suited to these users because of the nature of what they do.



Illegal applications include prison drug smuggling

"We're doing a lot more training for the emergency services, mainly the police and fire service, but because of the way they do their daily business, it doesn't really lend itself to doing online training, because it's done in their own time, and if you are a policeman or firearms officer for example, it is homework of sorts," Jones says.

"With the emergency services, the course is much more tailored towards them. The flight assessment is also more scenario-based, to plan for operations that are more likely to rear their head in their industry."

Jones says that while the media industry was also a key client for Resource Group when it began offering UAV training, this has subsided somewhat and is being overtaken by other sectors that are just beginning to adopt this technology into their operations. Resource Group has just completed a training course in Kosovo, for example, where it was offering training for landmine inspection.

"We have just had a team come back from Kosovo, training some operators for humanitarian mine action, which is training for safety and speed to use an unmanned technology for finding and identification of remnants of war and mines where there have been conflicts," Jones says.

"It is very niche, but is one of those industries where drones are carrying out a good role. We were training people that had flown in from Syria, Libya, and those from charitable organisations that can see the benefit of using this technology to keep human beings away from explosives."

Jones adds that the company is regularly receiving enquiries from potential users that are interested in what unmanned technology can do, for example regarding potentially deploying UAVs underground to survey mines, or from roofers that could use them to survey high buildings without having to erect scaffolding.

He adds that clients are becoming more aware of what UAVs can do, and so are wanting more from their operations than just to collect interesting aerial shots. Two years ago, he says, a lot of his discussions with clients were "semi-educational, we were trying to educate on what a drone can do. Now, to a certain degree, it is managing expectations. They are seeing how technology is rushing forward, and they want to get on it."

DRONE, COUNTER-DRONE

With the proliferation of such a disruptive technology – that can gain access to areas that people might not be comfortable with them entering – there has not surprisingly been a focus on development of blocking technologies. Companies are employing radar and electro-optical technology to detect and track potentially malicious UAVs,

CONTRACTING BETH STEVENSON LONDON

Leonardo sees commercial demand for services model

While in the military domain unmanned air vehicles are often contracted out on a services basis, this is not something commonly done in the commercial industry. Leasing or acquiring data collection services from an OEM can help support military customers that are only carrying out a particular operation for a short period of time. Many, therefore, do not need to permanently acquire a fleet of UAVs.

Now, Leonardo has identified that there is a market for contracting in the commercial sector as well, and has introduced a new model to offer UAVs – beginning with its fixed-wing Falco – on a services basis.

Leonardo is close to setting up the new business, Fabrizio Boggiani, senior vice-president of support and service solutions Italy, tells FlightGlobal. And, he notes, specific regulations for this type of UAV use still need to be ironed out, so the company is working from the rules for manned operations.

"We have mirrored exactly what a manned service operator must do in terms of organisation and internal documents, specifically the safety management system," he says.

"The Italian authorities, due to the fact we have cer-

tain organisation and procedures, and sets of documents and internal rules, can give us a permit to fly for activities that are not [necessarily] in segregated areas, and they are in well-defined areas."



Leonardo has teamed up with air service operator Heli Protection Europe to facilitate intelligence, surveillance and reconnaissance (ISR) services using UAVs through the new business.

Boggiani says the services model will appeal for applications different to military ones, such as border control, disaster recovery and fire monitoring.

"Of course, this is already happening with very light drones, but there is a trend to also use heavier UAVs for doing missions that will not be so different to the military ones in the sense that they will be surveillance activities for critical areas," Boggiani adds.

"We see at first that it will be orientated to security, protection and activities where

manned platforms could be more at risk."

Leonardo is building on its experience offering ISR services to the UN for its peace-keeping mission in the Democratic Republic of the Congo, but it is exploring different ways of offering it.

