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ROTORCRAFT

Up for the fight

Boeing breaks cover in armed scout battle



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Positive outlook

Why Dassault chief is upbeat, despite current headwinds **16**

One year on

As anniversary of grounding passes, can 737 Max recover? **26**

THE 777X TAKES TO THE SKIES



The world's largest and most efficient twin-engine jet took its first flight, a major milestone for Boeing's 777X built on years of development, testing and rigor. With technological advances that allow it to fly farther with less fuel and emissions, the 777X will fly passengers more comfortably and efficiently than ever before. Keeping safety at the core of everything we do, we're building the future of flight together.

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Handover sees Russian carrier reflect on long-haul needs P13

BEHIND THE HEADLINES

Craig Hoyle (pictured) embarked aboard the Royal Navy's aircraft carrier HMS *Prince of Wales* in Liverpool and received an update on the Wildcat helicopter (P8). Elsewhere this issue, Murdo Morrison interviewed Dassault chief executive Eric Trappier in Paris (P16), and our reporting team marks the anniversary of the 737 Max's grounding (P26)



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Boeing's bid to match arch-rival Airbus with a re-engined version of its best-selling narrowbody proved a partial success – until two tragic accidents took the type out of service and cast a shadow of uncertainty over the airframer and the aerospace industry. One year on from the global grounding of the 737 Max, we examine the implications



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Image of the week

Legionnaires of the 2nd Foreign Engineering Regiment are pictured disembarking from an NH Industries NH90 Caiman flown by the French army's 5th Combat Helicopter Regiment during a winter exercise. France operates 40 examples of the troop transport variant, with another 34 on order, Cirium data records

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French army

The week in numbers

9%

Aeroflot

2019 passenger growth to 60.7m at Aeroflot Group helped turn Russian operation's \$840m 2018 loss into a \$200m profit

€37bn

Airlines for Europe A4E

Annual cost to Europe's airlines due to disunity of legislation after EU fails to complete its single aviation market initiative

6

Cirium Dashboard

Thai Airways sold five A330s and a 747 last year, maintaining its strategy to continue divesting decommissioned aircraft

NEXT WEEK DIGITAL-ONLY

We analyse the factors that contributed to Flybe's demise, and assess the likely impact of its departure on UK regional services. Our digital-only edition will be available to read as soon as we finish producing the issue on 14 March.

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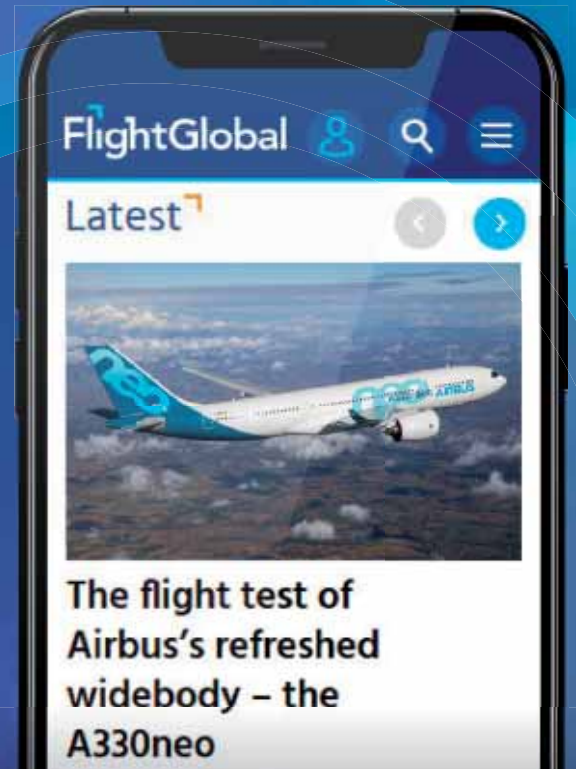
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Demand curtailed

Capping capacity

Covid-19 has seen airlines slash schedules and supplanted Boeing's 737 Max as the industry's big story. But what happens when it is cleared to fly again?

In the year since the March 2019 grounding of the Boeing 737 Max – triggered by the 10 March crash of Ethiopian Airlines flight 302 – airlines globally have been clamouring for Boeing to get the aircraft back into the skies.

They desperately needed all those parked jets to meet pent up demand for air travel.

But in recent weeks, some demand has dried up – though perhaps only temporarily.

The evolving coronavirus outbreak has hammered the global aviation industry, causing virus-skittish passengers to put off travel and leading airlines to slash flight schedules.

In the process, the 737 Max has lost its crown as the industry's top headline, replaced by a disease that is already having more impact on the airline sector than Boeing's troubled narrowbody ever did.

It is hard to predict the long-term impact at this point, but the scale of the fallout became more visible on 4 March when United Airlines announced it would cut 10% of domestic flight schedules and 20% of international schedules in April. United has also brought in a hiring freeze.

How the airline will implement the cuts is unclear, but it represents a massive reduction in capacity: the carrier operates over 750 aircraft and is one of the top customers for the Max, with 14 examples in storage and 170 on order.

While the industry has previously shown its resilience – notably in the face of the 2003 SARS outbreak – there is every chance the coronavirus will have a knock-on impact on aircraft manufacturers.

Boeing's plans for the speedy re-introduction

of all those parked Max aircraft, which would plug a fire-hose of capacity into the market, suddenly look a lot less certain.

Although the airframer cannot hold off on deliveries forever – it needs cash coming through the door – there may be benefits.

A slow and steady drip feed will allow Boeing to ensure that everything is perfect with an aircraft that will face unprecedented levels of scrutiny.

There is every chance the coronavirus will have a knock-on impact on aircraft manufacturers

In addition, it should better prepare the travelling public to fly again on a jet whose brand is tarnished in the short term, whatever Boeing decides to do with its name.

Plus, it could offer the manufacturer's management, which has been fundamentally reshaped by the Max crisis, breathing room to decide on its product strategy.

Perhaps it is worth noting comments from Ryanair's Michael O'Leary. Although he was referring to the coronavirus outbreak when he said that the travelling public would be "bored" of the disease within three weeks, a talent for forgetting may hold true for the Max and its history as well. ■

See Special Report P26

Stop bailing

Is there ever a case for a government bailing out a failed airline – even when its commercial shareholders judge it a bad bet? Plenty of people – including trade unions and politicians representing employees and passengers affected by Flybe's collapse – believe there is. Particularly when the carrier in question has been providing vital transport links between underserved UK cities.

Taxpayer support, the argument goes, is justified in a way it might not be for leisure operators such as Thomas Cook or Monarch, where, after short-term disruption, competitors will likely fill any gap. However, market mechanisms do not always work when it comes to regional connectivity. At many UK airports – Belfast City, Exeter, Newquay and Southampton, among them – Flybe dominated. Replacements may not be easily found.

Overnight, business people, hospital patients, students and extended families have been left stranded. The ending of many of these routes will also impact government aspirations to rebalance the skewing of wealth and investment from the southeast of England to other UK regions.

But does that make government intervention right? Legal arguments around whether ministers can support an airline under (still applicable) EU rules aside, there are clear reasons why a rescue would be wrong. The coronavirus crisis killed Flybe, but the airline had saddled itself with debt and a business model that left it trying to be two things at once – a point-to-point regional carrier and leisure airline serving agreeable middle-class destinations in Europe.

Picking winners – or saving losers – in the airline world or otherwise is rarely the answer. Flybe's failure is a tragedy for those affected. But an injection of taxpayer cash would have been unfair to rivals, wasteful, and postponed the inevitable. ■

See This Week P10



Shrinking violet

BRIEFING

ETIHAD NARROWS LOSS AFTER CAPACITY CUT

FINANCE Etihad Airways reduced its loss in 2019 to \$870 million from \$1.28 billion the year before, as the Abu Dhabi carrier cut capacity by 6% as part of a transformation programme. Passenger numbers declined by 1.7%, to 17.5 million. "Passenger routes were rationalised at the end of 2018 to optimise the network and improve revenue quality," says Etihad.

F-35 CLEARS 500TH DELIVERY

PRODUCTION Lockheed Martin has delivered its 500th F-35 fighter, with the milestone jet having been handed over to the Vermont Air National Guard. The airframer says its shipment total has included 354 conventional take-off and landing F-35As, 108 short take-off and vertical landing F-35Bs and 38 carrier-variant F-35Cs.

A350 POWERS ROLLS-ROYCE PERFORMANCE

PROPULSION Deliveries of the Airbus A350-900 helped Rolls-Royce cut its average unit losses on large engine programmes last year, and contributed to a record 510 Trent engine shipments. Average original equipment unit losses for its large engines fell by 14% in 2019, from £1.4 million (\$1.8 million) to £1.2 million, as production of the A350-900 continued to mature. R-R expects to deliver its first break-even Trent XWB-84 by year-end. See **Air Transport P12**

NEW V-150 BOOSTS UMS SKELDAR RANGE

LAUNCH UMS Skeldar has unveiled a V-150 vertical take-off and landing unmanned air vehicle, with the 150kg (340lb) type to be available for delivery around mid-year. With an expected 4h endurance, the new model carries a nose-mounted electro-optical/infrared camera weighing up to 12kg, while its main payload bay can accommodate sensors totalling 30kg.

FIRST DREAMLINER FOR VISTARA

INTRODUCTION India's Vistara has taken delivery of the first widebody in its fleet; a Boeing 787-9. The GE Aviation GEnx-1B-powered aircraft (VT-TSD) is the first of six Dreamliners that the carrier has on order. It will operate the type on domestic routes, before launching medium- to long-haul flights. Vistara's aircraft are configured with 30 seats in business class, 21 in premium-economy, and 248 in economy.

LHT AND SAFRAN IN A380 PACT

OVERHAUL Lufthansa Technik (LHT) and Safran Landing Systems have agreed a long-term partnership for the maintenance of landing gear on the Airbus A380. Facilities in Singapore and at London Heathrow airport will be used for the effort. The French manufacturer supplies and supports the A380's nose landing gear. The aircraft's body and wing landing gear is supplied by Collins Aerospace.

BRAZILIAN NAVY TAKES FIRST H135

DELIVERY Brazil's navy has inducted its first of an eventual three Airbus Helicopters H135s, with the light-twins to see use on operations in the Antarctic region. Designated the UH-17 in Brazilian service, the aircraft underwent completion at the airframer's local subsidiary Helibras. Duties will include search and rescue and emergency medical services operations.



Leonardo Helicopters

New weapon wing allows carriage of Martlet, Sea Venom missiles

PROCUREMENT CRAIG HOYLE HMS PRINCE OF WALES

Wildcat on target to protect carriers

Leonardo says rotorcraft enhancements on track for first deployment with Royal Navy carrier group next year

The UK Royal Navy's (RN's) Wildcat HMA2 rotorcraft will be ready to defend the service's largest-ever warships from next year, with the integration of key new armaments on schedule, Leonardo Helicopters says.

An ongoing effort to add Thales Martlet air-to-surface missiles and MBDA Sea Venom anti-ship weapons has completed environmental testing and carriage trials aboard the 6t-class rotorcraft, following the integration of a Leonardo-designed Wildcat Weapon Wing.

Louis Wilson-Chalon, maritime marketing manager for Leonardo Helicopters UK, says the company is on track to have the enhanced Wildcat ready for deployment in support of the RN's first worldwide operational Carrier Strike Group deployment late next year. This "CSG21" activity will involve HMS *Queen Elizabeth* – the service's first of two 65,000t aircraft carriers.

"We will be ready to support the fleet," Wilson-Chalon says, confirming that a production contract has been placed to build weapon wings for the navy's Wildcat fleet. Firing trials have

yet to be conducted, but the programme is on schedule, he says.

The RN carriers will operate with an embarked complement of Lockheed Martin F-35B Lightning combat aircraft and Leonardo AW101 Merlin HM2 multimission rotorcraft, including airborne early warning examples being prepared via the Lockheed-led Crowsnest programme. Deployed aboard accompanying Type 45 destroyers and Type 23 frigates, Wildcats will provide anti-surface warfare protection.

Each weapon wing-equipped helicopter will be able to carry a maximum load of 20 Martlet or four Sea Venom missiles, or a mixed fit of 10 and two.

With a 13kg (29lb) launch weight, 3-5nm (6-9km) range and Mach 1.5 performance, the laser-guided Martlet is integrated using five-round canister launchers. The high-subsonic speed, 120kg Sea Venom is 2.5m (8ft) long, and can attack surface targets to a range of over 11nm.

The navy's second carrier, HMS *Prince of Wales*, made a week-long visit to Liverpool from 28 February. ■



Coronavirus
outbreak seals
Flybe's fate
This Week P10

ENVIRONMENT DAVID KAMINSKI-MORROW BRUSSELS

Rolls-Royce has sustainable vision for green flight future

Engine maker says advanced propulsion research must be matched by other initiatives

Rolls-Royce's chief technology officer, Paul Stein, believes revenue passenger flights with aircraft featuring an element of electric propulsion are possible by 2029, but insists substantial advances in sustainable aviation fuel production must accompany the drive towards such technology.

While hybrid-electric aircraft could potentially be in service by the end of the decade, Stein stresses that two-thirds of all jet fuel is used on sectors longer than 1,000nm (1,850km) – a threshold at the far extreme of even the most optimistic forecasts for early electric aircraft range.

Speaking to *Flight International* at the A4E aviation summit in Brussels on 3 March, Stein said the aviation industry was looking at how to achieve net-zero carbon by 2050 rather than just meeting previous decarbonisation targets.

"We're sticking to our promise but exploring a much higher ambition," he says – meaning going beyond current programmes such as R-R's UltraFan engine.



This strategy centres on three main avenues: improved airframe-engine combinations, a substantial scaling-up of sustainable aviation fuel production, and acceleration of disruptive technology such as hybrid-electric power.

R-R's joint E-Fan X project with Airbus – which will use a hybrid motor to help power a regional jet – is intended to provide an evolution path towards electric "city hopper" aircraft and, while the technology is still new, Stein believes it is "one of the shortest routes to market" and transporting fare-paying passengers by 2029 is "entirely feasible".

E-Fan X is "streets ahead of anything else we've seen", says Stein, but stresses: "We won't be battery-powering A320s in the near future."

This means a corresponding effort is needed to drive sustainable aviation fuel technology because, says Stein, some 500 million tonnes of such fuel will be needed by 2050 to support air transport, and long-haul flight in particular.

