Flight International

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ENGINES

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Highest-cycle CFM56s face inspection following Southwest accident

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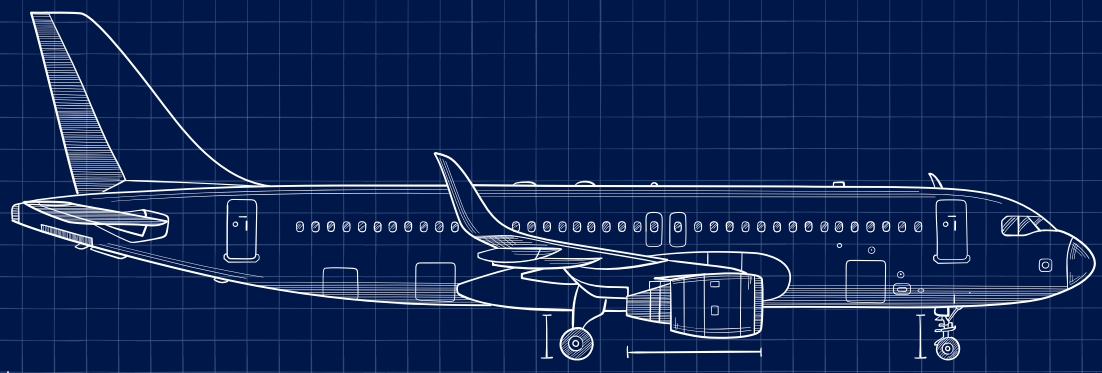
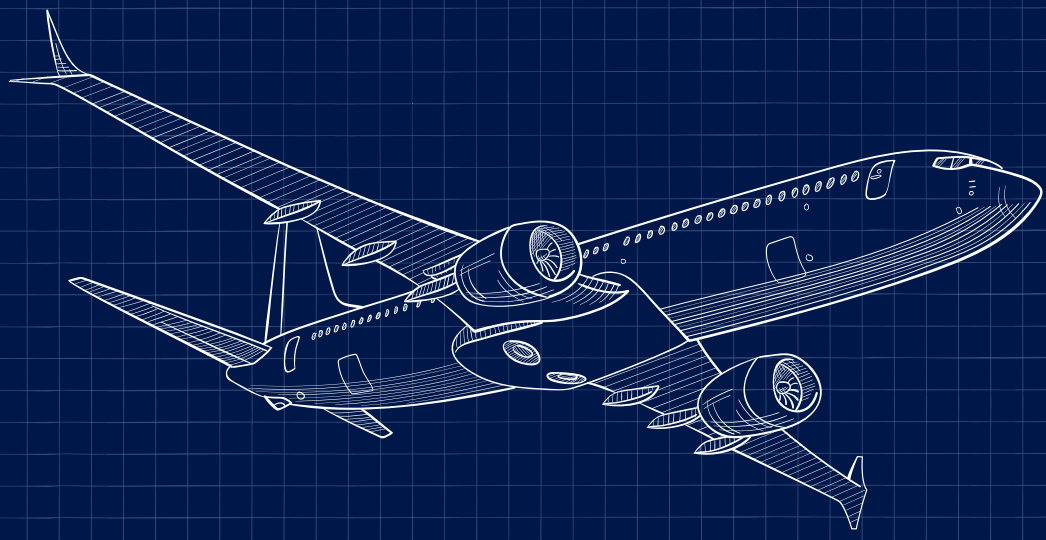


A320neo FIRST TO FLY ONE-STOP SHOP



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COVER IMAGE
With CFM International advising users of older CFM56 engines to make fan blade inspections, we chose this shot of a Southwest Airlines 737, by Felix Gottwald P11

BEHIND THE HEADLINES
Michael Gubisch (*left*) and **Craig Hoyle** (*right*) were at the **ILA air show** in **Berlin**, as pacts were strengthened with Paris (**P12**). In **London**, **Oliver Clark** heard about German carrier **Eurowings'** major **growth plans** (**P19**)

Image Broker/REX/Shutterstock

NEXT WEEK AIRPORTS
We look at the challenges posed by limited airport capacity. Plus, our report from the Xponential show

NEWS

THIS WEEK

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USA reveals long-term F-35 acquisition plans P21

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REGULARS

Textron Aviation, Boeing

Textron cautious despite fast-rising backlog P22. Turkish takes 787-9s among March market activity P24

Image of the week

Sikorsky's CH-53K heavy-lift rotorcraft was one of the stars of the ILA Berlin air show, as the company gave the King Stallion its debut on the international stage. Germany is considering the US-built type, along with Boeing's CH-47 Chinook, for its heavy transport helicopter contest

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

flightglobal.com/flight-international

Sikorsky

The week in numbers

12.3%

Flight Dashboard

Year-on-year increase in freight tonne km at Cargolux, as a market rebound led to record net profit of $122.3m in 2017

$525m

TransDigm Group

TransDigm has completed its all-cash acquisition of Extant Components, from private equity owner Warburg Pincus

39.2cm

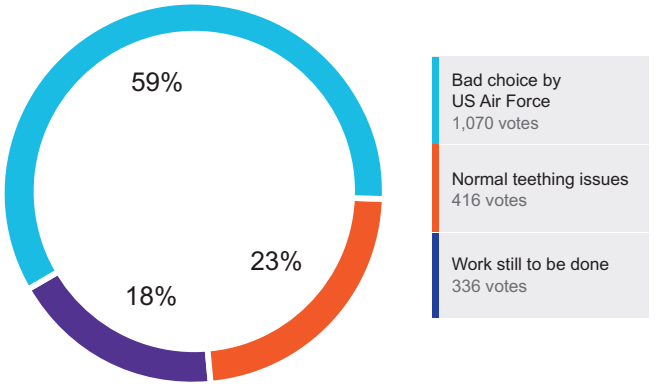
Komy

Length of telescopic stick devised by Komy, the mirror people, for Japan Airlines cabin crew to check bins are closed properly

Question of the week

Last week, we asked: **Boeing's latest tanker problem?**
You said:

Total votes: 1,822



This week, we ask: **Future Airbus/Dassault fighter?**
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Growing pains

Already suppliers are struggling to match the output increases planned by the industry's big two, but with no sign of narrowbody demand easing, there is currently no other game in town

Suppliers can call it "crazy" to even discuss right now (and they have a point), but it is inevitable: single-aisle production rates for Airbus and Boeing will continue to grow.

By 2021, it now seems assured that the combined output of A320s and 737s will rise to six new aircraft every working day, or 126 aircraft per month. Both jets may be single-aisles, but they are not small aircraft. Such a delivery rate in the narrowbody market category implies an industrial effort never seen before in the jet age.

And that does not count the output of similarly-sized aircraft from new entrants, such as Comac and Irkut.

It seems like a bad time to raise the idea of a further rate increase. Spirit AeroSystems is behind schedule on shipping 737 fuselages to Boeing, and engine suppliers CFM International and Pratt & Whitney are, for different reasons, struggling to keep production on track.

The combined backlog for both product lines at the end of March stood at a huge 9,730 aircraft

That explains why some suppliers' chiefs, such as Safran boss Philippe Petitcolin, want to tap the brakes – at least for another few months.

Boeing's official production rate for the 737 is currently 47 per month, after increasing output from 42 last year. But Renton's three final assembly lines delivered only 132 aircraft in the first quarter – an average rate of 44 per month. Airbus' official target for A320 production is currently 50 per month, but it delivered aircraft at an average monthly rate of 40 up to 31 March, or 121 in total.

Paramount Television/Kobal/REX/Shutterstock

"She cannae take another rate rise, Captain"

The industry is growing, but it is clear that it is not immune from the associated pains. However, the outlook remains bright. The supplier shortages and technical glitches are being managed and, if the big two are believed, could become merely a painful memory after the third quarter. Demand for single-aisle aircraft remains strong.

Although a combined 253 single-aisles were delivered in the first quarter, 208 total new orders for 737s or A320-family aircraft were added, during what is typically a weak period for demand. The combined backlog for both product lines stood at a huge 9,730 aircraft at the end of March. As "crazy" as it sounds to increase production at this moment, sitting on such a backlog may be an even stranger response.

But there are costs. Airbus reportedly has dropped plans to develop an "A322neo". Boeing has pushed back the arrival of any New Mid-market Airplane. To meet the world's insatiable appetite for single-aisle aircraft, the focus on any other product must suffer. ■

See This Week P9, P10

Safe hands?

World events can be so confusing. One day, French President Emmanuel Macron is engaging in high-profile – and surprisingly tactile – meetings with his US counterpart Donald Trump, and the very next, the defence industry champions of Berlin and Paris have gone all protectionist.

In related and potentially highly significant moves, Airbus Defence & Space and Dassault have pledged to work hand-in-hand on a future fighter to succeed their respective Eurofighter and Rafale products, and on an advanced unmanned surveillance asset to end reliance on US and Israeli designs.

That Europe's leading nations should want to ensure sovereign capability in the combat aircraft sector is, of course, not surprising. After all, the current frontline types of France and Germany are living proof of their determination to develop their own fighters – but only after failing to agree on common requirements to do so together.

Will the companies and governments involved be able to stay in formation this time? If so, they will field a broad-ranging future combat air system from around 2035. If not – and the disarray of Anglo-French plans after the UK's Brexit decision shows how fast things can change – Lockheed Martin is already waiting in the wings with the offer of its F-35 as a replacement for Germany's Panavia Tornados. No pressure. ■

See Show Report P13

BRIEFING

S7 TENTATIVELY SIGNS FOR 75-SEAT SUPERJET

ORDER Russia's S7 Group has been confirmed as the first potential customer for a shrink version of the Sukhoi Superjet 100, having contributed to the definition of the 75-seat aircraft, tentatively named the Superjet 75 or SSJ75. Sukhoi's civil aircraft division says that S7 Group, which includes S7 Airlines, has signed a letter of intent covering 50 aircraft with an option on 25 more; deliveries could start in 2022.

CHINA'S CTRIP JOINS LIST OF BOOM BACKERS

FUNDING Chinese online travel agency Ctrip has made an undisclosed investment in Boom Supersonic, bringing to $85 million the amount raised by the Colorado-based start-up. In exchange, Ctrip will gain seats on one of the company's first commercial flights. Five carriers, including Japan Airlines and Virgin Atlantic, have committed to buy up to 76 Boom airliners.

AEROSTAR PERFORMS FIRST NEO C-CHECK

MAINTENANCE Aerostar has completed a C-check on a Pegasus Airlines Airbus A320neo, which the Romanian MRO provider says is the first such overhaul event on the re-engined type in Europe. MSN 7140, a CFM International Leap-1A-powered example (TC-NBA), arrived at Aerostar's Bacau facility on 10 April; work finished "on schedule" four days later.

GENX ENGINES WILL POWER TURKISH 787-9S

PROPULSION Turkish Airlines has selected GE Aviation GEnx engines to power its Boeing 787-9s. The carrier has 25 of the type on order and holds options for a further five. Deliveries of the aircraft are to begin in 2019. GE Engine Services will support the powerplants, the airline adds.

MAGELLAN NAVIGATES TO A330 WING WORK

STRUCTURES Airbus has handed a new A330 wing structures package to Canadian manufacturer Magellan Aerospace. The company will supply wing ribs – numbers 2 to 5 – for the twinjet under a five-year agreement worth in excess of C$48 million ($38 million). Magellan will manufacture the parts in the UK.

KY CONTINUES AT EUROPEAN REGULATOR

MANAGEMENT Patrick Ky has been re-elected as executive director of the European Aviation Safety Agency for another five-year term, meaning that he will oversee the regulatory transition as the UK withdraws from the EU.

SEOUL PLANS HELICOPTER CONTEST LAUNCH

ROTORCRAFT Seoul intends to issue a request for proposals during May linked to its latest maritime helicopter contest. Some $780 million has been allocated for the project, with new anti-submarine warfare rotorcraft to enter use by 2022. Leonardo won a first-phase award in 2013, supplying eight AgustaWestland AW159s. The type is likely to face competition from the NH Industries NH90 and Sikorsky MH-60R Seahawk.

NORWEGIAN SLIMMING SINGLE-AISLE FLEET

LEASING Norwegian is aiming to divest up to 140 aircraft, including Airbus Neo jets, into a planned spin-off leasing operation. The leasing arm will take Norwegian's "excess" short-haul aircraft, including both Airbus and Boeing jets.

Air Teamimages

US regulator has introduced weight limit to some long-range flights

SAFETY **GREG WALDRON** SINGAPORE

ANZ recruits Hi Fly to plug 787-9 gap

Airline wet-leases A340 as durability issues on certain Trent 1000 engines lead to restrictions and lower fleet availability

Air New Zealand (ANZ) has returned to wet-lease specialist Hi Fly to fill the capacity gap caused by the ongoing problems with some of the airline's Rolls-Royce Trent 1000-powered 787-9 fleet.

The flag carrier is to lease in an Airbus A340 from the Portuguese operator from mid-May "to minimise customer impact" as it works through "the challenges created by the Rolls-Royce Trent 1000 issue," says ANZ.

This is not the first time that ANZ has turned to Hi Fly on the back of 787 disruption: late last year, it wet-leased two aircraft – an A330 and an A340 – to cover a capacity shortfall caused by unexpected maintenance required on the same Trent 1000 engines.

ANZ has detailed the disruption to its network caused by the latest Trent 1000 issue. It says that services to the USA and Japan have been affected by the operational limitations imposed by the US Federal Aviation Administration on the Package C version of the powerplant.

"Weight restrictions included in an FAA directive issued [in late April] mean some Boeing 787-9 Dreamliner flights to certain destinations will be required to make refuelling stops," says the carrier.

Routes affected include Los Angeles and Houston, services to Tokyo Haneda, and some trans-Tasman and Pacific island flights.

"Depending on en-route weather conditions, some flights may not be able to depart with all the fuel they require, prompting the need for the fuel stop."

In the immediate aftermath of the FAA directive, fuel stops were made in Cairns, Darwin, Guam and Sydney.

Durability problems with blades in the Trent 1000's intermediate-pressure compressor have prompted regulators to mandate additional inspections and some operating limits for extended twin-engined operations (ETOPS) flights.

British Airways, which is also affected by the issue, says it is making "minor adjustments to our flight plans" to cope with the 140min ETOPS limit.

Norwegian, meanwhile, says it has yet to ascertain the degree of potential disruption from the revised inspection regime, although it too indicates that it will have to turn to the lease market in order to cover the likely capacity shortfall. ■

Additional reporting by David Kaminski-Morrow and Michael Gubisch in London

Aero Vodochody and IAI team up
This Week P10

ANALYSIS STEPHEN TRIMBLE WASHINGTON DC

Boeing sees good times roll – for now

Impressive first-quarter results show airframer benefitting from efficiency gains, but headlines indicate a trickier path ahead

Judging by the headlines Boeing generated during the first three months of the year, it had a nightmare first quarter.

The aircraft manufacturer lost a trade dispute with Bombardier in front of a US government panel; suppliers fell behind on deliveries to the 737 assembly line; the engine for the 777X entered flight testing several weeks late; a crisis involving hundreds of Rolls-Royce engines on operational 787s deepened, with dozens of aircraft now sitting parked on runways around the world; and a new courtship with Embraer became tangled up in complications with Brazilian government officials.

In spite of all those problems, Boeing's financial performance in the first quarter may be one of the finest in the company's 100-year history. By almost any metric, its results were impressive.

In the first quarter alone, Boeing produced $3.14 billion in operating cash flow, which only a decade before would have been a respectable full-year total. As it stands, that was enough to give the firm confidence to raise full-year guidance on cash flow by $500 million to an eye-popping $15.5 billion.