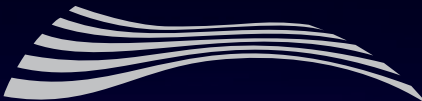
"An experienced operator like we are, that has collected thousands of flying hours, must be open to any possible formula," he says. "We have all of the capabilities from simply training... up to a full service where pilots, payload operators, maintenance crew and so on are provided by us, and so the user is only paying for flying hours and delivery of data."

He notes that while the main focus for Leonardo is its own UAVs, starting with the Falco and possibly also moving to rotary-wing systems, it is also open to providing third-party aircraft if the company does not have a system that fits the requirements. ■

Services-only deals are already offered using the fixed-wing Falco



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Regulatory work is paving the way for heavy, low-flying types like this Airbus air taxi concept



» which then employ countermeasures such as jamming to halt an aircraft's operations and bring it to the ground.

These systems are often employed near critical infrastructure, as government and private agencies alike look to protect against malicious UAV use.

In September 2017, DroneShield revealed its DroneGun MKII counter-UAV system at the DSEI show in London, and subsequently announced that the system was due to be evaluated by Spanish military and law enforcement agencies – including the Guardia Civil and Policia Nacional – in October. French and British military and law enforcement agencies are also trialling the rifle-shaped system, the company says, and it has previously demonstrated the technology to the US government.

The DroneGun provides countermeasures against a wide range of UAV models, the company says, and allows for a controlled management of the payload, that could include explosives, with no damage to the surrounding environment. The system blocks video transmission from the UAV, and the air vehicle remains intact once it has been brought to the ground, so that it can be later analysed.

SPECIFIC FOCUS

Both the British and French governments have been exploring this kind of technology for some time, and the former released details last month of a requirement for an air defence system for use against UAVs. The Ministry of Defence released an urgent capability requirement document for a counter-UAV system for the UK armed forces, which can detect, track,

identify and tackle UAVs weighing 2-250kg at ranges of less than 500m (1,640ft).

The specific focus, however, is on systems in the 2-22kg category; concern about this small end of the range reflects fears that terrorists may be able to turn small commercial UAVs into weapons. With relatively limited accountability for sales of this type of system, and an increase in development of small payloads that only need to be carried small distances to a target, the use of these systems for illegal activities is proliferating.

Counter-UAV technology is also being applied against dangerous, though not necessarily malicious, activity – namely, careless operators who do not appreciate the risks of flying near other critical infrastructure and aircraft.

But what is ultimately colouring technology development, application and regulation is the fact that UAVs are increasingly seen as normal; a disruptive technology, perhaps, but not an

unusual one. Thus the excitement – and fear – surrounding unmanned systems has somewhat waned, and industry, regulators and other agencies are getting down to the business of ironing out some of the issues associated with their use.

And critically, UAVs are no longer a niche technology, simply used to collect aerial images that would be impractical or expensive to gather from traditional aircraft. Since UAVs are now mainline tools in many industries, their cost and performance has to match or better that of a manned platform in order for operators to justify running the risk of using them.

Hence the increasing importance of sound regulation – however experimental that regulation may often be, given that unmanned flight is still a very new venture. The alternative is that it will be a very long time before commercial UAV operations are as safe, robust and cost-effective as manned aviation. ■



DroneGun promises to take control of a UAV and its payload



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Probe into BBC VC10 howler

The makers of a BBC drama, *The Last Post* – which follows the fortunes of a unit of military police and their families in the 1960s – had spotters jamming the switchboard (or, its modern equivalent, taking to social media) to point out a howler. For one key scene, the production company went to the trouble of computer-generating a BOAC Super VC10 – complete with real actors disembarking.

However, they made one big mistake: they used the RAF's K3 version, which has a number of differences from the civil variant, not least a refuelling probe on the nose. Oddly, had the geeks made a trip to Duxford they could have photographed a real BOAC Super (right).

Saving the world

Comic company Marvel has been forced into an U-turn after fans protested about a tie-up with Northrop Grumman designed to promote careers in science, technology, engineering and maths.

Many Marvel aficionados did not like the fact that the company behind Captain America and The Hulk was cosying up to a defence firm.

