FlightGlobal.com August 2021

FLIGHT INTERNATIONAL

Learning from tragedy

Rolls-Royce speeds electric charge **p26**

Veteran Islander's green future **p34**

Rising hopes

Airframers get set for recovery p48

Orders split
United boosts Max and Neo backlogs
p10

Lightning Bern
F-35 downs its rivals in Switzerland
p24

£4.99

SUSTAINABILITY
A CLEAR AMBITION

Sustainability is at the heart of our business. From the beginning, we have invested in technologies to make our engines cleaner, quieter and more efficient. Our clear ambition is to push the limits of innovation, demonstrating uncompromising technologies that will help pave the way for an ever more sustainable future. A common mission, extraordinary together.

cfmaeroengines.com

CFM International is a 50/50 joint company between GE and Safran Aircraft Engines

cfm

Moviestore/Shutterstock

Join the future!

United Airlines has been on an order spree, assembling the building blocks it thinks will be required for 21st century air travel. Is chief executive Scott Kirby a visionary or a gambler?

In the past eight months, United Airlines has been on a tear. The Chicago-headquartered company has committed to at least six massive investments in innovative aerospace technologies that it hopes will relegate its image as a lumbering behemoth of the US skies – weighed down with the baggage of tradition – to the history books.

Chief executive Scott Kirby and his airline are on the cusp of a new era in aviation, and are banking on the fact that United's future passengers will gladly pay a premium to get from point A to point B faster, and in style. The company has embraced electric vertical take-off and landing (eVTOL) air taxis, electric regional aircraft as well as Concorde-like supersonic airliners.

The current airline transportation system is based around passengers driving to overcrowded major airport hubs and then cramming on to large jet airliners.

United thinks eVTOL and electric regional aircraft could feed travellers to major airports more effectively – or bypass hubs completely – while supersonic jets would cover longer routes in less time.

Turning this futuristic vision of aviation into reality will probably take decades. And the cost? Well, no-one is sure. But United has at least made a few down payments against its plan.

There has been a steady flow of orders from the carrier this year as it brings together these transformational jigsaw pieces. In February, there was a deal with Archer Aviation for 200 eVTOL air taxis; in June, Kirby committed to the purchase of 15 faster-than-sound "Overture" aircraft from Boom Supersonic, with options for 35 more; and in July, United and its regional partner Mesa Airlines announced their intention to acquire up to 200 19-seat electric regional aircraft from Sweden's Heart Aerospace, plus an undisclosed investment in the company.

While only the Archer order had any indication of its value – $1 billion – it is safe to say that shaping the future does not come cheap.

It is difficult to say which of these three projects is the riskiest – or most rewarding. All of the technologies face an uphill climb to become technically viable, certified and financially sound. And so far not a single one of the in-development aircraft upon which United has placed its costly bets has flown a single – even uncrewed – test mission.

Amid the whizz-bang of supersonic travel and electric aircraft, Kirby has also made fighting climate change a top priority, launching several schemes as United becomes ever more aggressive in its efforts to achieve carbon neutrality by 2050.

But the airline's core business – transport of passengers between cities in today's commercial aircraft – is not being ignored: in June, United placed the biggest new aircraft order in its history as it speeds the renewal of its narrowbody fleet. Those 200 Boeing 737 Max and 70 Airbus A321neos are due to begin entering service in 2022.

To some observers, Kirby is a visionary; an ambitious ambassador for an industry reinventing itself as travel habits and expectations shift in a post-Covid environment; a bold futurist who has taken the crisis and turned it into opportunity.

For others, he is a fool, sinking billions of the company's hard-earned cash into pie-in-the-sky futuristic projects that may never see the light of day, or gain the acceptance of the customers it aims to serve.

Kirby the technophile is determined to lead his airline in the 21st century with a host of new technologies that could permanently change air travel.

"United is the new leader in global aviation," he declared at the event celebrating the aircraft order on 29 June.

It remains to be seen if the flying public agrees.

See p10

In focus

All aboard How big is the market for Airbus A220?

In depth

Air Team Images

Russia eyes Checkmate with Su-75 move

Sukhoi's single-engined stealth platform could see deliveries from 2026, with international customers being targeted

Vladimir Karnozov

Vladimir Karnozov Moscow
Garrett Reim Los Angeles

The Sukhoi Su-75 will fly in 2023 and be delivered from 2026, according to United Aircraft (UAC), which unveiled Russia's latest lightweight fighter design at the MAKS air show on 20 July.

UAC chief executive Yuri Slyusar says the single-engined jet – which was earlier revealed to Russian President Vladimir Putin – is "more than just a mock-up". Instead, the result of its project "Checkmate" is understood to be an engineering prototype for ground testing, including iron bird and copper bird functions.

While Slyusar referred to the design as the Su-75, the right to confer designations traditionally belongs to Russia's armed forces, once an aircraft is operational.

He notes that the name is a deliberate reverse of the digits on Sukhoi's twin-engined Su-57 stealth fighter, developed for the Russian air force.

Slyusar describes the Su-75 as an affordable fifth-generation fighter that offers high performance at low acquisition and sustainment costs. Sergei Chemezov, chief executive of UAC parent Rostec, says the "flyaway" price of each aircraft will be between $20 million and $30 million. UAC is targeting 300 sales.

"This is not a dream," insists Slyusar. "We made a thorough assessment of the global market using a number of criteria and found that the demand for such an aircraft is large, provided we bring the product to market quickly enough."

He admits that to do that within five-and-a-half years is challenging, but progress on the programme has allowed UAC to bring the entry-into-service target date forward from 2027.

The type's primary role will initially be aerial combat, with

Domestic deals boost UAC

David Kaminski-Morrow London

United Aircraft (UAC) used the MAKS air show to highlight its commercial development activities, and announce fresh commitments for domestic airliners.

Speaking to Russian President Vladimir Putin ahead of the show, UAC chief executive Yuri Slyusar said the manufacturer is aiming to reach a production rate of 36 Irkut MC-21s per year by 2025, and to double this figure within the following two years.

Slyusar says the certification programme for the MC-21 has completed more than 500 flights, and that the Ulyanovsk-based Aero-Kompozit facility has "mastered" the composite technology to produce the type's wings.

According to UAC estimates, around 600 aircraft in the twinjet's class will be acquired in the Russian market over the next 10 years.

"We expect, of course, that a significant part of our domestic market will be held by MC-21 aircraft," Slyusar says, partly as a result of "protectionist support measures" from the state. "We need to be technologically ready for this," he adds.

Russia's Rossiya has been confirmed as launch operator for the MC-21, with the Aeroflot Group carrier expecting to start operations with the type next summer. The

Vladimir Karnozov

Orders for a total of 58 Superjets were announced at MAKS show

UAC aims to sell 300 examples of fighter unveiled on 20 July

adaptations for ground attack, anti-ship, and reconnaissance following. The aircraft will have five internal weapons bays and a weapons load of up to 7.5t. Maximum speed is given as Mach 1.8, and range as 1,620nm (3,000km).

UAC says the Su-75's aerodynamic shape will give it better stealth credentials than existing lightweight fighters. Although it has not named an engine, it is believed to be considering a variant of the "Item 30" version of the NPO Saturn AL-41F1 being developed for the Su-57M.

Mikhail Strelets, the chief designer who heads the project at Sukhoi, says the Su-75 will be equipped with an active electronically scanned array radar capable of tracking 30 targets simultaneously and guiding missiles against six of them.

Slyusar says the Su-75 is an industry-led initiative rather than a response to a specific Russian air force requirement. However, he is confident that Moscow will order a number of examples.

Russia's trade and industry minister Denis Manturov says industry has been working on the fighter concept for four years, and notes that the Su-75 marks an attempt to re-enter a segment that was once served by the likes of the Mikoyan-Gurevich MiG-21.

Yuri Borisov, a deputy to the Russian prime minister with responsibility for the defence industrial sector, says potential customers include India, Vietnam and "African countries".

Meanwhile, Alexander Mikheev, director general of Russia's Rosoboronexport arms export agency, says five countries are interested in procuring an international version of Sukhoi's current stealth fighter.

"The interest from foreign customers [in the Su-57E] has risen substantially," he says. "The aircraft does have a high export potential despite the unfair competition in the form of sanctions."

airline says it has been assured by Irkut that the technical acceptance process for its first example will start in the spring of 2022.

Irkut completed mating of the left wing of the initial customer MC-21 on 14 July, following installation of the centre section and right wing, and says it will start assembling the aircraft's systems "in the near future". The -300 variant jet will be powered by Pratt & Whitney PW1400G engines.

Rossiya says it has commenced preparations to organise cockpit and cabin crew training, establish a maintenance network on potential routes, and update information systems.

"These aircraft are designed to serve as an additional basis for the growth and development of Rossiya's domestic and international routes," says general director Sergei Aleksandrovsky. The carrier says the MC-21 will be an "integral part" of a strategy to operate a core fleet of modern, Russian-built aircraft.

Irkut gave a show debut to its Aviadvigatel PD-14-powered MC-21-310, which flew in the opening display alongside its PW1400G-equipped sibling.

In the show's main orders announcement, four domestic carriers signed agreements covering the acquisition of a combined 58 Sukhoi Superjet 100s.

Done deals

Red Wings' agreement covers 25 aircraft to be received by 2022. These will join seven examples in use since last September.

Red Wings general director Evgeny Klyucharev describes the Superjet as "perfect for regional transport in Russia".

Rossiya signed for 15 examples in an agreement which involves leasing company PSB Aviaprofleasing. The carrier has since January introduced 38 Superjets drawn from Aeroflot's mainline operation, and expects to have 66 by year-end. The first three of its new aircraft – produced with a 100-seat, single-class layout – are due to be delivered during August.

Southern Russian operator Azimuth, which already has 15 of the type, also has reached a preliminary agreement to take another 10 by 2026. It will also take six Airbus A220-300s.

Also at the show, Russian carrier Aurora signed a preliminary agreement to acquire eight Superjets by 2024 on lease. The airline also has emerged as a customer for 19 examples of the Ilyushin Il-114-300 twin-turboprop.

Slyusar says UAC expects to deliver 30 Superjets this year, taking the overall operational fleet to more than 180.

Development of an Aviadvigatel PD-8-engined 'SSJ-New' version is "proceeding on schedule", Slyusar says. "We hope that, in a two-year horizon, we will receive our new domestic engine, which will be offered to customers along with the [PowerJet SaM146]", he adds.

AirTeamImages

BA 787 incident pinned on mistake during maintenance procedure

Nose-gear retraction that left aircraft damaged took place as engineers attempted to rectify fault before cargo flight

David Kaminski-Morrow London

British Airways is to speed up implementation of a fix to prevent a repeat of the nose-gear retraction incident that damaged one of the carrier's Boeing 787-8s on the ground at London Heathrow, in the aftermath of two similar events in the previous five years.

UK investigators have yet to complete their assessment of the factors that led to the 18 June event, but have attributed it to a nose-gear locking pin being inserted in the wrong location before the landing-gear was cycled on the parked aircraft as part of a maintenance check.

The incident involving the widebody, G-ZBJB, occurred at Heathrow's stand 583, as the aircraft was being prepared for a cargo service to Frankfurt.

It sustained damage to its lower forward fuselage – which came to rest on the articulated arm of a ground power unit – and engine cowls, which struck the ground. One passenger door detached as a result of contact with the access stairs as the aircraft sank. "The door hinges and actuating mechanism had failed and the door, which was resting on the top platform of the stairs, remained attached to the fuselage by the remains of its wiring loom," says the Air Accidents Investigation Branch (AAIB).

Deferred defect

The jet had been undergoing a procedure to clear maintenance messages relating to a deferred defect when the incident occurred, says the AAIB.

This procedure required the landing-gear selection lever to be cycled with hydraulic power applied to the aircraft.

To prevent the landing-gear retracting during this process, pins were required to be inserted in the nose-gear and the main landing-gear downlocks.

But that pin was mistakenly inserted into an adjacent hole, the AAIB says. "When the landing gear selector was cycled the [nose-gear] retracted."

Two mechanics had been tasked with inserting the locking pins. But the inquiry says that one of them was "not tall enough" to reach the insertion point on the nose-gear, and so he simply pointed to the location while the other mechanic fitted the pin.

Four personnel were on board the aircraft. One suffered minor injuries, as did another individual who was operating a cargo loader.

Although an airworthiness directive, with a three-year compliance deadline, had been issued in January last year to install an insert

2013-built aircraft G-ZBJB is currently being repaired

over the apex pin bore – in order to prevent incorrect fitting of the downlock pin – this had not been implemented on the BA 787 at the time of the event.

That safety mandate followed several such incidents involving landing-gear issues.

One of Ethiopian Airlines' 787-8s suffered an inadvertent nose-gear retraction at Addis Ababa in March 2016, as the aircraft was preparing for a flight.

Passengers were on board the aircraft at the time, according to the US Federal Aviation Administration (FAA), and some received minor injuries, while the aircraft received "substantial" damage.

Lack of clarity surrounded the Ethiopian incident. Boeing acknowledged the retraction to the FAA but believed the event was not caused by a wrongly inserted lock pin, but was "specifically due to there being no ground lock in installed at all" – which technically amounted to a different issue.

But the FAA, in a December 2019 directive, said it had received "conflicting information" over the probable cause of the incident, suggesting that it might have occurred as a result of wrong insertion.

There was less doubt over a second occurrence, two years later in March 2018, when a 787-8 experienced an on-ground nose-gear retraction while undergoing maintenance testing at a US conversion facility in Grant County airport, Washington.

"Although no maintenance personnel were injured, the incident resulted in major structural damage to the forward fuselage," the FAA stated. It attributed the nose-gear retraction to the lock pin being fitted in the apex pin inner bore of the nose-gear's lock link assembly – which was immediately adjacent to the correct location for the lock pin. This mirrors the AAIB's findings in the BA event.

After the Grant County incident the FAA received a safety report from an operator's maintenance technician which described the risk of accidental nose-gear retraction arising from misidentification of the lock pin's insertion point.

United Airlines had pre-empted Boeing's identification of the potential for such an error and devised its own solution to prevent it. The US carrier introduced a sealant to fill the apex pin inner bore completely and block any attempt to insert a nose-gear lock pin.

When the FAA put forward a proposed directive to mandate Boeing's solution – an insert fixed with a cotter pin – the airline asked for its sealant-based mitigation to be accepted as an alternative, given that it had already modified its 787 fleet, and to delay adoption of the Boeing fix until the next component overhaul.

But both Boeing and the FAA argued that sealant was "not a long-term solution" because it could degrade over the life of the landing-gear, whereas the bore insert was a "more robust" answer which could withstand the nose-gear's rough environment.

Long deadline

While the FAA directive mandated the Boeing fix from mid-January 2020, it provided operators with a three-year compliance deadline.

BA had published a technical leaflet regarding nose-gear lock pin installation in April 2020, three months after the FAA directive, highlighting the correct and incorrect positions. This was reissued the following December, with an expiry date of 9 June – nine days before the Heathrow event.

The aircraft had not undergone the modification. It sustained substantial damage from the nose-gear retraction, not least because, as the jet sank, one of its forward left-hand passenger doors was almost completely torn off.

BA plans to "expedite" implementation of the modification in the aftermath of the event, says the AAIB. The inquiry has yet to reach conclusions on the human factors that might have contributed, but states that the lead mechanic tasked with fitting the landing-gear lock pins was not tall enough to reach the nose-gear insertion point without the aid of steps.

But the investigators add that the lead mechanic fitted each main landing-gear assembly with two pins "with the aid of some portable steps", while the other mechanic observed. The lead mechanic then confirmed to an engineer, both in the cockpit and over a headset, that the pins had been installed.

G-ZBJB is a 2013-built 787-8, powered by twin Rolls-Royce Trent 1000 engines, Cirium fleets data records, and is scheduled to return to service in September.

Air Accidents Investigation Branch

Forward fuselage came to rest on a power unit and engine cowls struck the ground

United's order reinvigorates Boeing's Max, but Airbus deal casts unwelcome shadow

Airbus

Carrier's 70 A321neos will operate from slot-constrained airports

While 200-aircraft deal for 737 Max is a boon for Boeing, a win for its rival is a reminder of the A321neo's competitive threat

Jon Hemmerdinger Tampa

There is no getting away from the fact that United Airlines' recent 200-unit order for Boeing's 737 Max throws considerable – and much needed – additional momentum behind the programme, even if the airframer had to offer a significant discount to secure the business.

But the carrier's simultaneous deal with Airbus for another batch of A321neos is a reminder that the European airframer is continuing to encroach on Boeing's turf.

Unveiled on 29 June, the parallel commitments comprised 50 737 Max 8s and 150 Max 10s – the largest variant of the 737 Max family – plus 70 A321neos. United expects to begin operating both the Max 10s and A321neos in early 2023, around the time that Boeing plans to deliver its first examples of the variant.

That deal for A321neos – added to an existing commitment for 50 of the longer-range A321XLR – is illustrative of the success Airbus is having with the largest variant in its narrowbody line-up.

"Those 70 [A321neos] could have been 737s, but Boeing doesn't have an airplane that can do what the A321 can," says BofA Securities financial analyst Ron Epstein. "To me, the real story is [that] Airbus is taking more share at an airline that... was leaning toward Boeing."

Analysts view the split order as perfectly logical. The airline can use its 737 Max fleet primarily to operate domestic flights – a role well suited for the 737 Max 10. That jet can carry more passengers than other Max variants and has 3,300nm (6,110km) range – enough to fly transcontinental US routes.

$30bn

List-price value of the combined Airbus-Boeing orders, according to BofA Securities

Meanwhile, United can deploy its new A321neos on both domestic and international routes, and from slot-constrained airports. With a baseline range of 4,000nm – rising to 4,700nm for the in-development A321XLR – those jets can serve transatlantic destinations from places such as Newark, a major East Coast hub for the airline.

Discount deals

BofA pegs the list-price value of the combined Airbus-Boeing orders at $30 billion, though airlines, particularly those the size of United, do not pay list prices. The actual value of a new 737 Max 8 is $49.6 million, compared with $49 million for an A320neo, according to Cirium, which also values a 737 Max 10 at $54.6 million, and an A321neo at $58.8 million, giving a deal value of about $15 billion.

"United probably got very good pricing coming out of a

downturn," says George Dimitroff, head of valuations at Ascend by Cirium. "I'm almost certain [the Max 10's price] was cheaper than the A321, which explains why they ordered 150 Max 10s."

Dimitroff says the deal's heavy tilt toward Max 10s further benefits Boeing because those jets command a higher price than smaller Max 8s and Max 9s, but cost comparatively little more to produce. "Even if United got a sweet deal for the Max 10, Boeing is getting more money for the Max 10," he says.

Analysts also view United's order as an endorsement for the Max 8, which the airline chose over the A320neo.

"I think it's important to acknowledge that... in sheer performance and technical merits, the Max 8 is doing better than the A320," says Michel Merluzeau, analyst with consultancy AIR.

In a two-class layout, the Max 8 can carry about 162 passengers – eight more than the A320neo – and costs 5-8% less per seat-mile to operate, according to data from AIR affiliate AirInsight Group.

"If you line up the 737 Max [8] to an A320, it's a better plane," Epstein adds.

Some additional good news for Boeing can also be discerned from United's commitment: disclosing its new order, the airline said only 25 of the incoming 737 Max will be white tails – meaning aircraft that have been built but which are not assigned to specific customers. Boeing's inventory of such jets has accumulated in recent years as airlines cancelled orders amid the Max grounding and Covid-19 pandemic.

In 2020, the airframer logged 641 Max cancellations, offset by new orders for 130 of the jets. Last year, Boeing also stripped another roughly 550 Max orders from its backlog to reflect uncertainty that those sales would complete owing to factors including the financial condition of the buyers.

That trend has reversed in 2021. In the year to date, Boeing has landed new orders for at least 505 737 Max, offset by 255 cancellations, according to customer reports and Boeing's data. (Those figures will probably change, as Boeing has not yet reported final June order and delivery numbers.) Besides United, Alaska Airlines, Dubai Aerospace Enterprise, SMBC Aviation Capital and Southwest Airlines have ordered Max aircraft in 2021.

As of 1 July, Boeing's pool of completed aircraft included only 23 Max white tails, according to Rob Morris, Ascend by Cirium global head of consultancy.

> "I'm almost certain [the Max 10's price] was cheaper than the A321, which explains why they ordered 150 Max 10s"
>
> **George Dimitroff Head of valuations, Ascend by Cirium**

Latest order gives Max programme valuable boost

Boeing

Loyal customer

"Those orders seem to have cleared up the inventory of white tails," his colleague Dimitroff says. Finding customers for those jets can help Boeing "slowly increase their pricing on the Max", he adds.

As the airline is one of its most loyal customers, the United deal was always Boeing's to lose. The carrier is the product of the merger between the legacy United Airlines and Continental Airlines – a famously staunch Boeing operator long headed by Gordon Bethune, who had previously worked at the airframer.

That is not to say the airline has shied away from Airbus products. Pre-merger United was an early customer of first-generation A320-family jets. It still has nearly 200 of those in service and storage, but they are aged between 14 and 28 years and quickly approaching retirement.

But the bulk of United's narrowbody fleet are 737s. It has nearly 375 of those jets, including many new 737NGs and 737 Max jets,

plus outstanding previous orders for another 180 737 Max aircraft.

For those reasons, United might have been expected to stick solely with the Max for its narrowbody requirements. But the type's grounding set the programme back and threw Boeing off track, says Epstein. The company has not moved forward with a 757/767 replacement – the so-called "mid-market jet" that the aerospace community expected Boeing would have launched several years ago.

If not for the Max issues, "all those airplanes would have been 737s", Epstein says. "And Boeing probably would have had an answer in the middle of the market."

Analysts view United's A321neo orders as reflecting continued inroads into the middle market made by the European manufacturer.

Ten years ago, Boeing's 737 and legacy McDonnell Douglas types held about 60% of the global narrowbody market, with A320-family jets accounting for the remainder, Cirium data shows.

Shifting shares

Those figures have since shifted to an almost 50-50 split between the two airframers. At the end of May, Airbus had 6,144 A220s and A320-family jets in its backlog, compared with Boeing's 4,014-strong Max order book.

Analyst Richard Aboulafia of Teal Group has predicted that the A321neo's success could drive Airbus's share of the narrowbody market to 60%. As of end-June it had taken orders for 3,543 examples, 47% of total A320neo-family sales, the airframer's data shows.

Industry watchers also broadly view United's order as another reminder that neither Boeing nor Airbus offers a jet truly filling the mid-market niche – the space long occupied by 757s and 767s.

United chief executive Scott Kirby says the incoming jets will replace the airline's roughly 40 757-200s, which have up to 176 seats in the airline's configuration. But he says the carrier has not identified replacements for its roughly 20 757-300s – larger jets with 234 seats.

Boeing has hinted at developing a mid-market jet for years. But in early 2020, amid the Max struggles, it shelved a project called the "New Mid-market Airplane". There is, as yet, no sign of that plan being revived.

Kirby's grip

Latest order signals repositioning of the US major – and, in Scott Kirby, shows a chief executive unafraid of taking risks

United is buying 15 Overture supersonic jets from Boom

Pilar Wolfsteller Newark, New Jersey

United Airlines' new fleet plan not only shifts its focus to the premium-travel segment, but it also cements chief executive Scott Kirby's reputation as a leader unafraid of taking risks in the face of industry upheaval.