"Sustainable fuel is a huge challenge for our sister industry," says Stein, adding that aviation needs "lean heavily" on the energy sector's finding "cleverer and cleverer ways" to produce the quantities required. ■

SCHEDULE
DAVID KAMINSKI-MORROW
LONDON

Delivery of first A330-800 slips to third quarter

Kuwait Airways appears set to take delivery of its first Airbus A330-800 in the third quarter of this year.

Flight International understands that the airline is working to this timetable after the certification of the -800 in mid-February.

Kuwait Airways is configuring the Rolls-Royce Trent 7000-powered type with 226 seats, including 23 in the business-class cabin.

The airline ordered eight examples in October 2018. It has recently released footage of the first aircraft (9K-APF) being painted.

Airbus has not confirmed the timeline for handing over the aircraft. "It is the customer's privilege to communicate on delivery details," the airframer says.

At the time of the order, the airline had planned to take delivery of the A330-800 in March. There has been no firm indication as to the reasons for the timetable shift.

Kuwait Airways' A330-800 deliveries are scheduled to run until 2026. ■

ACQUISITION GARRETT REIM LOS ANGELES

Israeli interest will top up KC-46A export orders

The US Department of State has approved a potential \$2.4 billion sale of eight Boeing KC-46A Pegasus tankers to Israel.

Outlined by the US Defense Security Cooperation Agency (DSCA) on 3 March, the proposed deal would bolster Boeing's international KC-46A business after weak Foreign Military Sales demand. To date, its only export customer for 767-based type is Japan, with two examples on order.

An Israeli acquisition would boost the nation's security, and assist Washington "by potentially freeing US [tanker] assets for use

elsewhere during times of war", the DSCA says.

Cirium fleets data shows the Israeli air force currently operates seven Boeing 707 and three Lockheed Martin KC-130H tankers.

Boeing has secured orders to supply lead KC-46A customer the US Air Force (USAF) with 67 of the type, from a total of 179.

Boeing is currently working to fix issues with the tanker's refueling boom remote vision system. A retrofit solution will not be installed on the USAF's aircraft until 2022 or 2023, delaying its operational introduction. ■



Boeing is still trying to fix boom issues for US Air Force customer

COLLAPSE DAVID KAMINSKI-MORROW LONDON

Coronavirus outbreak seals Flybe's fate

Shareholder Virgin Atlantic says it could 'no longer commit' to regional carrier with trading affected by fear of disease

Impact of the coronavirus outbreak led to the demise of struggling UK regional carrier Flybe, shareholder Virgin Atlantic has claimed.

Virgin Atlantic was one of three investors in the Connect Airways consortium that took over Flybe a little more than a year ago, and had intended to develop the airline as a feeder for long-haul services under the Virgin Connect brand.

But the company says it has been unable to turn the airline around despite efforts from its personnel and more than £135 million (\$174 million) of investment over the past 14 months.

Virgin Atlantic says the coronavirus had a negative impact on Flybe's trading, and as a result the Connect Airways consortium "can no longer commit to continued financial support".

"We are deeply disappointed that Flybe has been unable to secure a viable basis for its continuing operations," it adds, following the regional operator's filing for administration, with Ernst & Young appointed to handle the process.

Flybe had been under financial pressure for considerable time, and Connect Airways was formed to prevent the airline's collapse.

Virgin Atlantic teamed with Stobart Group and Cyrus Capital Partners to take over the carrier.

But the consortium faced a potential Flybe collapse earlier this year, forcing the shareholders to negotiate a controversial agreement with the government in January – deferring payment of air passenger duty – to keep the airline operating.

Virgin Atlantic says the consortium had since invested £25 million of £30 million committed in January, while the "time to pay" arrangement with the UK treasury for the air passenger duty provided another £3.8 million.

"As a priority we are looking at options to provide support to



Connect Airways took over airline 14 months ago, planning to develop it as feeder for long-haul services

Flybe staff and to assist affected customers," states Virgin.

All Flybe flights, including those operated by Stobart Air, have been cancelled as a result of the entry into administration, says the UK Civil Aviation Authority (CAA). However, two of Flybe's franchise partners, Eastern Airways and Blue Islands, say their services will continue to operate.

"Flybe's decision to stop trading will be very distressing for all of its employees and customers"

Richard Moriarty
Chief executive officer, UK Civil Aviation Authority

"We know that Flybe's decision to stop trading will be very distressing for all of its employees and customers," says CAA chief executive Richard Moriarty.

There is no government directive to repatriate Flybe passengers through special flights, says the CAA, because there is

"capacity in the market" for them to secure alternative travel by air, rail or coach.

The UK Department for Transport (DfT), meanwhile, adds that it is working with the airline industry to "minimise any disruption to routes operated by Flybe, including by looking urgently at how routes not already covered by other airlines can be re-established by the industry".

"Through the reviews of regional connectivity and airport passenger duty we have announced, we will bring forward recommendations to help ensure that the whole of the UK has the connections in place that people rely on," the DfT says.

Stobart Group holds a 30% share of Connect Airways. It contributed its regional airline operation Stobart Air and leasing division Propius to the consortium, as part of its investment, but says Stobart Air's ability to trade is not directly affected by the collapse of Flybe.

It is, however, writing down to zero its investment Connect Airways, including a contribution of £43.3 million plus a £7 million investment made earlier this year.

Stobart Group adds that it has "foregone" deferred interest from which it would have benefited in the future.

But the group points out that Stobart Air is not wholly-owned by Connect Airways – while Connect controls 40% of the carrier, the balance is held by an employee trust.

"As such Stobart Air's ongoing ability to trade is not directly impacted by the decision to place [Flybe] into administration," it says.

GOOD PROSPECTS

Stobart Group is the operator of London Southend airport, and says the facility will experience a "short-term impact" given Flybe's plans to operate several routes from the site this year. However, it adds that the longer-term prospects for Southend "remain compelling".

Flybe, which was established as Jersey European Airways and later became British European, operated a fleet of more than 60 De Havilland Canada Q400 turboprops and Embraer E-Jets. ■

Additional reporting by Alfred Chua in Singapore



Blade woes cut into
Rolls-Royce profits
Air Transport P12

PROPULSION DOMINIC PERRY LONDON

CFM strikes deal with Boeing for Leap-1B payment in 2020

Ten-per-week output for re-engined 737 will keep costs at 'industrial' level, says Safran

Engine joint venture CFM International has struck an agreement to receive payment from Boeing for all Leap-1B powerplants delivered in 2020.

Although details of the deal are "confidential", Safran chief executive Philippe Petitcolin told analysts on a 27 February full-year results call that it covers all Leap-1B production this year.

"All engines which are going to be produced in 2020 will be fully covered," he says. The deal, covering the net cost, also includes provision for powerplants built last year, he says, with payments running until 2021 when they "will be complete".

Safran, which is a partner in CFM with GE Aviation, has been hit by the year-long grounding of the 737 Max and consequent suspension of production that began in January.

CFM anticipates building 10 Leap-1Bs – the exclusive powerplant on the Max – per week in 2020, although it remains ready to increase output if required, says Petitcolin. Boeing has indicated that deliveries of the narrowbody should recommence around mid-year.

Overall Leap output this year will be around 1,400 engines, including the Leap-1A for the Airbus A320neo family. However, that figure is a reduction on the previous 2,000-unit forecast.

Petitcolin says the 10-per-week rate is the minimum level required to maintain an "industrial" cost for the programme, rather than a "prototype kind of cost".

Any production increases would be agreed with CFM's supply chain, which is already under pressure to meet future rises in support of the A320neo programme; Airbus intends to take narrowbody output to 63 aircraft

per month in 2021, potentially rising to 67 by 2023.

Petitcolin says CFM is "more optimistic" about sealing an agreement with Airbus on the rate increase, based on the fact that its "forging [supplier] base" – a previous supply-chain bottleneck – is "today more open to these additional quantities".

However, Petitcolin cautions that some smaller suppliers are feeling "a bit brittle" and require additional assistance from Safran and CFM. "They have some financial situations which are not so good and we are supporting them the best we can," he says. ■



Joint venture has been talking to suppliers about further rate rises

AEROSTRUCTURES

JON HEMMERDINGER BOSTON

Spirit to resume production of Max fuselages

Spirit AeroSystems will restart production of 737 Max fuselages in March, ramping up to an output of 52 per month by 2022. Boeing was building the narrowbody at that rate before the jet was grounded on 13 March 2019.

Chief executive Tom Gentile says Spirit has responded to the 737 Max difficulties by laying off 3,200 employees: 2,800 in Wichita and 400 in Oklahoma. The redundancies represented about 28% of Spirit's 18,000-strong workforce.

The company suspended 737 Max fuselage production in January on the back of Boeing's decision that month to halt assembly of the narrowbody. Spirit says 737 work generates more than 50% of its revenue.

Earlier in February Spirit and Boeing reworked an April 2019 agreement related to 737 Max fuselage production. The new deal calls for the airframer to pay Spirit \$225 million in the first quarter, and pushes out to 2022 repayment to Boeing of a \$123 million loan.

Net income at Spirit fell 14% year-on-year in 2019 to \$530 million, reflecting the 737 Max issues, losses relating to a 787 production rate cut and a decline in margins from Airbus A350 work. ■

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PROPULSION DAVID KAMINSKI-MORROW LONDON

Blade woes cut into Rolls-Royce profits

Engine maker cites Trent 1000 faults in 2019 losses but insists it has cut groundings and is adding maintenance capacity

Rolls-Royce is taking a £459 million (\$591 million) charge provision to recognise the fact that some future Trent 1000 TEN contracts will become loss making as a result of margins being affected by the blade issues affecting the engine.

The engine manufacturer says the situation affects a “small number” of contracts, the result of increased costs associated with its revised estimate of high-pressure turbine blade durability on the powerplant, which is installed on Boeing 787s.

Its provision for the losses is part of a broader £658 million exceptional charge relating to the TEN which, in turn, is part of an overall charge of £1.36 billion taken for the Trent 1000 programme, the remaining £703 million of which is linked to costs for remedial shop visits and disruption payments.

But R-R insists it is making “good progress” on resolving the Trent 1000 issues that continue to burden the manufacturer.

It has designed eight of the nine component fixes required, seven of which have been certificated.

The fix to the intermediate-pressure turbine is fitted to almost the entire in-service fleet, across all the Trent 1000 engine variants.

Its revised intermediate-pressure compressor has been fitted to more than half of Package C variants and has been certificated for the TEN, with Package B planned for the second half of this year.

MAKING HEADWAY

Revised high-pressure turbine blades have been introduced into nearly 50% of Package B and C variants. Design work for the TEN blade continues to “progress well”, says R-R, which expects certification in the first half of 2021.

Over the first two months of this year, the company has cut the number of aircraft on ground to the mid-30s – down from 42 in the second half of 2019 – and is aiming to increase spare engine availability, as well as maintenance capacity to bring the figure down to fewer than 10 by the end of the first half of 2020.

R-R estimates in-service cash costs across all Trent 1000 variants



Eight of nine component fixes are designed, with seven certificated

will reach £2.4 billion over the 2017-2023 period, and it incurred £578 million of such costs last year – partly offset by £173 million from insurance.

It is expecting cash costs for the Trent 1000 to be around £450-£550 million this year and a similar level in 2021, before declining substantially afterwards.

“These primarily comprise the cost of replacing affected parts as

well as customer disruption-related compensation,” it says.

Returning the Trent 1000 fleet to full capability remained the company’s “top priority” for 2019, and it acknowledges that “much more work remains to be done” this year.

FINANCIAL BURDEN

R-R chief executive Warren East says there is “no denying” that the Trent 1000 situation “weighed heavily” on the company’s full-year 2019 financial performance, as the exceptional £1.36 billion charge contributed to an operating loss of £852 million for the company as a whole – an improvement on the previous £1.16 billion loss.

East says the company is making a “significant investment” this year to increase maintenance capacity and provide a near-50% increase in the Trent 1000 spare engine pool, adding that customers and investors have been given “greater certainty” and “clarity” over the programme.

“Our focus is now on executing the clear plan we have to reduce aircraft on ground and return the fleet to the level of service which our customers expect,” he states.

ORDERS

East insists powerplant is still competitive, despite defections

Rolls-Royce insists the Trent 1000 remains a competitive powerplant despite the technical problems, and the defection of high-profile customers to the rival GE Aviation GENx.

Japan’s All Nippon Airways (ANA) recently opted for the GENx, rather than the incumbent Trent, for its latest batch of Boeing 787s. Air New Zealand also selected the GENx for a follow-on order last year.

But R-R chief executive Warren East, while admitting that the company is “obviously disappointed” by the ANA decision, has shrugged off the switch.

“We look at it from a fairly

macro position,” he said during a 28 February briefing. “It’s not just about share on the 787 – it’s about share of widebody orders.”

East points out that R-R’s position on this broader front is “a reasonable result”, and that the ANA decision should be put into perspective, given that it has over 80 Trent-powered 787s.

“To be 100% dependent on Rolls-Royce when you have a choice is, perhaps, an unrealistic assumption when you get to a fleet growing to that sort of size,” he says. “To have 15 aircraft and a few options going to GE is not something that particularly surprises us.”

He stresses that all of ANA’s Trent-powered 787s will be “in the air, rather than on the ground” over the next few weeks, ahead of the Olympic Games in Tokyo.

“There are Trent 1000 [order] opportunities for us this year – we do hope to take orders this year,” adds East, highlighting the powerplant’s overall performance and reliability.

East acknowledges that a lack of spare engines – a consequence of being short on capacity – contributed to R-R’s burden as it struggled to deal with the technical problems, and stresses that the company is working to address this. ■



Airbus uncertain of coronavirus impact
Air Transport P14

PROGRAMME DAVID KAMINSKI-MORROW LONDON

Flight testing begins on higher weight A330neo

Airbus has commenced test flights with the first A330-900 with a higher maximum take-off weight (MTOW) of 251t.

The airframer has confirmed that aircraft MSN1967 – bearing the test registration F-WWCE – lifted off from Toulouse at 12:27 local time on 28 February.

Airbus is aiming to deliver the higher-weight version of the

A330neo, powered by Rolls-Royce Trent 7000 engines, in mid-2020.

The 251t version of the -900 has a projected range of 7,200nm (13,300km). Airbus lists two weight variants, the WV920 and WV921, at this MTOW, with maximum landing weights of 191t. It also lists a 247t MTOW variant, designated WV922.