One critic, who said her



Who needs drones?



"Shame, I quite fancied a trip to the sunshine."

favourite Marvel character was Spider-Man, noted that: "I like how he saves people and tries to keep everyone safe."

Ah, to live in a world where those profit-seeking defence contractors are no longer needed and next time we face an existential threat to our security and freedom we can simply call in a catchily-named, masked bloke in a tight jumpsuit.

Barking stats

Never suggest the UK Civil Aviation Authority isn't meticulous in its attention to detail. The regulator provided a rundown for number-crunchers as it kicked off a huge operation to repatriate 110,000 tourists caught out by the sudden demise of Monarch Airlines.

On the first day, it said, it had used 34 aircraft for 61 flights to bring back 11,843 passengers and, just to round off the figures, included an entry for "Number of dogs brought home". Alongside which it stated: "One."

A growing City

To mark the 30th anniversary of London City, veteran aviation journalist Malcolm Ginsberg has penned a history of the capital's downtown airport. Built on the derelict remnants of what was once the busiest port in the



Destination Docklands, 1987

world, the development was part of the late-1980s regeneration boom that also saw the emergence of Canary Wharf, ExCel and the Docklands Light Railway. Its beginnings were not auspicious. In its first year, London City moved 133,000 passengers. But by 2016, that figure was 4.6 million.

Ginsberg recalls the origins of the airport, when on 27 June 1982 Brymon's captain Harry Gee landed a de Havilland Canada Dash 7 aircraft on Heron Quays, to demonstrate the feasibility of a passenger aircraft flying in and out of a densely populated area of east London. A feasibility study followed and commercial services began on 26 October 1987. Carriers have included British Airways and Swiss, with progressively larger aircraft being cleared to use the runway. In 2009, BA introduced its transatlantic all-business service on an Airbus A318.

London City Airport – 30 Years Serving the Capital is published on 5 November.

Keep calm...

Lord Derby, Secretary of State for War, said this

100 YEARS AGO

country had, with the aeroplane menace, been

brought within the war zone, and people at home must show the same courage as their soldiers did at the front.

Sturmovik success

The fighting round Leningrad has recently

75 YEARS AGO

flared up again, with the Russians holding the initiative. On this

front both sides have started using new types of aircraft, and, in particular, good work has been done by the new Sturmovik Il-2.

Brain drain fears

Figures for the British aircraft industry given in the

50 YEARS AGO

Report of the Working Group on Migration, published on

October 10, show that emigration of engineers and technologists increased sharply from 1964 onwards. Totals for the years 1962-66 were as follows: 1962, 78; 1963, 66; 1964, 98; 1965, 156; 1966, 294.

Osprey approval

The Bell-Boeing V-22 tiltrotor programme is finally

25 YEARS AGO

to move ahead following a resounding show of support in the

US Congress and a possible change of heart by defence secretary Dick Cheney, who is rumoured to have agreed to drop his opposition to it.

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EDITORIAL, ADVERTISING, PRODUCTION & READER CONTACTS

EDITORIAL +44 20 8652 3842
Quadrant House, The Quadrant,
Sutton, Surrey, SM2 5AS, UK
flight.international@flightglobal.com

Editor Craig Hoyle
+44 20 8652 3834 craig.hoyle@flightglobal.com
Deputy Editor Dominic Perry
+44 20 8652 3206 dominic.perry@flightglobal.com
Head of Strategic Content Murdo Morrison FRAeS
+44 20 8652 4395 murdo.morrison@flightglobal.com
Features Editor Dan Thisdell
+44 20 8652 4491 dan.thisdell@flightglobal.com
Business & General Aviation Editor Kate Sarsfield
+44 20 8652 3885 kate.sarsfield@flightglobal.com
Consulting Editor David Learmount
+44 7785 901787 david.learmount@ntlworld.com
Magazine Enquiries
flight.international@flightglobal.com