In addition to disclosing an order for 270 more Airbus and Boeing narrowbodies on 29 June, Kirby says United's focus has shifted toward strengthening its presence in large markets – and scaling back in small ones. United has also recently committed to acquiring electric air taxis and supersonic jets, and pledged to invest in sustainable aviation fuels (SAFs).

United's latest order – for 200 Boeing 737 Max and 70 Airbus A321neos – is among the largest aircraft orders in history. As the industry digests the massive deal, United has signalled that it is squarely focused on premium customers and on squeezing efficiencies and profits from its multiple hubs.

The airline thinks a renewed fleet will drive up profitability as the sector recovers from the more than year-long global pandemic. It is also adding more lie-flat seats on long-haul flights, significantly upgrading in-flight entertainment (IFE) and investing in customer service improvements – changes United views as key to success in the post-pandemic era.

"This is much more than just an aircraft purchase," Kirby says. "This is about changing the entire customer experience.

"The bet we are making today is that the customers care about

Boom Supersonic

the product," he adds. "We had no chance to compete effectively, and this order is about remedying that."

The underlying problem for the carrier to date, executives say, has been the size, or gauge, of its jets.

"This is not about opening new cities and routes," says chief commercial officer Andrew Nocella. "This is about gauge. Gauge, gauge, gauge. This is about getting the right aircraft on the right mission."

The new jets, which will begin arriving in 2022, will significantly increase the size of aircraft in United's fleet, giving the carrier the opportunity to offer some 30% more seats per departure by 2026, and 75% more premium seats per departure, United says.

It estimates the larger jets will cost about six cents per seat, per mile (excluding fuel expenses) to operate, helping United drive down its overall adjusted unit cost by 8% by 2026. "We will essentially have the same cost as the ultra-low-cost carriers," Nocella says.

That will allow United to better compete, via its hubs, with ultra-discounters. Kirby thinks the airline will have a significant competitive advantage at large airports in major cities, which he views as too costly to be viable in the long term for low-cost competitors.

That is why Dallas-based Southwest Airlines left Newark, Kirby adds, and why UK discounter Ryanair does not fly to London Heathrow airport.

Kirby is shifting United's focus to larger aircraft and markets

Pilar Wolfsteller/FlightGlobal

United's first 737 Max 8 was delivered a day before it announced the new orders

Pilar Wolfsteller/FlightGlobal

"A low-cost carrier trying to fly in an expensive airport like Newark – the business model doesn't work," Kirby says. "They don't realise that yet."

United held a slick media event in a hot and humid Newark hangar on 29 June to promote its narrowbody order, part of a wider transformation the airline calls "United Next". The event's backdrop: its first 737 Max 8, which was delivered one day earlier. That aircraft is outfitted with seat-back IFE screens, larger overhead bins and other features United says improve customer comfort.

More space

Also on 29 June, United committed to retrofit older jets with the updated cabins and IFE. It promises larger overhead bins will provide enough space for every passenger to stow one carry-on bag.

It expects to receive 40 new narrowbodies in 2022, 138 in 2023 and the balance in 2024 and beyond.

At the same time, United expects in the coming years to operate only about 100 50-seat regional jets, down from about 300 before the pandemic. The airline will replace those aircraft with larger types.

United's fleet plan reflects a decision by the airline to accept its trailing position at many smaller US airports, where the carrier already lags behind competitors such as American Airlines and Delta Air Lines, Kirby says.

Therefore, United will focus on strengthening its position in major markets, where Kirby sees a competitive advantage.

"In smaller communities, we are on the smaller side," Kirby says. "We don't expect we are going to match the schedule depth of our primary competitors in some smaller markets. "We also know we are not going to bridge that entire gap," he adds. "We cannot be all things to all people."

United and other network carriers added many point-to-point leisure routes to their networks amid the pandemic – an effort to compensate for a total collapse of business travel. That strategy is clearly not United's long-term focus.

The hubs are United's "high ground", Nocella adds. "And we know it."

United's fleet renewal comes on the heels of other major technology and fleet announcements this year.

In February, United said it intended to buy up to 200 of Archer Aviation's in-development electric vertical take-off and landing (eVTOL) aircraft, which "are expected to give customers a quick, economical and low-carbon way to get to United's hub airports and commute in dense urban environments".

In April, United launched its "Eco-Skies Alliance", a programme through which it will allow customers and corporate partners to invest in SAF. The airline hopes this year to purchase 12.9 million litres (3.4 million USgal) of the fuel.

And just weeks ago, United said it had committed to buying 15 of Boom Supersonic's Overture supersonic jets.

"Whether it's this new aircraft order with the great interior, or supersonic aircraft or electric aircraft, or what we are doing for sustainability, United really is the new leader in global aviation," Kirby says.

Additional reporting by Jon Hemmerdinger

More trouble for Dreamliner

Fresh production problems identified on 787 spark another round of inspections, slowing output of the widebody twin

Jon Hemmerdinger Tampa

Latest issue centres on tolerances of forward pressure bulkhead

Mic Smith/AP/Shutterstock

Boeing's latest 787 manufacturing issue and associated production cut has raised more uncertainty about the programme, leaving analysts unclear about output this year and the pace of regulatory approval.

On 13 July, the manufacturer said it had discovered a new problem on the Dreamliner involving gaps in the forward pressure bulkheads of undelivered jets. While not a flight-safety issue, the components fail to meet exacting specifications, requiring the company to complete inspections and potential rework on about 100 undelivered 787s.

"As Boeing has previously shared, the company has been engaged in detailed discussions with the FAA [Federal Aviation Administration] on verification methodology for 787 fuselages, and conducting associated inspections and rework," the company says. "In connection with these efforts, the company has identified additional rework that will be required on undelivered 787s."

Boeing is shifting assembly workers to assist with inspections and rework, and as a result is cutting production to an unspecified rate; 787 output had been set at five per month this year.

Deliveries drop

"Based on our assessment of the time required to complete this work, Boeing is re-prioritising production resources for a few weeks to support the inspection and rework," the airframer says. "As that work is performed, the 787 production rate will temporarily be lower than five per month and will gradually return to that rate. Boeing now expects to deliver fewer than half of the 787s currently in inventory this year."

The latest problem follows Boeing's May halt to 787 deliveries as a result of another issue involving the flatness of the skin at areas where fuselage sections join.

Financial services firm JP Morgan says Boeing's disclosure of the new 787 problem raises more questions than answers.

"How much will [management] lower production? What will be the duration of that cut?" it asks. "And, more fundamentally, what is the process for Boeing to show the FAA that its 787 assembly process and inspections meet specifications fully?"

The answer to that last question is most critical, says JP Morgan – and most uncertain.

Boeing halted most 787 deliveries in May after the FAA said it needed more time to evaluate a company-supplied algorithm intended to aid inspections of the skin-flatness issue. Deliveries remain paused, except for a single 787 that was handed to Turkish Airlines in June; the airframer was able to ship that jet because it had been certificated before recent manufacturing problems, the company says.

Boeing also stopped 787 deliveries from October 2020 to March this year owing to a similar fuselage issue. The company delivered just 14 787s in the first half of 2021. Boeing still holds authority to issue airworthiness certificates for individual 787s, but regulations require the company to develop fixes before delivering more aircraft, the FAA says.

"We believe Boeing is still determining the scope of rework required, and we imagine regulators can always pose incremental questions about something as complex as assembling an aircraft," JP Morgan's report says. "There is still uncertainty regarding execution, and it may be some time before [management] can provide a detailed financial path forward."

Cancel culture

As delivery delays continue, so too does the risk that customers will cancel orders, notes BofA Securities. That is because aircraft sales agreements typically allow airlines to walk away from deals with little or no penalty when deliveries are delayed by more than one year – an issue Boeing is all too familiar with, given the 737 Max's travails.

"The delays in deliveries of over a year could start triggering penalties and no-fee walk-away optionality pretty soon," says BofA. "We estimate that, within the next 12 months, a third of current 787 orders in backlog will be affected by the [one-year-plus] delay clauses."

Boeing has accumulated the inventory of roughly 100 undelivered 787s during the course of the pandemic and delivery halts.

Exactly how many 787s Boeing will actually hand over in 2021 remains difficult to predict because much depends on the FAA's approval. Financial firm Jefferies estimates Boeing will ship 72 787s this year, down from 158 in 2019, before the Covid-19 pandemic.

See p50

GO BEYOND

PRATT & WHITNEY
GTF

THERE IS NO COMPARISON. NO EQUAL. THERE IS ONLY ONE.

THE COMMERCIAL JET ENGINE IN A LEAGUE OF ITS OWN.

Powered by an industry-first geared architecture – and more than 40 other groundbreaking innovations – the **Pratt & Whitney GTF™** is unlike any engine that's come before it.

EXPLORE THE FUTURE OF FLIGHT AT **PRATTWHITNEY.COM**

Pret a Porter

Canadian regional airline has selected Embraer 195-E2 jets to power route expansion, in the process ending any lingering interest in Airbus A220

Jon Hemmerdinger Tampa
Pilar Wolfsteller Las Vegas

Canada's Porter Airlines has ordered 30 Embraer 195-E2s and taken options to acquire a further 50 of the jets, while also announcing plans to expand to Toronto Pearson airport and to southern warm-weather destinations.

The deal marks a major fleet and network shift for Porter, an all-turboprop operator that has never previously served Pearson. It also spells the end for the carrier's interest in the Airbus A220, which dates back to 2012 when the aircraft was still known as the Bombardier CSeries.

Porter intends to place its E195-E2s into service in the second half of 2022.

Porter will not operate the jets from its hub at Billy Bishop Toronto City airport, where the airline is also headquartered. But Porter insists it will continue flying its De Havilland Canada Dash 8-400s from the downtown site.

Since beginning operations in 2006, Porter has operated only Dash 8-400s, of which it has 29, according to Cirium fleets data. It primarily operated those aircraft on regional Canadian routes from Billy Bishop, including to some US destinations, but only as far south as north Florida.

The carrier halted operations in March 2020 amid the Covid-19 pandemic and has pushed back its expected restart several times, most recently until 8 September.

"This is a defining moment in Porter's history," its chief executive Michael Deluce says. "Today, we lay the foundation for a new and further-reaching service for our customers." He cites the E195-E2's "spacious cabin, quiet operations and no middle seats".

Leisure destinations

"Porter intends to deploy the E195-E2s to popular business and leisure destinations throughout Canada, the United States, Mexico and the Caribbean, from Ottawa, Montreal, Halifax and Toronto Pearson International airports," the airline says.

Porter has not disclosed how it will configure its E195-E2s. The airline plans to release new planned routes in 2022. Moving into Toronto Pearson will see Porter competing more directly against major carriers like Air Canada and WestJet.

"The E195-E2's range allows for the creation of a continental route network," Porter says. "Potential markets reach coast to coast in Canada and the United States, including US sun destinations, as well as Mexico and the Caribbean."

Sister company Porter Aircraft Leasing will acquire the jets. The company also has the option to convert the orders to the smaller E190-E2, it says.

"This provides opportunities to introduce nonstop service in markets where connecting flights are often the only option today. It also enables higher-frequency service for routes with greater demand," the airline adds.

Deluce adds: "Now is the right time to make this investment, as the pandemic resets the aviation landscape. Adding a diverse selection of popular business and leisure destinations to our network means that we are better positioned to serve many more passengers."

The airline says its operation at Billy Bishop will "remain core to its business", adding that Porter will maintain a "high-frequency service" using Dash 8-400s from the facility.

"The airport is essential to the airline's immediate plans for re-establishing flights and developing future routes,"

Porter

Carrier has ordered 30 jets, with options to acquire a further 50

Porter says. "The E2s will not operate from this airport."

In addition, the airline's headquarters at Billy Bishop is "being maintained and we will continue serving the same network of regional markets from downtown Toronto," says Deluce. "We are moving beyond this existing footprint to welcome more travellers across North America."

Embraer previously disclosed Porter's 30-aircraft order but had not named the customer. The deal, including options, is worth $5.8 billion at list prices and will make Porter the launch customer for the E195-E2 in North America.

Conditional order

But while it is good news for Embraer, it is the end of the line for Porter's flirtation with the A220.

Porter was among early customers for the A220-100, signing a conditional 30-unit order in 2013, which firmed up a letter of intent from the previous December.

At that stage, the programme was owned by Bombardier and called the CSeries. Airbus bought the programme in 2018 and rebranded it.

But the order was always very conditional: Porter said it hinged on the city of Toronto lifting noise and aircraft size restrictions at Billy Bishop to allow the operation of A220s at the smaller airfield.

While there may have been hope in some quarters that the deal could be revived, Porter confirms that its selection of the E195-E2 has ended any lingering interest it had in the A220.

"Porter no longer has a conditional order with Airbus," it confirms; an outstanding letter of intent is believed to have expired in January.

"The A220 and E2 are both great aircraft. We looked at all of the aircraft options available today and chose the E2 for a number of reasons, including the ability to meet our preferred delivery schedule starting next year," Porter adds.

In addition, the airline says 37% of the E2's major components are produced in Canada, making the new order a sizeable investment in the country's aerospace industry. Airbus builds A220s at sites in Mirabel, Quebec and Mobile, Alabama. Both types are powered by Pratt & Whitney geared turbofan engines.

An A220-100 can carry 100-135 passengers and has a 3,450nm (6,210km) range, against 120-146 passengers and 2,600nm range for the E195-E2.

Embraer maintains turboprop course

Dominic Perry London

Embraer is pressing ahead with its plans for a new turboprop airliner and is eyeing a programme launch next year.

Arjan Meijer, chief executive of Embraer Commercial Aviation, says the airframer has been "more and more vocal" in recent months over its intentions for the market.

"Embraer is very much focused on the segment. We are still working on a turboprop and hope to launch the programme in 2022," he said in late June.

Last year, Embraer showed updated renderings of its design that now shares the same fuselage cross-section as its current E-Jet family.

This, says Meijer, will allow the new aircraft to "bring much better passenger appeal to the turboprop segment".

Service entry is likely in the 2027-2028 timeframe, he says. "It will really stand apart from the products out there today."

Meijer says Embraer has also "selected the turboprop as the platform for the future", allowing the airframer to add "more sustainable solutions" to later iterations.

That does not imply that the manufacturer is moving away from jets, but that it views the turboprop as an ideal fit for new power or propulsion technologies.

Discussions with several potential partners on the project are "progressing well", Meijer adds.

JetBlue Airways took delivery of its first A321LR in April

Airbus

Half-year data hints at recovery

Orders and deliveries inch higher at big two airframers in first six months of 2021, though cancellations remain high

Jon Hemmerdinger Tampa
David Kaminski-Morrow London

If you look only at orders, then the first half of the year belonged to Boeing, which racked up deals for almost 600 aircraft in the first six months of 2021. On the other hand, if deliveries are what counts, then Airbus comfortably outscored its rival, shipping just shy of 300 jets.

Boeing's first-half cancellations also outstripped those disclosed by Toulouse, which will continue to worry the US giant.

But whichever side of the fence you sit on, what the first-half data does appear to indicate is a recovery of some sort, or at least airlines positioning themselves for that.

Positive territory

United Airlines' blockbuster deal for 200 Boeing 737 Max jets and 70 Airbus A321neos in late June was very much with the future in mind. It also contributed one-third of Boeing's 2021 half-year total and pushed Airbus into positive order territory for the year.

In all, Boeing recorded 599 gross orders in the first half of the year, albeit that 356 cancellations took the net figure to 243. Still, that compares well with the first half of 2020, when gross orders stood at 59. June was the fifth straight month that the airframer's orders outstripped cancellations.

Airbus, meanwhile, had seen its net order figure languish in negative territory over the course of 2021 until the United order was recorded on 28 June. The deal meant the airframer's gross orders for the half-year of 165 aircraft exceeded the 127 cancellations.

599

Gross orders recorded by Boeing for the first half of the year

In terms of deliveries, however, Airbus is comfortably ahead, having shipped 297 aircraft in the first six months of the year – over 100 more than the 196 recorded at the same point in 2020.

In addition, the 77 aircraft handed over in June marked the second-highest monthly figure since the onset of the air transport crisis. The level was exceeded only by the 89 achieved by the airframer during its end-of-year push in December 2020.

Boeing, which has been slowly ramping up 737 Max deliveries following the type's re-approval, shipped 45 aircraft in June, more than in any month since March 2019, including 33 Max jets.

However, that narrowbody shipment total was well shy of the 57 A320neo-family aircraft that were delivered by Airbus, plus five of the smaller A220s.

Dreamliner woes

And while Boeing is returning the Max to an even keel, production problems on the 787 meant that it handed over a solitary example in June – and just 14 in the first half of the year.

June's activity brought Boeing's backlog to 4,166 aircraft, up from 4,121 at the end of May. That comprises: 3,334 737s, 11 747s, 107 767s, 286 777s and 428 787s.

Airbus, meanwhile, currently has a total backlog of 6,925 aircraft: 484 A220s, 5,666 A320-family jets, 293 A330s, 479 A350s and three A380s.

Better freight than never for Boeing, as cargo customers keep lining up

Figures at the half-year point clearly illustrate the difference that Boeing's freighter line has made to the two main airframers' long-haul order activity following the onset of the air transport crisis in the early months of 2020.

Both Airbus and Boeing have struggled to secure orders for twin-aisle passenger aircraft since the pandemic took hold.

Over the 18 months to the end of June this year, Boeing obtained gross orders for 58 new long-haul freighters – of which 56 were gained after March 2020, the point where the Covid-19 crisis started severely affecting airline operations.

These 56 freighters included 26 777Fs, 25 767-300Fs and five 747-8Fs.

But Airbus attracted no interest in its A330-200F, the only freighter it offers, over the period – and actually fell into negative orders after a previous agreement for three was cancelled.

Atlas Air Worldwide has ordered four more 747-8 freighters

Boeing

The European airframer is contemplating development of an A350 freighter to establish a stronger presence in the cargo aircraft sector and provide a competitor to the 777F.

Airbus and Boeing respectively recorded gross orders for 21 and 29 long-haul passenger aircraft in the pre-pandemic first quarter of 2020.

But this market, which had already been weak, virtually evaporated for the remaining months of 2020 and has picked up only slightly over the first half of this year.

Airbus has listed orders for just seven twin-aisle passenger aircraft, including a private jet, since March 2020, while Boeing has fared better with 21, among them a 747-8.

Boeing's business also benefited from large orders for 29 military 767 tankers over the period, compared with Airbus's total of two military A330s.

No moon shots for NASA Aeronautics

Agency's latest demonstration project for commercial aviation lays the ground for next-generation narrowbodies

Jon Hemmerdinger Tampa

NASA has left no doubt that it wants to help make next-generation narrowbody jets significantly more efficient.

That will be achieved via its Sustainable Flight National Partnership (SFNP), a technology development effort aimed at bringing 25% efficiency gains to single-aisle jets coming to market in the 2030s.

Under the SFNP, which encompasses several existing projects, NASA intends to develop and fly a demonstrator of a new commercial airliner, alongside compact engine cores, hybrid-electric systems and advanced composite manufacturing methods.

"If we are successful, it puts technology into the design and trade space that [industry] can look at," says Richard Wahls, strategic technical adviser at NASA Aeronautics' Advanced Air Vehicles Program. "It doesn't mean that it automatically makes it on to an aircraft."

Narrow options

The SFNP will help "enable the next-generation single-aisle transport, expected by the early 2030s, to be a game-changing, ultra-efficient and low-carbon-emitting design at least 25% more fuel efficient than today," NASA says in its fiscal year 2022 budget request.

Analysts widely expect Boeing and Airbus will each bring to market a new narrowbody in the 2030s. That leaves NASA needing to move fast: new technologies need to be demonstrated by the mid- to late-2020s to be sufficiently mature for an aircraft to enter service next decade, Wahls says.

Or as its documents note: "NASA will ensure that the technologies will be ready by the mid-to-late 2020s to transition into US industry's next-generation single-aisle transport aircraft."

NASA's proposed SFNP funding is a fraction of what industry spends on research and development. But, being free of commercial pressures – though dependent on Congressional purse strings – allows the agency to advance technologies that industry might otherwise consider too revolutionary for near-term applications. "NASA has pinpoint focus and can take bigger risks," Wahls says.

The SFNP's "centrepiece" will be a "full-scale Sustainable Flight Demonstrator X-plane to validate integrated systems and their benefits," NASA says. The agency aims for the X-plane to make its first flight in FY2026, which starts in October 2025.

25%

Targeted improvement in fuel efficiency for new single-aisle in 2030s

NASA intends to solicit proposals from industry to design and build the X-plane in its next fiscal year. As such, which companies will participate remains unknown.

Boeing says: "We are excited about the opportunity to be part of this Sustainable Flight National Partnership and look forward to working with US industry, research and academic collaborators on this important project for future transport aircraft technologies.

"We were pleased to see that the president's budget request included a 10.4% increase in the NASA Aeronautics account, and the prioritisation of critical subsonic aircraft technologies."

The X-plane's configuration is also undetermined. In recent years, NASA has studied various designs, including "double-bubble" fuselages, blended-wing bodies and truss-braced wings. Wahls calls the truss-braced design a "leading candidate" for the X-plane – one that could boost efficiency by 5-10%.

Trusses can support longer, more slender wings, meaning higher aspect ratios and "much higher levels of aerodynamic efficiency", says NASA. But trusses bring complexity. They have joints and differing load paths. Engineers must address powerplant-integration challenges and buffet and icing concerns.

NASA

Sustainable Flight Demonstrator X-plane will probably have truss-braced wings

Truss tests

The agency, which plans to perform truss-wing buffet tests in the next fiscal year, has long studied trusses. It previously partnered with Boeing to advance the concept via its Subsonic Ultra Green Aircraft Research programme. In 2019, Boeing revealed a conceptual Mach 0.8 truss-braced airliner featuring folding wings with a span of about 52m (170ft) – 18m wider than the span of a 737.

Initially at least, the X-plane will not demonstrate all the technologies being advanced by the SFNP. High-power-density turbofan cores, for example, will probably be

> "If we are successful, it puts technology into the design and trade space that [industry] can look at"
>
> Richard Wahls **Strategic technical adviser, NASA Aeronautics**

insufficiently mature by the date of the X-plane's planned first flight, Wahls says. "There are multiple parallel paths that are demonstrating different technology... If you put too many miracles on a big demonstrator, the risk goes way up."

NASA says the project will benefit US competitiveness and help industry meet emissions goals.

"SFNP is NASA's response to increasing challenges from international entities to the nation's long-term leadership in commercial aircraft manufacturing," it says. "This partnership aims to accomplish the aviation community's aggressive climate change agenda."

Pressure to curb emissions has never been greater. The US Congress is evaluating an infrastructure bill that includes clean-energy initiatives, and lawmakers have proposed subsidising biofuel production. Meanwhile, the airline industry is working to slash emissions by 2050 to half of 2005 levels, but how it can achieve that is still unclear.

Aerospace analyst Michel Merluzeau with consultancy AIR views NASA's efforts at least partly "about preparing Boeing to be competitive... for the next generation of commercial airplanes". Boeing's 737 replacement might look nothing like the X-plane but could incorporate some technologies matured under the SFNP, Merluzeau adds.

NASA launches the SFNP against the backdrop of an US-EU trade dispute that finally seems to be heading for resolution.

For years, governments have hurled allegations, via the World Trade Organization, that each unfairly subsidised aircraft development.

But on 15 June, the sides seemed to reach a detente when they agreed to a "co-operative framework". Under that deal, they committed to support their respective aerospace industries "on market terms" and to "make the results of fully government-funded R&D widely available".