Deliveries of heavier variant are due to get under way this summer

Airbus's current version of the A330-900 has an MTOW range of 230t up to the maximum of 242t, but the airframer confirmed in 2017 that it intended to develop a 251t variant – a

modification which will also cover the A330-800.

Cirium fleets data indicates that the aircraft carrying out the maiden flight is destined to be delivered to AirAsia X. ■

FLEET CIRIUM TOULOUSE

A350 delivery is 'milestone' at Aeroflot

Russian flag carrier begins replacement of older widebodies as Airbus confirms airline as customer for eight more -900s

Russian carrier Aeroflot has taken delivery of the first of 22 on-order Airbus A350-900s, which will be used to replace its A330 fleet.

In all, the airline will receive 10 of the Rolls-Royce Trent XWB-powered twinjets this year, with deliveries completed by 2023.

In addition to the first aircraft – registered VQ-BFY, and named after Russian composer Pyotr Tchaikovsky – a further four A350s for Aeroflot are in various stages of assembly at the airframer's facility in Toulouse.

A fifth is currently in the final assembly line's station 40, where the wings, vertical and horizontal stabilisers, and landing gear are attached to the fuselage.

Aeroflot will deploy its A350s on flights from its Moscow base to Dubai, London, New York, Miami, Osaka, Singapore, and Beijing – as well as other Chinese destinations, the carrier says.

The airline has configured the aircraft with 28 business-, 24 premium-economy- and 264 economy-class seats. It is equipped with a Panasonic eX3 in-flight entertainment system, high-definition screens and wi-fi connectivity.

Deputy chief executive for strategy, service and marketing

Andrey Panov describes the A350 as "a milestone" in Aeroflot's history.

Cirium fleets data shows that Aeroflot's long-haul fleet com-

prises 14 A330-300s (including two in storage), five A330-200s and 19 Boeing 777-300ERs.

Aeroflot has leased three A350s via Ireland-based GTLK



Nine additional Trent XWB-powered twinjets will arrive this year

UPGRADES

Airline weighs possibilities for long-haul renewal programme

Aeroflot Group is in the process of reviewing options for expanding its long-haul fleet, and is looking at widebodies from both the big two Western airframers.

Although the carrier is refurbishing its Boeing 777s – and has three more -300ERs on order – it is already evaluating their eventual replacement.

Deputy chief executive for strategy, service and marketing Andrey Panov says the review also covers potential future

expansion. The airline's leadership aims to decide on the future fleet strategy in "approximately" a year's time, Panov notes.

He will not be drawn on the likely size of the future long-haul fleet. But he says the carrier is evaluating the Airbus A350 and A330neo, as well as the 777X and 787. Considering the limited number of available "new widebodies", it is "logical" to look at all available options, he argues.

Europe. Roman Lyadov, the lessor's chief executive, says it will be "happy to participate in the next tender process" to arrange leases for its A350 fleet.

Airbus has additionally confirmed that Aeroflot is the previously unidentified customer for eight A350-900s.

The carrier originally committed in 2007 to 22 A350s, but later cut eight -800s from the order, a variant since axed by the airframer. During the 2018 Farnborough air show, Airbus disclosed the order for eight -900s, but did not name the customer. ■

In 2007, Aeroflot placed an order for 22 787s, in parallel with its A350 commitment. But the 787 order was subsequently cancelled.

Aeroflot last month disclosed its intention to grow its fleet from 364 at the end of 2019 to about 520 aircraft – including 80 long-haul jets – over the next three years.

The Moscow-based mainline operates 39 widebodies, while sister carrier Rossiya has 21, including nine 747-400s. ■

DISEASE DAVID KAMINSKI-MORROW BRUSSELS

Airbus uncertain of coronavirus impact

Despite caution, airframer's chief commercial officer emphasises SARS outbreak in 2003 showed resilience of industry

Airbus chief commercial officer Christian Scherer is uncertain whether the air transport impact from the coronavirus outbreak will translate into an effect on the airframer.

Speaking during the A4E aviation summit in Brussels on 3 March, Scherer pointed out that the aircraft manufacturing business "operates to longer cycles".

"It's too early to say if there'll be a ripple effect onto the industrial side," he says.

Scherer notes that the airline representatives at the summit were optimistic of a relatively quick rebound.

"History tell us the resilience is there," he adds, pointing to the SARS virus outbreak in 2003.

At the peak of the SARS crisis, Airbus senior executives publicly insisted that the air transport system was being badly affected by publicity exaggerating the overall seriousness of the situation.

SARS was a more lethal illness than coronavirus, but Airbus's then chief Noel Forgeard said in April 2003 that, nevertheless, the problem was being "extremely overstated by the media".

The airframer's then sales head John Leahy – whose role is now occupied by Scherer – had



Scherer notes that aircraft manufacturing 'operates to longer cycles'

believed the SARS impact would be "relatively short-term".

IATA data shows the effect of SARS on Asia-Pacific carriers' traffic lasted less than nine

months, with traffic on Asia-Pacific airlines down by 35% by May 2003, the outbreak's worst point.

IAG chief executive Willie Walsh also rejects any notion that airlines which were struggling before the coronavirus outbreak should receive state aid to help with its impact. "I don't believe it's appropriate for governments to provide financial support to weak airlines," he says.

Although the fatality rate from coronavirus is relatively low, "I think it would be wrong for us to dismiss it," Walsh says.

Air France-KLM chief executive Ben Smith says there are a number of weak carriers in parts of the world, including Asia, and the outbreak will "accelerate consolidation" within the industry.

OUTLOOK CIRIUM BRUSSELS

European airline leaders report limited reduction in demand

Leaders of some the largest airlines in Europe believe that the coronavirus will only have a limited impact on demand for air travel on the continent.

IAG's outgoing chief executive Willie Walsh, speaking at the A4E summit, acknowledged that the group had seen a significant fall in demand for travel to Asia, and has cut back its routes in China.

Walsh says there has been only a small impact on demand in

Europe, although that changed in late February when the virus began spreading rapidly in Italy.

But he rejects the notion that the situation could be compared with the aftermath of 9/11, when passenger aircraft were grounded across the globe. "If [demand] follows the pattern that was seen in Asia, it will stabilise in the coming weeks," says Walsh.

Ryanair group chief executive Michael O'Leary says the carrier

has seen a fall in leisure demand, but does not expect the impact to last beyond the summer. "People will get bored with coronavirus" after three weeks, he suggests.

Air France-KLM chief executive Ben Smith plays down the longer term impact of the virus, although he does assess the coronavirus outbreak's effects to be worse than SARS – something he partly attributes to amplification of anxieties on social media. ■

FINANCE GRAHAM DUNN LONDON

Regulators open new inquiry into Alitalia state aid

European Commission competition regulators have opened a second state aid investigation into a loan totalling hundreds of

millions of euros granted by the Italian state to struggling Alitalia.

The €400 million (\$438 million) loan was designed to facilitate the

streamlining of the company in order to sell its assets.

Alitalia has been in extraordinary administration since May 2017, after key investor Etihad baulked at fresh funding when staff rejected a unions-brokered productivity deal.

In January 2020, a decree-law authorising the loan was converted into law by the Italian parliament. It also stipulates that the disposal of Alitalia's assets must be carried out by 31 May 2020.

A new sales process, carried out by the extraordinary commissioner, is expected to be launched shortly, the Commission notes.

"The investigation will provide clarity to Italy and the company as well as interested buyer(s), if the €400 million loan constitutes state aid and if it complies with EU state aid rules," it says.

A separate European probe has been running since last April into a €900 million bridging loan to Alitalia dating from 2017. ■





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RESULTS MURDO MORRISON PARIS

Dassault looks for lift from future fighter and Falcons

Trappier says R&D spend boosts company's prospects in business aviation and defence

Eric Trappier suspected something was wrong when BAE Systems stopped returning his calls. It was 2017 and, for more than four years, the Dassault Aviation chief executive had been working with his opposite number at the UK defence contractor on an Anglo-French project to develop an unmanned combat air vehicle, an effort set in process by the Lancaster House treaties aimed at pooling the talents of Europe's big two defence industries.

The 2010 agreement was a legacy of then-UK premier David Cameron and French president Nicolas Sarkozy. But Sarkozy's successor-but-one, Emmanuel Macron, was not a fan of the latter-day entente cordiale.

After the UK's 2016 vote to leave the EU, the newly elected Macron and German chancellor Angela Merkel – passionate believers in the European project – wanted to strengthen defence ties across the Rhine instead. Trappier's line to BAE's Farnborough HQ went dead and he was

told to switch allegiances.

The outcome was the Future Combat Air System (FCAS), formally launched after much wrangling at the Paris air show in 2019, and finalised earlier this year. While Trappier is "delighted" to be working with new partner Airbus Defence & Space – as prime industrial contractor on the German side – and to have a firm contract, he regrets having to abandon his former ally. "It should have been the UK and France after Lancaster House," he tells *Flight International*. "It was a French political decision related to Brexit."

ADJUSTMENT REQUIRED

Under the new arrangement, Dassault will take the lead on a Next Generation Fighter, due to fly in 2026. Trappier admits dealing with the Germans will be a different challenge to that of co-operating with UK industry, more because of political cultures than the relationship with Airbus's Bavaria-based defence arm. Like the UK, France's strong executive

has considerable autonomy when it comes to defence policy, while Germany's parliamentary and federal structure of checks and balances can mean decisions take much longer.

Trappier has also not given up on the possibility of a grand alliance coming together at some point – combining the work done by Dassault and Airbus, and separately by BAE and Leonardo under the now rival Anglo-Italian Tempest project, which also has involvement from Sweden's Saab – into a four- or five-nation initiative to design a future European fighter.

However, he admits: "Who knows what the future will bring? But it will be difficult in [the medium term] to stop the train that has been set in motion."

While FCAS is Dassault's long-term bet, the Rafale – a fighter Trappier expects to be flying into the second half of the century – remains its linchpin.

After years of trying, Dassault secured its first foreign customers – Egypt and Qatar – in 2015, fol-

lowed by India, and 47 of 75 aircraft in the backlog are destined for overseas buyers. Dassault delivered 26 Rafales last year, all for export, and expects to follow up with 13 this year. The next French tranche of 28 is set to be handed over between 2022 and 2024, with potential for a fifth batch, to add to the original 180 orders from Paris, to begin delivery in 2027.

Elsewhere, Dassault is pitching the Rafale – which will celebrate its 20th anniversary in French service next year – in fighter competitions in Finland and Switzerland. "We have made new proposals in both and during 2020 we will continue our talks," he says, adding: "We have other prospects but these I will not tell you about."

On the civil side, Dassault is also putting down a serious marker, with a likely response later this year to moves by rivals Bombardier and Gulfstream in the ultra-long-range business jet segment. The Global 7500 and G700 have ranges around 7,500nm (13,900km), about 1,000nm greater than Dassault's flagship 8X.



Airframer is making concerted effort to ensure the 6X remains on schedule for service entry in 2022





Boeing's FARA
contender belatedly
breaks cover
Cover Story P18

DASSAULT AVIATION



Trappier has not ruled out an expanded alliance to design a future European fighter

How Dassault will respond remains to be seen. Trappier will only hint that details about the "Future Falcon" – whose existence was confirmed at the National Business Aviation Association convention last October – may become clearer "in the first half of this year".

Dassault's current in-development jet, the 6X – which has a range of 5,500nm and the widest cabin in the market – continues, with a maiden sortie due in the first quarter of next year and entry into service in 2022. Trappier says the company is "very vigilant" over the schedule after the debacle of the 5X – delays by original propulsion provider Safran to deliver its all-new Silvercrest engine prompted Dassault to cancel the programme and replace it with the Pratt & Whitney Canada PW812D-powered 6X.

SIGNIFICANT SETBACK

Trappier reckons that axing the 5X – which had been set to enter service in late 2017 – set Dassault back about four years, losing it precious orders at a time when

demand for large business jets was robust. "We are suffering," he says. "We lost what we had in the book for the 5X and would have got more orders after [entry into service in] 2017. For now, we are just focused on being on time with 2022."

Dassault needs a boost to its orderbook, with its Falcon backlog at 53 at the end of December and the company forecasting 40 deliveries this year. This is the same number as it took orders for and shipped in 2019, but five fewer

than its start-of-year prediction for deliveries.

However, Trappier remains upbeat, despite concerns about the effect of the coronavirus outbreak and other factors on the global economy. "I am pretty confident we can get to 40," he says. In addition, everything is "going according to plan" on the 6X, he says, with tests on the PW812D – on a Boeing 747 test-bed – complete, and assembly of the first aircraft under way.

Trappier, who stepped up to become Dassault chief executive on the retirement of veteran industrialist Charles Edelstenne in 2013, says he was "not in the shoes" of the senior management group who took the decision to go with the Safran engine in 2009.

"On paper, it was a perfect fit for the 5X," he says. "We knew it was a risk, but we trusted Safran. That was a mistake." Having to abandon the engine and adapt the 5X to the 6X was "really a trauma for me and the teams", he says, but "we were lucky to discover the engine from Pratt & Whitney Canada".

Trappier maintains that he feels "lucky, because our shareholders backed development of the two aircraft at the same time", something that has involved considerable investment at a time when business aviation revenues have been tight. "That is the advantage of being a family company," he says, referring to the descendants of the late Serge Dassault, who hold more than three-quarters of the voting rights in Dassault Aviation through the Group Industriel Marcel Dassault parent organisation.



Future Combat Air System is a project with Airbus Defence & Space

tion that also controls design software house Dassault Systemes.

Despite the challenges, the business remains in robust shape, taking €5.7 billion (\$6.4 billion) in orders in 2019, compared with €5 billion the previous year, and notching up €7.3 billion in revenues versus €5.1 billion in 2018.

"Who knows what the future will bring? But it will be difficult to stop the train that has been set in motion"

Eric Trappier

Chief executive, Dassault

Self-funded research and development spend also increased from €392 million in 2018 to €527 million, much of that accounted for by investment in the Future Falcon project. Operating margins sank from 13.2% to 10.4%, but Trappier says around 4% of the 2018 figure was accounted for by a one-off indemnity paid by Safran over the Silvercrest debacle.