EFFICIENCY GAINS

The company has never been more efficient: quarterly operating margins rose to 12.3%, higher than the full-year guidance of about 11%. Boeing still plans to achieve an operating margin in the mid-teens by the end of the decade, which possibly includes 2020. Long mired in single-digit operating-margin territory, Boeing's mid-teens goal once seemed wildly ambitious, but it is now within striking distance.

But to some extent, the financial performance smoothed over the challenges still lying ahead.

Boeing is still in the midst of a trade war with Airbus, even as its home government attempts to ignite another one with China, the company's biggest market.

Boeing

Narrowbody output is rising, but supplier troubles and nascent trade war with China could derail plans

> "The timing of that [NMA] decision is still to be determined as we work our way through the details"
>
> **Dennis Muilenburg**
> Chief executive, Boeing

The commercial sector remains on an unprecedented, extended growth cycle, but it is not clear Boeing's suppliers can keep up with serial production ramp-ups. The company is struggling to meet the US Air Force's demands over converting the 767 into an aerial refuelling aircraft, yet the 777X – its boldest project since delivering the first 787 seven years ago – still lies ahead.

Boeing chief executive Dennis Muilenburg faced questions about many of those issues on an hour-long first-quarter earnings call with analysts and media on 25 April. As is his style, Muilenburg betrayed no concern that Boeing's trajectory is approaching a plateau.

The Trump administration's threatened trade war with China is, so far, only a threat, Muilenburg points out, noting that a high-level US delegation is poised to travel to Beijing to begin negotiations.

Muilenburg also acknowledges the shortages of engines and airframes from suppliers, but says those issues were well understood and is confident of recovery.

POSITIVE OUTLOOK

Moreover, business still looks bright. The 767 line, which once seemed resigned to the military conversion market, is showing new life as a freighter. Boeing plans to increase the production rate in 2020 to three 767s a month, resulting in six additional aircraft deliveries a year. There remains "upward pressure" on 737 production rates, he says.

Nobody asked about concerns with the Rolls-Royce Trent 1000 Package C engine for the 787 family. For Boeing, however, the impact seems limited: it offers a choice of propulsion suppliers for the 787, and R-R's problems have not dented demand for the widebody, as American Airlines' recent order for 47 787s – powered by GE Aviation's GEnx-1B engines – demonstrates.

Even within the 787 programme, fortunes have improved. American's deal includes 22 787-8s, a variant that had gone 20 months without an order. Boeing has redesigned the aft fuselage and other areas of the -8 to improve commonality with the larger -9 and -10, resulting in lower production costs with each delivery.

According to Muilenburg, Boeing still sees future demand for the 787 concentrated on the -9 and -10, a statement that answers questions over whether a 787-8 revival spells trouble for its proposed New Mid-market Airplane (NMA).

The NMA provided the only glint of negativity during the call. In describing the timeline for introducing the proposed 200-270-seater with up to 5,000nm (9,260km) range, Muilenburg dropped "2024" as the earliest year the NMA could enter service. It is now described with a potential entry into service in 2025, but Boeing is hesitant to make any commitment.

"We have not made a launch decision at this point. The timing of that decision is still [to be determined] as we work our way through the details," Muilenburg says. "We're making progress and clearly advancing our analysis." ■

SUPPLY CHAIN **STEPHEN TRIMBLE** WASHINGTON DC

Safran 'not ready' for further ramp-ups

Chief executive of French aerospace giant rules out additional output increases at CFM International engine joint venture

A key supplier for Airbus and Boeing will not entertain until after January next year any proposal to further raise production rates for single-aisle aircraft engines beyond those already planned for 2019.

An analyst on a 25 April first-quarter earnings call asked whether another round of production volume increases was coming, but Safran chief executive Philippe Petitcolin dismissed the idea completely.

Safran is a 50-50 partner with GE Aviation in CFM International, which is already six weeks behind committed production volumes on the Leap engines that power Airbus A320neo and Boeing 737 Max aircraft.

"We think that at the level we are today it would be crazy to accept additional quantities when I just told you we are six weeks late," Petitcolin says.

CFM's owners secured an agreement with Airbus and Boeing last year to hold off on further production rate increases until at least the end of next year.

"We're not ready and we are not going to negotiate anything," Petitcolin adds. "We want to stick to what we said 12 working months ago."

Petitcolin's response came only hours after Boeing chief executive Dennis Muilenburg repeated a familiar company line during his company's first-quarter earnings call, noting "upward market pressure on the 737 production rate".

After similar comments in 2015, Boeing announced a plan to increase narrowbody output to 57 aircraft per month by 2019; the airframer is already raising monthly production this year from 47 to 52 aircraft.

In February, Airbus executives also acknowledged interest in taking A320 production past next year's 60-per-month rate.

These plans are straining an already stretched situation for certain suppliers. Spirit AeroSystems acknowledged falling behind on deliveries of 737 fuselages to Boeing's final assembly centre in March.

CFM has one of the hardest challenges as it works to maintain a 1,000-unit output of the current CFM56 series, as well as ramping up to make 1,100 Leap engines.

Safran and GE are both dealing with a shortage of castings and forgings, Petitcolin says, but are on track to recover by the third quarter. ■

Airbus

DEBUT

Long-range A350 gets airborne

Airbus has conducted the maiden flight of its A350-900ULR, the heavier and longer-range variant of the twinjet tailored to operate specialised long-haul routes. The initial aircraft, MSN216, departed the airframer's Toulouse headquarters at around 10:45 on 23 April. It features three primary modification aspects, of which two will be applied to all new-build A350-900s. Airbus has hiked the maximum take-off weight to 280t, from 275t previously. It has also incorporated a series of aerodynamic changes which, it says, will contribute to a 1% fuel-burn saving. These include a further slight twist of the wing, a taller winglet, trailing-edge extension and clean-up of the upper wing fairing. Airbus puts the reference range of the -900ULR at 9,700nm (18,000km), compared with the standard 8,100nm of the basic -900. Launch customer Singapore Airlines will receive the first of its seven examples in the second half of this year.

UPGRADE **DOMINIC PERRY** LONDON

Aero Vodochody and IAI team up

Czech Republic-based Aero Vodochody and Israel Aerospace Industries (IAI) are to develop and market an advanced version of the former's L-159 trainer and light-attack aircraft.

The partners will integrate a new avionics suite and "other solutions" onto the platform, as well as jointly marketing the Honeywell F124-100-powered type.

With the L-159 already used for training and aggressor missions, the cockpit update is designed to "enhance its position in the light-attack market", state the pair.

Giuseppe Giordo, Aero Vodochody chief executive, says: "The agreement brings us a strong international partner with access to new potential customers."

Giordo had in February indicated that Aero Vodochody was pursuing an international marketing agreement for the L-159 with a "big aeronautical company".

The L-159 already has some equipment provided by IAI companies, including an Elta Systems radar and optional datalink.

Flight Fleets Analyzer records 45 examples in service with operators including the Czech Republic and Iraqi air forces.

The parties will also enhance the L-39 Albatross trainer's overall system with the use of IAI's virtual training solutions. ■

Pact centres on L-159 , but also includes L-39NG

Katsuhiko Tokunaga/Aero Vodochody

More Eurofighters the 'logical choice' Show Report P12

PROGRAMME **CRAIG HOYLE** LONDON

Saab speeds investment to sway Gripen exports

Strengthening interest in the Gripen E has prompted Saab to accelerate its investment in the programme, with the step to include the introduction of enhancements intended to heighten the product's attractiveness to prospective buyers.

"Due to the strong interest in Gripen E/F, Saab has now accelerated the pace of investment to develop the system for future exports," a quarterly results announcement said on 26 April.

Chief executive Håkan Buskhe describes the measure as relating to "industrialisation, and also some key development on features for the export market". While he declines to identify specific updates, he notes: "There are things that will enhance the product that we have seen during the development time for the Gripen E." This process began for launch customer the Swedish air force in 2013.

Buskhe says Saab received fresh interest in the new-generation fighter from several undisclosed nations during the first three months of this year. The company cites a long list of prospective customers for the type, including Austria, Bulgaria, India and Slovakia.

Saab

Sweden and Brazil will receive their first E-model examples next year

Saab will deliver its first production examples of the Gripen E to Sweden and export buyer Brazil next year and the nations will receive a combined total of 96 examples up to 2026. ■

PROPULSION **STEPHEN TRIMBLE** WASHINGTON DC

CFM engines face urgent inspections

Fatal blade-loss on Southwest flight prompts recommendation for ultrasonic checks on high-cycle 737 powerplants

CFM International has sent an alert to Boeing 737 operators recommending ultrasonic inspections within the next 20 days of fan blades on CFM56-7B engines with more than 30,000 cycles.

The service bulletin released on 20 April also calls on operators to perform inspections on fan blades with more than 20,000 cycles by August and on all fan blades as soon as they reach 20,000 cycles.

About 680 engines are covered under the 30,000-cycle inspection deadline and 2,500 engines fall under the August deadline, says CFM, a joint venture formed by GE Aviation and Safran.

The inspections target the oldest examples in the global fleet of CFM56-7B powerplants, which has accumulated 350 million flight hours since entering service 21 years ago, CFM says.

Repeat inspections for all engines with more than 20,000 cycles should take place at intervals of 3,000 cycles, representing about two years of average airline service, says CFM.

The service bulletin comes in the wake of an incident in which a fan blade blew out of a CFM56-7B engine with 40,000 cycles on a 737-700 operated by Southwest Airlines, causing the death of one passenger.

An initial inspection of the damage by the US National Transportation Safety Board found signs of metal fatigue where the blade fractured at the hub.

That early finding echoed the NTSB's preliminary report on a similar blade-out failure of the same engine type in August 2016, which also led to engine shrapnel puncturing the fuselage and wing of a Southwest 737-700.

CFM's service bulletin stops short of a mandatory inspection, but carriers such as Southwest and United Airlines have already moved to scrutinise metallic fan blades on older CFM56-7Bs. ■

For insight and analysis of the latest developments in the defence sector, visit: flightglobal.com/defence

ILA 2018

While it lacks the high-profile commercial orders of a Farnborough or Paris air show, Germany's biennial ILA gathering – in Berlin from 25-29 April – offered the best chance to check on its defence priorities and the emerging technologies pursued by the nation's industry. This year's event was dominated by closer co-operation between Airbus and Dassault on future combat air systems, while several of Berlin's other key procurements also heated up. Report by Michael Gubisch and Craig Hoyle

Messe Berlin

PROCUREMENT

More Eurofighters the 'logical choice'

Consortium's chief points to Luftwaffe's in-service experience with type, as Lockheed also promotes its F-35 to Berlin

Germany's need to replace an aged fleet of 90 Panavia Tornados has prompted offers from the Eurofighter consortium and Lockheed Martin.

Tabled via Airbus Defence & Space on 24 April, the European proposal represents a "perfect" and "logical" choice for Berlin, says Eurofighter chief executive Volker Paltzo. An expanded acquisition would provide "the least-risk solution", as "Germany knows, uses and understands our aircraft". The Luftwaffe operates 130 examples.

Paltzo says a Eurofighter selection would be the "right choice for Europe", with continued production to sustain its defence industry into the 2030s and act as a "natural bridge" to a projected future combat air system.


Eurofighter

Enhanced model would assume all roles from aged Tornado fleet

Paltzo also reveals that Eurofighter will upgrade the Typhoon's Eurojet EJ200 engines and other systems, in support of the German campaign and further exports. Power will be boosted by "about 15%", he says, increasing payload and range performance. Additional capabilities are also planned for its Euroradar Captor-E active electronically scanned array radar.

Eurofighter sees potential to sell 300 additional Typhoons, with sales campaigns under way for Belgium, Bulgaria, Finland, Poland and Switzerland.

Lockheed has also offered the F-35, with two US Air Force examples debuting at ILA in the static display. Vice-president business development and strategy integration Jack Crisler says that if selected, Lightning II deliveries could follow with a "typical" lead time of three years. ■

ROTORCRAFT

Chinook campaign lifted by local partnerships

Boeing has partnered with 10 aerospace suppliers that have operations in Germany to support its bid to supply CH-47 Chinooks to the nation. The group includes CAE, Diehl Defence, Honeywell, Liebherr, Rockwell Collins and Rolls-Royce.

Agreements span "local long-term support and training" , maintenance, aircrew and technical training, research and development, and "supply chain enhancements". "Additional German companies will be joining Boeing's industrial plan for collaboration on communication and mission systems integration," it adds.

Boeing's director for vertical lift programmes in Germany, Michael Hostetter, says the CH-47F or MH-47G would provide a "proven and reliable" and "extremely affordable" platform for the Bundeswehr.

Sikorsky debuted its CH-53K King Stallion, having teamed with companies including Liebherr, MTU and Rheinmetall. ■


Boeing

Berlin could be offered baseline CH-47F or longer-range MH-47G

BLADE sharpens focus on fuel savings
Show Report P14

PACT

Duo advance on future fighter alliance

National champions Airbus and Dassault outline joint effort to develop next-generation combat air system capability

Airbus Defence & Space and Dassault used the show to advance their planned collaboration on the development and production of a far-reaching future combat air system (FCAS) capability.

Describing the step as "a landmark industrial agreement to secure European sovereignty and technological leadership in the military aviation sector for the coming decades", the pact seeks to create a successor for the Eurofighters and Dassault Rafales currently operated by Germany and France. The partners envision a new "system of systems" as being available from 2035-2040.

"Never before has Europe been more determined to safeguard and foster its political and industrial autonomy and sovereignty in the defence sector," says Dirk Hoke, chief executive of Airbus Defence & Space. "We are committed to tackling this challenging mission together with Dassault Aviation."

Craig Hoyle/FlightGlobal

Partners envision replacement of current German and French fleets

Hoke adds: "The schedule is tight, so we must start working immediately to define a joint roadmap on how to meet the requirements and timelines to be set by the two nations." The partners are calling on Berlin and Paris to "launch an initial joint study this year to address this task".

"European sovereignty and strategic autonomy will only be ensured through independent European solutions," says Dassault chief executive Éric Trappier. "The programme will strengthen ties between Europe's core nations and reinvigorate its aerospace industry," he adds.

MTU Aero Engines chief programme officer Michael Schreyögg welcomes the proposed activity, but says European manufacturers must increase technology development efforts without delay if they want to supply its powerplant.

Schreyögg says an engine programme must be launched around 2022 to support a flight-test effort by 2030, meaning that MTU and its potential partners must develop new technologies and demonstrators "now".

The joint FCAS activity includes proposals to develop demonstrators from 2025. Likely elements include a next-generation fighter, a medium-altitude, long-endurance remotely piloted air system, advanced cruise missiles and unmanned air vehicles capable of operating in swarms.

Pointing to potential wider participation in the initiative, the companies say they "agree on the importance of efficient industrial governance in military programmes. This also includes the involvement of other key European defence industrial players and nations, based on government funding and on the principle of best contribution". ■

PROGRAMME

Full-size MALE model reveals Europe's ambitions

European industry's drive to develop a future medium-altitude, long-endurance (MALE) remotely piloted air system (RPAS) has taken another step forward, with its key partners unveiling a full-size mock-up of the product.

The European MALE RPAS has the backing of airframers Airbus Defence & Space, Dassault and Leonardo, along with multiple system suppliers. The twin-turboprop design is the result of a definition-phase study backed by the governments of France, Germany, Italy and Spain.

Chosen in mid-2017, the propulsion configuration "will supply ample on-board energy for the mission system, and provide proper redundancy to limit restrictions when operating over European densely populated ground and [in] unrestricted airspace", the programme's three main industrial players say.

A system requirements review was completed in January, with a system preliminary design review activity scheduled for the end of this year. An operational capability could be available from the middle of the next decade.