Propulsion focus

Much of the SFNP's focus will be on propulsion. As part of the programme, NASA plans to award contracts to demonstrate "1MW-class electric powertrain systems" for single-aisle jet hybrid-electric powerplants, documents say. The agency aims to begin flight testing such systems in FY2024 or FY2025, Wahls says. The effort is related to NASA's Electrified Powertrain Flight Demonstration programme.

The SFNP also encompasses NASA's Hybrid Thermally Efficient Core effort to develop smaller, more-efficient and more-powerful engine cores, from which up to 20% of power can be extracted for conversion to electricity. Smaller cores can mean greater bypass ratios (meaning more efficient engines), and the electricity generated can be used to power other systems on the aircraft – replacing heavier pneumatic and hydraulic systems.

Longer term, engineers hope to use electricity to "hybridise propulsion", meaning to store electricity in batteries and use that to supplement power from jet fuel, Wahls says.

Material improvements

But smaller cores require different architectures and new, high-temperature-capable materials, which NASA is studying, Wahls says. The agency hopes to perform small-core ground demonstrations in FY2026.

Small-core engines could be 5-10% more efficient, and increased electrification could deliver another 3-5% efficiency gain, Wahls says.

Under the SFNP, NASA will also demonstrate new methods of carbonfibre production, continuing work already started under its Hi-Rate Composite Aircraft Manufacturing programme.

Widebodies such as the 787 and Airbus A350 already have composite fuselages, but, at their high-point, were built at rates of 14 per month, in the Dreamliner's case; in contrast, even in the current downturn, Airbus has been churning out 40 A320neos each month.

Enabling complex composite production to hit those narrowbody rates is the challenge, Wahls says.

Therefore, NASA intends to demonstrate technologies that will enable composite airframe structures to be produced four to six times faster. "The project focus will be airframe structural components for single-aisle transport aircraft," it says.

NASA's FY2022 budget proposal calls for $915 million for its Aeronautics division: it is less than 4% of the agency's total proposed $24.8 billion budget but is a 10% increase on the amount received this year.

By comparison, Boeing alone spent $1.4 billion on commercial aircraft research and development in 2020, down amid the pandemic from nearly $2 billion in 2019.

De Havilland Canada will modify a Dash 8-100 to house the hybrid-electric technology

Powering ahead

New P&WC hybrid demonstrator gets funding from Canadian government, with goal of test flights by 2024

Jon Hemmerdinger Tampa

Canada is backing an ambitious project to convert a turboprop airliner to hybrid-electric power, with demonstration flights scheduled to begin in 2024.

Led by Pratt & Whitney Canada, the effort also involves airframer De Havilland Canada, which is supplying a Dash 8-100.

The programme advances work that P&WC and its sister companies had already started under their Project 804 initiative, which stalled in 2020 amid the fallout from the pandemic.

P&WC has now committed again to the hybrid-electric technology – this time with the backing of the Canadian federal and Quebec provincial governments, which are together contributing around half of the C$163 million ($129 million) total investment.

"The new hybrid-electric propulsion technology will drive significant improvements in aircraft efficiency by optimising performance across the different phases of flight, allowing the demonstrator to target a 30% reduction in fuel burn and [carbon dioxide] emissions, compared with a modern regional turboprop airliner," P&WC says.

It is a significant commitment by an engine manufacturer to develop a propulsion system that could significantly reduce fuel burn. Though several start-ups are working to develop all-electric passenger aircraft, most are commuter-category designs with 19 or fewer seats, where the drawbacks of battery power are not as significant.

P&WC aims to begin ground-testing its hybrid-electric propulsion technology in 2022, followed by flight testing of the system on a modified Dash 8-100 in 2024.

P&WC president Maria Della Posta says the programme will make the engine maker "an integral part of Canada's green recovery plan".

"Hybrid-electric technology has an important role to play in enabling the next step-change in efficiency for aircraft engines, and we are uniquely positioned to demonstrate this potential," she adds.

P&WC is collaborating with De Havilland, a unit of Longview Aviation Capital, which acquired the Dash 8 programme from Bombardier in 2019.

Cockpit interfaces

The companies will integrate a hybrid system into a Dash 8, which typically carries 40 passengers. The system will include an "advanced electric motor and controller" supplied by Collins Aerospace, a sister company of P&WC under the Raytheon Technologies group.

De Havilland will "design a modified nacelle structure to house the hybrid-electric technology" and "be responsible for the cockpit interfaces needed to safely monitor and control" the system. It will also "conduct the flight-test and demonstration programme and interface directly with Transport Canada for the corresponding experimental flight permit".

"We are immensely proud to be the first manufacturer of regional aircraft supporting the development of hybrid-electric propulsion technology," says De Havilland chief transformation officer Dave Riggs.

Canada's Strategic Innovation Fund, which helps bankroll large-scale Canadian research and development projects, "is backing the technology demonstrator", P&WC says. The province of Quebec is also supporting the programme through government corporation Investissement Quebec and the province's ministry of economics and innovation.

"We are investing to create good, well-paying jobs for our recovery," Canadian Prime Minister Justin Trudeau says. "This investment will also secure the [aerospace] industry's long-term future in Canada" by advancing "green aviation" technologies.

P&WC calls the effort a "successor" to Project 804, a programme launched in 2019 by United Technologies Advanced Projects (UTAP), a rapid-prototyping division of former P&WC parent United Technologies, which merged with Raytheon to form Raytheon Technologies in April 2020.

As of 2019, Project 804 – named for the distance in miles between P&WC's Montreal site and Collins' electric-technology facility in Rockford, Illinois – aimed to equip a Dash 8-100 demonstrator with a 2MW hybrid-electric system, which would replace one of the aircraft's two P&WC PW120 turboprop engines.

Project 804's hybrid system was to consist of a 1MW gas turbine paired with a 1MW electric system, each helping drive a propeller via a gearbox and each providing power during take-off. After take-off, the turbine, optimised for cruise, was to provide 100% of the hybrid system's output.

UTAP said the hybrid-electric system would increase the Dash 8's operating empty weight and approximately halve its fuel capacity, leading to a 400nm (740km) range reduction, to around 600nm.

However, no details are available on the performance characteristics of the new hybrid demonstrator.

Raytheon in mid-2020 said it had slowed the Project 804 effort as a result of Covid-19.

De Havilland Canada

PROUD PERFORMERS FLY E2

CONGRATULATIONS HELVETIC AIRWAYS, ON TAKING DELIVERY OF THE E195-E2.

As part of their strategy to optimize their fleet mix, Helvetic Airways have recently taken delivery of the first of four E195-E2s. Striking a great balance between range, fuel burn and environmentally friendly operations, this new-generation jet also gives Helvetic the seating capacity and flexibility to match capacity with demand. We wish this innovative and proud European carrier every success for the future.

embraercommercialaviation.com
#E2Sustainability

EMBRAER

CHALLENGE.
CREATE.
OUTPERFORM.

F-35A proves Swiss precision

Lockheed offer wins out in Bern's Air2030 contest, with 36-strong fleet to be delivered to Alpine nation from 2027

Craig Hoyle London

Switzerland will replace its Boeing F/A-18C/D Hornet fighters with 36 Lockheed Martin F-35As, following a decision announced by Bern on 30 June. Widespread speculation about a victory for the US-built stealth fighter had built in the week before confirmation came from the nation's federal department for defence, civil protection and sport.

The outcome of the Alpine nation's Air2030 competition represents a dual blow to European industry, with Switzerland's Federal Council having rejected offers of the Dassault Rafale and Eurofighter Typhoon – along with the F/A-18E/F Super Hornet – and the Eurosam SAMP/T air-defence system. The programme's ground-based air-defence element is to be met by acquiring five Patriot systems from Raytheon.

"An evaluation has revealed that these two systems offer the highest overall benefit at the lowest overall cost," Bern's Armasuisse defence procurement agency says.

While all four fighter candidates met the nation's evaluation requirements, Armasuisse says the F-35A's procurement bill will total Swfr5.07 billion ($5.48 billion): "by far the best result". Bern had received budget approval to spend Swfr6 billion on the new fighter fleet, plus Swfr2 billion on air-defence equipment.

"With 336 [evaluation] points, it showed the highest overall benefit and was the clear winner, with a lead of 95 points or more over the other candidates," Armasuisse says of the F-35A. The type ranked first in three of its four main assessment categories, falling short only in terms of direct industrial participation.

Factoring in projected operating costs over a 30-year period, the F-35A acquisition should total approximately Swfr15.5 billion, which Armasuisse says is roughly Swfr2 billion less than any of its rivals.

Stealth factor

"In terms of effectiveness, the F-35A achieved the best result because it has a marked technological advantage over the other candidates: it includes entirely new, extremely powerful and comprehensively networked systems for protecting and monitoring airspace," the procurement agency says. Also pointing to the type's stealthy design, it adds that "the resulting high survivability is a great advantage for the Swiss air force".

The type's "ease of operation... means that it requires about 20% fewer flight hours than other candidates, and about 50% fewer take-offs and landings than the air force's current jet aircraft", its assessment continues.

Lockheed's candidate also was ranked first with regard to product support, "because of its efficient operation and maintenance, modern training design, and the high security of supply throughout its service life".

An assessment of co-operation potential also placed the US model ahead of its rivals, "offering extensive opportunities for operational collaboration and broad access to data and technical resources".

"Ultimately, as the most modern weapons system, the F-35A can be assumed to have a technological lead well into the future. This is a major advantage over the other candidates," Armasuisse adds.

However, "In direct offset, the F-35A did not achieve the best result at the time the bid was made. The offset obligation of 60% of the order must be fulfilled in full no later than four years after receipt of the final delivery."

Late last year, Lockheed said it had identified potential industry

Swiss air force's F/A-18C/D Hornet fighters will be phased out

Michael Derrer Fuchs/Shutterstock

Lockheed Martin

Stealthy type was the clear winner in nation's evaluation process

partners in all three of Switzerland's language regions, and that the country could become a European centre for F-35 transparencies and canopies. Before the selection, the airframer had two Swiss firms working in its F-35 supply chain, both "mostly in the optical area".

"Switzerland will become the 15th nation to join the F-35 programme of record, joining several European nations in further strengthening global air power and security," says Bridget Lauderdale, Lockheed's general manager of the F-35 programme.

"Swiss industry will have the opportunity to participate in research and development, production and sustainment opportunities that will extend their capabilities into the future," Lockheed says.

Delivered via the US government's Foreign Military Sales (FMS) framework, Lockheed's offer had included an option for Swiss industry to perform the final assembly of four aircraft at RUAG's Emmen facilities. The same company and the Swiss air force will be responsible for in-country maintenance.

Introduction of the new fleet is scheduled for completion by 2030, with deliveries to commence in 2027. The new type will also replace the Swiss air force's obsolete Northrop F-5s.

Evaluations of the fighter candidates were conducted at Payerne air base between April and June 2019, with Saab's in-development Gripen E excluded from the process before reaching this stage.

"The Swiss selection was very, very data-driven. They looked into all of the concerns that all of our customers have for the cost and sustainment of their aircraft, and their comments were that it was a hands-down winner across the board," says JR McDonald, vice-president business development, integrated fighter group at Lockheed's Aeronautics unit.

Binding contract

Armasuisse notes that it has more than 40 years' experience in conducting FMS deals with the US government, and that "there were no cost overruns in any of the many [previous] contracts".

"The prices and the contractual conditions are binding and are also demanded by means of strict supervision," it says. In the event of any cost overrun, "the American government would demand that the prices be binding on the manufacturer in favour of Switzerland".

Lockheed is eager to build on its success in the Swiss contest, McDonald notes, pointing to ongoing competitions in Canada and Finland, the United Arab Emirates gaining US government approval last December to acquire up to 50 F-35As, and Israel's interest in acquiring a third squadron of the type. "We are seeing interest now in Spain, Greece and the Czech Republic, and we expect more to follow," he adds.

Separately, Lockheed's F-16 programme could be facing an orders boost, after the US government gave its approval for a potential sale to the Philippines.

Worth up to $2.43 billion, the FMS programme deal would include 10 single-seat F-16Cs and two F-16Ds, in the Block 70/72 production standard.

"The proposed sale will improve the Philippines' capability to meet current and future threats by enabling the Philippines to deploy fighter aircraft with precision munitions in support of counter-terrorism operations in the southern Philippines, increasing effectiveness and minimising collateral damage," the US Defense Security Cooperation Agency says.

Manila is also considering the Gripen C/D in a process to reinstate a dedicated fighter capability which has lapsed since the retirement of its F-5s in 2004. The Philippine air force currently operates 12 Korea Aerospace Industries FA-50 armed trainers and six Embraer EMB-314 Super Tucano turboprop-powered strike aircraft.

Additional reporting by Greg Waldron in Singapore

Leading the charge

Rolls-Royce may be better known for its large gas-turbine engines, but it sees a huge opportunity as the market for electric aviation takes off

Dominic Perry London

Should all proceed to plan, later this summer a small electric-powered aircraft in a distinctive red, white and blue livery will lift off from Boscombe Down airfield in Wiltshire.

Its pilot, Phil O'Dell, will take the modified Sharp Nemesis NXT up to around 1,000ft before performing four consecutive passes along a pre-designated 3km course, in the process smashing the current speed record for an electric aircraft of 210mph (337km/h).

Such are the power demands of the effort that during the record attempt lasting just 10min the charge in the aircraft's 6,000-cell battery pack will be almost completely depleted.

"It is," says Matheu Parr, who heads the ACCEL project for the UK engine manufacturer, "great to be an electrical engineer at Rolls-Royce today."

Turbine troubles

Parr is customer director at R-R's electrical business unit. Having joined the Derby firm in 2006, he has seen electrical power slowly assume ever greater importance for the company.

Of course, that is in some part a result of the propulsion specialist's travails in the market for gas turbine engines for large commercial aircraft, where a particular exposure to the long-haul segment has posed recent challenges.

That downturn has coincided with technological advances that have made electrical power for aviation a viable prospect – illustrated by the ACCEL project – plus an increased focus on the decarbonisation of aviation.

All of which does not mean that R-R has rapidly switched course – research into the potential for electric power has been taking place for several years – but what it has done is to push that interest to the fore.

The current focus is on two key segments: urban air mobility (UAM) – air vehicles operating at ranges in the region of 100nm (185km) – and commuter aircraft capable of carrying nine to 19 passengers over distances of around 500nm.

Crucially, the manufacturer has already secured contracts in both sectors: in the former, R-R was recently selected by UK-based start-up Vertical Aerospace to provide the electrical propulsion system – save for the batteries – for its VA-X4 four-passenger aircraft; and in October 2020, Italian airframer Tecnam announced R-R was to supply the electrical powertrain for its nine-passenger P-Volt commuter aircraft. The two programmes are also in the healthy position of having launch orders in place.

While R-R has maintained an interest in engines for light helicopters with its M250 series, the move into the new segments is a "big step" into markets that the company has not previously addressed, says Parr.

That is doubly so for UAM, which is an entirely new proposition whose business model relies significantly on the cost savings and architectures enabled by electric propulsion.

But it is a sector that is evolving quickly: Vertical Aerospace plans for its VA-X4 to enter service in 2024 or 2025, in line with other similar programmes. While an initial prototype due to fly this year will not have the R-R powertrain, the first system will still need to be shipped in 2022 for integration with the developer's Iron Bird test rig, says Parr.

2024

Vertical Aerospace's service entry target for its VA-X4, to be powered by R-R's electrical propulsion system

Rolls-Royce

Sharp Nemesis NXT has been modified with electric motors and battery pack

Rolls-Royce

"We want to go and establish ourselves as the number one electrical propulsion system provider"

Matheu Parr
Customer director, Rolls-Royce Electrical

P-Volt commuter aircraft will carry nine passengers

"It is accelerating much faster than traditional aerospace development timelines," he says, and is an area that is "coming at us quite a bit quicker than we thought a few years ago". However, that is backed by what he describes as "credible plans from our customers".

The rapid pace of progress is not an issue for R-R, says Parr, "because we are not starting today – we began four or five years ago".

For the UAM segment, the propulsion system is sized to deliver around 100kW of power – around 135hp – which Parr says is the optimal size for the architecture planned by Vertical Aerospace and others which feature multiple tilting rotors. The VA-X4 will use eight R-R-supplied motors.

Stored energy

Steve Mountain, engineering director at Rolls-Royce Electrical, says that the design of the system and its size is driven by the eventual application. Other considerations include how to make it "resilient to different failure modes".

Although Vertical Aerospace has chosen to develop its battery pack in-house, for future applications R-R hopes to deliver a complete power system: from the energy storage at one end, through to the electric motors at the other.

In mid-June, the company announced a significant £80 million ($110 million) investment in energy storage systems (ESS) for aerospace applications to complement its existing electrical propulsion systems.

210mph

Speed record for an electric aircraft – which ACCEL project aims to surpass

The move, says Parr, is about "taking the battery technology" it has used in several research programmes "and turning that into a product range".

While the VA-X4 may not use R-R's ESS, it is central to the Tecnam P-Volt's powertrain, which is sized to deliver 600kW to a pair of electric motors.

Based on the P2012 airframe, the P-Volt's new propulsion system replaces the 375hp Lycoming turbocharged piston engines of the original. As yet, no range or speed performance has been released for the aircraft.

Service entry for the P-Volt will be in 2026 with Norwegian regional carrier Wideroe.

R-R's move into the segment can also benefit from the research carried out by the firm's power systems business into the use of renewables to generate the electricity for so-called microgrids – potentially feeding the charging infrastructure required for commuter operations to give a zero-carbon operation. "Our portfolio plays really strongly across the group," says Parr.

He believes the compelling economics promised by electrical power – lower operating and maintenance costs – will reinvigorate the commuter segment. Even when the need to replace batteries is factored in "it remains an incredibly attractive proposition".

But, says Mountain, the frequency with which those cells need replacing, and the speed at which they can be charged are two significant variables for developers of electric aircraft to consider.

Design goals

While you can have batteries that last longer or will charge more quickly, extra weight is the penalty in both cases.

"It's about educating the customer and coming to an agreement on what the design trade-offs are," he says, noting that an aircraft's intended mission profile "sets the parameters of what the battery must do".

Key to R-R's success in these new markets is how many units its airframe partners can sell. Vertical Aerospace is gearing up for the production of thousands of units each year – similar output levels are predicted by other UAM manufacturers – but there have been few forecasts yet for the sub-regional or commuter segment.

No details on the pricing for the P-Volt or VA-X4 have so far been released, but they are likely to be in the single-digit million range. Parr says R-R's contribution to such aircraft will represent 30-35% of their total value – a strong revenue stream to be sure, but many units will need to be sold to match the value of a single large gas turbine, which has a price ticket typically in the tens of millions of dollars.

Nonetheless, Parr says R-R has a clear ambition for the segment: "We want to go and establish ourselves as the number one electrical propulsion system provider." On top of which, the business continues to work on MW-class power systems for use elsewhere in the civil aerospace business.

Meanwhile, Parr's focus will shortly shift to the skies above the Wiltshire countryside in the hope of R-R securing a place in the record books.

From boneyard to digital twin

Creating a 3D model of the F-16 could help the US Air Force to cut support costs and speed up modernisation of its fleet

Garrett Reim Los Angeles

The US Air Force (USAF) is to disassemble and make 3D digital scans of two Lockheed Martin F-16s mothballed in the Arizona desert, believing the effort will help to lower future sustainment and modernisation costs.

Announced on 5 July, the activity will produce a "digital replica", giving precise specifications of the fighter's parts and airframe.

"Our goal is to create a full-scale 3D model of the aircraft, with the exception of the engine," says First Lieutenant Connor Crandall, digital twin programme manager within the F-16 programme office.

"The data will be used to help address future parts obsolescence, and to mitigate supply chain risks, because we won't have to rely on legacy manufacturing sources and processes," he says.

The Air Force Life Cycle Management Center's F-16 programme office is sponsoring the project via a contract with Wichita State University's National Institute of Aviation Research in Kansas. This will also create 3D models of some of the aircraft's larger components, such as the environmental control, hydraulic and fuel systems.

Currently stored at the 309th Aerospace Maintenance and Regeneration Group site at Davis-Monthan AFB, the F-16s will be disassembled and transported to Wichita by 30 September.

The service last October launched a similar effort with Wichita State University to create a digital replica of the Boeing B-1B bomber.

The USAF has been looking for ways to break so-called vendor lock, a situation where it has only one supplier for a component, software program or aircraft. By having its own set of digital specifications the service could, in theory, ask multiple manufacturers to compete for business.

"We'll have the 3D models, and designs that we can send to the manufacturers we choose," Crandall notes.

With a digital replica available, the USAF – which Cirium fleets data shows has a current active fleet of 997 F-16C/Ds – says it "expects to save time and money on sustainment". It could, for example, bring some MRO work in-house, by having its maintenance groups use 3D printers to recreate parts.

Despite being the incumbent provider for many such support activities, Lockheed is supporting the effort.

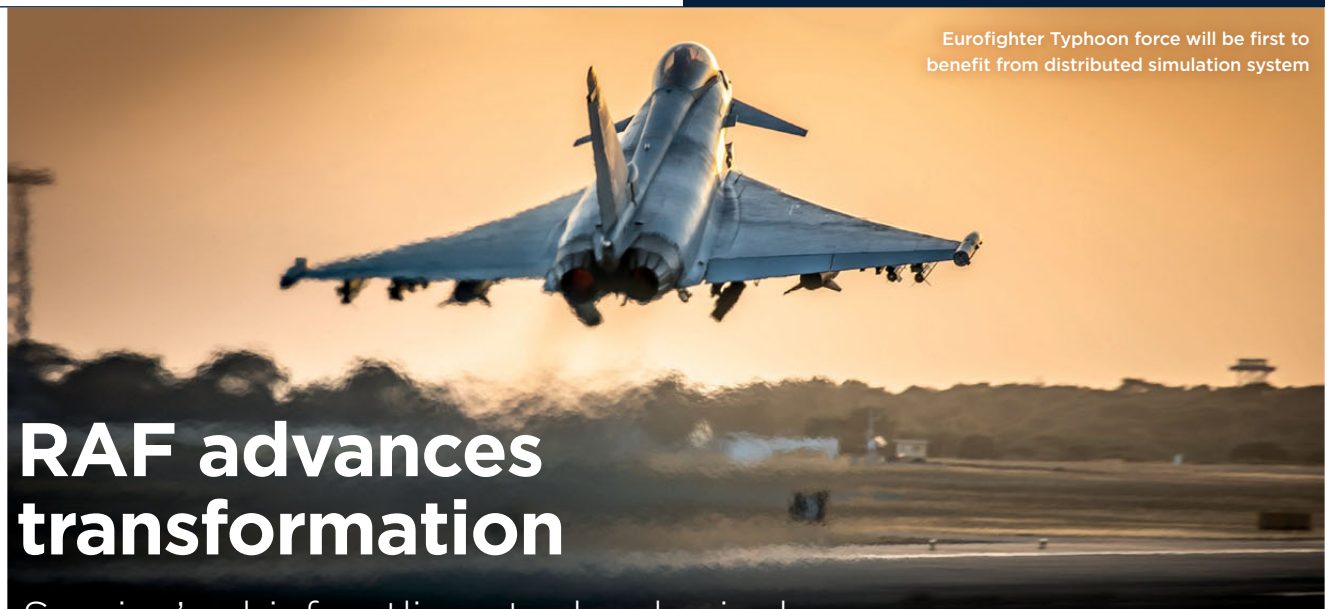
"Using a proven platform like the F-16 to advance digital twin data models allows our team to demonstrate a further reduction in lifecycle cost for sustainability while also introducing additional capability through digital thread continuity," says Aaron Martin, programme manager for Lockheed Martin Skunk Works StarDrive, the company's proprietary digital engineering programme.