Dassault has also been investing in its footprint in India – part of an offset requirement of the Rafale deal – including a production hangar in Nagpur to make engine doors for the Rafale as well as assemble Falcon 2000s. Trappier also expects to develop "an active supply chain" in the country. Additionally, the company has been improving its Falcon support network, last year acquiring ExecuJet's global MRO network from owner Luxavia, alongside TAG Aviation's European facilities.

Trappier's list of potential market headwinds range from the effect of coronavirus on business travel to the impact of Brexit on doing business in Europe, trade disputes and environmental protests. However, reflecting on the troubles of one of his competitors, being forced to divest most of its business to remain as a purely business jet manufacturer, he notes: "I would rather be doing this job than being chief executive of Bombardier." ■

ROTORCRAFT GARRETT REIM LOS ANGELES

Boeing's contender for FARA battle belatedly breaks cover

Airframer reveals its answer to US Army scout helicopter need, with bids now submitted

With three rotors spinning in three separate axes, Boeing's compound helicopter bid for the US Army's Future Attack Reconnaissance Aircraft (FARA) competition might strike the novice as complex.

But that is not the case, says the manufacturer.

"What we have here is a conventional helicopter configuration with a propulsor on the tail," says Shane Openshaw, Boeing's FARA programme manager. "So there's a clutch in the drive train, behind the intermediate gearbox that drives the tail rotor, that adds the power to the configuration."

The helicopter has a six-bladed main rotor, four-bladed conventional tail rotor and a four-bladed propeller on the back. It uses a single engine and should be able to reach the army's cruise speed requirement of 180kt (333km/h), says the company.

Boeing says its FARA bid is so far a one-company effort, even though several of its competitors have established teams, such as Karem Aircraft's AR40 partnership with Northrop Grumman and Raytheon. It says the clean-sheet design was developed by its

Phantom Works unit, with contributions from subsidiaries AvionX and Aurora Flight Sciences.

In particular, Boeing is leaning on the simplicity and performance of the compound helicopter's hingeless rotor.

SUPERIOR HANDLING

"The high solidity, hingeless rotor is going to give this aircraft phenomenal manoeuvrability characteristics that are going to meet the army's expectations without necessarily associated complexity," says Openshaw. "Due to a greater offset of the effective flap hinge from the rotor centreline, a hingeless rotor generates more control moment to the airframe than an articulated rotor. The greater blade area, and number of blades, delivers additional load factor – that is, manoeuvrability – in the flight regime with the most excess power."

The use of the propeller enables the vehicle to maintain airspeed during manoeuvres that would cause other helicopters to lose momentum, he adds.

Boeing notes its experience with hingeless rotors on two rotorcraft from the 1970s: the Boeing Vertol YUH-61 utility

helicopter and the Boeing Vertol Model 222 tiltrotor.

The YUH-61 lost out to Sikorsky's YUH-60A in the US Army's Utility Tactical Transport Aircraft System competition. Nonetheless, Boeing's FARA main rotor is derived from the YUH-61 design, says Openshaw. The Boeing Vertol Model 222 never left the drawing board, as it lost a prototyping contract in NASA's XV-15 tiltrotor competition to the Bell Model 301. But in the 1980s, Boeing and Bell would team up to develop the V-22 Osprey tiltrotor for the US Department of Defense.

Most recently, in 2015, Boeing says it windtunnel tested an active rotor system using a hingeless hub under US Army sponsorship.

While all of its competitors – Bell, Karem, Sikorsky and an AVX Aircraft and L3 Technologies team – unveiled their FARA designs to the public months ago, Boeing decided not to release images or give specifics about its configuration until final bids were submitted in March. The company has previously said it believes it could lose a competitive edge if it were to tip its hand prior to the final deadline.

The FARA competition is aimed at reintroducing a scout and light attack helicopter to the army's inventory after the 2017 retirement of its Bell OH-58 Kiowa. Later this month, the service is expected to select and fund two designs to be built into prototypes, with one finalist aircraft to be produced and introduced to service by 2028.

Boeing's FARA design was the result of careful trade studies, which tried to balance the army's desire for more speed and manoeuvrability with a low life-cycle cost, says the company.

"We did not go into this effort with our mind made up on what our approach was to be," says

Openshaw. "We went through an array of trades and prioritisation to define our solution, and it is purpose-built for the army."

For example, Phantom Works played with the idea of powering its rotorcraft with two turbines or even one turbine plus a supplemental power unit – like the Bell 360 Invictus design also bid for FARA – but ultimately decided that the US Army's chosen GE Aviation T901 was all that was needed.

DISTANT RELATIVE

The company's FARA offering resembles the Lockheed AH-56 Cheyenne, an experimental attack helicopter with a wing and tail-mounted thrusting propeller that first flew in 1967. Boeing says the likeness does not go beyond the basic configuration, but adds that it



Rear-facing propulsor augments conventional main and tail rotors





Early downselect puts ARRW on point
[Show Report P21](#)



Hingeless rotor would deliver greater manoeuvrability

Boeing

did examine some aerodynamic data from AH-56 testing.

Boeing's design is also smaller than the AH-56, although Openshaw declines to reveal its exact dimensions, citing these as a competition secret. However, the army has limited its future FARA system's maximum rotor diameter to 12.2m (40ft), to allow the scout aircraft to fly between buildings in imagined battles within mega cities of the future. Openshaw also notes that its compound helicopter configuration is more feasible than its AH-56 predecessor, based on its use of fly-by-wire flight controls.

The Boeing FARA design is most similar to a conceptual Compound AH-64 Apache, an idea the company floated in May 2019. Windtunnel tests on the tail section of a subscale model of

that aircraft are being used to prove out the FARA design, the manufacturer says. Its rotor system is being examined in windtunnel tests of another subscale model.

Other features of the Boeing design include a tandem cockpit to allow for maximum visibility

and combat survivability, but also to streamline aerodynamics.

"The focus of our effort was high speed [and] low drag," says Openshaw. "Managing the drag is an important element of being successful at operating at those speeds, for whatever configuration is participating."

Boeing emphasises that development and manufacturing risk to the US Army have been taken out of its bid because of its reliance on existing technologies from fielded aircraft, including flight controls, communication, navigation, survivability equipment, sights, weapons, and data management technology.

"There is no invention required," says Openshaw. "While the rotors, drives, airframe, flight controls, landing gear, fuel, and propulsion systems are FARA-unique, they draw heavily on technologies from other Boeing aircraft."

The company mostly declines to say from which aircraft the borrowed technologies come, although "the tail rotor and propeller blades draw on the AH-64 composite tail rotor blade for performance, strength and combat readiness," says Openshaw.

The presumptive current leader of the FARA competition is Sikorsky's Raider X, a compound helicopter that recently started construction and is based on the already flown S-97 and X-2 technology demonstrators.

To catch up with Sikorsky, Boeing says it is in talks with suppliers and has bought some undisclosed long-lead-time components. Ultimately, should Boeing be granted a prototyping contract in March, it will rely on its

expertise in digital technologies to leapfrog the competition and stay in sync with the army's tight timeline. This calls for a fly-off competition during 2023, before deliveries begin five years later.

For example, the company is extensively using computer fluid dynamics software programmes to study the aircraft's aerodynamics outside of windtunnel and flight testing, says Mark Cherry, vice-president and general manager of Boeing Phantom Works.

WINNING FORMULA

The airframer also aims to move quickly by using model-based systems engineering methods that were central to its recent programme wins to supply the US Air Force's T-7A advanced jet trainer via the T-X contest and the US Navy's MQ-25 unmanned tanker. "Model-based system engineering gives us additional confidence, with previous programmes, aircraft like T-X, like the MQ-25, that we're going to be able to hit those timelines," says Cherry.

Boeing's T-X bid was priced billions of dollars below the air force's expectations, and caused Marillyn Hewson, chief executive of competitor Lockheed Martin, to speculate that the company was selling the aircraft to the service at a loss, with the intention of making profits on international sales. Boeing denies that was the basis of its bidding strategy and points back to savings from its model-based systems engineering approach.

While Boeing has revealed little about its model-based engineering systems approach, Cherry explains the method allows designers to save time and money by catching mistakes early – a tactic it wants to repeat successfully with FARA.

"We're able to do design in a much more integrated way such that you don't have rework. First-time quality and engineering is something that we're driving hard," says Cherry. "We will spend more time up front in the design phase and we've seen evidence that has reduced time in the production, as well as test phase." ■



Lockheed Martin

Lockheed AH-56 Cheyenne from 1967 inspired basic configuration

AIR WARFARE SYMPOSIUM

Hosted in Orlando, Florida, from 27-28 February, the Air Force Association's annual Air Warfare Symposium provided a forum for service leaders to outline their strategic priorities. Highlights included the US Air Force (USAF) laying out its vision for unmanned combat aircraft and developing hypersonic missile technology – and the show was also notable for a cameo appearance by OpenAI, SpaceX and Tesla entrepreneur Elon Musk. Show report by Garrett Reim



US Air Force

CAPABILITY

USAF eyes unmanned, attritable future

Service sees cost-effective solution to changing mission requirements in low-cost, autonomous unmanned air vehicles

With its oldest Lockheed Martin F-16s approaching the end of their service lives later this decade, the US Air Force may replace the manned fighters with so-called attritable unmanned air vehicles (UAVs).

General James Michael Holmes, head of the service's Air Combat Command, wants the air force to rethink the way it wages aerial combat, by using new technology, including attritable UAVs.

"I hope that 30 years from now I'm not still trying to maintain 55 fighter squadrons," he says. "I think we'll advance and there'll be some other things cutting in."

Instead of laying out a traditional acquisition plan centred around buying manned combat aircraft, Holmes wants the USAF to think more conceptually.

"As we go forward in the future, what I would rather build is a capabilities roadmap that shows how we're going to accomplish

the missions for the air force that we traditionally have done with fighters," he says.

The first opportunity to add attritable aircraft to the inventory could come with the retirement of Block 25- and 30-standard F-16s in the mid-2020s.

"Sometime in the next five, six, seven or eight years, depending on budgets and capability, we'll have to decide what we're going to do about those airplanes," Holmes says. "There's an opportunity if we want to cut in something new – a low-cost attritable loyal wingman, the different things that we're looking at and experimenting with."

Next, the USAF's Block 40/50-model F-16s – which will have substantial airframe life remaining, but require major upgrades – could be up for replacement, he says.

"The [current] idea of what a fighter is... still works pretty well

in the European environment," Roper says. "It's still a pretty effective solution to the range, payload and distance problem. [However,] it's not as effective a solution in the Pacific, because of the great distances."

COMBAT RANGE

Lockheed Martin's F-35A has been criticised for having a combat range of only 600nm (1,110km) – insufficient to avoid a surprise strike by Chinese long-range ballistic and cruise missiles if positioned at air bases in the western Pacific.

In part to solve that limitation, the US Air Force Research Laboratory and Kratos Defense & Security Solutions have been developing the XQ-58A Valkyrie: a low-cost UAV with a 1,500nm combat radius. Such an asset could be flown independently, or act as a loyal wingman alongside manned aircraft.

The range problem is also influencing the USAF's thinking on its Next Generation Air Dominance (NGAD) fighter development, says Holmes.

"As you look at NGAD and follow-on programmes, I wouldn't expect it to produce things that necessarily look like a traditional fighter, in that same kind of swap between range and payload and distance," he says. "How about the unmanned, low cost of tradable options? And how might they do those same missions?"

"What we're concerned about at Air Combat Command is not whether it'll be a manned fighter, but how are we going to provide the capabilities that the joint force depends on us to do?"

Voicing his opinion during the symposium, Elon Musk, the founder of artificial intelligence company OpenAI, rocket manufacturer SpaceX and automotive disruptor Tesla, said: "The fighter jet era has passed. For the air domain, things are definitely going to go into locally autonomous drone warfare."

Musk suggests that an unmanned rival to the F-35 should be developed. "The competitor should be a drone fighter plane that's remote controlled by a human, but with its manoeuvres augmented by autonomy," he says. Later elaborating on Twitter, he claims: "The F-35 would have no chance against it." ■



XQ-58A Valkyrie has a 1,500nm combat radius

US Air Force Research Laboratory

REQUIREMENT

Early downselect puts ARRW on point

Air force makes accelerated decision to select hypersonic missile design ahead of its alternative Lockheed concept

A US Air Force decision to cancel the Lockheed Martin Hypersonic Conventional Strike Weapon (HCSW) and instead proceed with the same company's Air-Launched Rapid Response Weapon (ARRW) came down to the respective weapons' size and shape, budgetary pressures and production considerations, the service says.

The ARRW programme passed its critical design review on 27 February, several weeks after the decision to axe the "promising" HCSW effort.

"I hate having to downselect between HCSW and ARRW a year early," says Will Roper, assistant secretary of the USAF for acquisition, technology and logistics. Lockheed and government teams "were green, ready to get to flight testing in the next year", he adds.

The USAF in 2017 awarded Lockheed a \$780 million contract to develop ARRW. After being released by a carrier aircraft, the boost-glide hypersonic vehicle will accelerate using a rocket, before its payload separates and glides unpowered to its target at speeds up to Mach 20.



Boost-glide vehicle uses rocket motor for acceleration after release

In 2018, the company was allocated another \$928 million to also develop the boost-glide HCSW.

With the US Department of Defense having requested a roughly flat budget allocation of \$169 billion for fiscal year 2021 and several new big-ticket procurements to fund, programme savings have been targeted.

"We had to make tough choices, and one was downselecting early" on hypersonic weapon developments, says Roper.

"The reason that we went with ARRW was not that HCSW was bad, but ARRW is smaller: you can carry twice as many on the [Boeing] B-52," he says. There also is a possibility that the new type could be deployed from the centreline of a Boeing F-15.

Having the AGM-183A ARRW in the Pentagon's quiver also adds variety to its selection of hypersonic weapons, Roper notes. "At the department portfolio level, it diversifies the number

of flight bodies that are being looked at, so you're not all looking at the same thing. We would like to get to dual suppliers so that we don't just succeed in flight testing, [but] we move into an industry base that's capable to produce at scale."

SPIRAL UPGRADES

The air force does not intend to acquire a large number of hypersonic weapons, and instead wants to be able to perform "spiral upgrades, [by production] lot to lot", he says.

"We're really looking at suppliers who can 3D print components like leading edges, that we think we'll need to iterate on, so that we've got an adaptable, agile industry base where we don't have single points of failure," says Roper. "By downselecting earlier, we're able to start bringing on the second supplier," he adds.