"This model represents a first milestone of what Europe can achieve in a high-technology sector if it bundles its industrial strength and know-how," says Airbus Defence & Space chief executive Dirk Hoke.

Reaffirming Dassault's "full support to Airbus Defence & Space as programme leader", the French company's chief executive Éric Trappier says: "Co-operation and high technology legitimate the leadership of the European industry and guarantee the strategic autonomy of Europe."

Leonardo Aircraft managing director Lucio Valerio Cioffi adds that the project "will contribute to sustaining key competencies and jobs within Europe."

A combined development, production and initial in-service support phase could be launched during 2019, with the project managed by Europe's OCCAR defence procurement agency.

Meanwhile, defence electronics specialists Elettronica, Hensoldt, Indra and Thales used the show to offer a "future-proof" package of mission system equipment for the MALE platform. ■

Dassault

Twin-turboprop would become operational in middle of next decade

AERODYNAMICS

BLADE sharpens focus on fuel savings

Flight tests of laminar-flow demonstrator aircraft highlight substantial real-world benefits from drag-reducing changes

Airbus says the drag-reducing effects of the experimental wings on its laminar-flow demonstrator are proving more effective than previously thought, making application of the technology on a next-generation aircraft more feasible.

Last September, the airframer began a flight-test campaign with an A340 that has been modified with reshaped outer wing sections to assess natural laminar flow on the aerofoil's upper surface.

Some 66 flight hours have been completed under the partly EU-funded Breakthrough Laminar Aircraft Demonstrator in Europe (BLADE) project, says Airbus senior vice-president research and technology Axel Flaig. Laminar flow could be observed from the aircraft's first flight, and has been more stable than expected, he adds.

A key area of the BLADE project has been to assess how robust the laminar flow is when the wing flexes and twists in the air, and which design methods can be employed to build such aerofoils on a commercial scale.

Airbus

A340 was modified for testing with reshaped carbonfibre aerofoils

Airbus and its industrial partners constructed the left wing laminar-flow section with an integrated upper-wing surface and leading edge, which was made of carbonfibre and required an extremely high degree of accuracy. The right wing section followed a more conventional design, with a carbonfibre upper wing surface and a separate metallic leading edge.

Flaig acknowledges small differences in aerodynamic effects between the two structures, but says both wings sustainably generate the desired effect. Airbus is "very confident" that the project will achieve "more than we targeted", he adds. The company estimates that laminar-flow wings could reduce drag by around 10%, cutting fuel burn by up to 5% on an 800nm (1,480km) sector.

Aerodynamic benefits could be sustained during flight tests at Mach 0.78 – a typical cruise speed for an A320-family jet. Airbus had predicted that the aircraft would need to fly at M0.75 to deliver fuel savings.

Flaig says the tests have shown "the door is wide open" to employ the technology on a potential next-generation single-aisle aircraft from the late 2020s.

Testing is scheduled to continue until 2019, with a plan to assess the effects of wing contamination on the laminar flow and to install a fixed Krüger flap. Such a device is being considered as potential protection against insect contamination on the leading edge – which could disturb the laminar flow – and for high-lift during take-off and landing. ■

PROPULSION

Partners outline integrated approach to UltraFan

Rolls-Royce will co-operate with Airbus to develop a nacelle and pylon for flight tests of the UK manufacturer's under-development UltraFan demonstrator engine.

The European airframer has been recruited to provide "both nacelle and engine/aircraft integration architecture and technology enablers" for ground and flight tests under the future engine programme, R-R says.

"Airbus integration solutions will play an important part in achieving the overall fuel-efficiency improvement," the engine maker says, through an "innovative architecture and associated technologies". The trial will be conducted on "a Rolls-Royce flying test-bed", it notes; it currently employs a Boeing 747 in this role.

Airbus's senior vice-president research and technology, Axel Flaig, says the co-operation represents "a key project to pave the way towards the next-generation integrated propulsion systems that will be needed by airline customers towards the end of the next decade".

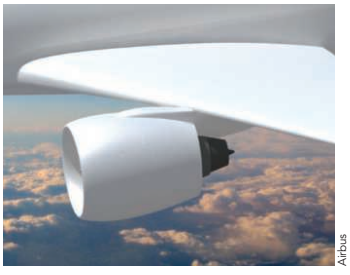
The partnership will enable Airbus to "fully integrate the overall powerplant system onto future long-range aircraft products", and facilitate "scalability for future short-range aircraft", the airframer says. Advanced manufacturing techniques, including high-deposition-rate 3D printing, welded assembly and high production-rate thermoplastics, are to be employed.

Under the UltraFan programme, R-R will develop a geared turbofan that will utilise an engine core being developed in a separate future technology effort named Advance. The new engine should reduce fuel consumption by 25% compared with the Trent 700, and is scheduled to become available for service entry from 2025. R-R is already testing individual sections and components, including a demonstrator version of the Advance engine core.

Meanwhile, R-R is considering a possible transfer of engine certification processes to Germany to guarantee that its powerplants can be approved under European regulations post-Brexit.

"We have to consider what contingency measures we may need to take to ensure our operations in the UK and elsewhere can continue [after Brexit]," the company says. "These may in the future include the transfer of the design approval for our large jet engines from the UK to Germany."

R-R says "no final decision" has been taken on whether to "activate this precautionary measure". It already handles certification in Germany for business jet engines assembled at its Dahlewitz site near Berlin. ■


Airbus

Airframer will make nacelle and pylon for demonstrator engine

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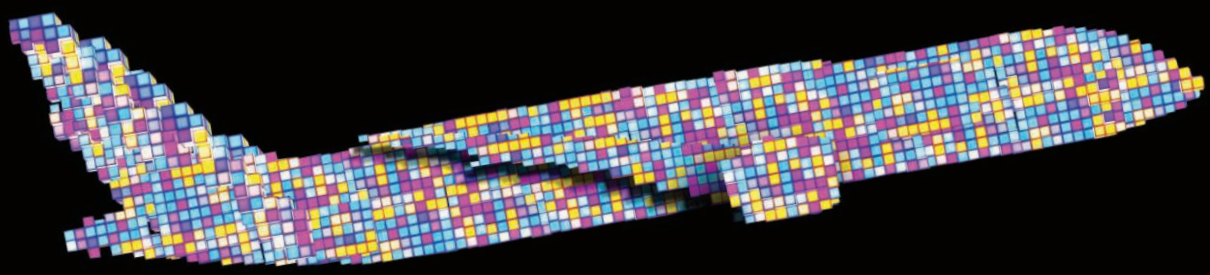

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ACCIDENT **DAVID KAMINSKI-MORROW** LONDON

Pitot checks missed before An-148 crash

Data recordings show crew did not perform items on crucial pre-take-off list, including activating sensor heating system

Investigators believe the crew of a crashed Antonov An-148 did not carry out a crucial checklist which should have included a deferred confirmation that the pitot-static heating system was active.

The Saratov Airlines twinjet came down a few minutes after departure from Moscow Domodedovo on 11 February. None of the 71 occupants survived.

Russian federal air transport regulator Rosaviatsia says the crew contacted apron control at 14:00 for permission to start engines. The crew performed the "before engine start" checklist and – after starting the engines at 14:02 – carried out the "before taxi" checklist, commencing the manoeuvre at 14:07.

Domodedovo tower cleared the An-148 to continue taxiing to runway 14R, and the pilots turned their attention to two more checklists, including that for line-up, which includes an item to check the activation of the pitot-static heating system. But Rosaviatsia says that in the carrier's flight operations manual, this item is deferred to the "before take-off" checks.

KommersantPhotoAgency/REX/Shutterstock

Investigators comb wreckage near Moscow Domodedovo airport

Analysis of flight-data recordings shows that, before take-off, the aircraft's integrated information system indicated "no heating" on any of the three pitot-static sensors.

"Almost immediately after taxiing the aircraft to the runway, the crew received take-off clearance," says Rosaviatsia.

It says that the "before take-off" checklist was "not performed", suggesting that the pilots did not confirm whether the pitot-heating was active. The crew instead commenced the take-off roll.

The aircraft lifted off at 14:21 and the crew engaged the autopilot at 130-150m (426-492ft), and completed flap retraction at 550m.

Some 2min 30s into the flight the aircraft began to display unreliable airspeed indications, and the crew lost control of the jet. ■

COMPLAINT
STEPHEN TRIMBLE
WASHINGTON DC

WTO dismisses Canadian effort to block probe

A World Trade Organization panel has rejected Bombardier's request to throw out a Brazilian government complaint over alleged improper subsidies, allowing the dispute to progress.

In February 2017, Brasilia, acting for Embraer, requested consultations at the WTO, claiming that Bombardier received over $7 billion in illegal subsidies from the Canadian government over the 2006-2016 period.

After consultations led to an impasse, Brazilian officials requested last August that the WTO create a panel to adjudicate the dispute.

Bombardier then asked the WTO to throw out the complaint, saying that Brasilia had not provided a "summary" of the products benefiting from the alleged subsidies. However, the WTO panel says the complainant does not need to list specific products. ■

INTERIORS **JON HEMMERDINGER** BOSTON

Alaska begins cabin overhauls as it aligns ex-Virgin America A320s

Seattle-based Alaska Airlines has begun a major overhaul of the cabins on the Airbus A320-family aircraft it inherited as part of its December 2016 acquisition of Virgin America.

The carrier is a long-term Boeing 737 operator and is attempting to offer more cabin consistency across the two aircraft types.

"We have made a decision to standardise all Airbus A319s, A320s and A321s to the Alaska standards," says Jason Lai, the airline's managing director of cabin systems and airframe MRO.

The company will equip its 69 Airbus narrowbodies with new carpets, curtains, lights and other furnishings, and will fit the aircraft with new Recaro seats, says Lai.

"This will give us the opportunity to have common parts and common suppliers, and to introduce more first-class and more premium-class [seats]," Lai says.

AirTeamImages

Carrier inherited Airbus narrowbodies after buying Californian rival

The move will also enable better network planning flexibility, he says.

Alaska expects to complete the first A320 cabin overhaul in the third quarter of 2018, with the project running until end-2019.

The carrier operates 10 A319s, 53 A320s and six A321neos, according to Flight Fleets Analyzer.

In addition, the airline is performing a similar update to 11 737-700s. Those aircraft will receive new seats, lighting, carpets, curtains, lavatories and in-flight entertainment systems, says Lai. ■

United remains true to its 2020 vision
Air Transport P18

PROGRAMME GREG WALDRON SINGAPORE

Mitsubishi hints at Farnborough flights for MRJ

Mitsubishi Aircraft plans to show off its MRJ regional jet at this year's Farnborough air show, where it may appear in the flying display, a move that would be a public first for the type.

"Mitsubishi Aircraft is working to bring the MRJ to the 2018 Farnborough air show in July for static display and flight demonstrations," says company president Hisakazu Mizutani.

BillyPix

Type made its first public appearance at Paris air show in June 2017

The MRJ made its air show debut at Paris in June 2017, with prototype FTA-3 flying in from its flight-test centre in Moses Lake, Washington; any aircraft for Farnborough will be drawn from the same four-unit contingent.

Given the programme's flight-test campaign – which involves four airframes at Moses Lake and one in Nagoya, Japan – the company is likely to have only one aircraft available for Farnborough, which takes place from 16-22 July.

Mitsubishi Aircraft says its fleet at Moses Lake has now returned to flight after a five-week hiatus that ended on 21 March. While on the ground, improvements were made to the jets' wiring harnesses, bringing them closer to the production standard. The Nagoya-located aircraft is undergoing ground testing, meanwhile. The test fleet has accumulated almost 1,900 flight hours.

Work to reconfigure the aircraft's avionics bay is almost complete, says Mitsubishi. ■

AIRLINE GREG WALDRON SINGAPORE

ANA aims high with seating on A380s

Three on-order superjumbos will each carry 520 passengers, yielding second-densest passenger cabin of any operator

Japan's All Nippon Airways (ANA) will equip its three on-order Airbus A380s with 520 seats, the second highest accommodation density deployed on the type.

The four-class layout includes 383 economy-class seats on the main deck, says ANA, while the upper deck will have 137 seats: eight in first class, 56 in business, and 73 in premium economy.

Flight Fleets Analyzer reveals that this will be the second densest A380 configuration, behind only the 13 615-seat superjumbos operated by Emirates. The average seat count across the total 221 in-service A380s is 496.

ANA will commence service with the double-deck type, which will be powered by Rolls-Royce Trent 900s, in spring 2019, operating on the Tokyo-Honolulu route. Its first A380 is in final assembly in Toulouse.

"This marks the first time ANA has offered first class on this resort route, and its aim is to provide passengers with a luxurious onboard experience. Each [first-class] seat features its own door and provides passengers with the privacy they need to enjoy their personal space," says the carrier.

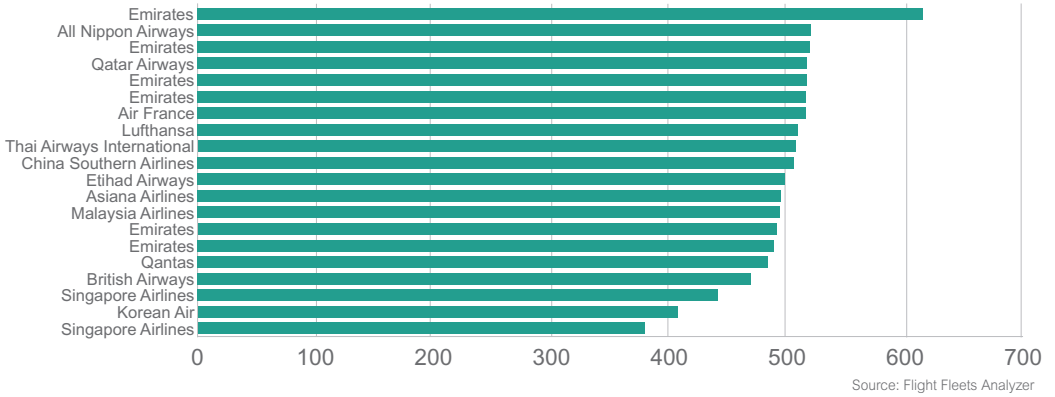
All Nippon Airways

Services to Honolulu with double-decker will begin in spring 2019

Acknowledging that the Honolulu route is popular with couples, including newlyweds, business class offers several rows of seats directly next to one another, dispensing with the typical herringbone configuration, where seats are at angles to one another.

In addition, economy class includes 60 of what the airline calls "couch seats" – where the footrests of a seat row fold up to form a bed. The carrier expects the couches to be particularly popular among families travelling with small children. ■

A380 cabin configurations



Source: Flight Fleets Analyzer

Air Italy

Aircraft are sourced from fleet of 49% shareholder Qatar Airways

BRANDING

Air Italy shows new colours on Max

Air Italy has unveiled the first aircraft featuring its new livery – a Boeing 737 Max 8, painted with a scheme using the maroon shade prominent in the branding of shareholder Qatar Airways.

Air Italy, formerly Meridiana, had only previously shown the livery as a digital mock-up. In March, the full-service carrier announced that it would be adding five Airbus A330-200s and three 737 Max 8s to its fleet as the summer season commences.

The aircraft are being leased from 49% shareholder Qatar Airways as Air Italy embarks on a rapid short- and long-haul expansion programme with Milan Malpensa as its focus.

Flights under the new name began on 1 March, operated with 737s and 767s still bearing Meridiana's livery. Those aircraft will be phased out as the A330s and 737-8s enter the fleet.

In May 2019, the airline is set to begin receiving 787s, also leased from Qatar Airways. Air Italy will have a fleet of 50 aircraft by 2022, majority owners Alisarda and Qatar Airways envision. ■

STRATEGY **EDWARD RUSSELL** WASHINGTON DC

United remains true to its 2020 vision

Carrier will not place further orders for narrowbodies before end-decade, ruling out fresh deals with Bombardier or Embraer

United Airlines does not expect to add any new narrowbody aircraft before 2020, beyond those already in its orderbook – effectively ruling out a near-term deal for Bombardier or Embraer jets.