A digital model could also help the USAF and Lockheed to modernise the F-16 with new weapons and improved parts, and upgrade electronics faster.

"Developing a virtual engineering environment that integrates structures and systems components will provide a virtual testbed for future modifications and other sustainment actions prior to physical implementation," says Melinda Laubach-Hock, F-16 programme manager and director of sustainment at Wichita State University's National Institute of Aviation Research.

Two jets stored at Davis-Monthan AFB will be disassembled during project

US Air Force



Eurofighter Typhoon force will be first to benefit from distributed simulation system

RAF advances transformation

Service's chief outlines technological leaps, as net-zero target prompts study into electric-powered trainer purchase

Craig Hoyle London

UK Royal Air Force (RAF) investments in command and control, swarming drone and networked training technologies are starting to pay off, as the service also embarks on a campaign to reduce its environmental impact.

Speaking during the service's annual Global Air Chiefs' conference on 14 July, RAF chief of the air staff Air Chief Marshal Sir Mike Wigston announced that its Rapid Capabilities Office-led "combat cloud" development has been completed.

Demonstrated aboard an Airbus A330 Voyager tanker/transport earlier this year, the Nexus technology fuses data in real time "from every sensor, on any platform in the operating space, [which is] flagged to any user with a need for that information", Wigston says.

"We are now at the point where Nexus can begin to be introduced operationally," he says, describing it as "flexible, secure, proven and developed at a fraction of the cost of comparators".

Wigston also notes that the RAF's 216 Squadron drone test unit "has proved beyond doubt the disruptive and innovative utility of swarming drones under our Alvina programme".

"Working with our Defence Science [and Technology] Laboratory and specialist industry partners, we have exercised swarms of over 20 ultra-low-cost drones operating together against threat systems to brilliant effect," he says. "We have been focused on confusing and overwhelming adversary air defences, but we are already contemplating new disruptive missions," he adds.

"That success, in little over a year, points to the operational utility of swarming drones," he says. "I aim to declare it operational in an equally short period of time, with more than one squadron."

Meanwhile, looking at the service's training activities, Wigston says: "I can see a future where almost all training, force generation, and mission planning and rehearsal is done in a synthetic environment, preserving our real world activity for live operations or strategic signalling."

Gladiator training

The RAF's synthetic versus live training balance is already at or beyond parity, and deputy commander Air Marshal Andrew Turner told a Farnborough Connect online audience on 13 July that it eventually aims to achieve an 80:20 mix.

A new distributed simulation system named Gladiator is on track to achieve initial operating capability by the end of this year. While its initial focus has been on enhancing training for the Eurofighter Typhoon force, Wigston says another £40 million ($55 million) will be spent to incorporate additional platforms, such as its future Boeing E-7A Wedgetail airborne early warning and control aircraft and General Atomics Aeronautical Systems Protector RG1 remotely piloted air system.

Wigston says the Gladiator system will be connected to the Nexus combat cloud, to "experiment how artificial intelligence can hone our warfighting edge, both in live and training environments".

Turner believes it will be possible to achieve "flight-free certification" of the UK's Tempest future combat air system and Mosquito loyal wingman, thanks to the use of digital-twin technology. "There will be components or facets that we simply don't want to show in the public domain, because it will compromise capabilities," he says.

Separately, Wigston wants the RAF to balance its carbon emissions a full decade ahead of a UK government commitment to achieve net-zero status by 2050.

The service plans to fly an undisclosed aircraft on 100% synthetic aviation fuel (SAF) before year-end, and make the enhancement operationally ready for the type within around a further two years. It recently made an investment in a private company that has demonstrated production from apple and lavender by-products, with laboratory results "more stable than jet fuel".

However, with SAF typically costing around four times as much per litre as Jet-A1 fuel, Turner says broader adoption is needed to close this price gap. "We need a momentum in society to be demanding of change such that airlines, the whole industry, moves in this direction," he notes.

A more visible sign of change will be acquiring an electric-powered aircraft to replace the RAF's Babcock-operated Grob Aerospace Tutor elementary trainers.

"We will have a competition," Turner says, outlining an in-service target from 2024. "If battery technology moves faster, then we will move with it," he notes.

WORLD DEFENSE SHOW
SAUDI ARABIA

Take your place on the global stage for defense interopera

6-9 March 2022

Riyadh, Saudi Arabia

Experience the future of defence with the industry's newest global exhibition. A unique opportunity to showcase your business with interactive product displays, live demonstrations and leading insight across air, land, naval, satellite and security systems.

Discover why the World Defense Show will deliver unmissable opportunities to engage with industry leaders from around the world.

bility

FOUNDED BY

الهيئة العامة للصناعات العسكرية
General Authority for Military Industries

D328eco gains momentum

Deutsche Aircraft working to secure first sale of modernised turboprop by year-end, as design activities continue

Dominic Perry London

Deutsche Aircraft is confident it will end the year with a launch order for its developmental D328eco, as the regional airline market shakes out in the wake of the coronavirus crisis.

Jose Costas, vice-president of sales and marketing at the German airframer, says that while he cannot disclose names, the company is in discussions with "a number of potential launch customers".

"Before the end of the year we hope to have someone relevant on board," he tells FlightGlobal, although he clarifies that this may be an early commitment rather than a firm order, given that service entry is not due until 2025.

As Deutsche Aircraft continues to work through the preliminary design review (PDR) phase it will in the second half of this year bring together a customer advisory board in order to help refine the configuration of the modernised Dornier 328 twin-turboprop.

Its plans call for a 2.1m (6.8ft) stretch of the fuselage, raising accommodation to a maximum of 43 passengers, 10 more than previously. Maximum take-off weight also increases by 1,700kg (3,750lb) to 15.6t – the same as the legacy jet-powered 328-300.

New world

Costas believes that the likely commercial economics of the D328eco versus small regional jets can persuade operators to switch to the turboprop as the industry rebuilds in the post-Covid-19 world.

Changes to travel patterns and behaviours will require airlines to rethink operating models, he argues, while a possible population

Hydrogen power planned for future demonstrator

Aside from the D328eco programme, Deutsche Aircraft is also partnering with German fuel-cell developer H2FLY on a project to demonstrate a hydrogen-powered Dornier 328 by 2025.

H2FLY has previously flown a hydrogen-electric-powered four-seater, but the partnership with Deutsche Aircraft will see it scale up its fuel-cell technology for the regional aviation market.

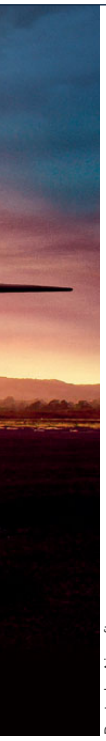
Ultimately, the two companies are aiming to "validate the potential" for hydrogen fuel cells to power a 40-seat aircraft – a 328-100 can accommodate 33 passengers.

Under the collaboration, covered by a memorandum of understanding, the pair will use a 1.5MW fuel-cell system to power a 328. At present, the twin-turboprop uses a pair of Pratt & Whitney Canada PW119C powerplants, each rated at 2,180shp (1,620kW).

Aside from the integration of the new powertrain, the two companies will work together to define the technical and certification standards that will be required for large transport aircraft.

While it may be for illustrative purposes only, the image supplied by Deutsche Aircraft to accompany its announcement shows an aircraft branded as a "D328H". It also bears the registration D-CAAN – a 1996-built airframe acquired by 328 Support Services in 2018.

Deutsche Aircraft's sister company 328 Support Services is the holder of the 328-100's type certificate.



Deutsche Aircraft

shift away from urban areas will also drive a need for new routes from secondary airports.

"All of these changes are bringing new dynamics to a segment that was pretty quiet," he says.

Key suppliers to the programme have recently been announced, including Garmin, GKN and Heggemann, which will supply the flightdeck, empennage and tail, and landing-gear, respectively.

Costas says a number of additional partners will be revealed shortly, likely to include suppliers for the wings and fuselage.

Pratt & Whitney Canada is to provide its PW127S engines for the D328eco, replacing the PW119Cs of the earlier 328-100. Maximum take-off power on each powerplant rises to around 2,750shp (2,050kW) at 1,200rpm, from 2,180shp at 1,300rpm.

Deutsche Aircraft intends for the aircraft to be able to operate on 100% sustainable aviation fuel and Costas says it has received assurances from the engine manufacturer that the powerplants will be compatible.

"Together with P&WC there is a roadmap to get to that level," he says, but notes that it is "too early to tell" what percentage will be achieved by service entry.

Single pilot

Garmin's presence on the aircraft – a first foray into the airline segment for the US firm – is driven by its ability to deliver a flightdeck based on its G5000 suite that will in future enable a transition to single-pilot operations.

Costas says the airframer is already talking to the European Union Aviation Safety Agency to understand "what's the roadmap to get to single-pilot [operations]".

Deutsche Aircraft aims to conclude the PDR process for the D328eco by year-end, with the critical design review following around 12 months later, allowing the flight-test campaign to start in early 2024.

Two prototypes will be constructed at Deutsche Aircraft's current Oberpfaffenhofen site, before serial production begins at a new facility at Leipzig Halle airport.

That will be sized to support production of 40-50 aircraft per year, depending on demand; Costas anticipates reaching a rate of 48 per year around three years after service entry.

Regional carrier Aurigny is selling a Dornier 228 to the developer

ZeroAvia eyes Dorn of new age in testbed plan

David Kaminski-Morrow London

H2FLY is not the only company looking to use Dornier aircraft as test assets for advanced propulsion systems: US-based ZeroAvia is also acquiring a pair of 228 turboprops for research, as it seeks to progress towards developing a 19-seat hydrogen-electric-powered aircraft.

The company has also obtained further funding for a proposed engine intended for aircraft of around 50 seats.

North Carolina-based AMC Aviation and the Guernsey regional operator Aurigny are supplying the Dorniers, which will respectively be used for research in the USA and the UK.

ZeroAvia had demonstrated a 250kW hydrogen powerplant in a six-seat Piper M350 aircraft, under a project designated HyFlyer I which was part funded by the UK.

While this aircraft was badly damaged in a landing accident towards the end of the test programme, ZeroAvia says it "successfully demonstrated" the powerplant.

It will incorporate its findings into the follow-on HyFlyer II project, which aims to develop a 600kW powerplant for a 19-seat aircraft.

The work will take place at Kemble, Gloucestershire, supported by testing at the company's Hollister, California facility, which will build a second demonstrator for the North American market.

Two 600kW powertrains will be installed to replace the turboprops, while tanks will be fitted to hold 100kg (220lb) of hydrogen gas. ZeroAvia, which aims to achieve a 500nm (926km) range for the aircraft, gives a "commercial offering" date of 2024.

"We are eager and ready to begin testing our hydrogen-electric powertrain technology on a larger commercial-size aircraft," says ZeroAvia founder and chief executive Val Miftakhov.

The company's work is being backed by investor AP Ventures and other funding sources, providing another $13 million for an engine-development programme for aircraft in the 50-seat sector.

This follows another private investment of $24 million for the 50-seat initiative unveiled a few weeks ago.

Aurigny chief Nico Bezuidenhout says that, along with achieving decarbonisation, the 19-seat programme could "expand the reach" of regional aviation by reducing operating costs and making smaller aircraft "competitive" with larger ones.

Aurigny identifies the aircraft it is selling to ZeroAvia as a 1985-built Dornier 228. Registered as G-SAYE, the twin-turboprop was acquired by the airline in 2015 and is currently in storage at its Guernsey airport base, having been withdrawn from service in April 2019.

However, Aurigny stresses that its participation in HyFlyer II is limited to the sale of the aircraft, which it does not expect to receive back at the end of the test campaign.

AirTeamImages

Britten-Norman

Green machine

The UK's last surviving airframer has become an unlikely zero-emission pioneer. Britten-Norman is backing twin projects to develop an alternative-powered Islander

Murdo Morrison Lee-on-Solent

Known for its enduring, no-nonsense, short take-off and landing (STOL) Islander – an aircraft it has been building since the 1960s – tiny Britten-Norman might seem an unlikely trailblazer in commercial aviation's quest for sustainability.

However, the UK's last surviving airframer is playing a key role in two government-backed technology initiatives to develop greener aircraft, and firmly intends to be "at the forefront of the electric aircraft revolution", according to its long-serving chief executive William Hynett.

One, Project Fresson, sees the Hampshire-based company working with a consortium headed by Cranfield Aerospace Solutions to develop a passenger aircraft capable of being powered by hydrogen fuel cells. A demonstration flight is planned for September 2022.

Another, Project HEART – it stands for hydrogen electric and automated regional transportation – aims to demonstrate an autonomously-controlled Islander on essential routes such as those serving the thinly-populated far north of Scotland.

While Project Fresson initially focused on developing an aircraft powered by a hybrid-electric powertrain, that path was abandoned, and Hynett believes that hydrogen-based technology is the "game-changer" that will allow commercial aviation to achieve its zero-carbon goal.

That became clear last year, as Project Fresson began to scope out the potential of hydrogen fuel cells rather than alternatives such as batteries. "It started to make sense," says Hynett. "It takes away the need for charging. It takes away weight."

Core offering

Such is his confidence in Project Fresson's progress that Hynett believes a hydrogen-powered aircraft could be Britten-Norman's "core offering" by the end of the decade. "We are very comfortable that we could sell a hydrogen-powered aircraft in our market," he says.

That market is mostly tiny airlines and public sector-run entities – there are some 230 operators of the nine-seat Islander around the world – serving remote communities from North America's Great Lakes to the Falkland Islands, and from the Scottish isles to Pacific archipelagos.

Island Airways is typical. The 76-year-old carrier serves Beaver Island, a settlement of around 600 people in Lake Michigan. In September, it will take delivery of a second-hand Islander sourced by Britten-Norman, its fifth, and a requirement driven by increasing tourist traffic, says the airline.

Aside from sightseers, the husband and wife-owned airline transports locals, mail and cargo, and provides a medical evacuation service. In winter, when Lake Michigan freezes, its operation becomes all the more vital. With ferries out of action, the 15min flight is the only connection to the mainland.

Another recent customer is the Falkland Islands Government Aviation Service (FIGAS), which accepted its fifth Islander, a new-build, last December. FIGAS has operated the type since the 1970s, performing air ambulance and environmental monitoring missions, as well as scheduled flights.

Of the roughly 1,300 Islanders produced over 56 years, 470 are thought to still be in service. Some 80% are powered by Lycoming O-540s; the remainder by Rolls-Royce M250-B17 turboprops, which deliver a higher maximum take-off weight. Most of the latter are in government or special mission use.

Hynett believes a compact and simply engineered type like the Islander is "perfect" to pioneer tomorrow's green technologies such as hydrogen power. "Opportunities

for-longer range aircraft will happen through the work we do in short-range," he says.

As well as collaborating on the green projects, Britten-Norman, which has Oman-based backers, has spent much of the pandemic period settling into new premises on the former RNAS Lee-on-Solent naval air base, now operated as a private airfield and aviation park by the local authority.

It had been working from Second World War-era hangars since being evicted from its former home at Bembridge on the Isle of Wight around a decade ago, but moved into the modern, local authority-owned units just as the pandemic was taking hold in March 2020.

"Covid has not been a completely awful story for us," says Hynett. Although MRO activity has dipped and a target to be assembling up to four aircraft per year for the commercial market is on hold, the crisis has driven up demand for domestic tourism, and hence for pre-owned Islanders, he says.

However, as they also have for much larger aviation companies, Hynett concedes that pandemic-related travel restrictions have made it difficult to visit most of the company's far-flung customers, either to discuss sales or to carry out repairs.

The company has a Miami-based sales and service operation, but Hynett – who is formally in charge of the entity, and maintains a local apartment – has not been able to visit for 15 months. "My car's battery is flat and the tyres are square," he says.

The focus on the civil market – a sector Hynett admits the company had allowed to "wither a bit" – followed a relatively lucrative spell for Britten-Norman, when it had a contract to supply 10 Defender variants for the UK Ministry of Defence, and maintain them during service in Afghanistan and Iraq.

> "There is a clear political agenda when it comes to aviation's emissions. Fail to go down this road and we'll be left behind"
>
> **William Hynett Chief executive, Britten-Norman**

With production at between one and five new aircraft per year, Britten-Norman's main business for now remains MRO and brokerage – sourcing used aircraft for customers, and usually updating them with new interiors and avionics at Lee-on-Solent.

Kit construction

New aircraft are built as kits by Britten-Norman's long-standing partner, Bucharest-based Romaero, transported by truck, and assembled. Until 2010, Islanders were flown "green" to Bembridge, but this caused more problems than it solved, as aircraft had to be registered too early, says Hynett.

Hynett has considered bringing production in-house, but says the labour rates in Romania for a type that is largely hand-built from metal structures make it unviable. "We could automate it, but I can't see a scenario where the volumes would justify the investment," he adds.

While the Islander remains a no-nonsense aircraft, Hynett admits that customer expectations have changed, just as they have with cars, where motorists are no longer prepared to accept the "idiosyncrasies" of a budget brand.

To this end, he is looking at launching a new interior for the aircraft, although he rules out upgrading to a full Garmin 1000 integrated glass cockpit, instead offering less expensive Garmin options. "We would fit a Garmin 1000 if our customers asked for it, but they don't," he says.

Hynett has not yet settled on the platform for a hybrid-electric or fully hydrogen-powered Islander. As well as the turboprop version, Britten-Norman offers 260hp (194kW) and 300hp piston variants. Its offering is likely to be a "customisation of one or two variants to create the optimal chassis".

Other questions include whether to opt for a liquid or gas hydrogen system. Hydrogen in liquid form will provide more range, but require a heavier airframe. "The most important consideration is that we mustn't lose our STOL capability. That's what our customers tell us is the bottom line," he says.

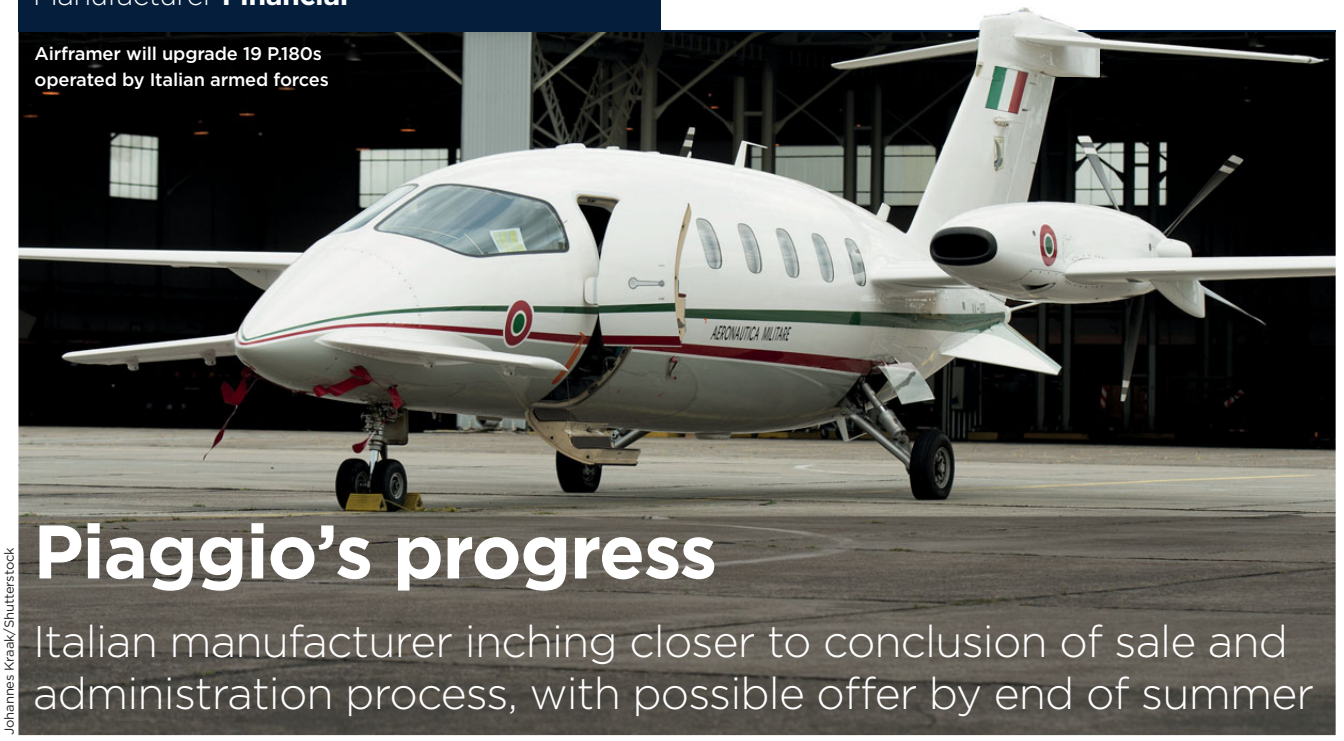
Britten-Norman may have been offering essentially the same design for six decades, but the company has been a disruptor since former de Havilland trainees John Britten and Desmond Norman devised their simple transport piston twin that could be used on short runways, says Hynett.

Britten-Norman innovated 15 years ago when new compact surveillance equipment suddenly made it possible for much smaller aircraft such as the Islander to be developed into cost-effective special mission platforms, and the Defender variant was born, he says.

Its bet on hydrogen power is its latest challenge. "It will be a long journey – the regulators have no way at the moment of certificating an electric aircraft," says Hynett. "But there is a clear political agenda when it comes to aviation's emissions. Fail to go down this road and we'll be left behind."

Britten-Norman

Company has new premises at former RNAS Lee-on-Solent naval air base



Airframer will upgrade 19 P.180s operated by Italian armed forces

Johannes Kraak/Shutterstock

Piaggio's progress

Italian manufacturer inching closer to conclusion of sale and administration process, with possible offer by end of summer

Dominic Perry London

Negotiations between the administrator of Italy's Piaggio Aerospace and a potential buyer for the troubled airframer have been given the go-ahead by the country's economic development ministry.

Piaggio has been in extraordinary administration – a form of business rescue – since 2018, with Vincenzo Nicastro appointed by the state as a commissioner to oversee its restructuring and sale.

In March, Nicastro disclosed that he had received four offers for the company; that has now been whittled down to one contender which is seeking to acquire both of the group's businesses, Piaggio Aero Industries and Piaggio Aviation.

Piaggio says the preferred bidder was "deemed most suitable" due to the "quality of the industrial plan and long-term vision, jobs preservation and value of the offer". However, it declines to reveal the identity of the potential buyer.

Negotiations are expected to last around one month and should culminate in an "irrevocable and binding offer" by the "end of the summer", it says.

Several government approvals will be required for the deal to proceed – including from the authorities regulating anti-trust legislation and the sale of Italy's strategic assets – plus workforce unions.

Nicastro had hoped to conclude the sale talks by April, but disruption caused by the pandemic delayed the process. However, Piaggio plays down the delay, noting that the company has remained operational and has "added new orders to its portfolio" during the period.

New commitments

Piaggio has commitments for 14 new P.180 Avanti Evos, plus contracts related to the modernisation of 19 examples of the twin-pusher turboprop operated by the Italian armed forces.

Of those 14 new-build examples, nine are destined for the Italian air force: five in a transport and ambulance configuration, and four for special missions. These will be built to the P.180 Evo Plus standard, specifically designed for governmental customers, says the company.