AIR TRANSPORT TEAM
Editor Flightglobal Premium News Graham Dunn
+44 20 8652 4995 graham.dunn@flightglobal.com
Managing Editor Niall O'Keefe
+44 20 8652 4007 niall.okeefe@flightglobal.com
Managing Editor - Flight Airline Business
Lewis Harper +44 20 7911 3105
lewis.harper@flightglobal.com
Air Transport Editor David Kaminski-Morrow
+44 20 8652 3909
david.kaminski-morrow@flightglobal.com
Air Transport/MRO Reporter Michael Gubisch
+44 20 8652 8747 michael.gubisch@flightglobal.com
Senior Reporter Oliver Clark
+44 20 8652 8534 oliver.clark@flightglobal.com

AMERICAS
Americas Managing Editor Stephen Trimble
+1 703 836 8052 stephen.trimble@flightglobal.com
Deputy Americas Editor - Air Transport
Ghim-Lay Yeo
+1 703 836 9474 ghimlay.yeo@flightglobal.com
Americas Finance Editor Edward Russell
+1 703 836 1897 edward.russell@flightglobal.com
Senior Reporter Jon Hemmerdinger
+1 703 836 3084 jon.hemmerdinger@flightglobal.com
Aviation Reporter Leigh Giangreco
+1 703 836 7442 leigh.giangreco@flightglobal.com

ASIA/PACIFIC
Asia Editor Greg Waldron
+65 6780 4314 greg.waldron@flightglobal.com
Asia Air Transport Editor Mavis Toh
+65 6780 4309 mavis.toh@flightglobal.com
Asia Finance Editor Ellis Taylor
+61 498 878 583 ellis.taylor@flightglobal.com
Reporter Aaron Chong
+65 6780 4851 aaron.chong@flightglobal.com
Reporter Firdaus Hashim
+65 6780 4313 firdaus.hashim@flightglobal.com

EUROPE/MIDDLE EAST
Israel Correspondent Arie Egozi

FINANCE
Global Finance Editor Sophie Segal
+1 212 448 2253 sophie.segal@flightglobal.com
Europe Finance Editor Jamie Bullen
jamie.bullen@flightglobal.com

FLIGHTGLOBAL.COM
FG.com Editorial Content Manager
Rebecca Springate
+44 20 8652 4641
rebecca.springate@flightglobal.com

EDITORIAL PRODUCTION
Global Head of Design & Production
Alexis Rendell
Chief Copy Editor, Europe Dan Bloch
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Regional Sales Director
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Sales Executive Kaye Woody
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ITALY
Sales Manager Riccardo Laureri
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Laureri Associates SRL, Via Vallazze 43,
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ISRAEL
Sales Executive Asa Talbar +972 77 562 1900
Fax: +972 77 562 1903 talbar@talbar.co.il
Talbar Media, 41 HaGiva'a St, PO Box 3184, Givat
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ASIA/AUSTRALASIA
Key Account Manager Jay Ee
+65 6780 4301 jay.ee@flightglobal.com
Fax: +65 6789 7575
1 Changi Business Park Crescent,
#06-01 Plaza 8 @ CBP, Singapore 486025

RUSSIA & CIS
Director Arkady Komarov
komarov@worldbusinessmedia.ru
Tel/Fax: +7 (495) 987 3800
World Business Media, Leningradsky Prospekt, 80,
Korpus G, Office 807, Moscow 125190, Russia

CLASSIFIED & RECRUITMENT
Business Development Manager Katie Mann
+44 20 8652 3074 katie.mann@flightglobal.com
Sales Manager Sophie Wild
+44 20 8652 4239 sophie.wild@rbi.co.uk
Classified Sales Executive Chris Pilkington
+44 20 8652 8130 chris.pilkington@flightglobal.com
Recruitment Sales Executive Chris Harding
+44 20 8652 4900 recruitment.services@rbi.co.uk

ADVERTISEMENT PRODUCTION
Production Manager Sean Behan
+44 20 8652 8232 sean.behan@rbi.co.uk