The comments from airline president Scott Kirby follow speculation that the Chicago-based carrier could order a small mainline narrowbody, like the Bombardier CSeries or Embraer 190-E2, or additional 76-seat regional jets if it secures scope-relief from pilots, whose contract becomes amendable in January 2019.

A new order requires a number of steps, says Kirby. These include negotiation and ratification of a new pilots' contract, discussions with airframers, and then roughly 18 months until delivery of the first aircraft. "There was never enough time to get all that done," he says, referring to United's three-year capacity growth plan.

United Airlines

Airline will add 10 Leap-1B-powered jets this year

The airline plans to grow by 4-6% a year until 2020, driven by what Kirby has called a "temporary" bump in 50-seat regional aircraft, as well as increased utilisation of its mainline fleet.

United in 2018 intends a net increase of 24 mainline aircraft, including its first 10 Boeing 737 Max 9s, and 36 regional aircraft, including a number of 50-seat regional jets, a plan released in mid-April shows. Chief financial officer Andrew Levy says he expects the mainline fleet will continue to grow in 2019 and 2020.

United is scheduled to take delivery of nine 737-9s and two 787-10s in 2019, and 20 737 Max 9/10s and five 787-10s in 2020, Flight Fleets Analyzer shows.

The airline continues to discuss possible deals for used narrowbody and widebody aircraft to boost its fleet in the interim, says Levy.

It will add three used 767-300ERs from Hawaiian Airlines to its fleet this year, and recently announced a deal for 20 pre-owned Airbus A319s that it will add in 2020-2021. ■

DELIVERY

'Swoosh' livery underlines re-engined single-aisle's credentials

The Boeing 737 Max 9 has made its US debut, with the first delivery of the CFM International Leap-1B-powered twinjet to United Airlines on 23 April.

The aircraft (N67501) was handed over to the Chicago-based airline at Boeing's Seattle delivery centre.

"In honour of this more eco-friendly aircraft, United has given the Max a new livery… so that employees and customers can recognise the plane and its superior fuel efficiency," the airline says.

The livery adorning the Max matches the "swoosh" paint-scheme applied to its 787 fleet.

United is planning to debut the 737-9 from its Houston Intercontinental, Texas and Los Angeles bases in June.

It holds firm orders for 60 more 737-9s and 100 737-10s. ■

Tokyo sizes up options on future fighter
Defence P20

STRATEGY **OLIVER CLARK** LONDON

Eurowings lays out its expansion plans

Germany-based no-frills carrier outlines ambition to boost European market share, growing fleet by one-third, to 300

Eurowings will seek to grow its fleet by more than a third to some 300 aircraft and open new continental bases over the coming years as part of plans to become a pan-European low-cost carrier.

Speaking at a conference in London in mid-April, chief commercial officer Oliver Wagner said the budget carrier has both "offensive" and "defensive" roles within Lufthansa Group.

Its first priority is driving "digitisation" and growing its market share in the traditional "DACH" markets of Germany, Austria and Switzerland. He says the Lufthansa group seeks to be the number one or two operator in its key markets.

But he says the second step in the carrier's growth plan is to become a truly pan-European airline.

To achieve this, Wagner says the carrier will likely use a mix of organic and inorganic options to grow its fleet from 185 aircraft this summer, to a target of 300. He does not reveal a timeline for this.

The airline will add 30 aircraft to its fleet this year and is growing its operations at markets such as Berlin, Cologne-Bonn, Düsseldorf and Munich.

The decision to open a base at Munich last summer was an example of a defensive move that Wagner says carried the message to rivals that "this is our home turf".

Dinendra Haria/REX/Shutterstock

Initial focus is on DACH nations before boosting presence elsewhere

In what Wagner terms "sensitive routes", Eurowings is working closely with Lufthansa to combat competitors. Elsewhere, especially on long-haul routes, Eurowings is serving the leisure, cruise and tour operator markets which have traditionally been ignored by its mainline sister operator.

He says the Düsseldorf-based carrier has experienced "tremendous growth" following its absorption of assets from Air Berlin including regional carrier LGW and those of Lufthansa subsidiary Brussels Airlines.

That has presented a challenge of standardising its product offering, but Wagner expects the task to be finished by the winter. ■

TURBOPROPS

Route-wide review will determine future of ex-Air Berlin Q400s

Lufthansa Group subsidiary Eurowings is reviewing the future use of 20 Bombardier Q400s it inherited when it acquired the assets of German regional carrier LGW from Air Berlin.

Eurowings chief commercial officer Oliver Wagner says the budget carrier is carrying out a "route-wide" review "looking into potential future operation" of the turboprops.

"As a matter of fact there is a market [for these aircraft] within Germany: there are routes that are more business-focused, that are thin, which are much less leisure-focused," he adds.

Lufthansa acquired LGW's assets from the administrators of Air Berlin in January as part of a €1 billion ($1.18 billion) deal. These included 20 Q400s and 13 Airbus A320s which were transferred, along with all LGW's employees, to Eurowings' control.

Flight Fleets Analyzer shows that the 20 Q400s are leased. Seventeen are managed by Nordic Aviation Capital and the remaining three by GECAS.

Wagner says the integration of LGW's fleet and staff is at an advanced stage, with the majority of the turboprops now painted in Eurowings' livery.

The aircraft are being used on routes from Berlin and Düsseldorf, he adds. ■

BillyFix

Former EasyJet chief warns high fuel prices could have major impact

ANALYSIS

Worries over low-cost 'correction'

A period of good economic conditions has led to complacency among low-cost carriers that is ripe for a "correction", in the view of former EasyJet chief executive Ray Webster.

Speaking at the Routes Europe conference in Bilbao on 23 April, Webster – who was chief executive of EasyJet between 1996 and 2006 – said that the outlook for low-cost airlines was "quite worrying" as they were unprepared for future economic shocks.

A period of "very good" economic conditions has been punctuated by the lack of a "serious downturn or runaway fuel prices", he states.

As a result, carriers have not been put under "pressure" and so have "incrementally added costs" and lost efficiencies over time, while not experiencing the typical "peaks and troughs" of the market.

Webster forecasts that oil producers could raise prices, which would have a "dramatic" impact on airline bottom lines. ■

For insight and analysis of the latest developments in the defence sector, visit: flightglobal.com/defence

MUNITIONS **GARRETT REIM** LOS ANGELES

Hypersonic missile project enters development

Lockheed Martin Space will develop the US Air Force's first hypersonic cruise missile, under a contract awarded on 18 April. Worth up to $928 million, the award suggests that the service is ready to move past several decades of development and demonstrations of weapons that can cruise for long distances at speeds exceeding Mach 5.

The hypersonic conventional strike weapon contract follows a competitive process in which three offers were received. While the USAF has not named the other contenders, when the competition was announced in July 2017 it identified Boeing, Lockheed, Northrop Grumman and Raytheon as the only valid bidders.

Lockheed's selection could imply a shift in technology leadership from Boeing, which has received several previous contracts, including for its X-51A scramjet, which reached M5 in 2010. However, the USAF also intends to develop a future hypersonic air-launch rapid-response weapon.

A future hypersonic cruise missile must be capable of being carried by bombers and fighters, according to the USAF's solicitation notice. It also must have precision strike capability against high-value, time-critical fixed and relocatable surface targets in a single or multi-theatre challenged environment, the service adds.

The difficulty of defending against hypersonic weapons has pushed the Department of Defense into action, due to the advances and investments being made in such technology by China and Russia. Undersecretary of defense for research and engineering Michael Griffin in March described the development of hypersonic weapons as the US military's "highest technical priority". ■

US Air Force

Requirement calls for a weapon suited to multiple delivery platforms

TECHNOLOGY **GREG WALDRON** SINGAPORE

Tokyo sizes up options on future fighter

Acquisition agency continues to consider strategy for new combat type and possible foreign partnership, as X-2 tests end

Japan's Acquisition, Technology & Logistics Agency continues to weigh ideas for a futuristic fighter to replace the nation's Mitsubishi F-2s.

"We have been doing the RFI [request for information] process continuously, and our questions have been changing," says an official familiar with the programme to develop a new aircraft, which is likely to be designated as the F-3. The source declines to comment on a recent Reuters report, citing anonymous sources, which suggested that Lockheed Martin intends to offer a hybrid of its F-22 and F-35 products for the requirement.

A number of proposals are being considered, according to the official, who notes that Japan and the UK also have a joint study to look at "potential opportunities for the future fighter programme".

Tokyo has been exploring a new fighter for several years, with potential options including developing an all-new type indigenously, collaborating with a foreign partner on a new design, or buying or upgrading an existing product.

Developing a Japanese fighter from a US baseline would not be without precedent, as the locally-made F-2 is largely derived from Lockheed's F-16. Designed to carry a larger payload, especially in an anti-ship strike configuration, the Mitsubishi type has 25% greater wing area than the F-16, and also features other modifications such as increased use of composites. However, the F-2 was so expensive to develop and produce that Tokyo halted procurement after only 94 of a planned 144 examples. Flight Fleets Analyzer shows 88 as remaining in service with the Japan Air Self-Defence Force.

Japan previously wanted to acquire the F-22, but in 1998 the US Congress blocked a potential sale and any international licensing of the Raptor. A downgraded export variant seemed briefly possible in 2006, but Washington also prevented such a development after voicing concerns about Japan's ability to safeguard technology, following a 2002 leak of data concerning the US Navy's Aegis combat system.

While Mitsubishi is producing 42 F-35As under licence at a final assembly and check-out facility in Nagoya, it is unclear how much further the US government could be willing to go to provide the technology transfer necessary were it jointly to develop a hybrid of the type and the larger F-22.

Meanwhile, the same official confirms that work using Japan's X-2 technology demonstrator has ended after a total of 34 flights. The programme had originally been envisaged to include up to 50 sorties, but the source states: "We've finished the testing that we planned."

Used to explore technologies necessary for a stealthy fifth- or sixth-generation aircraft, the platform remains at Gifu air base. "Nothing is determined about the X-2's future," the source notes. "We may do more testing." ■

Crown Copyright

Production of current-generation F-2 proved prohibitively expensive

Textron plays down 33% backlog jump
Business Aviation P22

PROCUREMENT **GARRETT REIM** LOS ANGELES

DoD takes shine to multi-year F-35 deal

Long-term plan for cost-saving contracts will acquire large number of fighters from 2021, as full-rate production begins

The US Department of Defense has revealed a long-term plan to sign a series of cost-saving, multi-year procurement contracts to buy a total of nearly 2,000 Lockheed Martin F-35s starting from fiscal year 2021.

As the F-35 programme moves towards full-rate production, the US Air Force and US Navy plan to transition from purchasing the aircraft in one-year blocks to multi-year deals, a recent Selected Acquisition Report reveals. The USAF plans to start such a transition with a three-year contract in 2021, followed by successive five-year procurements between FY2024 and the end of the programme. The USN plans to continue making one-year procurements through FY2023, followed by five-year deals from the following fiscal year.

Multi-year procurement contracts are a special mechanism that Congress permits the DoD to use for a limited number of programmes at full-rate production to reduce costs by several per cent. In total, the department plans to purchase 2,456 Lightning IIs: 1,763 F-35As for the USAF, 353 F-35Bs and 67 F-35Cs for the US Marine Corps and 273 F-35Cs for the USN.

US Air Force

Lockheed has committed to cutting type's flyaway cost to $85 million

The USAF plans to purchase 60 F-35As per year starting in 2024, so the Joint Programme Office's (JPO) first planned five-year procurement contract would guarantee Lockheed 300 orders.

"Multi-year procurements are a key tool to reducing F-35 acquisition costs, improving industrial base stability and enhancing efficiencies," the company says. "We are working closely with the Department of Defense on the acquisition approach for a multi-year procurement beginning in 2021, and we have submitted savings information to our customers to help support their analysis and decisions."

Writing in the recent report, the JPO says it is pursuing other cost-saving initiatives, including a shared database of parts costs with Lockheed to be used to negotiate "fair and reasonable" pricing for the USA and partner nations, plus looking for production line efficiencies.

Lockheed delivered 66 F-35s last year, taking its programme total to 265 examples by the end of 2017. The goal this year is to deliver 91: 85 from its Fort Worth site in Texas, plus two and four, respectively, from final assembly facilities in Italy and Japan.

Lockheed has committed to reducing the F-35A's flyaway unit cost to about $85 million by the programme's Lot 13 low-rate initial production contract, although chief financial officer Bruce Tanner cautioned last year that this could be in jeopardy if the DoD fails to find additional production efficiencies and implement multi-year buys. ■

PROGRAMME **GARRETT REIM** LOS ANGELES

B-21 Raider clears its preliminary design review

Northrop Grumman has finished its preliminary design review of the B-21 Raider stealth bomber, with the programme moving towards critical design review, says Lt Gen Arnold Bunch, the US Air Force's military deputy for acquisition.

"We are making good progress," Bunch says. "I am comfortable today with were we are at, [and] the progress that Northrop Grumman is making on the programme."

The USAF plans to field 100 B-21s from the mid-2020s, to replace its 62 Boeing B-1Bs and 20 Northrop B-2s.

However, Lt Gen Jerry Harris, its deputy chief of staff for strategic plans and requirements, hints that it could ask for funding to acquire dozens of additional examples.

"We would like to fix the nine squadrons [of bombers] we have right now to give them more airplanes per squadron and then continue to grow to somewhere in the neighbourhood of 14 or 16 squadrons that are ready for the mission," Harris says. ■

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STRATEGY **STEPHEN TRIMBLE** WASHINGTON DC

Textron plays down 33% backlog jump

Despite higher order intake for Cessna and Beechcraft brands, tough market means output increases are not planned

Textron Aviation's order backlog for new business jets and turboprops swelled suddenly by 33% in the quarter to 31 March, reversing a long-term trend in a stagnant market.

The Wichita-based manufacturer of Cessna and Beechcraft aircraft finished the first quarter of 2018 with a $1.6 billion backlog, up $400 million on the previous three-month period. It was the largest increase since Cessna bought Hawker Beechcraft in 2014 and absorbed the latter's orderbook. Since 2015, Textron Aviation's backlog has hovered between $1 billion and $1.2 billion.

But Scott Donnelly, chief executive of parent company Textron, downplayed the first-quarter backlog surprise. Although one analyst on its 18 April earnings call described the increase in dramatic terms, Donnelly was more circumspect: "I wouldn't say it's a dam bursting."

Despite the three-month order windfall, he remains dissatisfied with the profits earned on each aircraft sold, suggesting the business aviation sector is not yet strong enough to give manufacturers pricing power over customers.

Textron Aviation

Certification of Citation Longitude is expected in the second quarter

"We're still at price levels that we're not very happy about," Donnelly says. "The amount of capital and the amount of investment you make in this business warrants a better return. We have been walking away from deals that are at price levels that are just not acceptable to the business."

Overall, Textron Aviation revenues totalled $1 billion during the quarter, a 4% increase over the same period last year. Revenues grew by about $40 million, despite delivering only 36 aircraft in the first quarter, or one more than the same period in 2017. Donnelly attributes $9 million of revenue growth to improved pricing, leaving about $30 million credited to a shift towards more expensive models and options.

Textron Aviation is not considering increasing business aircraft production significantly, despite the backlog jump, Donnelly says, but adding a few deliveries for certain models is possible.

The company now plans to certificate the first super-midsize Cessna Citation Longitude in the second quarter, a slight delay from the original goal of the fourth quarter of 2017.