That variant is now entering the critical design review (CDR) phase, which is expected to conclude by the end of the summer. First flight of the new model is anticipated in early 2022, with certification following later that year.

Meanwhile, the 19 aircraft already in use by Rome will be raised to the P.180 Avanti II Plus standard, gaining new landing gear and brakes, plus enhancements to their communications systems. The CDR was passed earlier this year and test flights with an initial conforming example should lead to civil certification in the coming months, with military approval to follow in the autumn.

Piaggio's financial troubles were triggered by the decision of former owner, Abu Dhabi's Mubadala, to pull out of the business.

Based in Villanova D'Albenga near Genoa, Piaggio has a successful maintenance, repair and overhaul business and builds engine components, but it remains a single product company, and the Avanti, though updated twice, is a 1980s-designed platform.

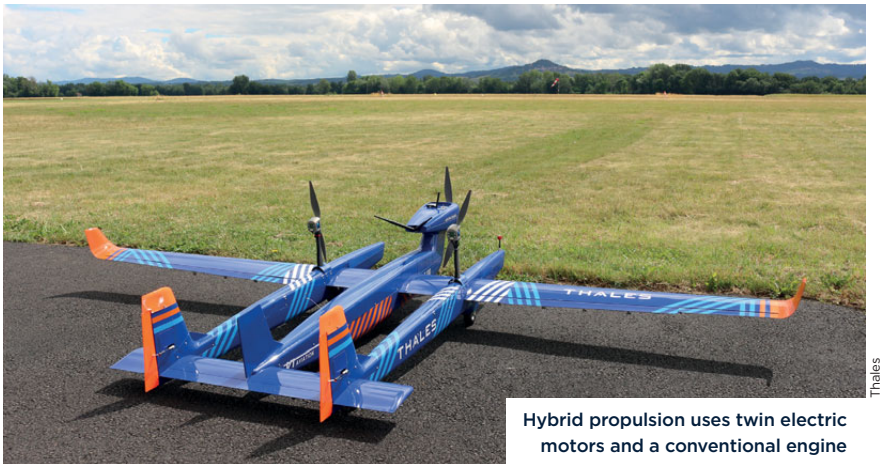
Since it went into administration, orders and commitments from the Italian government worth $980 million has provided a lifeline.

While the administration may have resolved the company's immediate financial troubles, the underlying issues around its future direction and product range remain so far unresolved questions.

Thales shows unmanned ambition

Half-scale model of three-engined UAS 100 makes first flight as French manufacturer develops multiple market prospects

Craig Hoyle London



Thales

Hybrid propulsion uses twin electric motors and a conventional engine

Thales is targeting 2023 for European civil certification of its new UAS 100 unmanned air system, after conducting the first flight of a half-scale model on 22 June.

Developed in partnership with French general aviation manufacturer and composite materials specialist Innoaire Aviation and autopilot software provider Hionos, the three-engined aircraft will have a maximum take-off weight of 100kg (220lb) and a 10kg payload.

A hybrid propulsion system comprises a pair of electric motors and a mid-mounted conventional engine, each driving propellers. This configuration – installed on a tri-hull airframe – offers "optimum safety, endurance and discretion", the company says, referring to its low noise output.

"Having three engines is part of the safety concept," notes Marc Duval-Destin, vice-president strategy, product policy and innovation at Thales's flight avionics business.

With a 5.4m (17ft 6in) wingspan and 5h endurance during autonomous operations, the UAS 100 has short take-off performance, requiring "much less than a football pitch" to get airborne.

Government applications

Range will be in excess of 54nm (100km), with expected commercial or government applications including powerline inspection, border surveillance, fire monitoring, event security and search and rescue (SAR) tasks.

Multiple payloads will be carried simultaneously, such as an electro-optical sensor and GSM signal receiver for SAR duties.

The company's concept of operations involves automatic flight in non-segregated airspace at no more than 10,000ft, but typically only 1,500ft above populated areas.

"It is not our aim to operate in controlled airspace," says Duval-Destin. "Our challenge is to fly in open zones, near general aviation, to be safe doing that with a light system that is easy to operate and deploy."

Thales says the operational UAS 100 will meet the European Union Aviation Safety Agency's Special Condition – Light Unmanned Aircraft Systems regulations, with "world-class safety performance".

"We have safety features that have no equivalent on the market today" for this category of unmanned system, Duval-Destin says. This includes the use of co-operative sense and avoid technology, and Thales is also exploring the use of equipment for non-co-operative capability.

"We will be capable of still flying even after two failures of our critical systems, and land safely in a known remote area," says Emmanuel Guyonnet, drone programme director at Thales's flight avionics business.

Military roles could also be explored for the system, with the development activity supported by the French defence ministry via its Defence Innovation Agency. Thales says that its modular design concept means that longer-endurance surveillance operations could be performed by using a larger wing.

Yannick Assouad, Thales's executive vice-president, avionics, also notes that "the new system paves the way for the [unmanned] air mobility solutions of tomorrow".

Continued testing with the half-scale vehicle will progress to conducting automatic beyond line-of-sight operations. It also is scheduled to perform in a flight demonstration during the UAV Show near Bordeaux on 21 October.

A full-scale example is due to get airborne for the first time in the second half of 2022.

Market interest

Thales has already received market interest in the UAS 100 design, with Duval-Destin noting: "Our first prospects are out of France."

Meanwhile, eyeing a projected massive increase in the commercial use of UAVs over the coming years, Thales is promoting its TopSky air traffic management technology for use during drone operations.

Referring to the challenge of safely introducing a high volume of UAVs alongside manned aircraft while also defending against their reckless or malicious use, Olivier Rea, Thales's head of unmanned traffic management services, notes: "We have to do what aviation did in [its first] 100 years within 10 years."

The company and Operational Solutions also have announced a teaming agreement to offer the latter's FACE command and control software with Thales's counter-UAV and unmanned traffic management technology.

Eviation confirms Alice design changes

Electric aircraft developer ditches three-motor configuration in favour of more conventional architecture

Eviation Aircraft

Switch to T-tail will result in improved performance and handling, says company

Jon Hemmerdinger Tampa

Eviation Aircraft has significantly shifted the design of its in-development Alice all-electric aircraft, and says it remains on track for a first flight this year.

The aircraft developer – now based in Washington state, having moved from Israel – also says the nine-passenger Alice will have more powerful Magnix-made propulsion systems than previously planned.

Additionally, figures from Eviation's website show the company has in recent years tweaked Alice's advertised capabilities, shaving some 100nm (185km) off its range.

Eviation on 1 July released an image showing the latest design iteration for Alice. The new configuration has two electric motor-driven propellers – one mounted on each side of the aircraft's rear fuselage. It also has T-tail and clean wings with small upturned tips.

As previously designed, Alice had a V-tail and three electric motors – one on each wing-tip and a third powering a pusher propeller at the rear of the fuselage. That configuration was displayed on a prototype at the 2019 Paris air show.

"The production configuration, optimised based on real-world lessons learned and customer feedback, defines Alice's path to certification and entry into service, expected in 2024," Eviation says. The aircraft "is on track for first flight later this year".

Changing from a V-tail to a T-tail will "optimise performance and handling, making it easy for pilots to seamlessly transition to flying the aircraft".

The updated design "represents a final step in our iterative journey toward Alice's first flight", adds Eviation chief executive Omer Bar-Yohay.

Powered up

Eviation also confirms Alice will use two of sister company Magnix's 640kW Magni650 electric powerplants, rather than three 280kW Magni250s. In June Magnix said it was replacing the Magni250 and a previous model, the Magni500, with two more powerful motors, the Magni350 and Magni650.

The design changes were not unexpected. In December 2020, Bar-Yohay said Eviation had made "a few minor modifications" to Alice, resulting in a design "slightly different than what you have seen at the Paris air show".

Alice is to be a nine-passenger, two-crew commuter or private aircraft. In 2019, the developer named US regional airline Cape Air as the type's launch customer.

Eviation's website now says Alice will cruise at 220kt (407km/h) and have 440nm range, with power coming from an 820kWh lithium-ion battery system weighing 3,720kg (8,200lb).

Previously, Eviation had said Alice would cruise at 240kt, and have 540nm range and a 920kWh battery system weighing 3,600kg.

As currently designed, Alice will be 17.1m (56ft) long, 3.8m high and have an 18m wingspan. Previously, Alice's dimensions were given as 13.2m long, 4.2m high and with a 16.1m wingspan. Eviation has also seemingly upped Alice's advertised maximum take-off weight from 6,350kg to 6,670kg.

When Eviation changed the figures remains unclear.

Lessons learned

The company tells FlightGlobal that the performance modifications "are a result of several design lessons learned and an adaptation to the needs of our clients, focusing on cabin and baggage compartment volume, passenger comfort and compliance with the safety guidelines of the FAA [Federal Aviation Administration]".

Alice will have an altitude ceiling of 32,000ft and maximum payload of 1,130kg, Eviation says. It will have a composite fuselage and Honeywell fly-by-wire flight controls.

Eviation's latest image confirms the accuracy of a separate rendering published by FlightGlobal in January and obtained from an unnamed source who said the image showed design changes to Alice.

Eviation had previously hoped for Alice to make first flight in 2020, but that milestone slipped. In January 2020, a fire damaged an Alice prototype on the ground in Prescott, Arizona, where Eviation and partner Magnix were performing tests. The fire involved lithium-ion batteries and occurred after hours of powerplant testing, according to US and local government reports.

Eviation's decision to eliminate wing-tip-mounted propulsion units could reflect challenges with that design. Such a configuration can reduce drag-causing vortices and deliver improved efficiency, according to a 2017 NASA research paper. But placing motors on an aircraft's wingtips risks instability, as failures can cause "a large yaw moment due to asymmetric thrust", NASA said.

THE AIRLINE STRATEGY AWARDS

Airline Business

MONDAY 27 SEPTEMBER | LONDON

The Airline Strategy Awards 2021 proudly recognises the winners' contributions in these areas of leadership and excellence

Executive Leadership

For the airline president/ chief executive who has demonstrated outstanding strategic thinking and leadership during the Covid-19 crisis.

SPONSORED BY Collins Aerospace

Sector Leadership

For the chief executive or management team that have demonstrated excellence leading a carrier providing strong transportation links within a market sector during the Covid-19 crisis.

SPONSORED BY CIRIUM

Low-cost Leadership

For the chief executive or management team that have demonstrated excellence in leading a low-cost or ultra-low-cost carrier during the Covid-19 crisis

SPONSORED BY GO BEYOND

Air-Cargo Leadership

For the chief executive or management team that have demonstrated excellence in leading a cargo carrier or cargo business unit during the Covid-19 crisis.

SPONSORED BY SmartKargo

Business Innovation

For an airline of any business model or size that demonstrates true business innovation during this time of crisis.

SPONSORED BY volantio

Corporate Social Responsibility

For an airline of any business model or size that demonstrates an unwavering commitment to corporate social responsibility throughout this time of crisis.

SPONSORED BY cfm The Power of Flight

Airline Business Award

This special award is made by Airline Business to recognize an individual making a lasting strategic contribution to the air transport business.

SPONSORED BY Tampa International Airport

Thank you to all our sponsors and event partners

Find more information at FlightGlobal.com/StrategyAwards

ORGANISED BY FlightGlobal

IN ASSOCIATION WITH Airline Business | KORN FERRY

Aircraft collided with ILS localiser antenna before coming to a halt

Transportation Safety Board of Canada

747 freighter wrecked after minor factors conspired to cause overrun

Sky Lease jet came to rest 270m beyond opposite-direction runway threshold as crew braked late during tailwind landing

David Kaminski-Morrow London

Canadian investigators have found that belated braking during a Boeing 747-400F's landing at Halifax in Nova Scotia led to its overrunning the runway and being written off as a result of substantial damage.

The Sky Lease Cargo aircraft's crew, arriving from Chicago on 7 November 2018, had conducted an ILS approach in darkness to Halifax's wet runway 14 after unwittingly believing the longer runway 23 was unavailable.

NOTAMs had advised that the runway 23 threshold was displaced for repairs, and the landing distance was reduced. But the Transportation Safety Board of Canada says the "ineffective" presentation style of NOTAMs led the crew to think the runway was unavailable owing to approach restrictions.

The crew instead chose to land on the shorter runway 14, about 2,350m (7,700ft) in length, thinking it was the only option.

Although a shift in the wind direction prompted a change in arrival runway from 14 to 23 – while the 747 was still 52nm (96km) from the airport – this was not communicated to the crew, although it was broadcast on the automated terminal information system.

It was not until the aircraft (N908AR) was 80s from the runway 14 threshold that the crew discovered it was subject to a tailwind component.

But with only limited time to touchdown, the pilots did not recalculate the landing performance data to confirm sufficient runway length was available.

Braking bad

While the unexpected tailwind did not extend the required landing distance beyond the runway length available, the inquiry says a "rapid succession" of events upon touchdown meant the aircraft did not brake sufficiently.

The jet touched down "firmly" at 179kt (331km/h) groundspeed, about 410m beyond the threshold, crabbing 4.5° to the right.

Although the spoilers began to deploy, the investigation found that the thrust lever for the outboard left-hand Pratt & Whitney PW4000 engine advanced beyond its idle position. This went unnoticed by the crew, says the inquiry, and the reason for the lever movement could not be determined. Reverse-thrust was engaged only on the other three engines.

The shift in the lever was critical because it caused the spoilers to retract and the autobrake to disengage. The aircraft's weight-on-wheels switches reverted momentarily to

> "During the overrun, the aircraft crossed a significant drop [of 2.8m] past the end of the runway and was damaged beyond repair"
>
> **Transportation Safety Board of Canada**

'air' mode before transitioning again to 'ground' mode.

Investigators state that the right crab, combined with a crosswind component and the asymmetric reverser selection, caused the aircraft to deviate to the right of the centreline.

About 6s after touchdown the outboard left-hand thrust lever was retarded to just above idle, allowing the spoilers to deploy fully.

But the first officer, the monitoring pilot, was focused on the lateral drift and required callouts for the position of deceleration devices were not made.

"Without the benefit of the landing roll-out callouts [the captain] did not recognise that all of the deceleration devices were not fully deployed and that the autobrake was disengaged," says the inquiry.

Just 8s into the landing the captain realised that the 747 was not decelerating as expected and began using manual braking, using the rudder pedals to try to regain the centreline.

With just 243m of runway remaining the aircraft was still travelling at 100kt and, although deceleration was markedly greater over the subsequent 7s, it failed to stop and overran at 77kt.

Drop zone

The jet ran over rough ground and collided with the ILS localiser antenna at 50kt, before coming to rest 270m past the opposite-direction runway threshold and 21m to the right of the extended centreline. It was also less than 50m from a public road.

"During the overrun, the aircraft crossed a significant drop [of 2.8m] past the end of the runway and was damaged beyond repair," the inquiry says. All three crew members suffered minor injuries but the fourth occupant, a deadheading senior captain, was uninjured.

The investigation notes that the crew was fatigued, operating a night flight through the circadian trough and having had "insufficient restorative sleep" in the previous 24h. This would have "degraded" the pilots' performance, it adds.

It also points out that the accident illustrates the additive effect of minor issues.

"Although the aircraft was flown within the stable approach criteria, the accident demonstrates how several factors affecting landing distance – although individually small – can combine to result in a reduced margin of safety," it says.

Built in 1997, the 747-400F was previously operated by Singapore Airlines' cargo division; Sky Lease Cargo took the freighter on lease in 2017.

Confusing NOTAMs influenced decision to land on shorter runway

Investigators probing the overrun that destroyed a Boeing 747-400F at Halifax have highlighted the contribution of poorly-presented NOTAM information to the accident.

The safety hazard posed by complex and cluttered NOTAMs is an issue being tackled by an ICAO campaign initiated earlier this year.

The Transportation Safety Board of Canada says the Sky Lease Cargo crew received 98 NOTAMs before departing Chicago O'Hare for Halifax.

Thirty-seven of these NOTAMs concerned Halifax, and 22 were about runway 05/23, referring to unserviceable navigation aids, runway lighting, and a displaced threshold owing to work in progress.

Ten of the 22 runway NOTAMs contained repeated information with modifications but had to be compared with the previous version in order to identify any differences.

Transportation Safety Board of Canada

Crew concluded that no approaches were available for runway 05/23

All the NOTAMs were presented in the sequence they were issued, without being prioritised, and all in a format containing entirely-capitalised text.

"NOTAMs are intended to be a clear, concise and unambiguous presentation of essential information," says the safety board's inquiry into the 7 November 2018 overrun.

"It is difficult to reliably extract the crucial information because of their presentation style, using all capital letters, and because of their sequence, in which important approach and runway NOTAMs are not prioritised but buried among other information," the inquiry says.

Those reading the NOTAMs must search "back and forth" to compare and extract information, in order to build a list of unavailable approaches or runways.

"This extraction process of elimination is usually performed mentally, increasing the risk of misinterpretation, resulting in the crew having an inaccurate mental model of the operational hazards affecting a flight, and reducing the crew's situational awareness," adds the inquiry.

Having read through the NOTAMs the Sky Lease Cargo 747 crew concluded that no approaches or lighting were available for runway 05/23 when, in fact, two approaches – involving NDB aids or lateral navigation – were an option.

The crew instead chose to conduct an ILS approach to Halifax's runway 14, which was shorter than runway 23, even taking into account the latter's displaced threshold.

Investigators determined that the 747 was subjected to a tailwind during the approach to runway 14 and that decisions including the use of a 25° flap setting, rather than 30°, further increased the landing distance.

STR/EPA-EFE/Shutterstock

Ethiopian Airlines Max 8 crashed shortly after take-off on 10 March 2019, killing 157 people

Changing the agency

The US regulator deviated from its role with the certification of the 737 Max by ceding too much responsibility to Boeing, but reform is not impossible, argues safety expert **John Goglia**

In March, veteran former Federal Aviation Administration (FAA) safety engineer Joe Jacobsen went public with concerns that the agency had an overly cosy relationship with Boeing. In interviews with *The Seattle Times*, Jacobsen said the FAA ceded far too much control in the certification of the 737 Max and left veteran FAA engineers out of the process until after problems became all-too tragically apparent.

Not until after the first Max crash in October 2018 was Jacobsen pulled into the Max project; he quickly identified numerous issues with the plane (including with the much-discussed Maneuvering Characteristics Augmentation System).

The FAA has been too close to the industry it is meant to police for too long, and has squandered its knowledge and resources during high-pressure certification efforts.

That Jacobsen was left out of the process is an illustration both of how deep the rot goes at the FAA, and how Boeing sought to take advantage of it. Jacobsen was right, is right, and must now be taken seriously.

It is pretty easy to hide what you have done in a massive amount of paperwork. The FAA did not work out what Boeing had done and why. It trusted the airframer and, you could argue, was being pressured not to dig too deeply.

This way, the flaws with the Max were overlooked.

That is the reverse of the FAA's intended role: its job is to question everything and never assume that changes are minor and therefore do not necessitate regulatory scrutiny.

Jacobsen would have been a familiar face to Boeing engineers. How he could have been excluded from the certification process – even in nothing more than an oversight role – is baffling. He had extensive knowledge, and was known inside the FAA and amongst manufacturers as a thorough and meticulous reviewer.

I spoke to several sources at the FAA while writing this article. Jacobsen has a reputation as being highly knowledgeable, particularly on certification. The FAA's Seattle certification office, which reportedly has been dysfunctional for quite some time, was largely held together by virtue of Jacobsen and a small team of veterans.

Despite his experience, the FAA did not use Jacobsen as part of the Max's original certification team – neither to ensure the plane's safety nor to mentor younger engineers who were supposed to be reviewing the Max. They were the ones in most need of an experienced hand to guide them; the ones perhaps most likely to be reluctant to challenge Boeing's assertions.

The FAA needs to put its best people in, at the very least, monitoring or mentoring positions. Its failure to do so embodies the long-time brain-drain catching up with the agency. If the bureaucrats above them do a bad job, smart engineers become frustrated and leave – taking their regulatory knowledge and influence to industry.

The FAA needs to be diligent in performing its duties. Trusting the companies it oversees is important, but the FAA has the obligation to verify that those companies deserve to be trusted. Boeing should not have been able to get the Max, as it was, through certification. The FAA's job is to be an independent body that protects the public, not an organisation that fast-tracks a billion-dollar corporation's project.

Honest approach

On the manufacturing side, Boeing needs to be open and honest – both internally and to regulators. It needs to clearly identify changes it has made, as a failure to do so puts passengers and crews in danger. Months after the FAA re-approved the Max, it was forced to ground some jets again when a wiring issue that needed to be fixed immediately became apparent. That the most-scrutinised jet ever made it through re-certification with another flaw (albeit minor) is troubling.

While it appears the FAA is trying to do better, whether it actually improves remains to be seen. Jacobsen called for replacements at the highest level of the FAA, citing the culture that placed corporate interests over safety.

The next certification programme is already upon us with the 777X. We need to identify where the FAA – and Boeing – deviated on the Max and have an independent review of the whole process.

Certainly a scenario where details are hidden in reams of paperwork is not one that can ever be repeated. But with the recent FAA pushback on the 777X certification, the signs are that the agency has listened to the criticism and perhaps changed its approach.

John Goglia is a former member of the US National Transportation Safety Board and is now an independent aviation safety consultant

THE FUTURE OF THE AEROSPACE INDUSTRY

14-18 NOVEMBER 2021

DWC, DUBAI AIRSHOW SITE

www.dubaiairshow.aero
Book your space today: sales@dubai.aero

Join us as we launch a range of new features including new content streams, emerging technologies showcase, intelligent matchmaking platform, enhanced networking and much more in a live format.

Follow us on: | #DubaiAirshow

COMMERCIAL AVIATION | AIRCRAFT INTERIORS | MRO | BUSINESS AVIATION | AIR TRAFFIC MANAGEMENT
SPACE | DEFENCE & MILITARY | AIR CARGO | EMERGING TECHNOLOGIES NEW

Supported by:

Bell ceased use of its V-280 Valor demonstrator, after 214 flight hours and achieving a top speed of 305kt (564km/h)

Bell

Berlin is to update the German navy's maritime patrol aircraft fleet with five Boeing P-8A Poseidons, due for delivery from 2024

Boeing

Irkut's PD-14-engined MC-21-310 received its flight-test livery before heading for July's MAKS air show

United Aircraft

US fractional start-up Jet It has become launch customer for Bye Aerospace's eFlyer 800 electric-powered twin

Bye Aerospace

The US Air Force released a new artist's impression of its in-development Northrop Grumman B-21 Raider bomber, featuring distinctive cockpit windows

US Air Force

Best of the rest

We showcase some of the other notable events covered by the FlightGlobal team between issues

Airbus Defence & Space has advanced weapons carriage trials with an Armed ISR variant of the C295 transport

Airbus Defence & Space

Greek carrier Sky Express has ordered six ATR 72-600s, with the type replacing operator's -500s

ATR

Aircraft Interiors EXPO®
VIRTUAL
14 – 16 SEPT 2021

THE CABIN INTERIORS INDUSTRY AT YOUR FINGERSTIPS
ACCELERATE YOUR RECOVERY

Welcome to AIX VIRTUAL

Take off and discover innovative products, insightful meetings and inspirational talks to take your business sky high.

Find out more at:
aircraftinteriorsexpo.com/FGfi

Co-located:
World Travel Catering® & Onboard Services EXPO

Organised by:
Reed Exhibitions®

Next month

How defence has helped the Top 100 aerospace firms amid crisis

US Air Force

FLIGHT INTERNATIONAL

On sale
2 September

Plus...