Despite its cancellation, Roper says the HCSW programme will continue through its critical design review phase, "so that we tie up that design in case it needs to be started in the future". ■

CONTRACT

Second order for Jolly Green II fleet lifts Sikorsky

Sikorsky has received a second low-rate initial production contract for another 12 HH-60Ws, with the US Air Force formally naming its new Combat Rescue Helicopter the "Jolly Green II". A first, 10-aircraft lot was ordered last September, with deliveries due from April 2021.

To date, a test fleet of seven HH-60Ws has amassed a combined 480 flight hours in support of engineering, manufacturing and development and systems design training work. Sikorsky sent one example to Orlando for a debut appearance at the event.

The USAF plans to buy an eventual 113 of the helicopters, to replace its aged HH-60G Pave Hawk fleet.

Although production is in its early stages, the service is already studying potential updates for the platform, having issued a request for information late last year.

"The air force is undertaking its own internal study to determine which of the features we have in our aircraft they would like to keep, those that they would like to eliminate because they are no longer relevant in today's battlefield, and those that they have to



Upgrades are already being considered for Combat Rescue Helicopter

upgrade," says Greg Hames, Sikorsky's Combat Rescue Helicopter programme director.

Among items likely to be removed are an automatic direction finder and situation awareness

data link, while additions could include Lockheed Martin's pilotage distributed aperture sensor system, and autonomous flight capabilities from Sikorsky's Matrix technology. ■

DISPOSAL GREG WALDRON SINGAPORE

Air USA trains eyes on retired Australian Hornets

Canberra is planning to sell 46 Boeing F/A-18A/B “Classic” Hornets to Air USA – a private company that provides tactical airpower training services to the US military and international customers.

The Royal Australian Air Force (RAAF) aircraft are being retired as the service takes delivery of up to 72 Lockheed Martin F-35As.

“The Classic Hornet aircraft will be used to provide training

services to the United States Air Force and will be prepared over the next three to four years,” says Melissa Price, Australia’s minister for defence industry.

No details have been revealed about the price of the acquisition, but work will be performed at the RAAF’s base in Williamstown, New South Wales.

Canberra has previously sold 25 surplus F/A-18A/Bs to Canada for A\$95 million (\$62.9 million), with the aircraft intended to fill a capability gap until Ottawa acquires new fighters. Eighteen of the aircraft will be used as combat assets, with the others supporting testing and spare parts provision.

Cirium fleets data shows 52 single-seat F/A-18As and 16 two-seat F/A-18B trainers are still in Australian service, with an average age of 32 years. It also shows the RAAF has so far introduced 18 conventional take-off and landing F-35As.

Air USA currently has 16 in-service aircraft. These comprise 11 BAE Systems Hawk Mk 67s with an average age of 26 years, four Aero Vodochody L-39ZAs which average 20 years, and a single L-39C, which is 41 years old.

It also has a pair of RAC MiG-29UBs in storage, and its website lists additional assets such as the Dassault/Dornier Alpha Jet and Aero Vodochody L-159. ■



Commonwealth of Australia

Legacy fighter is in process of being replaced with up to 72 F-35As

ROTORCRAFT DOMINIC PERRY LONDON

H145M poised for German army roles

Service may take 48 examples of light twin-engined utility type for missions including crew training and light attack

Germany is looking to buy more than 60 Airbus Helicopters H145Ms to address a broad spectrum of missions – including training and light attack.

The nation’s army requires nearly 50 rotorcraft: 24 for training and a further 24 as battlefield utility helicopters to equip its three aviation regiments. Its air force and navy are likely to need another 16 aircraft between them.

Detailing the requirement at Defence IQ’s International Military Helicopter conference on 26 February, a representative from the army’s rapid forces division said the helicopters could be required from 2021.

Initial examples would replace the older EC135s and Bell 206Ds currently deployed at the army’s multinational training school at Buckeburg, contracts for which expire next year.

“We are seeking to relieve the legacy fleet of today through buying a common platform,” the official says.

Germany has already achieved the smooth introduction of two variants of the H145M, which it calls the Light Utility Helicopter (LUH): 15 for the air force in support of special forces missions and five examples of a search and rescue model for the army.

“The H145 is already known to the German armed forces and we are now thinking of profiting from those good experiences,”

says the army representative. The new variant is to be known as the LUH Streitkräfte (LUH SK).

An initial eight LUH SKs equipped with Airbus Helicopters’ HForce modular weapons system will support the army’s Tiger attack helicopter fleet. However, all 48 rotorcraft will have the systems in place to use HForce.

“We want to use [those training aircraft] also in a wartime scenario

to support the fight,” the official says, describing the likely acquisition as a “smart” use of resources.

Additional tasks could include battlefield liaison, transport or medical evacuation. The H145 has achieved considerable success in the commercial emergency medical services market, the army representative says, so “why not do the same on the military side?” In addition, the LUH SK could allow Tiger or NH Industries NH90 crews to transfer certain training tasks onto the cheaper type, helping to make up for the platforms’ consistently low availability, which is blamed on “weak industrial support”.

Although the German army envisages an anti-armour mission for the LUH SK fleet, there is as yet no anti-tank missile integrated onto the H145M.

However, Airbus Helicopters and Israeli firm Rafael are due to conduct test firings using the latter’s Spike ER munition in early 2021; qualification should be achieved the following year. ■



Bundeswehr

Two variants have already been introduced by nation’s armed forces



VIP operations could offer rotary a lift
Business Aviation P24

REQUIREMENT DOMINIC PERRY LONDON

Islamabad weighs attack fleet options

With acquisitions of AH-1Zs and T129s halted by US sanctions, Pakistan could launch purchase of Chinese-built Z-10ME

Pakistan could turn to China to solve its attack helicopter replacement need, with US embargoes having halted sales of a combined 42 aircraft from Bell and Turkish Aerospace.

Islamabad in 2015 ordered 12 Bell AH-1Zs via the USA's Foreign Military Sales process, before also completing a 2018 deal to acquire 30 Turkish Aerospace T129s worth \$1.5 billion.

The AH-1Z sale has been on hold since US President Donald Trump cut Washington's security funding to Pakistan, while export sanctions related to the US-built LHTC T800 engines that power the T129 ATAK also have forced the suspension of that contract.

This impasse, and the need to retire a fleet of 48 AH-1Fs, is push-

ing Islamabad to consider alternatives, Major General Syed Najeeb Ahmed, commander, army aviation, told Defence IQ's International Military Helicopter conference in London on 26 February.

"We are looking at other options. One of them is in China in the shape of the new attack helicopter, the [CAIC] Z-10ME," he says. "In case the first two options do not materialise, this third option will be considered."

Pakistan had previously evaluated an earlier version of the Z-10, but Ahmed says the latest iteration is significantly improved.

Ahmed is extremely doubtful that the AH-1Z deal can be resurrected, and although Turkish Aerospace is developing an indigenous replacement engine for



Turkish Aerospace

Turkish deal was halted due to export ban on type's T800 engines

the T129, he is not confident that this will be ready in time for Islamabad's July deadline.

This urgency is driven by India's capability increases. The Indian air force already has received

Boeing AH-64Es, and the nation's army will also field the type.

"The Cobras are no match for the Apaches that the Indians are getting," Ahmed says. "We want to match that [capability]." ■

DEVELOPMENT GREG WALDRON SINGAPORE

Beijing fuels speculation of Y-20 tanker derivative



Strategic transport was introduced to service in 2016

Kin Cheung/AP/Shutterstock

China seems set to reveal a dedicated tanker variant of its Xian Y-20 strategic transport, with other special mission variants also suggested to be in development.

"The cargo plane has variants like the Y-20 aerial tanker and Y-20 AEW aircraft," a *Global Times* report quotes an air force aviation regiment commander, Teng Hui, as saying. "I believe our Y-20 tanker will make its debut in the not-too-distant future."

According to the report, the dedicated tanker variant will carry 90t of fuel: three times more than the adapted Harbin H-6 that China currently uses in the role.

The suggested AEW-rolled version could use a conformal radar array, instead of a more traditional rotating radome. Other applications could include electronic warfare duties, and at the Airshow China event in 2016 AVIC also revealed a proposal for a commercial version, the Y-20F-100.

Introduced to service in 2016, and powered by four Russian-supplied Soloviev D-30KP-2 engines, the Y-20 has featured in the Chinese military's delivery of airlift support in response to the coronavirus crisis. Development continues on an indigenous engine, the Shenyang WS-20. ■

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STRATEGY DAN THISDELL LONDON

VIP operations could offer rotary a lift

Expertise with current helicopter services could lay ground for transition to coming generation of eVTOL aircraft

Could air taxi services help the helicopter industry ease the pain of protracted downturns in other segments?

Sparring over the issue at the Helicopter Investor London conference on 25 February were Airbus Corporate Helicopters head of marketing Nitin Sareen and Nigel Watson, who leads Isle of Man-based VIP helicopter fleet management specialists Luvair.

Against the background of a global helicopter market that has been down or flat for several years, with low oil prices taking the buzz out of demand for offshore crew transport, the pair contemplated prospects for growth in VIP, air taxi, super-yacht and sightseeing business.

Sareen sees no particular environmental obstacles to expansion; a fully loaded helicopter making a short taxi trip could, he says, account for lower carbon dioxide emissions “than an Uber ride across town”. And, he says, helicopter air taxi services are already making up a growing share of usage – an “opportunity” to learn and adapt while develop-



S-92B gains gearbox and avionics upgrades – plus larger windows

ing infrastructure. Because infrastructure can be developed incrementally, Sareen foresees a gradual shift from helicopters to electric vertical take-off and landing (eVTOL) vehicles.

Nearly 2,500 helicopters work in the air taxi and tourism services sectors and account for about 3% of the total active fleet, he says, so the segments warrant attention.

Existing operators, with their deep experience of operations in vertical lift, will be the ones to lead this transition, forecasts Sareen: “It can’t be done by

university kids.”

Watson is less bullish. First, he notes, nobody should underestimate the power of helicopters’ “negatives”: noise and danger, perceived and real. What, he asks, are the OEMs going to do about those downsides? The “big players” – by which Watson means tech giants such as Google and Amazon – have the resources to develop the small unmanned cargo drones that “will deliver pizzas and body parts”, referring to time-critical payloads such as transplant organs.

Even then, he argues, the need to cut carbon emissions to neutrality is paramount – but electrification is not coming any time soon.

One OEM does have a view on transition, however. Though not addressing VIP usage directly, Sikorsky vice-president Audrey Brady outlines her company’s development plan for the S-92 transport. First, by about 2022 the S-92A+ upgrade package – including improved avionics and a new gearbox – will be available for retrofit.

Then, for delivery from 2025 is the S-92B, which gains the same enhancements as the A+, but also features bigger windows, made possible by titanium cabin structures and above all intended to ease egress for passengers in bulky immersion suits in the event of a ditching at sea.

Brady, though, points to ever-improving safety and reliability – and even hints at thinking about a “second life” for the S-92 in a “post oil and gas market”: “I’d like to think of those windows for viewing the sunrise,” she says. ■

DEVELOPMENT KATE SANSFIELD LONDON

Lilium unbowed after blaze destroys prototype

German start-up Lilium says flight testing of the second electric-powered Lilium Jet prototype could be delayed by several weeks as it seeks to determine what caused the initial aircraft to catch fire during maintenance on 27 February.

Lilium says the aircraft was “damaged beyond repair” at its base at Oberpfaffenhofen airport near Munich, but the second example, which is almost complete and was being readied for its first flight in the second quarter, was untouched by the blaze.

“Flight testing of the second Lilium Jet will only begin when

we have discovered the root cause of the fire and implemented any necessary updates to the aircraft,” says Lilium. “Safety is our key concern.”

The company says the fire is “not a major setback” for the programme as it “intended to transition to the second prototype as soon as it was ready”.

The first example has made “hundreds of air and ground tests” since its maiden sortie on 4 May 2019, says Lilium – including the crucial transition from vertical to horizontal flight.

The five-seat Lilium Jet is powered by 36 electrically driv-



Electric-powered jet performed maiden sortie on 4 May last year

en fans distributed across two sets of wings. Service entry remains on track for 2025, with the

jet designed for inter-city and short regional flights of up to 160nm (300km). ■



Troubled times
Special Report P26

ACQUISITION JON HEMMERDINGER BOSTON

Wheels Up initials Gama Aviation Signature deal

US charter company Wheels Up has acquired business aircraft operator and management firm Gama Aviation Signature, a move that continues the former's rapid expansion following a recent equity sale to Delta Air Lines and merger with the carrier's private aviation unit.

The deal also boosts the operator's fleet by about 100 aircraft, to more than 300 business jets and

turboprops, making Wheels Up the second-largest operator in the world. Fractional ownership, charter and management company NetJets is the market leader, with a fleet of over 750 aircraft.

Wheels Up provides an ad hoc and members-only charter offering, but relies on other companies, including Gama Aviation Signature, to operate the aircraft on its behalf.

These include its 120-strong branded fleet of Textron Aviation aircraft, comprising Beechcraft King Air 350i turboprops, Cessna Citation Excel/XLS and X models.

Wheels Up has not disclosed the price paid for the business.

Gama Aviation Signature is 49% owned by GB Aviation Services – a joint venture between UK firms Gama Aviation and Signature Aviation – with the remainder held by US partners. Gama Aviation says it will receive \$33 million from the sale: \$10 million for its 24.5% stake, plus \$23 million for “accelerated branding fees and other trading-related considerations”. That price suggests that Wheels Up will pay around \$40 million for the equity in the business alone.

Gama Aviation Signature will continue operating as a wholly

owned subsidiary of Wheels Up, it says, although the UK company says it has licensed the use of the brand for two years.

Gama Aviation has also signed a five-year “non-compete” agreement in respect of Part 135 charter operations in the USA. It also has a “thriving” maintenance business in the country which it has “absolutely no plans to sell”.

In late January, Delta acquired 27% of Wheels Up for an undisclosed sum. At that time, Delta merged Wheels Up with its in-house charter business Delta Private Jets, which operates some 70 aircraft.

In June 2019, Wheels Up acquired light jet operator Travel Management Company, and in September last year acquired Avianis Systems, a technology company that has developed a digital flight and operations management system. ■



Wheels Up

Move makes operator second-largest in the world after NetJets

DELIVERY KATE SARSFIELD LONDON

Acropolis takes Neo approach to luxury

First example of re-engined VIP narrowbody begins revenue flights with UK charter operator after February handover

UK VVIP charter operator Acropolis Aviation took delivery of the first outfitted Airbus ACJ320neo on 27 February from Swiss completions company AMAC Aerospace, and the luxury re-engined narrowbody made its first revenue flight on 3 March.