Meanwhile, development of Textron Aviation's first large-cabin jet, the Hemisphere, remains suspended, Donnelly says. The Hemisphere is specified with the Safran Silvercrest engine, which is struggling to overcome a series of design flaws. Dassault cancelled the Silvercrest-powered Falcon 5X last December, and launched the slightly larger and longer-range 6X, instead using a variant of the Pratt & Whitney Canada PW800 engine. Donnelly has said that Textron Aviation would walk away from the large-cabin segment if the Silvercrest 's problems cannot be resolved.

Textron Aviation is still waiting "to see how the engine plays out", Donnelly says, without elaborating. ■

DEVELOPMENT **KATE SARSFIELD** LONDON

Traveller moves closer to first customer deliveries

Italian airframer Tecnam is building the parts for the first customer-owned P2012 Travellers, and says it will begin assembling the all-metal piston-twins in mid-May, ahead of initial deliveries in early 2019.

"We are preparing the production line in Capua [near Naples] now, and plan to deliver the first Travellers shortly after US and European certification, which is on track for the end of the year," says Tecnam global sales and marketing director Walter Da Costa.

US regional airline Cape Air is the launch customer and co-developer of the 11-seat, 375hp (280kW) Lycoming TEO-540-C1A-powered Traveller. The Hyannis, Massachusetts-based carrier has ordered 100 aircraft to replace its fleet of ageing Cessna 402C piston-twins, and will take delivery of the first 10 units in 2019, says Da Costa.

"We plan to produce 20 Travellers in total next year, reaching production of between 25 and 30 aircraft in 2020," he adds.

Tecnam has an orderbook for over 130 Travellers, with charter operators accounting for the remainder. In early April, the company announced the sale of a single aircraft to Seychelles-based Zil Air, which will be delivered in July 2019. The operator is in discussions to acquire a second example, and Da Costa hopes to close the deal in the third quarter.

Tecnam

Production of the piston-twin is forecast to reach 25-30 units by 2020

The Traveller was launched by Tecnam in 2011 and made its maiden sortie in 2016, with the second flight-test aircraft joining the certification campaign in December 2017. So far, the pair have flown over 300h, says Da Costa.

The Garmin G1000 NXi-equipped Traveller has a range of 950nm (1,750km), a cruise speed of 190kt (351km/h) and a maximum take-off weight of 3,600kg (7,930lb). ■

Sales March on as backlog climbs
Data View P24

PROGRAMME **STEPHEN TRIMBLE** WASHINGTON DC

Nacelle certification drags on G500

Pratt & Whitney Canada is continuing to work on certificating the nacelle for the Gulfstream G500, with entry-into-service of the large-cabin business jet expected "later this summer", says Greg Hayes, chief executive of the engine maker's parent company, United Technologies (UTC).

Gulfstream originally planned to certificate the G500 in early 2018 when launching the programme more than three years ago, but advanced that schedule to the second half of 2017.

As the accelerated deadline came and went, Gulfstream explained that one supplier did not anticipate some of documentation requirements needed by the European Aviation Safety Agency. Gulfstream reset the entry-into-service for the G500 back to the original 2018 schedule.

P&WC supplies the integrated propulsion system for the G500 to Gulfstream, which includes its PW800 powerplant as well as the nacelle.

"The engine is certified," Hayes told analysts during a first quarter earnings call on 24 April. "We're still doing some work on the nacelle."

In 2014, P&WC announced the selection of Oklahoma-based Nordam to supply the inlet, nacelle and thrust reverser for the PW800. Earlier this year, Austria-based FACC Aerospace announced that it had been selected by P&WC to supply hybrid metallic-composite fan cases for the engine. ■

Gulfstream

Gulfstream had wanted large-cabin jet to enter into service in 2017

COMPLETION
KATE SARSFIELD
LONDON

Fokker will give VIP treatment to ACJ319neo

Dutch maintenance, repair and overhaul company Fokker Techniek has secured the first VIP completion contract for the Airbus ACJ319neo, following its appointment by German charter operator K5-Aviation to design and outfit a re-engined narrowbody on behalf of its unnamed owner.

The airliner will arrive at Fokker's facility in Woensdrecht in May 2019 and is expected to be ready for redelivery in early 2020.

The ACJ319neo will join K5's fleet of managed, high-end aircraft, including three current-generation ACJ319s and two Bombardier Global Express/XRS jets. K5 also has an ultra-long-range Global 7000 on order. ■

TESTING **KATE SARSFIELD** LONDON

SyberJet preparing SJ30i for take-off

Airframer targets third quarter of the year for maiden sortie of upgraded light jet, with initial deliveries expected in 2019

SyberJet Aircraft has begun ground functional testing on the SJ30i, in preparation for the revamped light business jet's first flight early in the third quarter.

Mark Fairchild, general manager and director of sales for the Cedar City, Utah-headquartered company, says the test aircraft's systems are being "rigorously evaluated". These include the hydraulics, avionics, electrical power generation, pressurisation, engines, fuel system, landing gear and flap/slat actuation, as well as flight controls and engine rigging.

The $8.3 million, Williams International FJ44-2A-powered SJ30i is an upgraded version of the SJ30-2, which was certificated in 2005 by its former owner, Emivest Aerospace. Four examples were delivered and remain in service. The programme was acquired in 2011 by SyberJet's parent company MTI, whose subsidiary, Metalcraft Technologies, supplied the aircraft's aft fuselage.

The main feature of the 2,500nm (4,630km)-range SJ30i is a new avionics suite called SyberVision. Based on Honeywell's Primus Epic 2.0 system, it comprises four 12in displays and features including SmartView synthetic vision, a moving map display system, electronic charts, TCAS II, dual flight management systems, graphical flight planning and onboard weather radar.

SyberJet has also upgraded the layout of the cockpit to boost its functionality and ergonomics and has added a sixth window on either side of the fuselage.

The interior will undergo a redesign in the coming months "to give it a more high-end, automotive look", says Fairchild. "These changes, along with improvements in manufacturing, and the use of lighter-weight materials, will reduce the aircraft's empty weight by about 200lb [108kg], and help boost its range," he adds.

The SJ30i's flight-test campaign is expected to take a year, and will involve around 250h of flying. "We hope to get an amendment to the type certificate in mid-2019 and deliver the first aircraft soon after," says Fairchild.

The SJ30i fleet will consist of the five unsold and incomplete units – serial numbers 9, 11, 12, 13 and 14 – that MTI acquired from Emivest. SyberJet is also offering the i-series retrofit to current SJ30 owners.

Serial number 15 will be the first aircraft to be wholly produced by SyberJet, and the initial example of the airframer's new baseline model – the SJ30x – featuring more fuel-efficient, higher-thrust FJ44-3AP-25 turbofans. First flight of the $8.8 million aircraft is scheduled for mid-2020. ■

SyberJet

Aircraft is updated version of SJ30-2, which was certificated in 2005

Sales March on as backlog climbs

Net orders hit 188 units in third month of year, with Jet Airways' and other commitments to the 737 Max dominating. But regional jet and turboprop sectors remained in the doldrums

GRAHAM DUNN & **ANTOINE FAFARD**
LONDON

Continuing an improvement in sales recorded the previous month, March saw orders for commercial aircraft rise to 204 units. However, this translated to net business for 188 airframes, as a result of 16 cancellations, while commitments for 17 aircraft were the subject of swaps, preliminary information from Flight Fleets Analyzer shows.

The industry's March performance represented by far its busiest month so far this year, and a 40% increase in business over the same period 12 months earlier, when net orders totalled 134 units.

Indian carrier Jet Airways stood out, after finalising a deal to purchase an additional 75 Boeing 737 Max aircraft. The new deal is in addition to a previous order for a similar number of 737 Max 8s – a mix of firm orders and purchase rights – that was announced at the Dubai air show in November 2015.

Boeing also logged an order for a further 79 Max-series aircraft, placed by a yet-to-be announced customer. In Europe, Ukrainian low-cost start-up SkyUp Airlines ordered five Max aircraft: a mix of -8s and -10s. Also in the narrowbody sector, VietJet Air added a further two Airbus A321s to its backlog.

Widebody business included a Turkish Airlines order for 25 787-9s, in a deal that also includes five options. The carrier has also tentatively agreed to take a similar number of A350s.

Turkish Airlines is taking 25 787-9s, plus five options

Boeing

Lessor BOC Aviation also ordered six 787-9s, noting that an undisclosed airline had exercised an option to purchase or lease the Dreamliners. These units seem most likely to have been transferred from Norwegian Airlines, as Boeing's orders and delivery numbers for that carrier have been reduced by the same figure.

Continuing what has been a dry run so far through 2018, no new regional aircraft were ordered in March. A net total of just four had been ordered in March 2017. No turboprop sales were recorded either, marking the first blank so far this year in this category.

At the end of March, the overall order backlog for commercial aircraft stood at 15,186: up 14 on the previous month.

Meanwhile, Fleets Analyzer shows that 174 commercial aircraft were delivered to 97 operators during March: a 9% increase on the same period the previous year. This made it the busiest month for shipments so far in 2018, with just one unit fewer transferred than during the first two months combined.

Lessor BOC Aviation also ordered six 787-9s, noting that an undisclosed airline had taken an option to purchase or lease the Dreamliners

Asia-Pacific-region carriers led the pack in delivery volume, taking a combined 61 units. Operators in Europe and North America took 60 and 38 airliners, respectively.

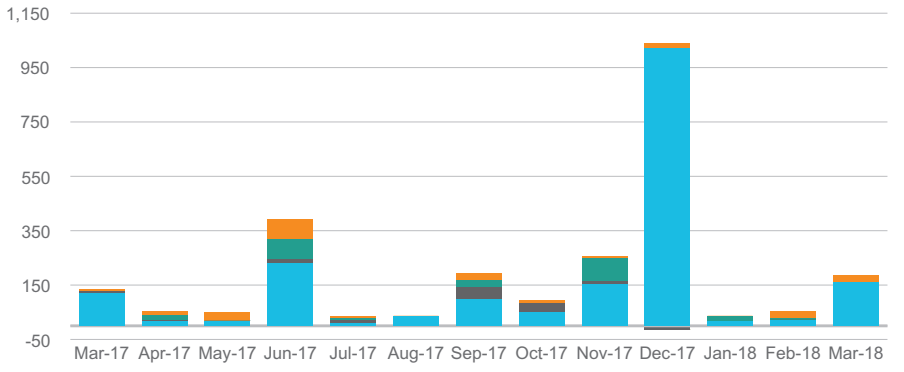
Narrowbody deliveries dominated business, with 114 aircraft transferred, along with 36 widebodies. The totals for regional jets and turboprops stood at 17 and seven units, respectively. Almost half of the global deliveries were made to mainline operators. ■

New orders, March 2018

Jet Airways	737 Max	75
Turkish Airlines	787-9	25
BOC Aviation	787-9	6
SkyUp Airlines	737 Max 10	3
SkyUp Airlines	737 Max 8	2
All Nippon Airways	777-200	2
VietJet Air	A321	2

Source: Flight Fleets Analyzer
Note: Information for known customers only

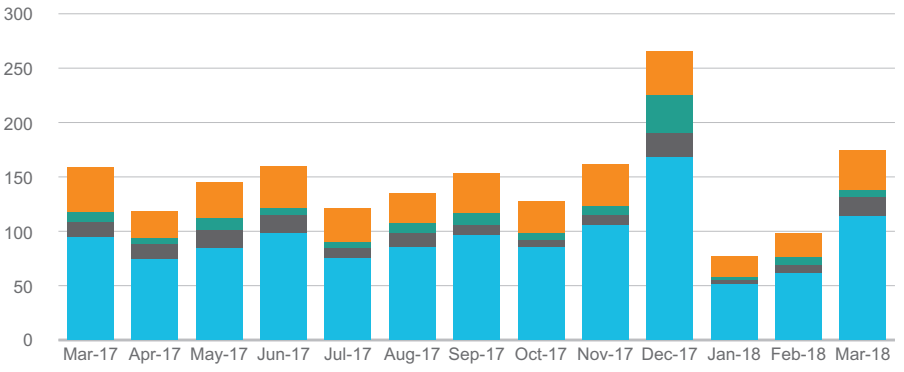
Commercial monthly net orders, March 2017-2018



Source: Flight Fleets Analyzer

Narrowbody | Regional | Turboprop | Widebody

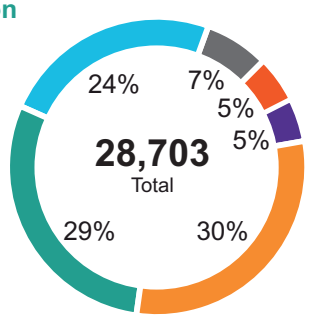
Commercial monthly deliveries, March 2017-2018



Source: Flight Fleets Analyzer

Narrowbody | Regional | Turboprop | Widebody

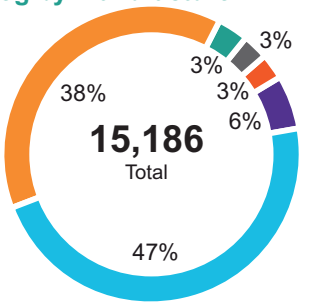
Commercial in-service fleet by region



Source: Flight Fleets Analyzer

North America 8,627	Asia-Pacific 8,459	Europe 6,862
Latin America 2,007	Middle East 1,446	Africa 1,302

Commercial aircraft order backlog by manufacturer

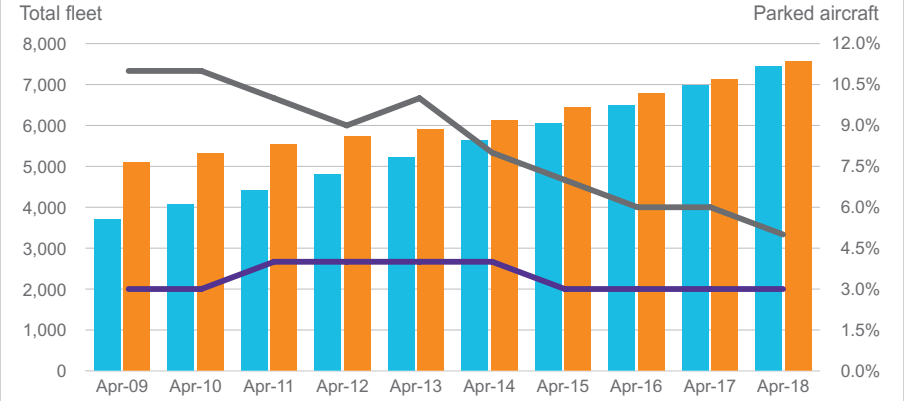


Source: Flight Fleets Analyzer

Airbus 7,160	Boeing 5,821	Comac 502
Embraer 421	Bombardier 424	Other 858

In focus: how narrowbody balance of power shifted

A320 vs 737 family, total fleet and stored aircraft



Note: Fleet information based on commercial operations only. Source: Flight Fleets Analyzer

A320 family | 737 family | Parked A320 family | Parked 737 family

Airbus introduced the A320 to service in 1988 as a rival to Boeing's 737, which at that time had been in the market for 20 years, and was then being produced as the -300/400/500 series.

It took Airbus three decades to achieve market share parity between the A320 and 737.

In terms of average age, the 737 is slightly older, at 11 years, against nine for the A320.

Over the past decade, more 737s have been in storage, peaking at 11% in 2010-2011, against a maximum of 4% for the A320.