Sean Pavone/Shutterstock

Dark day
Twenty years after 9/11: why flight security changed forever

Crown Copyright

Funding lift
We review UK military's programmes ahead of its DSEI show gathering

Up in the air

AirTeamImages

The Airbus A220 is finding success with regional carriers such as Swiss

As the industry emerges from the pandemic, its lead airframers face some familiar – and newer – challenges. In our special report on commercial airliners, we focus on seven key programmes or market segments, where decisions in the next months could be critical. For Boeing, these include how to breathe new life into the 787 as the type approaches a decade in service, whether it can push the 777X on a market that has fallen out of love with ultra-large widebodies, what its strategy should be to counter long-range versions of the Airbus A320neo family, and whether the 737 Max is over the worst. Its European rival is enjoying success with the A220 – how much more potential is there for the former Bombardier CSeries? Meanwhile, Airbus's lack of a dedicated freighter has seen it lose ground in the cargo market. Is an A350F on the cards? Finally, for Embraer, after delays and rejections, does the smallest member of the E2 family have a future?

787

Pausing the dream

Delivery interruptions caused by fuselage manufacturing have hit the 787 as it nears a decade in service – does the Dreamliner still have better years ahead?

Jon Hemmerdinger Tampa

If you must halt deliveries of a commercial airliner – a jet like, say, Boeing's 787 – doing so during the deepest downturn in the history of commercial aviation might be the best conceivable time.

At least there is that.

Boeing has halted 787 deliveries twice during the pandemic – both times as a result of problems with the jet's composite fuselage. The most-recent delivery pause remained in effect as of early July.

But despite stopped deliveries, fuselage issues, withered demand for international travel and markedly reduced 787 production rates, analysts still foresee bright tomorrows for the jet.

"Over the long term... it's a strong product," analyst Michel Merluzeau with consultancy AIR says of the 787 programme. "It has a shelf life that goes deep into the 2030s."

14

Maximum monthly output of 787s before the pandemic – and the current target Boeing says it is working towards

Boeing's chief executive insists that the airframer's flagship widebody programme will do more then endure. It will shine, he says, and production rates will climb back to output levels last seen in pre-Covid-19 days.

"We will get back to the rates that we used to be at," David Calhoun said on 3 June during an investor conference hosted by AllianceBernstein.

Calhoun clarified that yes, he expects 787 production – now at five jets monthly – will eventually return to the 2019 programme-high rate of 14 monthly.

"You don't go from five to that number overnight. You get there in increments, and we have plenty of cycle time to stage those increments appropriately and reconfigure the flow of airplanes to the factories, such that we can accommodate those kinds of rates," he said.

777X

Waiting game

Despite the pandemic, decimated international travel demand and certification delays, Boeing's chief executive has no regrets about developing the 777X

Jon Hemmerdinger Tampa

You might wonder if Boeing's top brass have come to regret the 2013 decision to launch the 777X programme.

After all, Boeing's newest widebody, now in flight testing and certification, has faced no shortage of hurdles – not least being the Covid-19 pandemic, which essentially evaporated demand for long-haul international travel.

Also, amid the pandemic and heightened regulatory scrutiny following the 737 Max's troubles, Boeing said it was tweaking design elements of the first 777X variant, the 777-9.

Knowing all that, was launching the 777X still a good move? Chief executive David Calhoun recently answered that question.

"If I had a clean slate of paper today, and [there] wasn't a 777X loaded in my development pipeline, would [Boeing] want to do it again? The answer is, absolutely. Yes," Calhoun said on 3 June during an investor conference hosted by AllianceBernstein.

"It will have a 40- or 50-year run," he added. "I have lots of confidence in it."

Freight factor

Calhoun cited the 777-9's cost per seat (and by volume of cargo) as a key attribute, and noted that competing jets such as 747s and Airbus A380s are at the end of their production runs.

Analysts likewise suspect the 777X programme will succeed ultimately – that sales will accelerate in the coming decade and that Boeing will tap into the cargo market with a freighter derivative.

"I think the 777X will have a renaissance in a year or two or three, when the international market is back and everything that was flying that market is mothballed," says Credit Suisse analyst Robert Spingarn. "Then you are going to see a wave of orders for big widebodies."

"The 777X is a little early for its time. The demise of the A380 could provide a second chance, but the timing is unfortunate"

Jefferies

Boeing

In January, Boeing delayed the planned first 777-9 delivery from 2022 to "late 2023". Calhoun also disclosed then that the company was making "design modifications" to reflect "expectations of global regulators". The news came as the US Federal Aviation Administration (FAA) stepped up oversight following the 737 Max's flight control problems.

Boeing is "still confident [the 777-9] will be certified in the fourth quarter of 2023", Calhoun said on 3 June. "We have incorporated all the timeline learning that we could possibly incorporate from the Max [recertification], and the architectural preferences that both the FAA and [European Union Aviation Safety Agency] EASA [have] embedded in their regulations."

Boeing

No regrets... David Calhoun says the 777X could be in operation for up to 50 years

That timeline means the 777-9 will enter service nearly 10 years after the company launched the programme.

Even still, the jet seems premature.

"The 777X is a little early for its time. The demise of the A380 could provide a second chance, but the timing is unfortunate," says a 21 June research note from Jefferies. "The issue is the 777-300ER isn't old enough to be replaced."

"I think the demand will come, but... you probably won't see that demand picking up until the late 2020s, early 2030s," adds Cirium head of valuations George Dimitroff. He cites a "surplus" of 777-300ERs.

The roughly 1,550 777s (of all variants) in service and storage globally are, on average, less than 12 years old, according to Cirium fleets data. Of those, some 800 are 777-300ERs, which are an average of 8.5 years old.

The 777-9 made its maiden flight in January 2020. That jet can carry 426 passengers in two classes and has 7,280nm (13,500km) range. In 2019, Boeing paused development of the smaller 777-8, an 8,730nm-range, 384-passenger variant. Boeing holds orders for 320 777X from customers ANA, British Airways, Cathay Pacific Airways, Emirates Airline, Etihad Airways, Lufthansa, Qatar Airways and Singapore Airlines, company data shows.

Boeing has not committed to a 777X Freighter, but Calhoun suggests such a project is likely.

"I am confident that this one will move down that path," he said on 3 June, referring to a potential 777X Freighter.

Production cut

Also in January, Boeing said it was taking a $6.5 billion charge against the 777X and trimming the programme's expected production quantity by 12.5%, to 350 from 400 aircraft. Boeing's former chief financial officer, Greg Smith, who recently left the company, attributed the changes to "what we are seeing in the marketplace with the current pandemic, as well as how we are seeing the marketplace shift in the near term".

Boeing's expectation of producing just 350 777Xs "highlights how niche the aircraft is", Dimitroff says.

But he suspects sales will exceed that number, because the 777-9 will particularly excel at operating "very long sectors", like those from the USA and Europe to Asia. A freighter will help also.

"It will have a market, but that market has shrunk," Dimitroff says, noting that smaller widebodies such as A350s and 787s, having extremely long range, can operate some long-haul segments that first-generation 777s once dominated.

But Boeing was cranking out 14 787s monthly when it had two production sites – the original in Everett, Washington, and the second, in North Charleston, South Carolina. This year Boeing stopped Everett 787 production as part of a programme overhaul. It now produces the jets only in North Charleston.

Some aerospace analysts, among them Teal Group's Richard Aboulafia, have doubted Boeing will ever recapture rate-14 on the 787. Aboulafia has said that 14 787s monthly was too many even in 2019, and noted that Boeing began trimming output even before the pandemic.

Doubtful demand

Merluzeau thinks a 14-per-month rate is feasible only if Boeing develops a new 787 variant – perhaps a 787-8 tweaked with new engines or other efficiencies. Such a derivative could help Boeing compete better in the mid-market segment – though only at the longer-range, higher-capacity end of that sector – where the company has lost ground to Airbus's A321neo.

"There is simply not enough demand for -9 and -10" to support 14 jets monthly, Merluzeau says. "Demand for [the] -8 has all but evaporated." Indeed, the 787-8, which has substantial fuselage differences from the two larger variants, has been a slow seller.

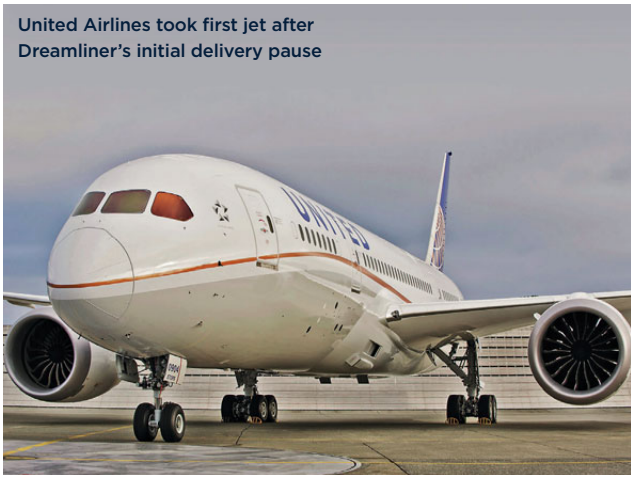
Boeing holds firm orders for 436 787s – enough to sustain years' more production.

The company first paused 787 handovers between October 2020 and March, then stopped again in May. Although Boeing did deliver one 787 to Turkish Airlines in June, that jet was built last year; the broader delivery halt remains in effect.

Boeing has attributed both pauses to a "skin-flatness" issue involving aft fuselage sections, saying it has been conducting inspections and repair work.

"Demand for [the smallest Boeing 787 variant] -8 has all but evaporated"

Michel Merluzeau AIR consultancy



United Airlines took first jet after Dreamliner's initial delivery pause

United Airlines

Mid-market

Minding the gap

Final Max variant matches A321XLR on capacity, but lacks its range. Could this spur Boeing to go ahead with plans to build a mid-market type?

Jon Hemmerdinger Tampa

As the pandemic eases, Boeing finds itself in the familiar position of still having to deal with the competitive threat posed by Airbus's A321neo – particularly the longer-range A321XLR variant.

Boeing took a long step toward addressing that threat on 18 June, when the 737 Max 10 made its maiden flight, inching Boeing nearer to beginning deliveries of the model.

But the Max 10 does not solve the entire problem for Boeing. That is because, while it carries about the same number of passengers, it lags the A321XLR in range. For that reason, some aerospace analysts still think Boeing must counter Airbus by launching a so-called "mid-market jet".

Max 10 takes off from Renton for its first flight on 18 June

Boeing

Boeing chief executive David Calhoun insists his company – which is in the midst of major 787 production problems and still clawing out of the Max grounding disaster – will indeed strike back with a new jet.

But Calhoun has provided few details. Nor has he said whether Boeing's next aircraft will be the mid-market jet for which analysts have clamoured, or a 737 replacement, or some combination.

Calhoun faces questions about Boeing's development plans nearly every time he speaks publicly. "It won't be all that long before we'll announce ours," he said of Boeing's next jet during an investor conference on 3 June.

Airbus launched its A321XLR at the 2019 Paris air show, quickly racking up orders and commitments. With advertised range of 4,700nm (8,700km), the 180- to 220-passenger A321XLR has transatlantic capability, which is exactly why airlines such as JetBlue Airways ordered the type. Airbus expects the first A321XLR will enter service in 2023.

Going further?

By comparison, the 737 Max 10 carries 188-204 passengers in two classes, but has only 3,300nm range, according to Boeing. It expects to deliver the first Max 10 in 2023.

Aerospace analyst Richard Aboulafia of Teal Group thinks Boeing will continue playing catch-up until it launches a wholly new jet to fill the "mid-market" space – the sector wedged between traditional narrowbodies and smaller widebodies. The A321XLR sits in the mid-market, as do 757s and 767s. The 737 Max 10 does not.

Still, Aboulafia thinks Boeing may not pull the trigger, at least not soon, noting the company has recently cut research and development spending and slashed its workforce.

Major customers such as Air Lease chief executive Steven Udvar-Hazy have likewise called for Boeing to move on a mid-market aircraft.

Financial firm Jefferies sees opportunity for Boeing to develop a 200- to 250-seat jet for service entry in the late 2020s or early 2030s. The aircraft could be a narrowbody with 4,000-5,000nm range, or a small widebody such as a 767 with 6,000nm range – enough "to reach any point in Europe from the East Coast", Jefferies says in a 20 June research report. Such a jet might nibble into shorter routes served by 787-8s, but would otherwise lack range to compete more directly with 787s or 777s.

Demand could potentially support production of 7,200 such aircraft over 20 years, or 30 monthly, Jefferies says.

Boeing has for years flirted with launching a mid-market jet, most recently working on a concept known as the "New Mid-market Airplane", which industry sources had expected would carry up to 270 seats and have 4,000-5,000nm range. But Boeing stepped away from that project, with Calhoun saying in January 2020 that the company was taking a different approach.

During the 3 June investor conference, Calhoun conceded the A321XLR holds a "performance advantage" – but only in what he described as a narrow segment of the jetliner market.

For that reason, Calhoun said, Boeing's next jet will not simply be "an overlay of the A321XLR".

"We are going to tackle something much bigger than that," he said.

Leaving aside Boeing's next aircraft, analysts generally describe the Max 10 as a capable jet with a promising future – one that helps bridge a competitive gap. That optimism stems partly from the Max 10's capabilities, and partly from the duopolistic make-up of the narrowbody aircraft manufacturing market.

Demand surge

Although China's Comac is working toward certification of its C919 narrowbody, Airbus and Boeing essentially have the narrowbody market to themselves. Market forecasts broadly point to surging demand in the coming years for narrowbody jets, as airlines replace 737NGs and A320ceos. Neither Airbus nor Boeing will be able to fill that demand alone, which bodes well for both companies' products.

The Max 10 also stands on its own merits, analysts say. It is significantly more efficient than the 737NG and has enviable seat-mile costs. Also, cockpit and pilot-training commonalities mean Max 10s fit seamlessly into the fleets of existing 737 operators.

"For the US majors, it's going to be a hit," Cirium head of valuations George Dimitroff says of the Max 10. He notes that the Max 10's range allows for transcontinental US flights and flights from the US West Coast to Hawaii. Also, US airlines are large enough to also order A321neos if they desire a narrowbody with a bit more range.

Boeing holds firm orders for about 430 Max 10s, including from customers Flydubai, Gol, Lion Air, United Airlines and Vietjet Air, according to Cirium data.

The Max 10 programme was given renewed momentum when the type got airborne for the first time, leaving Renton Municipal airport and flying for about 2h 30min before landing at Boeing Field in Seattle.

"I [fully] expect to see more orders," Boeing Commercial Airplanes chief executive Stan Deal said of the Max 10 on 18 June. "We are starting to see a recovery in the market, particularly pronounced in the US."

737 Max

Fighting back

Its troubles are not entirely over, but the 737 Max programme has landed some significant new orders, as Boeing looks to clear a huge inventory of aircraft

Jon Hemmerdinger Tampa

Despite ongoing technical issues, Boeing has won new orders for the once-grounded 737 Max narrowbody, progressed with clearing a hundreds-deep inventory of stored jets and achieved first flight of the Max 10.

"It's onward and upward," Cirium head of valuations George Dimitroff says of the Max programme. "As a whole, the programme will get back to health."

Boeing passed the highest hurdle in November 2020, when the US Federal Aviation Administration (FAA) lifted the type's 20-month grounding. During that period, Boeing had continued manufacturing the jets despite not delivering them, consequently accumulating an inventory of some 450 aircraft.

Finally, in December 2020, the airframer resumed deliveries and began working through the inventory, aiming to deliver about half of the stored jets by the end of 2021 and the majority of the remainder by end-2022.

Boeing has since whittled its Max inventory down to about 340 aircraft, some of which it produced after the FAA lifted the grounding, Cirium data shows.

But the Max programme suffered a setback this year when airlines pulled 106 aircraft from service owing to an electric grounding issue involving standby power control units. The FAA approved Boeing's fix in May, though the issue led Boeing to temporarily halt Max deliveries.

Smallest first

Still, Boeing has landed new Max orders in recent months, and surging air travel demand (at least in the USA) bodes well for continued sales.

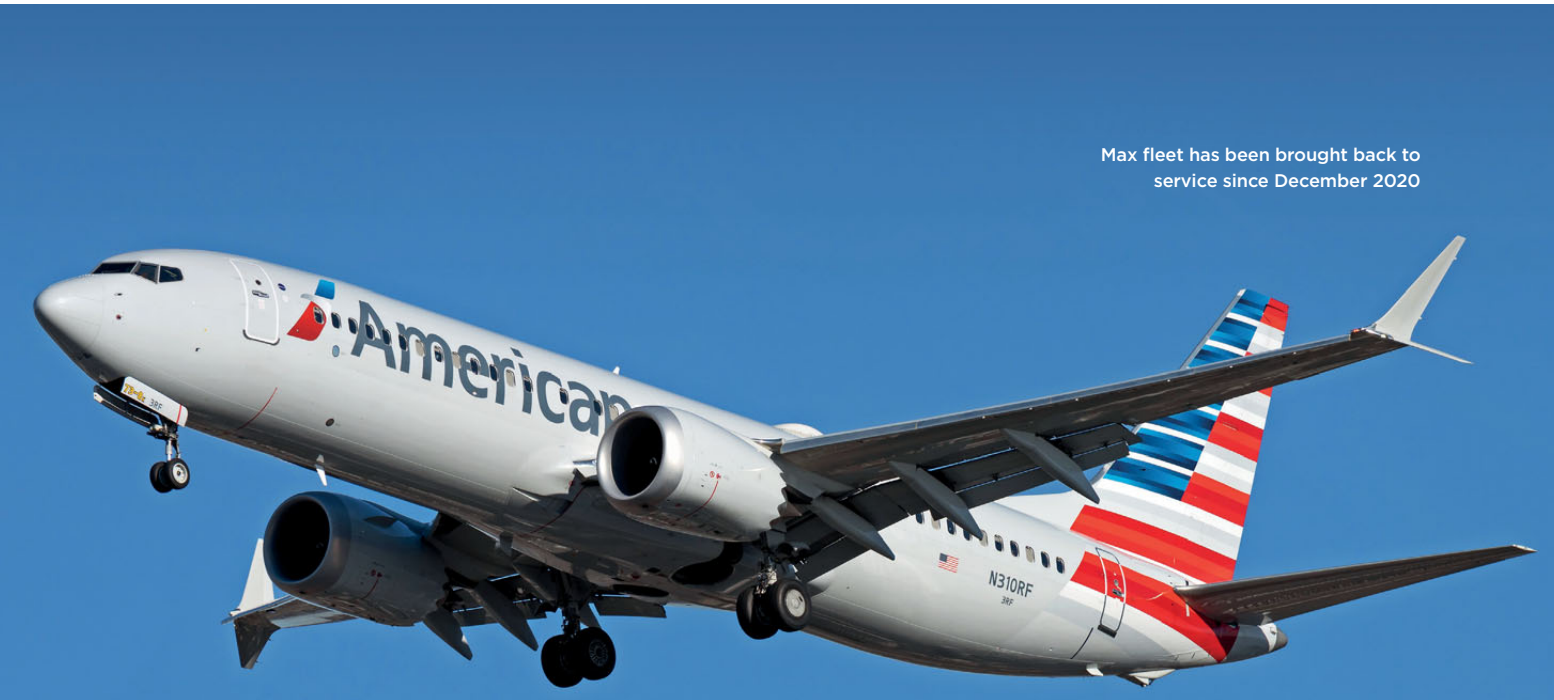
Southwest Airlines ordered 100 737 Max 7s in March, throwing a major wave of support behind the smallest Max variant, which Boeing expects to begin delivering in 2022. This year, Boeing has also secured Max orders from Alaska Airlines, United Airlines, financial company 777 Partners and lessors Dubai Aerospace and Aviation Capital. It has concurrently logged Max cancellations, but Max orders in 2021 through May exceeded cancellations by 61 jets, company data shows.

Boeing's Max momentum accelerated in June. Mid-month, it delivered the first high-capacity 737 Max 8-200 to low-cost carrier Ryanair. Then, on 18 June, the 737 Max 10 got airborne, kicking off a certification campaign that will lead to a first delivery in 2023.

AirTeamImages

Boeing has orders for 436 787s, with deliveries now approaching 1,000

Boeing



Max fleet has been brought back to service since December 2020

The Max programme faces several remaining hurdles, notable among those being China's recertification of the jet. When that might happen remains unclear; the process appears snarled in the broad US-China trade dispute. But China's approval is critical – the country's airlines will generate an expected 25% of the aerospace industry's growth in the next decade, Boeing chief executive David Calhoun recently said.

Making more

Ensuring the Max's success means more to Boeing than just about anything else. Of the 4,121 jets in Boeing's backlog at the end of May, 3,291 – 80% – were 737s (the majority being Max, with a small number being 737NG-based military surveillance jets), according to company figures. Boeing needs revenue from those deliveries to fund its future.

The company intends to ramp up 737 Max production to 31 jets monthly in early 2022. But the FAA remains involved. The agency still holds responsibility for issuing Max airworthiness certificates – the documents that clear individual aircraft to fly. The FAA took that duty from Boeing in 2019.

Additionally, as part of a 2021 settlement with the FAA, Boeing agreed to perform a safety risk assessment of its "readiness for increasing" Max production. The FAA will have the chance to evaluate Boeing's readiness ahead of production rate increases.

The US Federal Aviation Administration (FAA), which has taken keen interest in the problem, says the latest delivery halt came after the agency declined to accept a Boeing-proposed algorithm related to fuselage "shimming".

Shimming is one means of addressing the skin-flatness issue, Boeing has said.

The FAA requested Boeing provide data to support the algorithm, which would have freed the company from needing to individually inspect multiple components, says the FAA.

Complex composites

Neither the agency nor Boeing have disclosed more details, but the issues remind engineers and safety experts of complexities inherent in composite materials.

Composites require vastly different manufacturing processes than metals. They fail differently and require unique inspection and repair procedures, experts say. Composites are so complex they cannot be manufactured at rates high enough for narrowbody jets, which is why NASA is heading a programme to advance composite technologies.

Credit Suisse analyst Robert Spingarn notes that the fuselage issues are happening roughly a decade into the 787's production run. Why did the problems crop up now? Spingarn speculates that Boeing perhaps tweaked some aspect of production – after all, airframers are always adjusting processes in search of improvements. Perhaps such an adjustment created an unexpected issue.

But more broadly, Spingarn says, the fuselage troubles highlight "design and development" problems that seem ongoing at Boeing. The 787 programme trudged through battery issues last decade. Then came the 737 Max disaster. Meanwhile, Boeing delayed the 777-9 programme (first delivery is now scheduled for late 2023), citing factors including redesign of certain elements. The 767-based KC-46A military tanker has also suffered quality problems.

Amid the pandemic and delivery halt, Boeing had accumulated an inventory of about 100 stored 787s. Calhoun in June said it still hopes to deliver the majority of those jets in 2021, though he cautioned that the FAA's review creates some uncertainty.

Merluzeau suspects Boeing will not finish clearing the backlog until mid-2022 – later if the pandemic recovery stalls, or if travel remains locked down in countries and regions where the 787 shines, such as Australia, India and elsewhere in Asia.

A330-200F variant was met with fairly muted demand

Airbus

A350

Well worth freighting for

With its limited offering in the air cargo sector exposed during the Covid-19 crisis, Airbus is now weighing up its options for developing an A350 derivative

David Kaminski-Morrow London

Airbus has given its strongest signal yet that it is looking to revisit the dedicated freighter sector, in a bid to break a run of strategic missteps that have left rival Boeing virtually unchallenged.