The handover of the ACJ320neo (G-KELT) came a little over a year after the green aircraft arrived at AMAC's Basel headquarters.

Created by French design house Alberto Pinto, the interior accommodates 19 passengers. It features a forward lounge and dining area, a full-sized kitchen and a private master bedroom leading to a luxury en-suite shower, described by Acropolis as “the largest ever to be installed in an Airbus single-aisle aircraft”.

G-KELT has been fitted with the



Acropolis Aviation

Cabin can carry 19 passengers and features private master bedroom

Collins Aerospace Venue cabin management system and Stage in-flight entertainment system, “allowing hundreds of movies and TV programmes to be viewed on

19 individual iPads and four large TV screens throughout the cabin”, the operator adds.

Collins's Viu LED interior mood lighting system is also featured,

while its Airshow moving map display is beamed onto the four large cabin screens.

The CFM International Leap-1A-powered narrowbody also features in-flight wi-fi via a Ka-band internet connection.

G-KELT will make its public debut in May at the European Business Aviation Convention and Exhibition in Geneva. Airbus has sold 12 ACJ320neo-family aircraft to date: seven ACJ320neos and five of the smaller ACJ319neo.

The airframer says two more outfitted ACJ320neos are scheduled for delivery in 2020 – both to business aviation services company Comlux – while German operator K5 Aviation will receive the first completed ACJ319neo over the coming months from Dutch MRO firm Fokker Techniek. ■



TROUBLED TIMES

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Boeing's bid to match arch-rival Airbus with a re-engined version of its best-selling narrowbody proved a partial success – until two tragic accidents took the type out of service and cast a shadow of uncertainty over the airframer and indeed the aerospace industry. One year on from the grounding of the 737 Max, we examine the implications



Kamil Petram/Shutterstock



Boeing



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With the projected cost from the 737 Max grounding estimated at \$18.6 billion, the new management at Boeing (*left*) is taking a careful look at the case for its proposed New Mid-market Airplane – but time is of the essence, say analysts; 4,500-unit backlog presents airframer with a complex supply-chain headache (*centre*) following suspension of production in January; return to flight will necessitate a revised approach to how re-engined type's successors are conceived and built (*right*) – and a fresh look at pilot training

Long road to recovery

Two fatal crashes of its best-selling airliner have left Boeing reeling. But management faces a much bigger basket of challenges – both internal and in a changing global market

JON HEMMERDINGER BOSTON

For Boeing, 2020 is a second year consumed by the aftermath of two fatal crashes and a global grounding of 737 Max airliners. But heralding a new approach to the Max crisis, the company started this year with a change of leader at its Chicago headquarters. David Calhoun – a long-time Boeing board member and former GE Aviation executive – has even won early praise for transparency and humility, while mending ties with the federal agency which will decide the fate of the 737 Max.

But apart from the Max problem, Calhoun must grapple with related issues of product strategy, finances and other changes to top management, including the October 2019 replacement of commercial aircraft division head Kevin McAllister – described at the time by the *Seattle Times* as “the first Boeing executive head to roll as a result of the ongoing 737 Max crisis”. Other recent departures

include legal counsel and senior advisor Michael Luttig, who is viewed as having crafted Boeing’s legal response.

Where predecessor Dennis Muilenburg drew criticism for a tight-lipped style – and setting goals Boeing failed to reach – Calhoun has been characterised by candour and accountability. Says Scott Hamilton, aerospace consultant and founder of Leeham News and Analysis: “Muilenburg came across as incredibly scripted, incredibly uncomfortable in any kind of a public forum, incredibly reserved. Calhoun comes across as much more animated, much more engaging and much more open.”

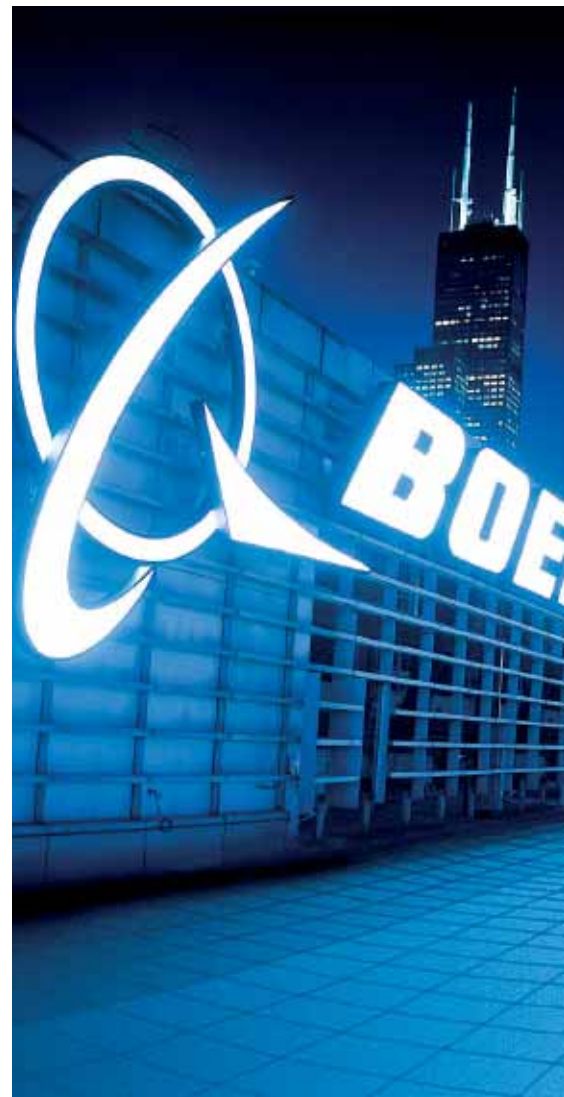
Michel Merluzeau, aerospace analyst with consultancy AIR, describes Calhoun as taking over Boeing on “the morning after the earthquake”. He praises Calhoun’s deferent tone with the Federal Aviation Administration (FAA) and calls his openness “refreshing”.

Likewise, McAllister’s successor Stan Deal has support. Merluzeau describes Deal – a long-time executive within the Seattle-area commercial jet division and formerly head of the services division – as “an exceptionally driven individual. He’s resolute and very defined in what he wants to achieve... He’s one of the best leaders [Boeing] could have hoped for.”

CUSTOMER SUPPORT

One major customer, Air Lease executive chairman Steven Udvar-Hazy, believes Calhoun has a solid grasp of Boeing’s challenges and gives the company credit for its response to the Max grounding. “Boeing has been out there working with customers,” Udvar-Hazy says. “Overall the team has done a very credible job to support the requirements that have arisen as a result of these tragedies.”

Despite positive signs, watchers note that Calhoun has only been in the post since 13



David Calhoun made a promising start but faces epic challenges as Boeing front man

January. In addition to the Max crisis, Boeing must quickly devise a product development strategy while facing significant uncertainty stemming from the coronavirus outbreak. Meanwhile, due largely to the Max, Boeing lost \$636 million in 2019, reversing its \$10.5 billion profit in 2018. In January Boeing estimated Max issues will ultimately cost it \$18.6 billion – about 18% of its 2018 revenue – including \$8.3 billion in concessions to customers and \$10.3 billion in production and programme costs.

Calhoun quickly started mending Boeing’s strained relationship with the FAA. Under Muilenburg, Boeing made optimistic projections about when the Max would return to service – projections earning Boeing and Muilenburg public reproach from FAA administrator Steve Dickson. “[Calhoun’s] pushing the Max return-to-service date out by months [to mid-2020], to remove any kind of perceived pressure on regulators, was very smart,” Teal Group analyst Richard Aboulafia says.

Observers initially expected Calhoun to be

Company estimates costs from grounding will reach \$18.6 billion



a temporary solution, setting a course before stepping aside for a rising Boeing star or even an outsider. However, expectations of a short-term departure have been downgraded.

There are many outsiders who may have the institutional knowledge and market vision to succeed at Boeing. “Rising stars” include Boeing Global Services head Ted Colbert, who Merluzeau calls a “visionary” and “potential CEO material”. Others to watch are Marc Allen, who heads the Embraer partnership and group operations; Travis Sullivan, vice-president and general manager at Boeing Distribution Services; and Jenette Ramos, senior vice-president of manufacturing, supply chain and operations.

BEYOND THE MAX

As for its overarching commercial aircraft strategy, analysts see Boeing in a competitive pinch. The Max grounding disrupted its plans to develop a twin-aisle, 270-seat New Mid-market Airplane (NMA), which was originally pitched for mid-2020s certification. That timeframe is critical, analysts say, because

airlines need to replace ageing 757s and 767s. With NMA sidelined, Airbus stepped into the void last year, launching its own mid-market aircraft, the A321XLR, which has proved a hot seller.

Calhoun in January said he ordered a “clean sheet of paper” rethink of NMA – suggesting a broader review in anticipation of decisions with long-lasting implications.

Those implications are hard to decipher. Aboulafia urges Boeing to launch a new mid-market airliner – a single-aisle that could replace both NMA and the 737. Hamilton doubts the business case for the 270-seat NMA concept, as airlines will need maybe 2,300 such aircraft, half of which Airbus might supply. And, Udvar-Hazy reckons Calhoun must, while improving morale and cultivating a more “co-operative relationship” with regulators, resolve compensation arrangements with Max customers – and sell more Max aircraft.

Sagging 777X demand is another quandary; deliveries are expected from 2021, but Boeing has only 309 orders, with demand in

Asia slowing even before the coronavirus outbreak put on the brakes. Says Udvar-Hazy: “Right now, big is not so beautiful. Smaller-sized, twin-aisle aircraft are the flavour of the month.”

Aside from strategy, there is execution. Udvar-Hazy, whose company holds orders for 135 737 Max and 33 787s, thinks the sales team has been “very engaged” and “done a very good job considering their formidable challenges”.

“Right now, big is not so beautiful. Smaller-sized, twin-aisle aircraft are the flavour of the month”

Steven Udvar-Hazy

Executive chairman, Air Lease

Also voicing support for Boeing is one senior fleet executive at a major North American airline, who says the sales team has acted with “integrity” amid the Max crisis and kept him well informed. Boeing’s sales staff have held frequent calls with that airline that have communicated “real-time information to us as best as they could”, says the source, who asked to remain anonymous due to the sensitive nature of the Max situation: “[I] have not at all felt like there is something lacking in the sales team whatsoever.”

Merluzeau’s assessment, however, is cutting: “It’s clear to me that the Max crisis has damaged relationships with key customers.”

At Boeing, vice-president of commercial sales and marketing Ihssane Mounir stresses that his team has valuable customer relationships and product knowledge. Mounir notes the 737 Max issues are “unprecedented” and that customers have been justifiably disappointed. He says his team has had the difficult job of informing frustrated customers of issues. But he insists that the Max’s difficulties bear no reflection on the sales team’s performance.

His team is also helping negotiate Max-related settlements with customers and working to help alleviate fleet issues caused by the Max grounding. That sometimes means helping customers make broader fleet adjustments, tweaking services support or other forms of assistance, but: “It’s impossible for us to just settle to the tune of what they’re asking, in some cases. Some customers, we have ways to address it, and others, you don’t have ways to address it.”

Udvar-Hazy concurs: “A lot of customers are asking, I think, [for] a lot more than is reasonable. Others are more modest.” ■



ANALYSIS DAN THISDELL LONDON

Toxic Max brand means purity will likely be a distant goal for Boeing marketing

Boeing faces a long list of daunting challenges in recovering from the 737 Max calamity, which only begins with actually fixing the problems that caused two fatal crashes of its best-selling airliner. The world's biggest aerospace company must also overhaul its management structure, grapple with a heavy financial impact, re-establish rapport with regulators, help suppliers cope with the massive disruption of a production shutdown, make up lost ground in deliveries to its airline customers and work out how to train pilots to fly the aircraft.

Perhaps equally massive, though, will be the task of repairing the damage to its brand and reputation. And, in this soft but critical context, Boeing looks to be sailing in uncharted seas, such is the global complexity of the situation it faces. One communications industry consultant contacted by *Flight International* observes that Boeing faces two different problems. One is to restore the faith of the aerospace industry in Boeing as a partner and customer. The second, says Harry Pirwitz, founder of London-based space, telecoms and IT consultancy Cicero & Friends, is to address the "emotional side" of the problem.

Pirwitz reckons that when it comes to restoring trust, suppliers and airlines will be more quickly forgiving than the flying public.

But complicating things for Boeing, he adds, is the fact that, for those people, the relationship with the aircraft maker is indirect via the airline, though both share an interest in ensuring flight and cabin crews are confident in their aircraft.

PRECEDENT?

Chris Bullick, managing director of the Pull Agency, a branding and marketing firm based in Surrey, the UK, highlights the difficulty Boeing faces for want of historical precedent in how to deal with such a huge problem. The modern "textbook" on handling a consumer confidence crisis was, he notes, written by Perrier in 1990, when bottles of the naturally sparkling spring water were found to be contaminated with benzene.

Up to then, says Bullick, the normal corporate reaction would have been to cover up the problem, but Perrier took the "radical" approach of quickly tracing the source of the problem, admitting fault and recalling the entire world supply of some 160 million bottles. Such transparency meant a huge financial hit but he reckons it was the only way to restore confidence in a brand that boasts "purity". Significantly, the root problem was traced to a cleaning fluid used at one bottling plant and, hence, could be fixed.

But for a better guide to Boeing's dilemma,



Perrier's transparent approach to bottling issue is the textbook case of crisis management

Bullick points to Coca-Cola's ill-starred attempt to change its formula, launching "New Coke" in 1985 – to immediate consumer derision. As Bullick notes, Coca-Cola did not try to "intellectualise" its way out of the problem by citing taste test trials in which people preferred the new formula. Instead, it gave in almost immediately, reintroducing "Classic" Coca-Cola within three months.

Bullick warns Boeing against any instinct to intellectualise its 737 Max problem. From a passenger or pilot perspective, the problem was caused by software – and fixing the problem with more software will not restore confidence. To go down this route and also try to keep the 737 Max brand, he says, would be like pushing on a string: "The consumer won't buy it." At the extreme, he says, such an approach could see Boeing "heading for an existential problem of their own making".