Although the commercial in-service A320-family fleet overtook that of the 737 last year, the total presence for the Boeing jet, including stored aircraft, is still slightly higher. The manufacturers' current order backlogs – mainly for the Neo and Max – see Airbus with a share of just over 50%. ■

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The 65,000t HMS *Queen Elizabeth* has already performed operational trials with helicopters aboard: its next arrival will be the Lightning II

Getting back in the big league

With its new aircraft carriers and embarked F-35Bs to reinstate a strike role lapsed since the Harrier's retirement, the UK is preparing to trial the combination's flagship capability

RICHARD SCOTT LONDON & WARTON

In November 2010, then-Lt Cdr James Blackmore became the last pilot of a BAE Systems Harrier to launch from the flightdeck of the Royal Navy aircraft carrier HMS *Ark Royal*, bringing to an end three decades of shipborne short take-off and vertical landing (STOVL) operations from the service's three Invincible-class carriers.

In a circuitous arc, now Cdr Blackmore will in five months oversee the re-birth of fixed-wing aviation in the RN, as HMS *Queen Elizabeth* – the first of its two new 65,000t aircraft carriers – begins first of class flying trials (FOCFT) with STOVL aircraft of an altogether different kind.

Two fully instrumented Lockheed Martin F-35B Lightning II development aircraft from the Integrated Test Force (ITF) at NAS Patuxent River, Maryland, will join the ship off the eastern seaboard of the USA for two development test periods – dubbed DT-1 and DT-2 – running through October and November.

The purpose of the FOCFT activity is to validate design modelling and support the production of the full ship/air integration release. To achieve these objectives necessitates operating the aircraft and ship in a wide range of load, motion, wind and environmental conditions, using instrumentation to capture detailed trials data. These individual test points are used to define the limits of the safe operating envelope.

> **"This ship is over three times the size of our previous aircraft carriers"**
>
> **Cdr James Blackmore**
> Commander Air, HMS *Queen Elizabeth*

As Commander Air – a role that sees him in overall control of aviation operations in, on and around the carrier – Blackmore and his air department will manage the FOCFT flying programme from the flying control (FLYCO) office extending out from *Queen Elizabeth*'s aft island.

"This ship is over three times the size of our previous aircraft carriers, and the flightdeck is two-and-a-half times bigger," he tells FlightGlobal. "So we've got much more area to park and operate helicopters and jets. And while the ship is a little smaller than a US Navy carrier, the deck area we've got is roughly similar."

FLYCO is the focal point for aviation control. "That's what's happening on the flightdeck and in the hangars and into the airspace around the ship itself," says Blackmore. "We've got full visibility across the deck, plus all the sensor feeds displayed »

Lockheed Martin

STOVL type has already completed ski-jump testing at NAS Patuxent River in Maryland

» on various screens, so we have massive situational awareness."

Also housed in FLYCO is the landing signals officer (LSO): a qualified fixed-wing aviator trained to assist pilots to safely recover to the carrier.

Already through rotary-wing flight trials, *Queen Elizabeth* will set sail from Portsmouth in August to begin the four-month WESTLANT 18 deployment. But while the embarkation of ITF development aircraft BF-04 and BF-05 will mark the first time that the F-35B has operated from the carrier, a nucleus of RN personnel is already familiar with the operation of the aircraft, thanks to a unique ship/air simulation environment built by BAE at its Warton site in Lancashire, northwest England.

SIMULATOR FACILITY

Previously used to de-risk the integration of the F-35B and the Queen Elizabeth-class (QEC) carriers, the simulator facility has more recently been employed to develop standard operating procedures for aviation operations on board.

Bringing the F-35B and vessels together presents both a unique opportunity and a complex challenge. The fact that the aircraft and ship are both new means it has been possible, to a greater extent, to optimise the carrier design to operate and support the STOVL variant of the fifth-generation Lightning II.

At the same time, a number of uncertainties have necessarily arisen from the fact that design, development and demonstration activities for the F-35B and new RN ships have effectively been run in parallel, albeit with some excursions en route.

Piloted flight simulation has played a major part in identifying and assessing integration issues well ahead of FOCFT. In 2007, BAE established an F-35/QEC integration facility in Warton as a tool to help characterise and de-risk the ship/air interface.

This facility, which adapted an existing motion dome simulator, was used to test the capabilities of both the aircraft and ship aviation systems, allowing integration issues to be ironed out early, informing options and choices, and enabling design changes to be implemented at a stage when their cost and programme impact was relatively small.

Having begun as a piloted flight simulation environment, the facility was enhanced in 2011 by the addition of a simulation of the LSO workstation. Networking these two entities provided for a realistic simulation of pilot and LSO interaction to allow for a more rigorous assessment of the capabilities of the aircraft and ship systems.

While the original simulation facility made a valuable contribution to F-35/QEC integration, it was recognised that it had some inherent limitations with regard to pilot field of view, motion response and cockpit fidelity. As a result, BAE took the decision in 2014 to invest in the development of a new and improved facility that could support ship/air integration through to FOCFT.

Commissioned last year, this updated simulation environment integrates two components: a fully representative F-35 cockpit mounted on a six-axis electric motion system inside a fixed-radius dome featuring a high-fidelity carrier model together with a dynamic sea surface; and an adjacent facility, fully integrated with the piloted simulator, that simulates the environment inside and "outside" FLYCO.

The representative FLYCO space includes a replica of the LSO workstation looking aft. A widescreen projection system shows a realistic outside world scene: visuals can include a selection of pre-recorded take-offs/recoveries, and/or "live" flights being conducted by the pilot in the adjacent flight simulator.

The first use for the new facility was to support a series of pilot evaluations of the short rolling vertical landing (SRVL) recovery manoeuvre. Designed to significantly increase "bring-back" performance, an SRVL exploits the ability of the F-35B to use vec-

HMS *Queen Elizabeth*, during sea trials in 2017. The vessel will embark two F-35Bs off the USA later this year

tored thrust to maintain limited forward speed until after touchdown.

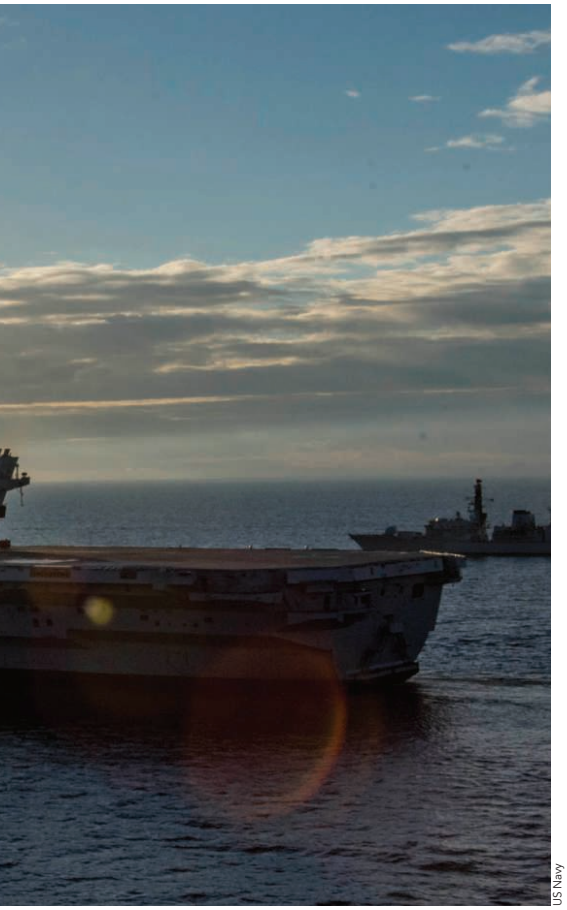
SRVL will be part of the forthcoming flying trials, says Blackmore. "It allows us to be more flexible with the way we use the deck, and more flexible in the way we bring our aircraft back because of the performance enhancements it brings."

OPERATIONAL DEVELOPMENT

Earlier this year, the focus of activities at Warton switched to initial preparations for FOCFT and supporting wider operational development. For a week in late March, personnel from *Queen Elizabeth*'s FLYCO worked together with a team of naval F-35B pilots from the UK's 17 Test and Evaluation Sqn (functioning as LSOs) and an ITF test pilot to develop and practise standard operating procedures for fixed-wing operations.

"This presented a first opportunity to train together and get ready to bring the aircraft on for real this autumn," Blackmore explains. "We plan to come back for a second period of simulator work in June, which will be a more structured 'rehearsal'.

"This is a really good way of de-risking and understanding that process. In fact, we've gone beyond what we're going to do in the autumn [and have] started to explore what operations will look like once we've fully delivered the capability – so, the ability to operate beyond four aircraft, multiple vertical landings, as well as bringing in the shipborne rolling vertical landing, which is a novel landing manoeuvre we are introducing with QEC."



US Navy

Richard Scott/Navypix

Test pilot Cdr Nathan Gray has prepared for future trials using BAE's advanced simulator

Cdr Nathan Gray offers a pilot's perspective on the Warton simulator. A former Sea Harrier FA2 pilot who subsequently flew the Harrier GR7/9 and, on exchange, the US Marine Corps' Boeing AV-8B Harrier II, he currently serves as a developmental test pilot in the F-35 ITF, and is one of the three UK pilots assigned to the forthcoming FOCFT programme.

> **"We've got an aircraft and a carrier that will change the way we do business"**
>
> **Cdr Nathan Gray**
> Developmental test pilot, F-35 Integrated Test Force

"We are just months away from landing the first F-35 on *Queen Elizabeth*, so it is critical now that we get procedures in place," says Gray. "Although these will be adapted as we go forward and gain a greater understanding of what capabilities we have, we still need that sound foundation of good practice, so we need to make sure that our initial decisions are the right decisions.

"That's why this simulation facility is a tremendous asset to our programme. When you walk into FLYCO and you see the environment around you – the sea and the motion of the ship – as a maritime aviator, you get that knot in your stomach. You feel like you're at sea.

"From the aircraft standpoint, it's the most realistic simulator that I have ever flown. It's full motion, with the helmet and full symbology, a highly-representative cockpit environment, and the 'outside world' graphics. This is the only simulator-unique facility in the world where we've combined the true F-35 air vehicle model with air wakes from computational fluid dynamics and with ship motion.

"All three have been brought together and then plugged in with a FLYCO simulator so we can run real-time motion."

Gray believes the UK is now as prepared as it can be to bring the F-35B on board *Queen Elizabeth*. "The aircraft development programme is complete, we've completed ski-jump testing at Pax River and we have all the learning from the simulation environment here. The test plan has been finalised, [and] we've got the evidence base so that we believe we know where the boundaries are.

"That said, simulator models can only be trusted so far. So we have to use our intelligent reasoning to slowly progress the flight trials, steadily working outwards from the centre of the envelope."

DT-1 and DT-2 will each amount to about three weeks of flying, with a week of downtime between. "There are going to be days when the weather doesn't support flight testing," says Gray. "So we have to find very benign conditions in the initial stages, and then as the tests progress, we have to go and find the harsher conditions.

"The biggest constraint will probably be the weather, because it only gets so bad on the east coast. Our challenge will be to predict where those sea states are [and] where we believe we are going to get that ship motion and the wind conditions."

While FOCFT will establish ship clearances for the F-35B, further development and operational testing will be required ahead of the UK declaring initial operating capability (Maritime) in December 2020. A first operational deployment will follow in 2021, with *Queen Elizabeth* to embark a USMC F-35B squadron alongside aircraft from the UK's Lightning Force.

"To be part of the Carrier Strike programme, and to know that this is our lasting legacy, is very exciting," says Gray. "We've got an aircraft and a carrier that will change the way we do business, and the way that the UK can project power." ■

Regional power

China and India are spearheading the Asia-Pacific region's push towards operating advanced aircraft carriers, with a desire to project force in their local areas of influence matched by substantial investments in new ships and more capable maritime fighters

Launched by China in 2011, the *Liaoning* is operational with J-15s

Xinhua/REX/Shutterstock

GREG WALDRON SINGAPORE

November will mark the sixth anniversary of China's first fixed-wing flight operations aboard the aircraft carrier *Liaoning*. Conducted with Shenyang J-15s – a clone of the Sukhoi Su-33 – the development was greeted with much pride in the nation.

The start of flight operations followed the launch of the *Liaoning* in 2011, after its transformation from an old Soviet Kuznetsov-class hulk, the *Varyag*. Although the effort involved both an aircraft type and a vessel from the Cold War era, it marked a renaissance in regional aircraft carrier development.

Beijing has gone on to develop a sister ship. Expected to commence sea trials soon, this vessel could enter service in 2019. The People's Liberation Army Navy has long-term plans to build larger, more capable vessels, possibly powered by nuclear reactors. These could see the ski-jump ramps found on the *Liaoning* and her sister ship replaced with electromagnetic aircraft launch systems (EMALS), which would allow a wider variety of platforms to be deployed, and with greater payloads.

Richard Bitzinger, senior fellow at the Military Transformations Programme at Singapore's S. Rajaratnam School of International Studies, expects that China will have four operational carriers by 2030. This does not include the *Liaoning*, which he believes will be retired in the 2020s.

SUBCONTINENT PROGRESSES

India has a single operational carrier, the Russian-built INS *Vikramaditya*, commissioned in 2013 after years of delays. This warship, also of Soviet vintage, is smaller than the *Liaoning*. Based on the Kiev-class cruiser, it features a ski-jump ramp. A second locally built carrier, INS *Vikrant*, is set to enter service in the early 2020s – again, after years of delays. The *Vikrant* will also use a ski-jump. New Delhi also has plans for a vessel equipped with EMALS. Reports suggest that the US government is willing to provide this technology, produced by General Atomics. The Indian navy aspires to have one active carrier on each coast, and a third in maintenance.

Nick Childs, senior fellow naval forces and maritime security at the International Institute for Strategic Studies, says Beijing's carrier strategy, for the time being, is based on outclassing rivals closer to home and supporting a more assertive naval strategy. New Delhi's ambitions are more limited, namely dealing with regional challenges such as Pakistan.

There have been notable developments in so-called "flat-tops" across the region, with Australia, Japan and South Korea all deploying such vessels in recent years. In the case of Australia and Japan, there are periodic bursts of speculation that these vessels, designated specifically to carry helicopters, will one day operate the short take-off and vertical landing Lockheed Martin F-35B. Both nations have already ordered the conventional take-off and landing F-35A for their air forces.

Japanese lawmakers recently called for

Tokyo to develop its own aircraft carrier and equip it with F-35Bs, but given the nation's pacifist constitution, this would be highly controversial.

The real action, however, is in China and India, where national pride and sweeping oceanic ambitions drive naval developments. While their short take-off but arrested recovery (STOBAR) carriers offer impressive capabilities compared with local rivals, their ambitions in the catapult-assisted take-off but arrested recovery (CATOBAR) space will be a true revolution in Asia-Pacific naval affairs.

"Any catapult launch will give you the maximum launch performance of the aircraft you're firing off the carrier," says Tony Ogilvy, general manager aeronautics at Saab and head of the company's Sea Gripen programme.

"STOBAR always means that the aircraft leaves the carrier with less payload. A catapult shot means you're putting an aircraft into the air at its maximum payload, so a catapult-equipped carrier is more effective. It may be more expensive, but it's a more effective warship. Its aircraft can do more, carry more, fight harder, and stay off board longer."

OPERATIONAL CONSTRAINTS

In a 30-year career with the UK Royal Navy, Ogilvy flew Blackburn Buccaneers, which required a catapult, and British Aerospace Sea Harriers, which launched from STOBAR carriers equipped with a ski-jump ramp.

Childs says the STOBAR carriers operated by the two aspiring Asia-Pacific powers are "relatively limited" compared with the supercarriers operated by the US Navy.

> **"The development of China's carrier capabilities are the most significant in terms of transforming its ambitions"**
>
> **Nick Childs**
> Senior fellow naval forces and maritime strategy, International Institute for Strategic Studies

India's *Vikramaditya* air wing comprises 26 RAC MiG-29K fighters and 10 Kamov Ka-31 helicopters. The larger *Liaoning* carries 26 J-15s, and up to 14 rotorcraft. However impressive these STOBAR ships are compared with other regional powers, their air wings are dwarfed by those deployed aboard USN carriers, which carry more than double the number of fixed-wing aircraft and helicopters.