When the airframer first showed off the A350 XWB family in July 2006, it featured a freighter version of the -900 variant. But the proposition has taken 15 years to emerge, with Airbus having experienced poor reception for its A330-200F and the stillbirth of the A380F in the interim.

"The freighter market has been put to the forefront during the pandemic because freight is the only thing flying in significant quantities," says Airbus chief commercial officer Christian Scherer. "It has exacerbated the fact that the freight market is underserved by Airbus." He claims customers have told the airframer that the A350, with its range, volume and operating costs, is a "really good platform" on which to develop a "fabulous freighter".

Key customers

"That's an important message to take into account," says Scherer. "To some extent we are now reacting to those market forces. I dare say we have some wind in our sails towards seeing the emergence of an A350 freighter as we consolidate our studies and our business case."

Some six months before it delivered its final A300-600F – to express cargo specialist FedEx in July 2007, exactly a year after unveiling the A350 – Airbus had committed to developing the A330-200F to compete against Boeing's 767-300F.

But while the 767-300F has secured more than 230 orders, just two customers – the express cargo integrators FedEx and UPS – have been central to its popularity, and Airbus was not able to convince them to defect to the A330-200F. Whether the A330-200F was unnecessarily capable, its price too high, or availability too low compared with the 767, Airbus was unable to replicate the success of its A300-600F in the integrator market.

This contrast was underlined recently when FedEx received its 100th 767-300F, and revealed that it was exercising options on another 20 of the type, taking to 48 the number to be delivered to it over 2022-2025, while the A330-200F backlog dropped to zero.

Just 38 A330-200Fs have been delivered across the type's entire customer base; barely half the number of aircraft ordered in the first year after its launch.

Airbus has not delivered a freighter for more than four years, following the handover of an A330-200F to Etihad Airways in February 2017, and its involvement in the freighter market has been more peripheral, through a participation in the conversion business.

Conversion therapy

Its EFW joint venture with ST Engineering has resulted in cargo modification programmes for the A330-300 and -200 – creating freighters with respective 61t and 60t payload capability – as well as conversions of the A321 and A320.

This venture had followed an earlier failed Airbus attempt to establish a conversion line for A320s with the involvement of EFW plus Russia's United Aircraft and Irkut.

Airbus has long been aware of its lack of presence in the freighter sector, a situation lamented by chief executive Guillaume Faury towards the end of April.

"I don't like the idea to remain weak on that segment in the future," he said. "Indeed we will be more aggressive. We believe we have the products to be able to be more aggressive in the future."

Creation of an A350 freighter might seem a logical step, given the Airbus rationale of developing the A350 to dent the dominance of the 777.

But the task is not straightforward. With 277 orders, the 777F has far outsold the passenger 777-200LR on which it is based, attracting interest from a diverse cargo customer portfolio.

Airbus, keen to avoid another misalignment with cargo customer requirements, will need to consider whether to pursue the original -900 freighter concept, producing a jet with around 90t payload capability, or aim for higher capacity.

Converting the larger -1000 instead might offer 20% more volume than the -900 – and more than the 650cb m (22,600cb ft) of the 777F – but the aircraft would also inevitably be more expensive than the Boeing product. The US company has not developed a 777-300ER freighter, but a -300ER conversion is becoming available.

The most radical idea would be to develop the A350 freighter with a tailored fuselage length, perhaps around 70m (229ft 6in) to position it midway between the two passenger variants. Such a decision would not be unprecedented; Boeing originally conceived the 747-8F as longer than the passenger 747-8, although the two eventually emerged with fuselages of the same length.

> "Indeed we will be more aggressive. We believe we have the products to be able to be more aggressive in the future"
>
> **Guillaume Faury Chief executive, Airbus**

Before the pandemic, Airbus had forecast a global demand for about 2,500 new-build and converted dedicated freighters over the two decades to 2038, with 60% of them intended for replacement – notably, a large number of Boeing MD-11Fs remain operational with cargo fleets – and 40% for growth.

But new-build aircraft would total some 850 jets, it predicted, and most of these would occupy the mid-size category. Airbus expected about 360 new-build freighters would be needed in the high-capacity category, with payload capabilities of more than 80t. Boeing has most recently estimated a need for 930 new-build freighters, split more or less equally between medium and large widebody models.

Airbus vice-president of programmes Philippe Mhun says an A350 freighter will be launched only "when launching conditions are met", without elaborating.

While the pandemic has generated an undeniable near-term surge in air-cargo traffic, less clear is the extent to which pre-crisis forecasts will need revising, and the degree to which the increasing focus on sustainability will influence Airbus's latest attempt to exorcise its freighter demon.

Airframer is still considering how best to reconfigure A350 as a specialist cargo aircraft

Airbus

S Ramadier/Airbus

A220

Proving its value

With air travel recovery likely to come first with smaller jets, acquiring the A220 programme from Bombardier now looks like a masterstroke by Toulouse

David Kaminski-Morrow London

One curious effect of the air transport crisis is that it has effectively pushed the sector back in time, resulting in a fleet technologically shaped to address the 2020s facing levels of demand that were last seen at the turn of the millennium.

"This industry, in a matter of a year, has lost something like 15 – if not more – years of growth," says Airbus chief commercial officer Christian Scherer.

Activity level might be back to that which existed when the Airb us A318 was entering service and the A319 was reaching peak deliveries. But Scherer believes the airframer's ability to pitch the 100- and 130-seat sectors with the A220 – an aircraft which was still an unlaunched Bombardier concept, the CSeries, at the time – will prove an advantage during the recovery of the single-aisle market.

"We had a very timid attempt in the past with the A318 in this category," says Scherer. "But we now have a family of products with A220-100 and -300 that clearly addresses the upper regional segment where Airbus wasn't really present before."

Neither the A318 nor rival Boeing's answer, the 737-600, sold more than 70-80 aircraft and the lower end of the single-aisle battleground has since become even tougher.

Airbus says successful A220 complements A320neo family

When Airbus re-engined its popular A319, it believed the updated aircraft would continue its predecessor's run of success, while consigning the CSeries, then a prospective competitor, to the status of also-ran.

But while the A319 and the 737-700 each managed to secure close to 1,500 orders, neither of their re-engined counterparts – the A319neo and 737 Max 7 – has been able to replicate these figures. The CSeries, however, took more than 400 orders under Bombardier and Airbus has added another 337 gross orders in the three years since acquiring the programme, now the A220, in mid-2018.

Crisis managed

Scherer believes the A220 hands Airbus an advantage in the current circumstances. While Airbus cut production rates of other aircraft in its portfolio, he points out, there was no such reduction for the A220 – the airframer only "adapted slightly downward the positive slope" for the type's ramp-up.

Airbus vice-president of programmes Philippe Mhun says the A220 was the "most active fleet in its segment during the crisis", claiming that a minimum 50% of delivered aircraft were still being operated at the lowest point, before the figure "very quickly" recovered to higher levels.

Carriers such as Air Canada, Delta Air Lines and Swiss were operating almost all their A220s by June, while keeping substantial numbers of A320-family jets parked.

The airframer plans to increase combined monthly A220 output from its Montreal Mirabel and Mobile, Alabama assembly lines from five to six aircraft in early 2022, and its aim is for 14 by around mid-decade.

"Our order book is pretty full, we have no issue in terms of open slots," says Mhun.

Although longer-range single-aisle aircraft have been able to encroach on routes traditionally plied by twin-aisle types, the use of smaller aircraft on such routes carries a potential comfort

> "This industry, in a matter of a year, has lost something like 15 – if not more – years of growth"
>
> **Christian Scherer** Chief commercial officer, Airbus

JetBlue says the A220 has 30% better cost-efficiency per seat than the E190

Airbus

penalty, requiring carriers to adapt single-aisle types to feature interior configurations suitable for longer-duration flights.

Radical interior reconfiguration is less of a consideration at the regional end of the scale, but Airbus believes the basic A220 already provides advantages by offering a tailored five-abreast aircraft rather than further stretches of narrow four-abreast regional jets or inefficient shrinks of larger six-abreast models.

"It's absolutely the reference in cabin comfort," says Scherer.

He believes that, although the A220 has "marginally higher" trip costs than its "direct competitor", by virtue of being 20-30 seats larger, customers will favour the range advantage and increased revenue generation potential.

"It clearly commands a value premium in the market," he says.

But it also shifts the competitive arena, pitching Airbus more directly against Embraer at a point where the Brazilian airframer remains without a strong partner after its proposed tie-up with Boeing suddenly collapsed last year.

Thinking big

Over the past three years – a period in which the Embraer E195-E2 and E190-E2 have entered service – the A220's net orders, under Airbus, have risen by more than 60%, while its backlog has increased by a third to nearly 500 aircraft. Customers have strongly backed the larger -300 over the -100, and a similar pattern has emerged at Embraer, where the E195-E2 has sold better than the E190-E2. Embraer's E2 backlog stood at 139 at the end of March.

New customer JetBlue Airways is taking the A220 to replace its older E190s. Chief financial officer Steve Priest says the carrier is "particularly excited about the outstanding economics", giving a figure of 30% better cost-efficiency per seat over the regional jet.

60%

Increase in orders for the A220 over the three years since Airbus acquired the programme

"This fleet will be pivotal to helping us reshape our cost structure and growing our margins," he adds.

Lufthansa Group carrier Swiss was the launch operator of the A220 during its period as the CSeries, and has built a fleet of 30 including both the -100 and -300 variants. The aircraft has the range to integrate smoothly with its A320 fleet, offering economical capacity options.

"We use our A220 and A320-family aircraft very flexibly on the entire short-haul network, according to demand, with very few exceptions for operational reasons," the carrier states, pointing out that the A220 is necessary for Swiss to access specific airports such as London City and Florence.

Scherer claims Chinese interest in the A220 from operators in regions "outside of the mainstream" routes, while the type has attracted interest from executive and premium operators interested in exploiting the long-range potential of low-density cabins.

Although Airbus has been enhancing the performance of the A220, with hikes in maximum take-off weight, it views the A220 and A320 families as separate products. Scherer says the lack of full commonality between the two types has "not proven to be a major handicap" and points out that there is "no such commonality" between upper-size regional jets and mid-size single-aisle aircraft.

"There are no plans to revamp or change the value proposition of the A220 or A320 to construct a common cockpit," he says. "That's not to say they won't converge over time, but there are no hard plans."

AirTeamImages

Air Canada had almost all its A220s in operation again by June

Embraer has pushed back entry into service for E175-E2 until 2024

Embraer

E-Jet E2

Scope for hope

Embraer has pushed back certification of its smallest E2-family member, but is confident that the jet will find favour with regional carriers

Pilar Wolfsteller Las Vegas

The smallest member of Embraer's E2 family, the E175-E2, has a long road ahead if it is to embark on the same path to success as its larger siblings, the E190-E2 and E195-E2.

The first Pratt & Whitney PW1700G-powered E175-E2 made its maiden flight on 12 December 2019, just weeks before the air transport industry was hit by the shock of the global coronavirus pandemic.

Since then, as airlines reconfigure fleets and plan post-Covid-19 strategies, Embraer has quietly pushed out the type's timeline to certification by three more years. The airframer hopes that changes in pilot contracts will allow it to sell the aircraft in the USA, the biggest regional jet market in the world.

And so far, Embraer has no firm E175-E2 orders.

"Demand for this segment of aircraft would naturally be high in the US, given the strong regional network already in place," says Daniel Galhardo Gomes, strategic marketing director at Embraer Commercial Aviation. "Of course, due to its heavier, but much more fuel-efficient engines, the aircraft doesn't meet current scope clauses – which is a huge missed opportunity environmentally."

Job protection

Scope clauses are passages written into contracts between major US airlines and pilot unions that limit the number and size of aircraft that may be flown by airlines' regional affiliates. They generally prevent carriers from farming out more flying to regionals – such as Mesa Airlines, Republic Airlines and SkyWest Airlines – thus protecting mainline pilot jobs.

Additionally, scope clauses largely prohibit regional affiliates from operating aircraft that have more than 76 seats or maximum gross take-off weights exceeding 39,000kg (86,000lb).

While the first-generation E170 and E175 did not exceed that limit, the E175-E2, with its heavier

Ian Dewar Photography/Shutterstock

Airframer is looking for a way round scope clauses that mean E2 variant is too big for E-Jet operators

P&W turbofan engines, is about 5,440kg over the maximum weight.

"Embraer recognises the uncertainty of the future scope clause scenario in the USA," Galhardo Gomes says. "Nevertheless, considering that all next-generation regional jets are heavier, mostly due to the larger, higher-bypass ratio engine, Embraer sees the 86,000lb [maximum take-off weight] scope relief as a natural step to allow airlines to benefit from new technologies and increase their efficiency in a highly competitive, low-margin industry. The environmental benefits should also not be overlooked."

The airframer touts the jet's increased fuel efficiency over older models, especially since the industry has committed to reducing its global greenhouse gas emissions to half of 2005 levels by 2050.

Launch ambitions

Embraer launched the E2 programme in 2013 at the Paris air show, building on its globally successful line of first-generation E-Jets, which include the GE Aviation CF34-powered E170, E175, E190 and E195.

Just three variants compose the E2 line-up: the 80-90-seat E175-E2, 97-114-seat E190-E2 and the 120-146-seat E195-E2. PW1700Gs power E175-E2s, while more-powerful PW1900G engines are used on the two other variants.

> "Embraer sees the 86,000lb [maximum take-off weight] scope relief as a natural step to allow airlines to benefit from new technologies"
>
> **Daniel Galhardo Gomes Strategic marketing director, Embraer Commercial Aviation**

Embraer also gave its E2s new wings and landing gears, and the company says 75% of all systems are new as well.

The E190-E2 entered service in early 2018 with launch customer Wideroe, in Norway, and the E195-E2 followed in September 2019 with launch customer Azul, the Brazilian airline founded by David Neeleman.

The E175-E2 now is unlikely to enter service until 2024, four years behind its original schedule.

At the 2013 Paris show, with the aircraft's launch, US regional carrier SkyWest announced a firm order for 100 E175-E2 jets, with an additional 100 options. That deal has since expired, Embraer says.

The E175-E2 has one more row of seats than the first-generation E175. It will burn 16% less fuel and save airlines 25% in maintenance costs, Embraer says.

Other markets

But even without the US market – into which it plans to continue to sell the lighter first-generation E175 – Embraer sees ample opportunity for the type in other regions.

"The US is not the only market for the E175-E2. In fact, we see relevant replacement opportunities in Europe, where the first-generation E175 is successfully operated by many carriers, as well as [the] Asia-Pacific, including China," Galhardo Gomes says.

Embraer has started sales campaigns in other parts of the world and expects to announce an E175-E2 launch customer soon.

The jet's certification campaign will be conducted with three aircraft, Embraer says. The first and second prototypes will be used for aerodynamic, performance and system tests, while the third will be outfitted with interior furnishings and used to validate maintenance tasks.

Embraer has not said how many E175-E2s it hopes to sell, but Galhardo Gomes says the company expects the model will be "as successful as the first-generation E175 along its lifecycle".

"This should give you an idea of our ambitions with this aircraft," he adds.

FlightGlobal
PREMIUM

Access all areas

Subscribe to FlightGlobal Premium

A FlightGlobal Premium subscription gives you all of the following, plus more:

- 24/7 unrestricted access to all FlightGlobal content, including our webinar series
- Premium Daily News Alert - get commentary on the key stories of the day
- Get unrestricted access to the FlightGlobal news archive
- Flight International magazine in print or digital format plus digital editions of Flight Dailies

Get unlimited access to all FlightGlobal content by upgrading to a FlightGlobal Premium subscription today.

Subscribe now at
FlightGlobal.com

A reduced volume of global flight activity should equate to fewer accidents being recorded, but the current slower rate of working also is providing the industry with extra thinking time around safety

Pause for thought

David Learmount London

Travel restrictions associated with the continuing Covid-19 pandemic mean that relatively little flying is taking place, so proportionately fewer fatal or serious accidents have happened so far in 2021 compared with the same period (January-June) in the pre-pandemic years.

The resulting slower pace in personal and working lives, however – including in commercial aviation – has given people time to question professional and private priorities. This may mean that the industry never entirely returns to its pre-pandemic operating philosophies. Indeed, it seems likely there will be an additional focus on specific safety priorities; a process that has already begun.

In the first six months of 2020, and again in the corresponding period this year, only four fatal accidents occurred worldwide: the joint lowest number ever. The first half saw only one of the fatal accidents involve a big jet – the remainder were turboprop aircraft.

But given that flying operations reduced worldwide in many of those months by between 90% and 50%, depending on the region, those figures mean very little on their own (*see figures for past decade, p66*). Similarly, the number of deaths – 102 and 77 respectively in the first halves of 2020 and this year – are low but unexceptional given the traffic reduction.

Paul Hayes, director of air safety and insurance at Cirium, describes the general commercial air transport safety situation now: "The airline industry's recovery following Covid-19 can be expected to result in a period during which threats to air safety are increased. This will need to be effectively managed. However, this situation will be transient and should have no significant negative impact on the long-term trend of improving airline safety."

He continues: "On average, globally, airline safety (measured by the fatal accident rate) is now three times better than it was only 10 years ago, and safety has increased by an order of magnitude in the last 30 years – more or less during a pilot's career."

In pointing out risks during the recovery period, Hayes refers to the need to prepare long-stored aircraft to fly again, and the challenge of providing furloughed crews with refresher training to return them to proficiency.

Storage risk

Some of the less obvious problems potentially involved in returning stored aircraft to service include, for example, an elevated risk of microbiological contamination of fuel, according to Conidia Bioscience's aviation manager Andrew Rushton. He explains that merely resuming normal fuel testing regimes might miss this type of biomass contamination. In any case, the airlines' operations, training and engineering departments will all be kept busy.

Meanwhile, the worst accident in this year's first six months, the Sriwijaya Air Boeing 737-500 crash off the coast of northern Java, Indonesia in January looks as if it may exemplify the main accident risk that airlines still face (*see listing, p67).*

By far the most common fatal accident cause globally for more than two decades has been crews losing control of aircraft that were perfectly controllable, even if aircraft faults had been the initial cause of their

The worst accident in the first half of this year involved Sriwijaya Air Boeing 737-500

Corvin Y O/Shutterstock

distraction. The two 737 Max 8 loss of control in-flight (LOC-I) crashes in Indonesia and Ethiopia, respectively in October 2018 and March 2019, involved complex technical causes for which specific pilot training had not been provided, but there were many LOC-I events involving multiple aircraft types in Indonesia, Asia, Africa and Russia over the past two decades.

Although the Indonesian air accident investigator of the Sriwijaya crash has not yet completed the full investigation, the circumstances established in its preliminary report suggest LOC-I is likely to have been the causal factor.

LOC-I as an accident category is, unfortunately, an established phenomenon. It shows no sign of being brought under control on a worldwide basis, despite the industry's awareness of it as as the greatest single killer of airline passengers and crews.

Even the USA, which normally would claim a good record on such issues, is not immune, as evidenced by a 23 April 2018 Atlas Air 767F crash in which the crew became disorientated, and the report noted a record of poor performance in training.

The fact that LOC-I accidents have already been eliminated by many airlines in some of the world's busiest aviation regions is evidence that the phenomenon can be beaten. The question is how to persuade the rest of the world that they can achieve the same.

Hayes describes the general situation neatly: "We laughed when the FAA [US Federal Aviation Administration] – in 1995 – announced a goal of 'zero accidents'. But, if we consider just fatal accidents alone, this goal is already being achieved by the vast majority of airlines every year. LOC-I accidents still happen, but none of these have been 'Acts of God', so there is certainly still scope for further improvement."

Basic skills

Hayes is not the only one to have identified this operational issue as needing attention. The Royal Aeronautical Society's (RAeS's) Flight Operations Group (FOG) ran a webinar in late June entitled: *Pilot Training: is it time to revisit the basics?* The issues addressed were summed up by the society like this: "It is not the number of accidents that is at issue here, it is the fact that so many of them were avoidable had the pilots used basic skills to recover from the situations they found themselves in. The lack of these skills raises the question as to whether the skills were ever in place, or whether this is evidence of skill fade due to an over-reliance on the automatics."

The conclusion suggested by the webinar contributors was primarily the former: the skills had not been instilled – or perhaps not consolidated – during training in the first place.

In the Sriwijaya accident, the left power lever is known to have retarded – probably automatically – during the early climb, but the crew appeared to take no account of the consequent asymmetric loss of power and its effect on the aircraft's performance.

77

Total deaths in aviation accidents in first six months of 2021

The aircraft was flying in instrument meteorological conditions owing to rain-bearing cloud with embedded cumulonimbus. When, about 5min after take-off, the autopilot could no longer hold the control forces caused by asymmetric power, it disconnected and the aircraft rolled rapidly left to a bank angle of 45°. Soon after this, it pitched dramatically nose-down and entered a high-speed descent to impact with the sea.

The failure of the crew to react to the developing situation during the climb is difficult to understand, unless it was because they had completely failed to monitor the engine and flight instruments. Then, when the aircraft rolled rapidly toward the left engine with its low power setting – the roll suggesting a flight condition close to a stall – the crew's failure to act to correct the aircraft's developing attitude, airspeed and power setting suggests that, by that time, they were so disorientated they could not recognise what needed to be done.

Even if this were the only recent fatal LOC-I accident the evidence of the crew's inability to manage the aircraft's performance would be worrying, but since it is one of many such events, the situation can no longer be ignored.

Human factors

A speaker at the RAeS webinar, Dr Kathy Abbott, a human factors specialist at the FAA, pointed out that pilots today need more training than their predecessors because of the increased technical complexity of the aircraft they fly. Unfortunately, many airlines have interpreted the provision of greater flight automation as a tool for reducing pilot workload, thus reducing the need for pilot training, especially in the cognitive and physical skills associated with manual flying – essential when the automation fails or disengages.

Also contributing to the webinar was aviation consultant and former British Airways and Ryanair training specialist Captain John Leahy. He recently co-authored – with RAeS FOG member Captain Robert Scott – a study for the RAeS journal *Aerospace* that sums up the training conundrum: "Pilot training has changed greatly in the last two decades. It is shorter in duration, with less flight time on real aircraft, less exposure to the stress of actual flight, and much of it computer-based. Simulator time is reduced in many cases to the minimum required to achieve certification."

Reliance on simulator-based training has been criticised

Vivooo/Shutterstock

Leahy and Scott continued: "Among the drivers for these reductions have been better automation and more reliable warning systems, resulting in aircraft that are considered to be easier to fly. Currently, pilot training is a combination of mastery of basic handling skills and the ability to manage complex automated systems, with an increasing emphasis on the latter. Thus, although management of automation has improved, less and less time is now spent on developing and maintaining the basic skills that are so necessary when automation fails or causes confusion."

Leahy and Scott are not the first to have called out this issue. But the question remains: how can the many airlines that persist with training their pilots to the absolute minimum legal standards be persuaded to do more, especially when accidents remain rare, however shocking they are when they occur?

Global standards

Leahy says the only solution he can suggest is that the world's leading airlines, which already choose to train to standards well above legal minima, need to take the lead as conspicuously as possible, setting standards for the global industry.