Ultimately, Bullick reckons Boeing's room for manoeuvre is very limited. Even the case of the de Havilland Comet, the pioneering 1950s jetliner that suffered a string of catastrophic structural failures, gives little guide to the Max problem. The Comet's problem was quickly identified as its square windows – fixed by a very visible design change. Boeing's problem may well stem from having made one too many upgrades of an ageing platform, and few will have true confidence in a software fix.

Pirwitz agrees that the Max dilemma "has all the hallmarks of a new paradigm" in restoring brand reputation. His advice to Boeing is, first,

to fix the underlying problem. Then it should inform about the steps taken to ensure no similar issues happen again and find pilots who are happy to report about their positive results in the simulator. But, he warns, in his experience, Boeing would have to wait about a year

Boeing looks to be sailing in uncharted seas, such is the complexity of its situation

after things calm down before stakeholders are receptive to messages promoting the brand and its century of delivering safe flying.

Another approach for Boeing to take is to address the name problem. Indeed, industry figures including leasing titan Steven Udvar-Hazy and Qatar Airways boss Akbar Al-Baker have called on Boeing to drop the Max name, and Bullick agrees that has to happen – if only to protect the hugely valuable 737 brand.

But he goes on to point out that nobody would be fooled by such a change, which leaves Boeing with the impossible challenge of having to convince all parties that they should have confidence in a software-based fix to what was a software-created problem. To Bullick, then, the only way out of this dilemma is find a different solution – perhaps going so far as to promise an all-new model and manage the transition as best as possible. ■



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Challenging numbers

Between its huge order backlog and the fact that its customers' only alternative, Airbus, is booked solid for years, restarting Max production is just the first hurdle for Boeing

DAVID KAMINSKI-MORROW LONDON

US leasing firm Aviation Capital Group was bestowed last year with the dubious honour of being the final customer to take delivery of a Boeing 737 Max before the type's grounding. It acquired the aircraft on 11 March 2019 and, as result, was the only company to receive a 737 Max after the Ethiopian Airlines accident that sparked Boeing's greatest commercial air transport crisis.

Aviation Capital Group is based in Newport Beach, California, practically next door to Long Beach, where Boeing – two decades before 737 production became embroiled in the Max saga – once considered assembling its ubiquitous single-aisle jet to simplify the 737 lines at its Renton plant.

The lessor's acquisition took total Max deliveries to 387 in the 665 days from when the first was formally handed over – to Lion Air Group's Malindo Air division – in May 2017.

Boeing's backlog for the re-engined Max family has stayed remarkably stable over this period, despite the highly publicised prob-

lems, barely wavering from a figure of just over 4,500 aircraft attained by the time of the grounding. When deliveries came to a halt, Boeing continued to take a small number of orders, including a deal for four aircraft just six weeks into the suspension.

A total of 37 post-grounding Max jets have been ordered – the largest identified carrier being Turkey's SunExpress for 10 aircraft, while an undisclosed customer is taking 20 – but Boeing has also notably received encouragement from British Airways parent IAG after the company provisionally agreed to take 200 of the Max 8 and Max 10 variants.

The steadiness of the backlog is probably a consequence of customers not wanting to lose their place in the production queue, given that there are few alternative avenues through which to source new single-aisle jets.

"It might look like a paradox but, in the short term, we don't benefit from the situation with [Boeing]," said Airbus chief executive Guillaume Faury during a briefing in Toulouse on 13 February.

Airbus is trying to smooth production flow for its A320neo family and cut through a



similarly voluminous backlog, which stood at more than 6,180 aircraft at the end of January – close to 10 years' output at Airbus's current rates. "We cannot take benefit for the A320," says Faury. "We are sold out until roughly 2025 and therefore we cannot step in to offset the needs of some airlines."

Neither is Airbus gaining on the margin side from the 737 Max situation, adds chief financial officer Dominik Asam. "When the backlog we are currently executing for 2020-2021 [was] locked in for the single-aisle programme, that was way before the grounding of the 737," he says. "So prices for that time-frame are fixed."

COMPLEX BURDEN

While the rivals' five-figure combined backlogs will ease the immediate sales pressure, the suspension of 737 Max production in January places a complex burden on Boeing as it strives to secure recertification of the aircraft. The US airframer cut monthly Max production from 52 to 42 aircraft per month after the grounding, maintaining this reduced rate for several months before the January halt and parking the undelivered aircraft.

Powerplant supplier CFM International had expected to produce 1,800 Leap engines



Max production was reduced to 42 examples per month – until it was stopped altogether



Boeing's Renton plant had a backlog of 4,500 aircraft at time of the grounding

last year, including the 737 Max's Leap-1B, taking into account this reduced Max production rate.

Aerostructures firm Spirit AeroSystems, however, had continued to produce the Max's fuselage at the monthly rate of 52, with Boeing paying for those in excess of its moderated 737 Max output.

Spirit also agreed to store and maintain

excess fuselages – primarily at Boeing's risk – at its own facilities. Both Boeing and Spirit had intended this arrangement to last until the beginning of May 2020. The production rates suggest Boeing has built more Max jets since the grounding (around 400) than it had delivered beforehand – none of which it has been able to hand over to customers.

Boeing's production stoppage in January



Aircraft previously in service – and those yet to be delivered – will have to be modified

led to a revised agreement with Spirit under which the supplier would provide fewer fuselages, just 216, this year. This covers barely one-third of the 605 fuselages it delivered in 2018, and appears to put Boeing at least four years behind its ramp-up schedule for the re-engined jet.

Spirit had been undergoing a transition to Max production in 2018, bringing the monthly fuselage output up to 52, while also coping with a design which, it says, is 35% different from previous 737 variants built on the same fuselage assembly lines. Its revised pact with Boeing – which depends heavily on the Max's reintroduction to service – shows that Spirit “does not expect” a return to the pre-grounding 52-per-month rate until late 2022.

Boeing had been intending to raise monthly Max production to 57 aircraft last year, but the new Spirit agreement means this hike will probably be delayed until the end of 2023 – and possibly later.

Spirit had been preparing for the higher rate by alternating daily output between two and three fuselages, to practise for a constant three-per-day rate, pointing out that a rate of 57 meant it would have three “balanced” production lines, each turning out 19 fuselages monthly, with “built-in surge capacity”. But the manufacturing halt and delayed introduction of this increased production rate means deliveries of hundreds of aircraft that were contracted to be built and delivered over the next three years will need to be deferred.

REORGANISATION EFFORT

While the Max backlog could undergo a restructuring as a result of airlines' reassessing their fleet requirements – as a consequence of economic cycles or unexpected developments, such as the Chinese coronavirus outbreak – Boeing still faces a daunting and costly reorganisation effort, requiring modification of aircraft already delivered, as well as those undelivered, and renegotiation of delivery arrangements for aircraft yet to be built.

“We recognise we have a lot of work to do,” new Boeing chief executive David Calhoun acknowledged during the airframer's full-year results briefing at the end of January.

“We are focused on returning the 737 Max to service safely and restoring the long-standing trust that the Boeing brand represents with the flying public.”

Adapting the aircraft, recovering production rates, compensating customers and resuming normal service are a matter of logistics, engineering, finance and mathematics. Boeing's most challenging task, arguably, is to rebuild its own reputation as well as that of the 737, its most successful aircraft family, so badly tainted by the debacle of the Max. ■

Clean sheet flying philosophy

After two fatal crashes and a grounding, extensive remedial work should fix the 737 Max; now Boeing must also rethink the basic design philosophy underpinning its future aircraft

DAVID LEARMOUNT LONDON

Recent statements by Boeing's new chief executive, David Calhoun, make it clear that the company is preparing to change the way it designs its aircraft for pilots.

Since the early days of commercial aviation, manufacturers had inevitably provided imperfect aircraft to the airlines, and their imperfect pilots had to learn to manage their shortcomings. Travellers assumed aviation was a relatively risky business, so the occasional accident – even a fatal one – was seen as just one of those things. Mechanical failures were common, and from time to time failure by the pilots to cope with the mishap was inevitable.

This has not been so for about 30 years. Passengers have become accustomed to the hugely improved reliability and higher safety standards that modern engineering and smart aircraft systems have provided.

So when – last year – the second of two fatal crashes within five months involved Boeing's latest product, the 737 Max 8, it caused considerable shock. As facts gradually emerged from the investigations, regulators at national aviation authorities (NAAs) all over the world deliberated about how to react. Gradually, a consensus developed that a change in the approach to airworthiness certification is overdue.

NEW PHILOSOPHY

Calhoun has clearly thought deeply about the implications for the future. This is what he said about the design philosophy his company must adopt for its next all-new product: "We might have to start with the flight-control philosophy before we actually get to the airplane. We have always favoured airplanes that required more pilot flying than maybe our competitor did. We are all going to have to get our heads around exactly what we want."

Calhoun says Boeing needs a change in company culture: "It will be built around the

level of light we shed on safety processes. It will be built on the engineering disciplines and what we do for pilots around the world, not just pilots in the USA." He explains why this is necessary: "Things have changed a bit. The competitive playing field is a bit different. We have to plan for China... We are going to start with a clean sheet of paper again."

In summary, the regulators believe that long-established assumptions about pilot reactions to failures might no longer be valid in the modern aviation environment. The fundamental question that arises is this: what can reasonably be expected of pilots when something goes wrong with the complex integrated systems in today's aircraft?

In both the accidents – the Lion Air and the Ethiopian Airlines losses – there were remedies the pilots could have deployed to prevent the crashes. On the other hand, critical failures of angle-of-attack (AoA) sensors in both cases had triggered very confusing aircraft behaviour for which the pilots had been ill prepared by their training and by Boeing's aircraft manual. This is where the consensus question arises in the case of the two

Max crashes: was it reasonable to have assumed that, in the short time available, given the aircraft's low height in both cases, they would definitely have been able to cope with the stabiliser trim movement that the AoA sensor failure triggered – and kept triggering?

Calhoun accepts that a flaw in the Max's flight-control system had proved disastrous, but claims the design did not result from a decision to put cost factors ahead of safety. The flaws, he says, came from long-standing assumptions about how pilots would react to a failure. Boeing designers had assumed they would get the measure of it within 3s, and act in mitigation.

A great deal has changed on flightdecks in the past 40 years. The advent of the digital flightdeck in the early 1980s gradually – over the subsequent four decades – brought ever-higher levels of automation, greater systems integration, more information for the pilots on their electronic flight instrument systems, more flight mode options for the flight management system/autopilot, and generally greater complexity. In the transitional 1980s



Instrumentation has grown more complex over the past 40 years, with greater automation



Re-engined 737's return to service will depend on updates of both training and systems

the most commonly voiced exclamation on the flightdeck became “What’s it doing now?”

Throughout this period – indeed, before it – the 737 series was doggedly present, its flightdeck gradually developing through four iterations of the aircraft from an analogue/electric interface to digital/electronic by the time the highly electronic Max entered service in 2017.

COMMERCIAL TRAINING

Meanwhile, the pilot supply had been changing, too. Gone was the military as the primary source of aviation training; it has been replaced by a massive worldwide industry of commercial training providers. This industry has been primed to supply licensed pilots at the lowest possible price to an airline industry looking for the lowest possible pilot induction cost, followed by the lowest possible recurrent training cost.

Of course, the airlines also want the highest possible pilot quality, but given the economic imperatives under which the training industry operates, it is reasonable to wonder how many of the graduate pilots could possibly achieve that level. Ryanair’s former head of training, Captain Andy O’Shea, has famously said that more than half of them have not reached an adequate standard, despite being awarded licences.

During the US Federal Aviation Administration (FAA) investigation of the 737 Max since its grounding, it set up the multinational Joint Authorities Technical Review (JATR) team

as an independent group to look at the big picture. One of its most profound – but simple – statements is that systems design “must not rely on pilot action as a primary means of risk mitigation”. Also, says the JATR, assumptions about pilot reaction to system failures need to be reviewed in the light of the complexity of aircraft systems and a new generation of pilots trained in different ways.

JATR head Christopher Hart told the FAA: “As aircraft systems become more complex, ensuring that the certification process adequately addresses potential operational and safety ramifications for the entire aircraft that may be caused by the failure – or inappropriate operation – of any system on the aircraft, becomes not only far more important, but also far more difficult.”

FAA administrator Steve Dickson concurs: “The lessons learned will ideally lead to a more holistic, rather than transactional item-by-item approach to aircraft certification – not only in the US, but around the world, where we will more effectively integrate human considerations throughout the design process as aircraft become more automated and systems more complex.”

Meanwhile, in a recommendation related to the introduction of the Max that may sound the death knell for “grandfather rights”, the JATR says: “The FAA should be provided [by the manufacturer] all system differences between related aircraft in order to adequately evaluate operational impact, systems integration and human performance.”

Summing up the need for change in design for the man/machine interface – or, to be more precise, the need to design a workable relationship between a pilot and what is effectively a network of integrated systems, Hart continues: “Other specific [JATR] recommendations relate to revisiting the FAA’s standards regarding the time needed by pilots to identify and respond to problems that arise. Although existing standards have served the industry well for decades, the JATR members recommend an examination of whether those standards are as appropriate for the complex integrated systems in today’s airplanes.”

MULTIPLE ALARMS

For clarity, Hart adds: “For example, when the failure or inappropriate operation of a system results in cascading failures and multiple alarms, query how adequately the certification process considers the impact of multiple alarms, along with possible startle effect, on the ability of pilots to respond appropriately. Inherent in this issue is the adequacy of training to help pilots be able to respond effectively to failures that they may never have encountered before, not even in training.”

The return of the Max to service is not only about the approval of new software and systems redesign, it is equally dependent on the FAA and other NAAs agreeing an approved pilot training regime to qualify them on the modified Max. The airlines would each also have to satisfy the regulators that they have prepared appropriate training arrangements. This would obviously entail a complete type rating course for those not rated on earlier 737 marques, and a differences course for those who are. It has already been agreed that the latter will entail time in a capable flight simulation training device.

The importance of pilot preparation has been heightened by revelations in internal emails within Boeing that Indonesia made it clear in June 2017 that it wanted Max simulator time for its carriers’ pilots. Boeing, however, talked it around, persuading airlines that computer-based training was sufficient. The manufacturer is not arguing this time.

There is very little doubt that a programme to return the Max to service will begin sometime in summer, and it will be successful. But this episode means Boeing will never think the same way again about the relationship between its increasingly sophisticated aircraft and their pilots.