MARKETING
VP Marketing Justine Gillen
+44 20 8652 8031 justine.gillen@flightglobal.com
Group Marketing Manager Jo Goodwin
+44 20 7911 1366 jo.goodwin@flightglobal.com

DATA TEAM
Director of Data Trevor Mountford
trevor.mountford@flightglobal.com
Fleet Research Manager John Maloney
+44 20 8564 6704 john.maloney@flightglobal.com

PUBLISHING MANAGEMENT
Chief Operating Officer
Philippa Edward
philippa.edward@flightglobal.com
Executive Director Content
Max Kingsley-Jones
max.kingsley-jones@flightglobal.com
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defense.aiaa.org/

29-31 May

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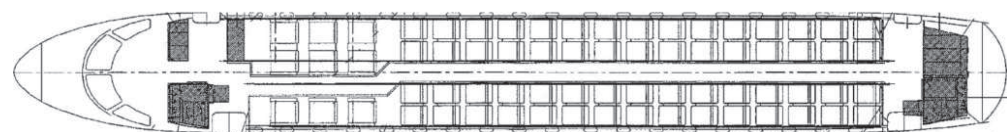
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Ref: DACPM/172/ACMI/2017/466

Date: 21 September 2017

Request for Proposal (RFP)

1. Biman Bangladesh Airlines Ltd. Invites Proposal/Offer for taking ACMI lease of Two(02) Aircraft for a period of 08 months. Airlines, Operators, Owners of Aircraft and/or Leasing Companies may submit their proposals as per terms and conditions given in the RFP Schedule. Basic information are mentioned below:

a.	Name and address of the Lessor, Owner and Operator	To be mentioned by the bidder: Lessor : Owner : Operator :
b.	Number and Type of Aircraft	02 (two) aircraft of any type (Bidder may offer one or two aircraft)
c.	Year of Manufacture	Aircraft must be manufactured in January 1998 or later
d.	MSN & Registration Number of the Aircraft	Bidder must provide MSN & Registration Number of the offered aircraft
e.	Nature of Lease	ACMI (Aircraft, Crew, Maintenance and Insurance) Lease
f.	Lease Term and commencement of lease	08 months lease (February – September 2018)
g.	Seat Configuration	Aircraft configured with 300 ± 10 % seats in two-class.
h.	Owner's Authorization	If the bidder/lessor is not the owner of the aircraft, then owner's authorization for leasing the aircraft must be provided along with the Proposal/Offer.
i.	Heavy Maintenance Check	Heavy Maintenance check or "D"-Check must not fall due in the offered aircraft during the lease term.
j.	Air Operators Certificate (AOC)	Valid AOC of the Operator must be provided along with the Offer for ACMI lease operation.

2. Detailed information is available in the RFP Schedule. RFP Notice and Schedule may be viewed at official website of Biman: www.biman-airlines.com.
3. Proposals/Offer are to be submitted to General Manager (Corporate Planning), Biman Bangladesh Airlines Limited, Head Office, Balaka, Kurmitola, Dhaka-1229, Bangladesh latest by **1000 hours BST (0400 hours UTC) on 15 October 2017** through Courier Service or e-mail todaycpm172@biman.com. The Proposal(s)/Offer(s) will be opened on the same day immediately after the closing time and date in presence of the Bidder(s), if any. No Proposal/Offer will be accepted after the closing time.
4. Bidders are requested to comply with the stipulated terms and conditions of the RFP Schedule, failing which the Proposals/Offer may be rejected at the option of Biman. For further information or query; General Manager(Corporate Planning) may be contacted at Telephone: +880-2-8901600/Ext. 2413, +880-2-8901588 (Direct), e-mail: gmp@bimbiman.com during the office hours.
5. Biman Bangladesh Airlines Ltd. reserves the right to accept or reject any or all Proposal(s)/Offer(s) partly or wholly at any time and/or stage without assigning any reason, whatsoever, and no claim will be entertained in this regard.