"Although India has had more experience of limited carrier operations in the past, China seems to be moving ahead more quickly with its plans, and the development of its carrier capabilities are potentially the most significant in terms of how they transform its maritime capabilities and ambitions," says Childs.

India's current shipborne assets include MiG-29Ks

US Navy

China's J-15 is the heaviest such aircraft in operation, with an empty weight of 17,500kg (38,500lb). This is higher than the Boeing F/A-18E/F Super Hornet's 14,600kg, but less than the USN's iconic Grumman F-14, whose empty weight was 19,800kg. Although the *Vikramaditya* is smaller than the *Liaoning*, it can carry the same number of jets, given the MiG-29K's smaller footprint and empty weight of just 11,000kg.

While details are sketchy to non-existent, it is speculated that Beijing hopes to one day deploy the AVIC FC-31 stealth fighter aboard its carriers, replacing the J-15. However, the development status of the FC-31, which resembles the F-35, is unclear, and AVIC has suggested that a foreign buyer is needed to help advance the programme.

India's future shipborne aircraft fleet is also open to question. While the *Vikramaditya* and *Vikrant* will operate MiG-29Ks, New Delhi issued a request for information for 57 multirole carrier-borne fighters (MRCBF) early last year. A request for proposals could come in mid-2018. In it, the navy called for the future type to undertake roles ranging from air defence and surface strike to reconnaissance and electronic warfare. "Buddy" tanking is also a requirement. The request also expresses an interest in local production and technology transfer.

These jets would equip New Delhi's possible CATOBAR carrier, referred to as IAC-2. This deal, for which New Delhi apparently wants to move beyond the MiG-29K, will be contested by such aircraft as the Dassault Rafale, Sea Gripen and Super Hornet. Boeing and Saab have both said their aircraft can operate from either a catapult or ski-jump.

In addition, India's Aeronautical Development Agency continues work on the LCA Navy Mk 2, based on the Tejas platform. Powered by a single GE Aviation F414, this prospective type would be a major update of the original indigenous Tejas design, which has suffered a long and troubled development. The Indian navy has conducted tests with two F404-powered naval Tejas prototypes, which feature a strengthened airframe structure and landing gear, plus a tail hook. Should India ever develop a large, CATOBAR-equipped carrier, it could host a mix of MRCBF fighters and LCA Navy Mk 2s.

For Beijing and India, a key benefit of CATOBAR carriers would be the ability to operate fixed-wing airborne early warning and control (AEW&C) aircraft. While both currently employ helicopters in this role, fixed-wing aircraft offer better altitude performance and can carry more powerful radars. For years, Northrop Grumman has quietly promoted its E-2D Hawkeye in India.

WIDER AIMS

"There are reports that the Chinese are working on developing an aircraft-based AEW&C platform, possibly the [Xian] KJ-600," says Dean Cheng, senior research fellow at the Heritage Foundation. "Given their steady pace of development, it should not be surprising if they are working on such a platform. It should also be noted that the air force has substantially increased its inventory of airborne early warning and electronic warfare aircraft. This suggests that the navy will probably not neglect either such capability."

The USN's aircraft carrier battle groups have been a fixture of military power for over half a century. They have played a decisive role in virtually every conflict in which the USA has participated, and remain a potent symbol of national will in peacetime. It is understandable that the rising powers of the Asia-Pacific region will try to attain this useful and prestigious capability.

Still, Childs warns that advances in technology, particularly unmanned systems, mean that naval aviation will evolve in the next 20 to 30 years.

"Carriers may be operating more unmanned systems, and there may be new platforms in service supporting unmanned capabilities, including in the Asia-Pacific region, that could look rather different to today's carriers," he says. "And what will US carrier and naval aviation capabilities look like then? Will they still be centred on 100,000-tonne supercarriers, or with a greater variety of other platforms operating unmanned vehicles, to counter the threats posed to big carriers?" ■

Stingray fuels change

After making multiple changes to its concept of operations, the US Navy is finally approaching a decision which will bring an unmanned tanker aboard its aircraft carriers

STEPHEN TRIMBLE WASHINGTON DC

A "Group 5" unmanned air system holds a special place in the US military's jargon. As the largest and most capable UAS in the inventory, the Group 5 fleet forms an exclusive club. For now, only three aircraft types in development or production are included: General Atomics Aeronautical Systems' MQ-9 Reaper, plus Northrop Grumman's RQ-4 Global Hawk and MQ-4C Triton.

By design, these large and long-endurance aircraft operate in secluded airspace as far as possible from manned aircraft, each performing their singular missions in safe isolation.

Within the next decade, the US Navy's next big aircraft contract intends to change that dynamic, thrusting a new Group 5 UAS into intimate proximity with manned aircraft in the air and on the deck of its aircraft carriers. The future MQ-25 Stingray's primary mission has devolved from a stealthy, carrier-based, unmanned bomber to an aerial refuelling system, but its fundamental contribution to the Department of Defense's portfolio of unmanned capabilities has never changed.

The DoD already has large unmanned aircraft that can launch weapons at targets. It also has Group 5 UAS that can collect intelligence during long-endurance flights. What it lacks is a large UAS designed from the outset to operate within metres or less of large manned aircraft.

The USN's uneasiness with that prospect has been apparent over the programme's long and unusually tortuous history. At the turn of the century, US naval aviators began pursuing an unmanned combat air vehicle based on an aircraft carrier. Hopes were rekindled about the prospect of reviving the deep strike capability once promised by the McDonnell Doug-

General Atomics' design would extend range of combat assets like F-35C

General Atomics Aeronautical Systems

las/General Dynamics A-12 Avenger, a stealthy, manned bomber cancelled in 1991. The navy's concept was folded into the US Defense Advanced Research Project Agency's (DARPA) joint unmanned combat air systems (J-UCAS) programme. DARPA planned to field the first unmanned bomber by 2008, but the programme lost funding support after 2004 and disappeared in 2006.

The USN moved forward on its own in 2008, awarding a contract to Northrop to develop the X-47B as an unmanned combat air system demonstrator (UCAS-D), showing it was possible to safely operate a tailless aircraft designed with a stealthy platform from a carrier deck.

SLOW PROGRESS

Although the demonstration was deemed successful, navy officials seemed paralysed about how to move beyond it. Internal frustrations over the deadlock spilled into public view in 2010, when then-chief of naval operations Gary Roughead yelled back at a questioner at the AUVSI convention about whether the USN's plan to field such an aircraft by 2018 was moving too quickly. "For me, [the schedule is] too damn slow," Roughead said. "Seriously, we've got to have a sense of urgency about getting these things out there."

Even as Roughead called for urgency, the programme's mission was facing an internal makeover. Rather than fielding a small, penetrating bomber, the USN reassigned the new aircraft to collecting aerial intelligence on long, 14h missions. The so-called unmanned carrier-launched surveillance and strike (UCLASS) aircraft would still carry weapons, but would lack the stealthy features required to operate deep inside defended airspace.

Lockheed's concept is result of fresh studies made after requirement shift in 2016

Lockheed Martin

That approach only seemed to inflame the controversy surrounding the programme, however, with senior US lawmakers, including Sen John McCain, pushing the USN to return to the bomber concept and the Obama administration reportedly calling for something in between a bomber and the navy's focus on intelligence gathering.

The impasse dragged on until January 2016, when Robert Work, then-deputy secretary of defense and previously an outspoken advocate for the bomber mission, intervened. After concluding that it would take too long to field an unmanned bomber with the same level of stealthy complexity as the Lockheed Martin F-35C, Work ordered the USN to accelerate procurement of the latter, according to an interview he gave to the *Aerospace America* journal in April the same year.

With the USN's aircraft carriers to rely on the 600nm (1,110km) range of the F-35C for decades to come, Work also ordered the service to convert UCLASS into a carrier-based air refuelling system (CBARS), allowing its F-35Cs and Boeing F/A-18E/F Super Hornets to fly longer missions.

Four contractors spent another year converting their designs from UCLASS into CBARS, but not without some difficulty. Lockheed attempted to modify its surveillance and strike UAS into a tanker, but ultimately gave up and started over with a clean sheet of paper, says Rob Weiss, vice-president in charge of its Skunk Works unit. Northrop also converted its flying wing design into a tanker, but, in the end, decided to drop out of the competition. »

Striking wing-body-tail configuration forms basis of bid launched by Boeing

Boeing


X-47B demonstrator served as initial proof of concept

» The UCLASS designs by Boeing Phantom Works and General Atomics had begun with a wing-body-tail configuration, so required fewer changes.

After responding to the USN's request for proposals, all three bidding companies are waiting for the scheduled contract award by the end of this year. The total value of the programme is not known, but the USN has earmarked about $2.2 billion in the budget through fiscal year 2022 to spend on the air system component of the MQ-25 programme. The milestone for declaring initial operational capability of the MQ-25 is set for FY2026.

UNORTHODOX APPROACH

The handling of the "air system" as merely a component of the programme betrays one of the most unique features of the USN's acquisition strategy for the MQ-25.

For the first time in an aircraft development programme, the navy will assume the role of lead systems integrator. This means that the service – and not the air system contractor – will develop the MQ-25's carrier-based cockpit, which is designated as the MD-5, as part of the control station and connectivity segment. The USN is also responsible for delivering the Carrier Vessel, Nuclear segment, which includes adapting its ships to accommodate the MQ-25 and the MD-5, such as modifying the joint precision approach landing system and the air-

PROCUREMENT **GARRETT REIM** ST LOUIS

Boeing scans for more Growler sales as US services face capability shortfall

Stretched thinly by escort jamming responsibilities not only for its native US Navy, but also for the US Air Force and soon the US Marine Corps, the Department of Defense's 160-strong fleet of Boeing EA-18G Growlers may need to grow. That is the belief of the type's manufacturer, which is eyeing a looming gap in such capabilities.

An electronic warfare variant of the F/A-18F Super Hornet, the Growler has assumed a joint service role since its introduction in 2009, including covering for the USAF's lack of a dedicated escort jammer, following the retirement of its General Dynamics EF-111A fleet in 1998 without a replacement. The EA-18G's role is expected to grow further as the USMC retires its Northrop Grumman EA-6B Prowlers in 2019.

The USN says it currently has five EA-18G Growlers per squadron, with each air wing containing one such unit.

"Boeing believes the navy needs eight to 11 Growlers per air wing and expeditionary squadron," says Dan Gillian, the company's vice-president of F/A-18 and EA-18G programmes. "We believe there will be a need for additional Growlers to be added into the budget in upcoming years."

The Joint Staff, which is responsible for assessing cross-service needs, could not be reached for comment. The USN says its fleet of Growlers is sufficient for its own missions, but that it cannot speak for the other services' requirements.

Boeing also contends that the airborne electronic warfare platform has broader appeal than with the USA alone. So far, Australia is the only export customer to have purchased the type, with its air force having taken 12. "Any nation that faces an advanced anti-access/aerial denial threat needs a Growler," says Gillian. "Finland, Germany, Japan, Poland and the United Arab Emirates are some of the countries that have interest in the Growler."


USN says 160-strong EA-18G fleet is sufficient for its own electronic warfare needs

US Navy

Designed to blind an enemy by interfering with and blocking its radar and communication systems, the EA-18G is the only tactical jamming aircraft in production in the USA today. Introduced almost 10 years ago as the navy's replacement for the EA-6B – which it retired in 2015 – the Growler is built alongside E/F-model Super Hornets at Boeing's production facilities in St Louis, Missouri. The manufacturer has delivered 153 examples to the USN so far, and the last is currently expected to be received by February 2019, the service says.

The Growler has one pilot and one weapons systems officer, as opposed to its predecessor the Prowler, which had a pilot and three electronic countermeasures officers.

"The four-person-crew Prowler is a 1970s design and is much more aircrew-intensive," notes Cdr David Rueter, the USN's deputy programme manager for the EA-18G, who has flown both types. He also notes the increased reliance on computer systems in the Growler, stating: "The aircraft does a lot more for you."

BRISTLING SENSORS

Stripped of the Super Hornet's Vulcan 20mm cannon and wingtip-mounted Raytheon AIM-9X Sidewinder air-to-air missiles, the EA-18G is a flying transmitter. Instead of weapons, it sports an ALQ-99 jamming pod under its belly and ALQ-218 radar warning receiver pods on its wingtips. The aircraft can also carry additional ALQ-99 pods under its wings, which Rueter says can be swapped out in 15min on the carrier deck to meet different mission requirements. The aircraft also carries weapons such as the Raytheon


US Navy

borne launch and recovery equipment systems.

Such an arrangement produces some awkward moments. When asked for details about the concept of operations for the aerial refuelling system, the contractors can only shrug and say the lead system integrator has not shared it yet. But it also narrows the contractor's focus on the air system component only. Although details of the in-flight choreography of aerial refuelling are not known, the contractors are responsible for designing a system that manoeuvres the aircraft around the carrier deck, obeying commands from a yellow-shirted deck handler as a manned aircraft would.

The UCAS-D activity allowed Northrop to take the first crack at inventing such a system. Its X-47B was controlled on deck by an additional crewman who stood beside the deck handler. The additional crewman wore a battery-powered controller on his right hand, which was connected by radio frequency data link to the vehicle. As the yellow-shirt commanded a manoeuvre, the crewman used the controller to move the aircraft right, left and forward.

Boeing is keeping its approach to deck handling operations a competitive secret, but General Atomics and Lockheed have provided full details. Neither company adopts Northrop's pioneering approach used on the X-47B, but has adopted two very different approaches.

In General Atomics' system, there is no need for adding a dedicated crewmember solely for deck handling. Instead of using a person to interpret the deck handler's commands and relay them to the aircraft, the company has developed a "smart wand". The gestures used by the deck handler are transmitted by the wand to the vehicle, which responds as if a pilot was on board.

Lockheed's system requires adding a crewmember simply for deck handling, but offers a certain degree of simplicity. A camera is embedded in the front of the aircraft. The video captures the commands by the deck handler, then transmits the feed in real time to an operator below decks. ■


US Navy

Manufacturer believes carrier air wings need to be bolstered with additional jamming platforms

AGM-88 High-speed Anti-Radiation Missile for use against enemy radars and two Raytheon AIM-120 AMRAAMs for self-defence.

Boeing's pitch to add new Growlers to the US arsenal comes as the DoD is being prompted to reconsider electronic warfare after a period of neglect and in the face of new threats.

"There was limited attention paid to electronic warfare in the 1990s across the Department of Defense," says Nicholas O'Donoghue, an engineer at Rand Corp, who specialises in radar signal processing. "The US Army, for example, got rid of its Combat Electronic Warfare Intelligence brigades, and chose not to modernise any of their equipment until it became necessary to counter IEDs [improvised explosive devices] in Iraq and Afghanistan, at which point they rapidly acquired and deployed vehicle-based jammers."

In recent years, new, sophisticated radars manufactured in China and Russia are also becoming increasingly difficult for US forces to jam, O'Donoughue says.

"The progression of improved analogue to digital converters, high-power microwave and millimetre-wave components, and active electronically scanned arrays means that a modern radar is capable of generating much more dynamic signals, which are more difficult to recognise and to counter," he says. "This dynamic nature, and the increasing number of benign signals in the electromagnetic spectrum, makes it very difficult to accurately identify incoming signals." Increased range on surface-to-air missiles is also making electronic warfare all the more critical, he adds.

But as adversaries' systems are improving, so, too, are the EA-18G's capabilities.