Meanwhile, thousands of the world’s faithful Boeing pilots are wondering whether the company is finally heading for sidesticks and more complete flight envelope protection. But the good news is that absolutely no-one is talking about the elimination of pilots from the equation. ■



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Man on the Moon

The Isle of Man – perhaps surprisingly for those not familiar with the tiny Crown dependency in the Irish Sea – has a thriving space sector, partly thanks to tax incentives for start-ups, an uncomplicated bureaucracy, and the presence of a number of spaceflight organisations. Ten years ago, our former colleagues at Ascend named the Isle of Man as the fifth most likely nation to put the next person on the Moon after the USA, Russia, China, and India.

Although a Manx lunar mission still remains a distant prospect, to emphasise those space associations, the island's post office has released a second series of stamps commemorating the Apollo campaign.

"One Giant Leap" – which marks the 50th anniversary of Apollo 13 – follows the post office's Apollo 11 celebration "One Small Step" in April 2019. The eight stamps, issued on 26 February, show scenes from various space missions over the years, and are designed to complement last year's launch.

Apollo 13 failed to land on the Moon after an oxygen tank was damaged. The fact that Jim Lovell, John Swigert and Fred Haise made it back to Earth was described by Lovell as a "successful failure".

The "One Giant Leap" collection is available as a sheet set, presentation pack, first day cover and booklet.



Marina Amaral/NATS

It's a happy 100th birthday to air traffic control towers. UK airspace regulator NATS is marking the centenary of the world's first "aerodrome control tower" at what was then London's main airport in Croydon. On 25 February 1920, the UK Air Ministry approved the construction of a new building at Croydon to be erected "15 feet above ground level" with "large windows to be placed on all four walls". Towers may have changed a bit in the century since, but both the basic design and the term "aerodrome control tower" have remained unchanged. To mark the occasion, NATS and Historic Croydon Airport Trust have worked with artist Marina Amaral to digitally colour a selection of black and white images of the era, including a shot of the original tower. Go to the NATS web site to see the spectacular results

Say again

When things get lost in automatic translation. From the opening paragraph to a Japanese news item previewing the Singapore air show:

"Airplanes such as Boeing, Airbus, and Embraer at the world's three largest air shows, held every two years, even in the even years and are the world's largest and odd-

summer summers in Paris, and even-summer in London near Funborough in the summer..."

Plastic dilemma

British Airways is doing away with single-use plastic on its flights. Hang on, though: isn't the Boeing 787 single-use plastic? It is unless someone invents a brilliant way of recycling all that carbonfibre in the next decade or so.

Crown it all

Scandinavian operator SAS partly blamed a turbulent financial performance over the first quarter on the "unfavourable" currency situation in Norway and Sweden. Sounds like the company has come down with a dose of kronorvirus.

The foggiest idea

Professor Melville Jones said he would not deal with the question of flying in a fog, since at present this was quite beyond us. He did not think this would always be so, but at present there was no known method of landing safely in a fog on anything but an indefinitely large aerodrome.

100 YEARS AGO

Paper parachute

Sir Miles Thomas told the Banbury Rotary Club that

75 YEARS AGO

he visualised commerce using the air to a great extent, and said he thought glider trains would distribute morning papers by parachute, with a light alloy printing machine aboard the tug plane to allow latest news flashed by radio to be stop pressed.

Airports at sea

The construction of off-shore airports is feasible,

50 YEARS AGO

according to the Ministry of Public Building and Works.

The ministry is researching the "gasholder" type of construction, a floating platform supported by a cushion of air, which is believed to offer the greatest advantages.

Level playing field

The UK government has pledged backing for its

25 YEARS AGO

business-aviation operators in ensuring a "level playing field" in Europe. The General Aviation Manufacturers and Traders Association urged its members to exploit the mainland European market while preparing for the reciprocal challenge.

FLIGHT INTERNATIONAL

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The opinions on this page do not necessarily represent those of the editor. Letters without a full postal address supplied may not be published. Letters may also be published on flightglobal.com and must be no longer than 250 words.

Penalty does not fit the crime

The “endemic” bribery at Airbus, described in your News Focus (*Flight International*, 11-17 February) confirms suspicions of shady business practices over many years in some EU countries.

What is especially depressing is the decision of EU countries involved in Airbus manufacturing to settle out of court for \$4 billion.

Much is made of figures for the supposed revenue risk to Airbus if banned from tendering for contracts – worth \$220 billion over 15 years. That is hardly realistic, in that it is the unlikely “risk” to Airbus of not securing 100% of those contracts. In the current Airbus/Boeing duopoly, half that figure would appear more realistic.

The Deloitte study commissioned by Airbus, mentioned in the article, forecast a potential loss of \$110 billion to the GDP of the Airbus manufacturing countries. To put this in its perspective, the total GDP of the European countries involved – France, Germany, Spain and the UK – is over \$10,000 billion.

Why are such considerations relevant to the penalty imposed?

Malcolm Bowden

McDonald, Tennessee, USA

TECHNOLOGY

A model design for the future

BAE Systems’ PHASA-35 high-altitude pseudo-satellite, which made its first flight last month

(*Flight International*, 25 February-2 March), is pure model aircraft stuff, but fuelled by the sun. It is wonderful, useful and such good value for money.

I have been an enthusiastic model aircraft flyer for many years, and I like to think these designs were pioneering.

If the “greens” do not cut off research and investment prematurely, I’m sure the airliners of the future will be just as environmentally friendly as the PHASA.

David Stevens

via email



BAE Systems

Pseudo-satellite has shown great potential

The Pilot Survey 2020 Report

We teamed up with Goose Recruitment to ask pilots worldwide all about health and wellbeing, career performance and pay, job seeking and job satisfaction and engagement.

Download your copy of *The Pilot Survey 2020* results to find out how the ever changing aviation industry is affecting pilots.



www.flightglobal.com/thepilotsurvey2020

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30 March-4 April
 Global Aerospace Summit
 Abu Dhabi, UAE
aerospacesummit.com

31 March-2 April
 Aircraft Interiors Expo
 Hamburg, Germany
aircraftinteriorsexpo.com

31 March-5 April
 FIDAE International Air & Space
 Santiago, Chile
fidae.cl

22-26 April
 Eurasia Air Show
 Antalya, Turkey
eurasiaairshow.com

13-17 May
 ILA Berlin Air Show
 Berlin, Germany
ila-berlin.de

26-28 May
 EBACE
 Geneva, Switzerland
ebace.aero/2020

17-19 July
 Royal International Air Tattoo
 RAF Fairford, Gloucestershire, UK
airtattoo.com

20-24 July
 Farnborough International
 Air Show
 Farnborough, UK
farnboroughairshow.com

16-20 September
 Africa Aerospace & Defence Expo
 Centurion, South Africa
aadexpo.co.za

24-25 September
 World Aviation Festival 2020
 London, UK
terrapiinn.com/conference/aviation-festival/index.stm

19 October
 Airlines 2050
 London, UK
flightglobalevents.com/airlines20502020

28-29 October
 Mexico's Aerospace Summit
 Queretaro, Mexico
mexicoaerospacesummit.com

10-12 November
 European Rotors
 Cologne, Germany
europeanrotors.eu

8-10 December
 MEBAA Show 2020
 Dubai, UAE
mebaa.aero

23-26 February 2021
 Australian International Airshow
 Avalon, Australia
airshow.com.au/airshow2021

30 March-1 April
 Aeromart Montreal
 Montreal, Canada
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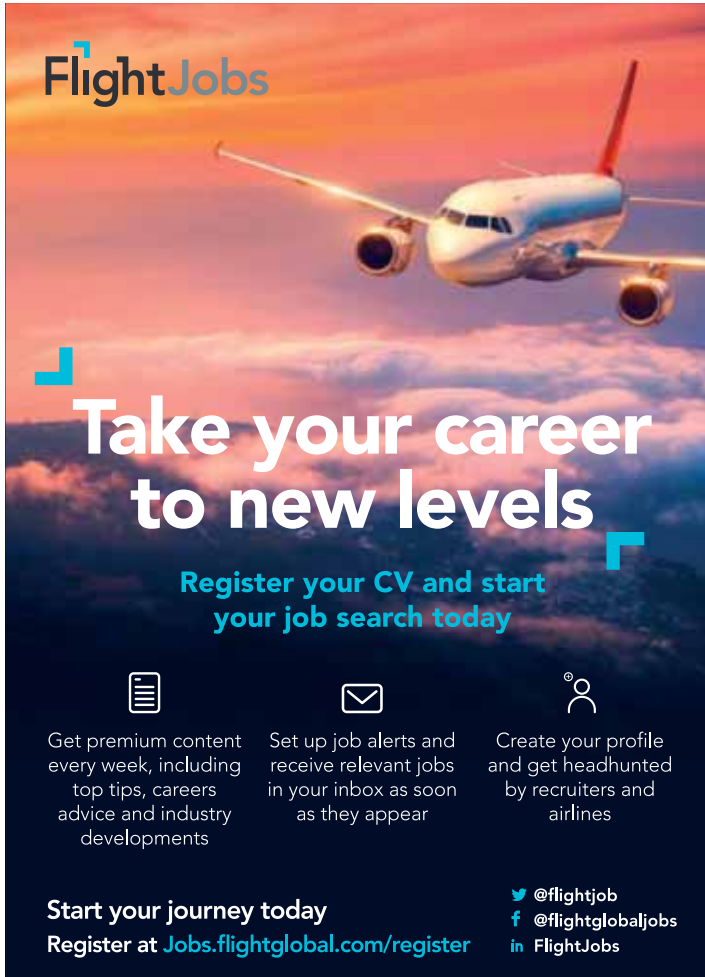
EASA Part 21 J Design Organisation Approval
Explains the European Union Aviation Safety Agency (EASA) Part 21 Subpart J regulations and the associated topics concerning the changes to Type Design, Supplementary Type Certificates (STC) modifications and repairs.
London Gatwick: 05 - 06 May 2020
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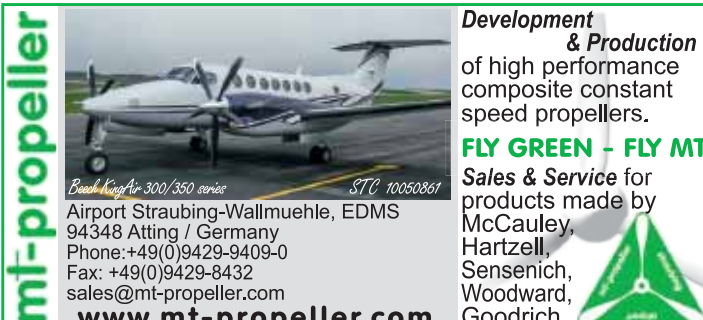
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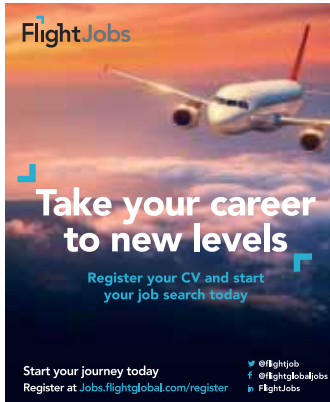
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WORK EXPERIENCE ABOUDY NASSER

Stansted chief refuses to stand still

Aboudy Nasser is chief commercial officer for London's fast-growing third airport, where he is helping the 'trailblazing' hub expand, enhance passenger experience and establish its full-service credentials

What triggered your interest in aviation?

I come from a family of aviation professionals – my father, brother and sister have all worked in the industry. Ultimately, I love the fact that aviation brings people together – whether travelling on business, visiting family or friends, or meeting people from completely different cultures. You can find every single emotion on each flight – happiness, sadness, excitement, nervousness, anticipation.

How has your career progressed?

I've been incredibly fortunate to have had such an amazing and varied career. Prior to joining London Stansted, I spent almost 20 years in the airline business in various commercial roles. I've lived and worked in Europe, Asia and the Middle East with established legacy airlines (British Airways), fast-growing full-service airlines (Etihad Airways, Oman Air), and leading low-cost airlines (AirAsia). Now I'm able to bring all that experience to bear on my current work at London Stansted airport, which itself is wide and varied. **What have been the highlights?** I'm immensely proud of having been part of the team in Abu Dhabi that led the growth of Etihad Airways, and turned it into the flagship carrier it is today. That was a once in a lifetime opportunity. I also loved working with AirAsia and really admire the strong culture that they've built there. Closer to home,



Challenging perceptions of a 'low-cost' gateway is key, says Nasser

working with my current team to bring the likes of Emirates and Air India to the airport has been great, as has seeing the growing awareness of London Stansted and the desire from global carriers to be part of our ongoing success story. **What are your responsibilities?** In my role as chief commercial officer, I am responsible for all aviation and non-aviation related income. Here too I enjoy the varied nature of the job. One day I might be talking to prospective airlines about the merits of flying to London Stansted, the next day negotiating a retail concession with one of the big high street brands, and the next day reviewing how we can build infrastructure and deploy technology to enhance the customer journey through the airport.

What is your strategy for the airport?

London Stansted is an airport with a trailblazing spirit and outlook. Together with our airline partners, we've grown from 18 million to 28 million passengers a year in just six short years. We've opened the world to travellers like no other airport in the UK, and we now serve more European destinations than any other airport in the country. We cherish that accolade and won't be giving it up any time soon – we'll continue to build capacity and work with our existing airline partners to support growing the breadth and depth of their services across Europe. Our trailblazing spirit will also see us opening up the world of long-haul and full-service travel to our

thriving catchment area in north London and the east of England. We're investing in new technologies and facilities to vastly improve the passenger experience.

What are your challenges as an airport?

Our biggest challenge is changing perceptions around London Stansted being a "low-cost" airport. We're a trailblazing airport, not a "low-cost" hub. We're here to serve London and the east of England, and all the data shows that there is so much demand for full-service and long-haul services from London Stansted. The Emirates experience is clear evidence of this. Full-service and long-haul passengers from our catchment area simply do not want to spend hours travelling to Heathrow or Gatwick – they really would prefer to travel from Stansted.

What do you enjoy most about your job?

It's not really work if you are having fun – I've got a great team and we love to have fun!

And the least?

It sounds like a cliché, but there's nothing that I don't love about the work I do. I've always lived by a motto of "relentless positivity" – nothing gets me down. ■

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