Mohd. Abdur Rahman Faruq
General Manager Corporate Planning
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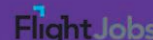
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WORK EXPERIENCE IAIN GRAY

Where research and business meet

After starting as an engineer, Professor Iain Gray now leads aerospace activities at Cranfield University, and manages its relationships with major companies in sector with a key role in UK's economic wellbeing

What triggered your interest in aviation?

There's a moment that stands out – seeing the first flight of Concorde on TV in 1969. My father was an aerospace engineer and there were all the other subliminal influences, like seeing the Vulcan and Lightning, but it was Concorde that made the real difference.

Tell us about your career

I joined British Aerospace in 1979 – the Concorde connection encouraging me to move down to Bristol from Scotland – where I had the chance to work on the project as a stress engineer, looking at fatigue data from Farnborough. I worked on the BAe 146 programme and had the good fortune to be involved from the beginning with the Airbus A310 project. This was my way into Airbus, following a path into management positions for the development of the A320, A330/A340 wing programmes, and leading on the UK involvement with the A380 and A400M.

When Airbus evolved into a single company, I became the managing director for Airbus in the UK until 2007. I led the government's original Technology Strategy Board (now Innovate UK) as its first chief executive. Aerospace is in my DNA and I was keen to be part of shaping its future, and with that in mind joined Cranfield University in 2015 as its director of aerospace.

What have been the most satisfying roles?

On 27 April 2005 I stood alongside the team at Airbus who had



Gray argues greater collaboration in aircraft manufacturing is vital

been developing the A380. On a big screen we saw the aircraft we'd been working on for 10 years go into service with Singapore Airlines. I'd had the chance to be part of the development from first concept to flight, leading a team of engineers. It had not been an easy project, there had been some big challenges, but we'd seen it through together.

Tell us about your current role

Cranfield is unique in terms of its facilities – its own airport and runway, the National Flying Lab, and now the new Aerospace Integration Research Centre and Digital Aviation Research and Technology Centre. This makes it the place where universities and industry can work together to demonstrate and validate research up to the higher technical readiness levels, 6 and 7. I have the dual role of leading all the aerospace

teaching, research and corporate relationships as if it were a business in its own right, as well as developing the integration of aerospace across the university with other departments, in other areas of technology, transport and manufacturing.

What are the key problems facing the UK aircraft manufacturing industry?

Challenges are also opportunities. We're on the cusp of a major transformation in the industry and in air travel itself with the rise of autonomous technologies, artificial intelligence and electric aircraft. The danger for the UK is that we're left behind, not helping to shape and lead on the design of holistic systems and aircraft, and only providing a supporting role in manufacturing hi-tech components. Given its heritage in aerospace, UK industry should be, and needs to be, much more than

a niche partner. We need the high-value design skills in the workforce now to ensure we're a sector leader.

What action needs to be taken?

There needs to be more collaboration. At Cranfield we're assembling the kind of national aerospace research facility that can be the basis for large-scale design initiatives among groups of universities and aerospace businesses internationally. The UK government can help by both looking at ways to anchor the key traditional businesses like Airbus and Rolls-Royce, and also find ways to support the development of new clusters of the smaller firms that will be essential to the revolution in air travel. These are the companies working on autonomous technologies, the elements of high-value design that aren't necessarily part of the traditional aerospace supply chain.

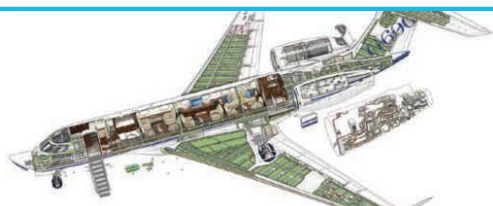
Are you optimistic about the industry's future?

It was the sense of excitement at the possibilities of supersonic travel that sparked my interest in aerospace – and we're into another new phase of excitement around digital aviation. It's a great time to be joining the sector. ■



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