"Growlers will receive the first significant hardware upgrade in 2021," says Rueter. "This includes an improved ALQ-218(V)3 receiver system and addition of improved datalink capability provided by the Tactical Targeting Network Technology terminal and the Distributed Targeting Processor – Network."

Boeing and the USN are also eyeing adding Super Hornet Block III upgrades to the Growler, including an advanced cockpit system and conformal fuel tanks, which would increase the range of the aircraft, allowing it to fly longer alongside strike platforms.

Both entities are also eagerly awaiting the arrival of the Next Generation Jammer, which will come in three frequency ranges and replace the ALQ-99. Production of the new mid-range jammer has been awarded to Raytheon, while low- and high-band contracts have yet to be assigned.

Forthcoming improvements aside, the USN declines to comment specifically on countering adversaries' increasingly sophisticated defences with the EA-18G. It does acknowledge, however, that the changing nature of electronic warfare presents difficulties to its current fleet.

"It's certainly a challenge, but we do the best we can," says Rueter. "It's a cat-and-mouse game." ■

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

Gatwick Herald turns new Page

Anyone who has flown out of Gatwick over the past 16 years may have noticed the Handley Page Herald slowly rotting on the airport's southern perimeter. G-CEXP is one of just four surviving Heralds in the world – the others are in museums – and has languished at Gatwick since July 1994, where it was grounded after developing problems on take-off with its Rolls-Royce Dart engines.

The aircraft – dating from 1968 and one of the last examples of the turboprop built – originally adorned the viewing terrace, but when that closed in 2002, it was moved to a corner of the airfield where it was used by the fire service.

Now, a newish body called the UK Heritage Aviation Trust (UKHAT) has agreed to restore the 50-year-old bird – which is presumably in better nick than it looks – and display it at St Athan, near Cardiff. Eventually, says UKHAT, "we hope to bring her back to life with engine runs and possibly even taxi demonstrations".

While the Herald was not a success – just 50 were delivered between 1959 and 1968 – it has a treasured place in UK aviation history: Prince Philip even flew the type on a sales tour to South America in 1962. It deserves a more dignified future than as a hulk for firefighters to practise on, so we wish the trust well.

Coining it

Ukraine's government has decided that Antonov's upgraded An-132 is worthy of commemorating on nothing less than the country's own money.

Antonov

An-132D: on the money

The military transport is based on the An-32, which is 20 years older than the Ukrainian unit of currency, the hryvnia, adopted in the mid-1990s.

Ukraine's national bank is putting the special silver 5 hryvnia and 10 hryvnia coins into circulation, according to the aircraft design bureau. The design includes the Antonov logo and the title "Aircraft of Ukraine".

Previous recipients of the honour have included the colossal An-225, the An-140 and An-2, although there doesn't appear to be much evidence of a coin with the An-28. Perhaps the Soviet Union wasn't amused by its NATO codename, "Cash".

Gatwick airport

"Ladies and gentlemen. We apologise for the 24-year delay. We are now ready to depart for South Wales."

Fare play

These days EasyJet may be a champion of technology, but the no-frills airline's former chief executive Ray Webster provides an insight into its early years before new-fangled algorithms and revenue management systems decided the fares passengers pay.

Back in the 1990s, when Squeezy operated a handful of routes, founder Stelios Haji-Ioannou would "manually" price tickets, recalls Webster, by checking how busy flights were looking each morning. If seats were selling too slowly, he would drop the price.

Webster convinced Stelios to give him control of pricing, whereupon he commissioned a programme to set fares automatically, consigning the market stall hawker approach of his boss to history.

REX/Shutterstock

Stelios: hand-cranked pricing

Havel stubs out

The decision by Prague's Václav Havel airport to become non-smoking is perhaps overdue. The former Czech president and hero of the Velvet Revolution, after whom it is named, was a one-time serial puffer who suffered from a number of pulmonary complications prior to his death in 2011.

The country is one of the last in Europe to permit smoking in indoor public places.

Emission statement

The inner 12-year-old of whoever penned this headline on the BBC's web site must be chortling with mirth: "Noxious gas found on Uranus".

Never outgunned

100 YEARS AGO

Flight Lieut. E. Dickson went to the assistance of a machine which was being attacked by twelve enemy scouts. Despite the fact that all the guns on his machine were useless, he charged the hostile formation, splitting it up.

Battling the bear

75 YEARS AGO

The Luftwaffe had excellent results with flying boats and long-range bombers during 1940 and in the beginning of 1941, but their co-operation with U-boats had to be discontinued because of the urgent calls on such aircraft on the Russian front.

All about meat

50 YEARS AGO

Reports from Buenos Aires last weekend that Britain had lost an Argentine Air Force order for eight transports through resentment over the recent meat ban were both premature and inaccurate in one essential. The order, said *The Times*, would go to the Fokker F.28 Fellowship rather than the Hawker Siddeley 748.

The price of war

25 YEARS AGO

The world airline industry could be facing a loss of $4.8 billion on international scheduled operations, according to IATA. The loss, twice as high as IATA had been expecting, is a result of the disastrous effects of the Gulf War.

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General

Expression of Interest

Lease of Glen Innes Airport
Plus
Sale of 10ha land incorporating Development Consent for a 600 student Pilot Training Academy

- Council seeks Expressions of Interest (EOI's) from suitably qualified and experienced Operators/Developers, Partners or Consortia to develop an approved 600 student International Flying Academy at the Glen Innes Airport.
- The site is located at 773 Emmaville Road, Glen Innes on 5.4 hectares of land.
- It is located eight (8) kilometres from the Glen Innes urban area, which is located in the Northern New England region of NSW.
- The Development Consent for the proposed aviation college comprises the construction of accommodation units, kitchen and dining hall, flight operations building comprising instruction classroom, 12 separate briefing rooms, offices and amenities, and classroom buildings.
- A further five (5) hectares is available for future expansion and the main airport, approximately 225 hectares, is available for lease with an option to purchase. The site is bound by farmland of various sizes including 10 rural dwellings within a two (2) kilometre radius of the runways.

Enquiries relating to the Expression of Interest may be directed to Council's Director of Development, Planning and Regulatory Services on +61 26730 2365 or email gprice@gisc.nsw.gov.au

Expressions of Interest close Friday 4.00pm 4 May 2018 and should be addressed to the General Manager and marked Expression of Interest – Glen Innes Airport

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Consultant Fee : HK$138,500 approximately US$17,756* per month

(*Based on exchange rate of HK$7.8 = US$1) (subject to fluctuation)

Entry Requirements : Candidates should have (a) a current Airline Transport Pilot's Licence (ATPL) (Aeroplane)(See note 1) with not less than 5,000 hours air transport pilot-in-command experience, of which a significant proportion should be on civil transport aeroplanes, (b) recent experience in civil aviation flight operations management and have been in current practice as a Training Captain (IRE/TRE) preferably on A320, A321, A330, A340, B747-400 or B777 aircraft, and (c) with not less than 12 years' relevant experience.

Note 1 : A current ATPL (Aeroplane) should include a current Class One Medical Certificate. Applicants who do not have a current Class One Medical Certificate may also apply; if selected, appointment will be subject to their obtaining of the requisite Class One Medical Certificate.

Note 2 : Candidates should submit their application forms together with an **Experience Resume** by mail to the enquiry address on or before the closing date for application. The Experience Resume can be downloaded from the Civil Aviation Department's website. (http://www.cad.gov.hk/english/recruitment.html)

Duties : The duties of Flight Operations Inspector Consultants include, but not limited to, the monitoring of the operational and management standards of the holders of Air Operator's Certificates, the appointment and supervision of type rating and instrument rating examiners (IRE/TRE), and providing advice on flight operational matters to the Civil Aviation Department. The Consultants may be required to travel extensively on duty and work irregular hours.

Terms of Appointment : The appointment will be on agreement, with vacation leave, of three years' resident service.

Fringe Benefits : The consultant fee is HK$138,500 (approximately US$17,756) per month. The fee will be adjusted in accordance with any pay adjustment to civil servants in Hong Kong remunerated at a pay point on a civil service pay scale, the salary value of which is equivalent to the consultant fee. The civil service salary adjustment may take the form of pay increase, pay freeze or pay reduction. Upon satisfactory completion of the full contract period, the Consultant(s) will be granted a gratuity for the period of service. In addition, in compliance with the Mandatory Provident Fund Schemes Ordinance, the Government will arrange to make contributions for the appointee to a registered mandatory provident fund scheme (MPF scheme). The gratuity payable for the agreement will be the sum which, when added to the Government's contribution to the said MPF scheme, equals 15% of the total consultant fee drawn during the period of agreement. The Consultants will be eligible for a housing benefit equivalent to the civil service Non-accountable Cash Allowance (NCA) subject to their meeting the eligibility criteria of the scheme. The NCA is, currently at HK$33,830 (approximately US$4,337*) per month subject to periodic revision. The terms of appointment and conditions of service to be offered are subject to the provisions prevailing at the time the offer of appointment is made.

Enquiry Address and Tel. No. : Assistant Departmental Secretary (Personnel)2, Civil Aviation Department, Level 5, Office Building, Civil Aviation Department Headquarters, 1 Tung Fai Road, Hong Kong International Airport, Lantau, Hong Kong S.A.R., People's Republic of China. (Fax.: (852) 2910 6399 or e-mail to <recruitment@cad.gov.hk>, or Telephone (852) 2910 6334 quoting reference CAD ADMD PR/5-25/59 (2018))

Closing Date of Application : 3 May 2018

General Notes :

(a) Persons who are not permanent residents of Hong Kong Special Administrative Region (HKSAR) may also apply for this vacancy but will be appointed only when no suitable and qualified candidates who are permanent residents of the HKSAR are available.
(b) As an Equal Opportunities Employer, the Government is committed to eliminating discrimination in employment. The vacancy advertised is open to all applicants meeting the basic entry requirement irrespective of their disability, sex, marital status, pregnancy, age, family status, sexual orientation and race.
(c) Non-civil service Consultants are not posts on the civil service establishment. Candidates appointed are not on civil service terms of appointment and conditions of service. Candidates appointed are not civil servants and will not be eligible for posting, promotion or transfer to any posts in the Civil Service.
(d) The entry pay, terms of appointment and conditions of service to be offered are subject to the provisions prevailing at the time the offer of appointment is made.
(e) Where a large number of candidates meet the specified entry requirements, the recruiting department may devise shortlisting criteria to select the better qualified candidates for further processing. In these circumstances, only shortlisted candidates will be invited to attend recruitment examination and/or interview.
(f) It is Government policy to place people with a disability in appropriate jobs wherever possible. If a disabled candidate meets the entry requirements, he/she will be invited to attend the selection interview/written examination without being subject to any further shortlisting criteria.
(g) Holders of academic qualifications other than those obtained from Hong Kong institutions/Hong Kong Examinations and Assessment Authority may also apply but their qualifications will be subject to assessments on equivalence with the required entry qualifications. They should submit copies of their official transcripts and certificates by mail to the above enquiry address.
(h) Towards the application deadline, our on-line system would likely be overloaded due to large volume of applications. To ensure timely completion of your on-line application, it is advisable to submit the application as early as possible.
(i) Non-civil service vacancies information contained in this column is also available on the 'GovHK' on the Internet at http://www.gov.hk.

How to Apply : Application Forms [G.F. 340 (Rev. 3/2013)] can be downloaded from the Civil Service Bureau's web site (http://www.csb.gov.hk). **Candidates must state clearly the details of professional qualification obtained on the application forms and attach the Experience Resume.**(See Note 2) Completed forms, together with the Experience Resume, should reach the above enquiry address of the recruiting department on or before the closing date for application. On-line application can also be made through the Civil Service Bureau's web site (http://www.csb.gov.hk). Candidates who apply online should submit **the Experience Resume within one week after close of application period** to the above enquiry address, and the online application number should be quoted on the envelope and the Experience Resume. **If candidates fail to provide the Experience Resume, their applications may not be considered.** Applicants should ensure that the correct address is clearly printed or written on the envelope and sufficient postage is affixed before posting so as to avoid unsuccessful delivery of application. Any underpaid mail items will be returned or disposed of by the Hongkong Post. Applicants are encouraged to provide their email addresses on the application forms. Candidates who are selected for interview will normally receive an invitation (by email or by post) in about eight to ten weeks from the closing date for application. Those who are not invited for interview may assume that their applications are unsuccessful. For enquiries, please call the telephone number indicated.

WORK EXPERIENCE GERHARD BRUNNER

Pushing learning to the next level

Gerhard Brunner is head of software development for AXIS Flight Training Systems, leading a team working at the cutting edge of innovations to develop robust, realistic and smart technologies for cockpit simulators

How did you get into the aviation industry?

In 2005, while finishing a Telematics degree at Graz University of Technology in Austria, I started developing a console-based air traffic control simulator in my spare time. I've always been fascinated by the creativity involved in game software development, and was inspired by the landmark Flight Simulator programmes Microsoft launched in 1982. I joined a group of home-cockpit builders at the Virtual Aviation Centre in Graz, where we built an Airbus A320 cockpit, integrated with that same flight simulator software. Building a simulator from the ground up was a complex undertaking, but it well and truly sparked my interest in aviation.

How has your career progressed?

I came to AXIS Flight Training Systems straight out of university, after meeting the chief executive at the Virtual Aviation Centre while I was working on the A320 cockpit. When I learnt about AXIS's plan to build a Fokker 100 full-flight simulator (FFS) I was desperate to be part of such an exciting project. I applied to be a software engineer, and began working at AXIS in 2006.

What is AXIS?

AXIS is an independent flight simulator manufacturer bringing first-class service and cutting-edge technology to our customers, regardless of the size, age or location of their organisation. We are a young and dynamic company, providing reliable and robust products that are ahead of the curve with regards to smart and intuitive technology.

AXIS

Brunner is proud to be a part of improving pilot skills and air safety

Can you describe your job?

I was appointed head of software development in 2014, and I now manage a team of six developers. In the software development department we actively seek out employees that demonstrate raw intelligence, skill and a forward-looking perspective on new tech. Our team members come from very different backgrounds, from physics to web development – we value the fresh insights that this diversity brings to our team.

What are you working on now?

Our team are working on interfacing an avionics system to the simulator software, as well as further progressing the diagnostic toolchain – all AXIS simulators have 24/7 online monitoring and predictive analytics, and this forms the backbone of the simulator's operation. We are also developing the IOS, environmental sound and cockpit audio simulation, and the interface to the cockpit, as we strive for ever-more realism for both pilots and trainers.

How is simulator technology evolving?

At AXIS, we've always been focused on achieving realism for the pilots that use our products, and part of this is simulating avionics systems as accurately as possible. With the new avionics systems in modern airliners and the increasing complexity of these systems, finding a way to replicate these is a key component of simulator technology. Another way simulator technology is evolving is through big data and data processing, so instructors can objectively assess the performance of trainees. The need for online processing of flight parameters and pilot reactions, and finding a good way to display that information to instructors, is a key fact of today's market.

What will simulators be like 10 years from now?

Since AXIS began developing its first FFS in 2004, the technology has changed exponentially – so it's almost impossible to imagine what simulators will be like in 10 years. There is a lot of interest in developing artificial intelligence in training, with machine-learning having a number of possible outcomes for simulator manufacturers.

What do you enjoy most about your job?

I'm proud to be a part of the relatively small circle of people worldwide who have the chance to build a FFS, helping to improve pilot training and contribute to safer skies. It's hugely exciting to be working at the forefront of new technologies, witnessing how they make a difference to the products that people rely on, and use, every day.

What do you enjoy the least?

In Graz, it would have to be the few months of the year when I get snowed in. My commute can be tricky at times. ■

If you would like to feature in Working Week, or you know someone who does, email your pitch to **kate.sarsfield@flightglobal.com**

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