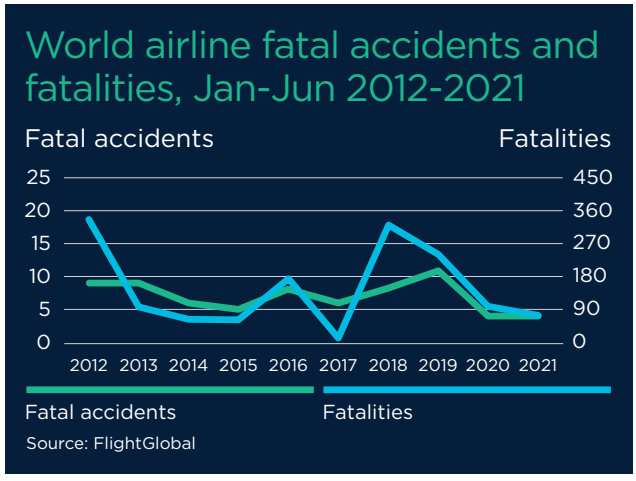
The travelling public are not stupid, he says, adding the observation that the 737 Max accidents have "woken the public up to the fact that aviation isn't perfect". They will notice, he suggests, that the carriers with high training standards simply do not have fatal accidents any more, while other airlines continue to crash.

There are examples from recent history that confirm dramatic improvement can be achieved. Between August 1997 and April 1999, Korean Air suffered four hull losses, two of them fatal, all of them involving jets, and three of them widebodies. Delta Air Lines, which had a code-share with Korean that it wanted to preserve – if possible – worked with the carrier to improve its safety management. For the last 22 years Korean has had no fatal accidents or hull losses.

Similarly, between November 1993 and May 2002 China Airlines suffered five hull losses of which four were fatal, and all were widebody jets. The Civil Aeronautics Administration in Taiwan then worked with international consultants and the US authorities to establish a safety management system culture, and since 2002 the carrier has had no fatal accidents.

The first six months of 2021 brought no brand-new safety lessons for the industry, but the thinking time conferred by the pandemic's effect on airline operations may yet motivate the action to eliminate LOC-I.

On the other hand, the financial strain imposed by an extended loss of earnings may tempt some airlines to do nothing. Vigilance is going to be important.



Dita Alangkara/AP/Shutterstock

There were no survivors of the Sriwijaya Air 737 crash in January

Fatal accidents:

Scheduled passenger flights

Date: 9 Jan ● **Carrier:** Sriwijaya Air ● **Aircraft type/registration:** Boeing 737-500 (PK-CLC) ● **Location:** In sea off northern Java coast, Indonesia
Fatalities (crew/pax): 6/56 ● **Total occupants (crew/pax):** 6/56 ● **Phase:** C

The aircraft took off normally at 14:35 local time from Jakarta International airport's runway 25R for a domestic flight to Pontianak, and began a wide right turn onto a north-westerly heading, initially cleared for unrestricted climb to 29,000ft, but later restricted to 11,000ft to avoid traffic. It was raining, overcast at 1,800ft, and there were cumulonimbus clouds in the vicinity. According to Indonesian accident investigation agency KNKT, just after the aircraft climbed through about 8,000ft the left power lever began slowly to retard and the engine N1 rpm to reduce, but this appears to have gone unnoticed by the crew. The right engine rpm and power lever remained where they were set. Shortly after that the crew requested a turn onto heading 075° to avoid weather, which was cleared, and a moment later the controller advised a temporary climb restriction to avoid traffic. Just over 5min after take-off the aircraft began an uncommanded turn left, and as it was climbing through 10,600ft the autopilot disconnected. The heading was 016°, pitch just above 4° nose up when the aircraft suddenly rolled left to a 45° bank. The left thrust lever was continuing to retard, the right lever still in the position the crew had set. The autothrust then disconnected and, with the nose pitched about 10° down, the aircraft entered a high-speed descent to impact with the sea. In the days before the accident, the autothrottle had twice been reported unserviceable, but the faults were written up as having been rectified with all deferred defects cleared.

Fatal accidents:

Non-scheduled flights

Date: 2 Mar ● **Carrier:** South Sudan Supreme Airlines ● **Aircraft type/registration:** Let L-410UVP (HK-4274*) ● **Location:** Near Pieri, South Sudan
Fatalities (crew/pax): 2/8 ● **Total occupants (crew/pax):** 2/8 ● **Phase:** C

The South Sudanese authorities report that one of the engines failed during the climb away from the departure airstrip at Pieri, then the other failed as the crew turned back to attempt a landing there.

*The registration HK-4274 is believed to have been counterfeit, as Colombian authorities had withdrawn it from use after the helicopter it originally identified was disposed of.

Date: 20 Mar ● **Carrier:** Aeronav Air Services ● **Aircraft type/registration:** Cessna 208B Caravan (5Y-JKN) ● **Location:** Near Marsabit, northern Kenya ● **Fatalities (crew/pax):** 2/0 ● **Total occupants (crew/pax):** 2/0 **Phase:** AA

The aircraft was chartered to carry out a flight from Marsabit to Nairobi, and set out on its positioning flight to Marsabit from Nairobi Wilson airport. It crashed into high ground in cloud at about the time it was due to start its descent.

Fatal accidents:

Non-passenger flights

Date: 16 Jun ● **Carrier:** Kin Avia ● **Aircraft type/registration:** Let L-410 (9S-GRJ) ● **Location:** Near Bukavu-Kavumu airport, Democratic Republic of Congo ● **Fatalities (crew/pax):** 2/1 ● **Total occupants (crew/pax):** 2/1 ● **Phase:** TO

Taking off for a short cargo flight (about 100nm/185km) to Shabunda with 1.6t of freight on board, the aircraft got airborne but came down about 3min later and hit the ground hard close to the airport. Both pilots and the one additional person on board were killed. The nature of the structural damage suggests an attitude at impact that was more or less flat, with little or no nose-up or nose-down pitch, and a low airspeed. The cargo consisted of sheet metal. According to Cirium fleets data the aircraft was first in service with the old Aeroflot in 1987.

Significant non-fatal accidents/incidents:

All commercial airline categories

Date: 4 Jan ● **Carrier:** Southern Airways Express ● **Aircraft type/registration:** Cessna 208B Caravan (N887MA) ● **Location:** Near Pittsburgh, USA
Injuries (crew/pax): 0/0 ● **Occupants (crew/pax):** 2/5 ● **Phase:** ER

The aircraft's belly luggage pod came open in flight. Contents or structure struck and damaged the aircraft's flaps and horizontal stabiliser. The pilot was able to maintain control and landed safely. The incident happened in darkness (06:02 local time) while the aircraft was operating a scheduled flight (FDY227) from Dubois, Pennsylvania to Pittsburgh.

Date: 16 Jan ● **Carrier:** Green Flag Aviation ● **Aircraft type/registration:** Antonov An-74 (ST-GFF) ● **Location:** Kidal airport, Mali
Injuries (crew/pax): 0 ● **Occupants (crew/pax):** ? ● **Phase:** L

Chartered by the UN, the aircraft overran the runway and suffered extensive damage.

Date: 19 Jan ● **Carrier:** West Atlantic ● **Aircraft type/registration:** Boeing 737-400F (G-JMCY) ● **Location:** Exeter airport, UK
Injuries (crew/pax): 0 ● **Occupants (crew/pax):** 2 ● **Phase:** L

Inbound on a domestic cargo flight from East Midlands airport, the aircraft landed so heavily on runway 26 that skin wrinkling in the fuselage just aft of the overwing exits was visible, and it was subsequently written off.

Date: 26 Jan ● **Carrier:** Pegasus Airlines ● **Aircraft type/registration:** Airbus A320 (TC-NBH) ● **Location:** Basel Mulhouse airport, Switzerland
Injuries (crew/pax): 0/0 ● **Occupants (crew/pax):** ?/? ● **Phase:** L

The aircraft, inbound from Istanbul on a scheduled passenger flight, developed a nosewheel fault which compelled the crew to land with the nosewheel locked at 90° to the direction of landing. Damage to the aircraft was slight.

Date: 1 Feb ● **Carrier:** Nippon Cargo Airlines ● **Aircraft type/registration:** Boeing 747-8F (JA13KZ) ● **Location:** Tokyo Narita airport, Japan
Injuries (crew/pax): 0 ● **Occupants (crew/pax):** 2 ● **Phase:** L

Inbound from Hong Kong Chek Lap Kok airport on a rainy night, the aircraft suffered a significant tailstrike while carrying out a go-around from its first attempt at landing on runway 16R. The pilots were able to land the aircraft safely on the second attempt, but the damage was found to be significant. Windshear is believed to have been a contributory factor.

Date: 10 Feb ● **Carrier:** Delta Air Lines ● **Aircraft type/registration:** Boeing 717 (N998AT) ● **Location:** Pittsburgh International airport, USA
Injuries (crew/pax): 0/0 ● **Occupants (crew/pax):** 5/72 ● **Phase:** G

While taxiing in snowy conditions, the flightcrew lost directional control as the aircraft was turning left from taxiway F towards runway 10R. The Boeing 717 subsequently ran part-way off the right side of the taxiway and its nose wheel continued a short distance down an embankment. The accident happened in darkness (18:29 local time) and reduced visibility in snow. The aircraft, which was operating a flight to Atlanta, Georgia, was found to have suffered minor damage as a result of the incident.

Date: 13 Feb ● **Carrier:** DHL Air (UK) ● **Aircraft type/registration:** Boeing 757F (G-DHKZ) ● **Location:** Near Leipzig, Germany
Injuries (crew/pax): 0 ● **Occupants (crew/pax):** 2 ● **Phase:** C

After taking off from Leipzig for Frankfurt at about 05:30 local time, the crew were warned during the climb that the forward cargo door was open. They elected to return to Leipzig and landed safely on runway 08L.

Date: 14 Feb ● **Carrier:** Manta Air ● **Aircraft type/registration:** Viking Air Twin Otter floatplane (8Q-RAE) ● **Location:** Velana International airport (water), Male, Maldive Islands ● **Injuries (crew/pax):** 0/0 ● **Occupants (crew/pax):** 3/6 ● **Phase:** L

The Twin Otter floatplane, inbound from one of the Maldives' many tourist resorts, overturned on its water landing. All on board were able to escape the aircraft safely and were rescued. The aircraft suffered major damage.

Date: 16 Feb ● **Carrier:** Azman Air ● **Aircraft type/registration:** Boeing 737-500 (5N-SYS) ● **Location:** Lagos International airport, Nigeria
Injuries (crew/pax): 0/0 ● **Occupants (crew/pax):** ?/? ● **Phase:** L

All four tyres on the aircraft's left main undercarriage failed during the landing on runway 18R at Murtala Muhammed International airport, with debris apparently being ingested into the No 1 engine, but the aircraft came to a halt safely. It was daylight (17:58 local time) with rain and a gusting crosswind from the left. The aircraft was operating a scheduled flight from Abuja.

Date: 20 Feb ● **Carrier:** United Airlines ● **Aircraft type/registration:** Boeing 777 (N772UA) ● **Location:** Near Denver International airport, USA
Injuries (crew/pax): 0/0 ● **Occupants (crew/pax):** 10/231 ● **Phase:** C

The aircraft's No 2 Pratt & Whitney PW4000 engine suffered a multiple fan blade failure as it was climbing through about 12,500ft at 280kt (518km/h) after take-off from runway 25 at Denver International airport. Following the failure the engine's inlet and fan cowl detached and broke away, falling in the residential district of Broomfield some 30km northeast of the airport. The falling debris damaged the roof of a house and a parked vehicle. A fire broke out in the aft section of the engine and continued to burn until put out by the airport fire service after it returned to Denver and landed safely. The incident happened in daylight (13:07 local time), and VMC. The aircraft was operating a flight to Honolulu, Hawaii. Further investigation identified multiple fatigue fracture origins on the interior surface of a cavity within one blade, and a second blade had also failed but in overload. When the blade failed, the engine had been in service for 2,979 flight cycles since its previous inspection. It had undergone thermal acoustic image inspections in 2014 and 2016, and the 2016 data had been re-examined in 2018 following a similar in-flight failure that year of another PW4000.

Date: 26 Feb ● **Carrier:** LAM Mozambique Airlines ● **Aircraft type/registration:** Boeing 737-700 (C9-BAR) ● **Location:** Quelimane airport, Mozambique ● **Injuries (crew/pax):** 0/0 ● **Occupants (crew/pax):** ?/? ● **Phase:** L

Inbound from Maputo, the Boeing 737-700 veered off the left side of runway 18 and came to a halt on the grass just past the high-speed turn off at the end of the runway. The incident happened in daylight (14:40 local time), but rainy conditions are likely to have been a factor. Runway 18 has an 1,800m (5,900ft)-long asphalt surface, which was wet from recent heavy rain.

Date: 6 Mar ● **Carrier:** Batik Air ● **Aircraft type/registration:** Airbus A320 (PK-LUT) ● **Location:** Sultan Thaha airport, Jambi, Indonesia
Injuries (crew/pax): 0/0 ● **Occupants (crew/pax):** 6/117 ● **Phase:** TO

After the crew selected the gear up after take-off, a nose landing gear fault on the aircraft led the gear to jam facing 90° from the direction of travel. The crew elected to return to Sultan Thaha airport and land. Damage was slight.

Significant non-fatal accidents/incidents:

All commercial airline categories

Date: 11 Mar ● **Carrier:** Transcarga International Airways ● **Aircraft type/registration:** Airbus A300F (YV560T) ● **Location:** Maiquetia, Venezuela
Injuries (crew/pax): 0 ● **Occupants (crew/pax):** 3 ● **Phase:** TO

The crew aborted take-off when the left GE Aviation CF6 engine suffered an uncontained failure. A disk failure, believed to be a turbine disk, detached and hit a workshop at the airport. The aircraft was delivered to Eastern Airlines in 1983 and began operating with Transcarga in 2014.

Date: 12 Mar ● **Carrier:** Grant Aviation ● **Aircraft type/registration:** Cessna 208B Caravan (N407GV) ● **Location:** Chevak airport, Alaska, USA
Injuries (crew/pax): 0/0 ● **Occupants (crew/pax):** 1/3 ● **Phase:** TO

The pilot began the take-off run for a scheduled domestic service, but then elected to abandon the attempt because of a combination of an icy runway surface and crosswind. The aircraft swerved off the runway and rolled onto a wingtip, sustaining considerable damage.

Date: 20 Mar ● **Carrier:** Trigana Air Service ● **Aircraft type/registration:** Boeing 737-400F (PK-YSF) ● **Location:** Jakarta International airport, Indonesia ● **Injuries (crew/pax):** 0 ● **Occupants (crew/pax):** 4 ● **Phase:** L

The aircraft was operating a cargo flight from Halim Perdanakusuma International airport, Jakarta to Sultan Hasanuddin airport, Makassar. Just before lift-off or during the initial climb after take-off, the right engine failed. The crew stopped the climb at 3,000ft and elected to return to Jakarta. The aircraft subsequently landed on runway 24 at Halim airport but touched down hard (1.79*g*) with some lateral drift, right wheel first. Shortly after touchdown, the right main undercarriage collapsed. Directional control was lost and the aircraft ground looped off the left side of the runway; coming to rest on the grass beside the runway on its belly. Tyre marks on the runway suggest that the right main wheel may have been shimmying during the short time between touchdown and the failure of the right main undercarriage. The accident happened in daylight (11:26 local time); weather, wind 060°/6kt, visibility 3,000m in haze, cloud, few at 2,000ft and temperature 32°C (90°F).

Date: 16 Apr ● **Carrier:** Lake Clark Air Services ● **Aircraft type/registration:** Beechcraft C99 (N991AK) ● **Location:** Chignik Lagoon airport, Alaska, USA ● **Injuries (crew/pax):** 0/0 ● **Occupants (crew/pax):** 2/9 ● **Phase:** L

The aircraft's right main undercarriage struck an obstruction on the runway, failed and collapsed during the landing roll. The occupants escaped unhurt.

Date: 27 Apr ● **Carrier:** ASL Airlines Belgium ● **Aircraft type/registration:** Boeing 737-400SF (OE-IAJ) ● **Location:** Porto airport, Portugal
Injuries (crew/pax): 0 ● **Occupants (crew/pax):** 2 ● **Phase:** TO

The aircraft was cleared for its night take-off from runway 35 while an inspection vehicle was still on the runway close to its far end, but motoring south toward the aircraft taking off. At the aircraft's unstick point, Portuguese investigators have established the 737 was about 300m laterally from the Follow Me car, which had been cleared onto the runway some 10min before take-off clearance was passed to the aircraft, and was carrying out its fourth runway inspection of the day. The car driver called the tower to ask about the lights he could see approaching, and was told to clear the runway to the left. The ASL flight was operating for FedEx.

Date: 10 May ● **Carrier:** Uni Air ● **Aircraft type/registration:** ATR 72-600 (B-17010) ● **Location:** Matsu Nangan airport, Taiwan
Injuries (crew/pax): 0/0 ● **Occupants (crew/pax):** 4/70 ● **Phase:** L

The aircraft undershot its final approach to runway 21 at Matsu Nangan airport, Nangan Island, Taiwan and its right main undercarriage struck a concrete wall just short of the runway. A go-around was performed and the aircraft returned to Taipei where a safe landing was made some time later. The accident happened in daylight (10:07 local time), wind 170°/5kt, variable between 140° and 210°, visibility 4,000m in mist and cloud, scattered at 300ft and broken at 2,500ft. The aircraft was operating a flight from Taipei.

Date: 12 May ● **Carrier:** Key Lime Air ● **Aircraft type/registration:** Swearingen Metro II (N280KL) ● **Location:** Denver-Centennial airport, USA
Injuries (crew/pax): 0 **Occupants (crew/pax):** 1 ● **Phase:** RA

The aircraft collided with a Cirrus SR22 (N416DJ) while on final approach to runway 17L at Centennial airport, Denver, Colorado. The collision occurred as the aircraft was descending through 6,400ft above mean sea level (515ft above ground level), on the extended centreline of the runway but about 3nm from its threshold. The SR22 had been cleared for a visual approach to the parallel runway 17R and its pilot had apparently been warned about the other traffic on approach to runway 17L. However, it would seem that the SR22 overshot the turn onto final approach to runway 17R and collided with the Metro. The centrelines of the two runways are only 200m apart, although their thresholds are displaced. That of runway 17R is about 600m further south than 17L. Although the aircraft was very badly damaged, the Metro pilot was able to maintain control of the aircraft and landed safely. The pilot of the SR22 used the aircraft's ballistic parachute recovery system to slow its descent and it crashed near Cherry Creek Reservoir, to the north of the airport. All on board both aircraft survived.

Date: 20 May ● **Carrier:** Fly Air Africa Aviation ● **Aircraft type/registration:** Antonov An-26 (3X-APL) ● **Location:** Near Bor, South Sudan
Injuries (crew/pax): 0 ● **Occupants (crew/pax):** ? ● **Phase:** ER

The aircraft's left propeller broke away in flight near Bor, South Sudan while it was en route from Juba to Paloich. The pilot maintained control and returned to Juba for a safe landing. The accident happened in daylight (14:30 local time) and in VMC.

NTSB

PW4000 engine of United Airlines 777 suffered uncontained failure in February

Notes on tables

Data comes from *Flight International*'s research in association with Ascend by Cirium, which compiles the *World Aircraft Accident Summary*, among other safety analysis products. In many countries, details of non-fatal incidents are not made available officially, but *Flight International* continues to list known significant incidents to maximise the availability of relevant information. We accept that the non-fatal listing may be weighted against the airlines of those countries that make safety information more readily available.

Glossary of terms and abbreviations
AA airfield approach/early descent ● **ATC** air traffic control
C cruise ● **EGPWS** enhanced ground proximity warning system
ER en route ● **G** on ground ● **ILS** instrument landing system
IMC instrument meteorological conditions ● **L** landing ● **RA** runway approach ● **TO** take-off ● **VMC** visual meteorological conditions

What long-term damage has the pandemic done to the aviation industry's production chain? And will managing the recovery be as much of a challenge as coping with the sudden collapse in demand?

Building back

Murdo Morrison London

Airbus monthly shipments at their second highest since the pandemic; Boeing 737 Max airliners flying out of Renton; packed airport terminals in the USA; and Mediterranean beaches busy again. Headlines in recent weeks must be giving commercial aerospace suppliers hope that – if not actually over – it is the beginning of the end for the industry's deepest crisis since the Second World War.

But what will be the long-term effect of almost 18 months – and likely many more – of lockdowns, international travel bans, aircraft groundings, and delayed and cancelled orders on a global supply chain that only at the start of last year was preparing its factories and workforces for an historic ramp-up in single-aisle production?

Sudden shock

It was the suddenness of the shutdown that was toughest to cope with. Although the shocks that followed 9/11 and the global financial crisis were dramatic, their impact was more gradual. This time, a commercial aerospace sector at full canter was over the course of a few weeks faced with a situation where most airliners in the world were parked, and no-one wanted or needed its products.

Despite this, perhaps the most surprising outcome has been that – as with airlines – there have been remarkably few business fatalities. Despite the trapdoor drop in demand from the two big airframers immediately after March 2020 – and this on top of the impact of the Max grounding – no high-profile suppliers and only a handful of small and medium-sized enterprises (SMEs) have gone to the wall.

This is largely down to three factors. Firstly, government support schemes have provided emergency loans, tax relief, and employee furlough payments. Secondly, after a pause, Airbus resumed monthly production rates only marginally down on 2019. And lastly, military programmes have been largely unaffected by the pandemic, cushioning suppliers with customers in that sector.

Spirit AeroSystems

Major Boeing supplier Spirit AeroSystems says 2020 brought unprecedented challenges to its business

Airbus

Airbus output levels are cited as a key factor in the survival of European supply chains

"Defence has really kept us going, and sales have actually been up over the past year"

Phil Hart Executive chairman, MEP

"If it wasn't for defence, I don't think we'd be having this conversation," remarks Phil Hart, executive chairman of MEP, a family-owned UK build-to-print manufacturer of complex metal and plastic components for avionics and electrical equipment. The company employs 39 people, and customers include BAE Systems, Collins, Safran, and ejection seat maker Martin-Baker.

Before the crisis, Aylesford, Kent-based MEP's turnover of around $5 million was split roughly equally between defence and commercial. In this financial year, Hart expects revenues to be down by a third, entirely due to the fall in the commercial market. "Defence has really kept us going, and sales have actually been up over the past year," he says.

In Germany, where Airbus accounts for about 70% of the supply chain's revenues, the airframer's decision to keep narrowbody output at rate 40, the A350 at rate five, and the A330neo on rate two has been crucial, maintains Volker Thum, managing director of the German trade association, BDLI. "We have to give a big thank you to Airbus," he says. "They have helped to give SMEs a future."

Christophe Cador, president of the SME division of France's GIFAS trade body, also attributes the survival of all but a small number of already-troubled aerospace firms in that country to Airbus maintaining healthy production rates, something that has also helped suppliers to Safran, which produces, with GE Aviation, the CFM International Leap-1A for the A320neo family.

Supplier stability

"The OEM has been fully transparent. They did what they promised us 14 months ago [after France's first lockdown was relaxed]," says Cador, who is chief executive of aircraft and railways interiors specialist Satys. He contrasts this "stability" for Airbus's suppliers with the impact on Boeing's manufacturing base of a production decrease that was exacerbated by the Max grounding.

The pandemic has spread red ink over the accounts of tier ones on both sides of the Atlantic. Spirit AeroSystems, a major Boeing supplier, lost $171 million in the first quarter of 2021. That followed a 2020, described by chief executive Tom Gentile, of "unparalleled challenges to our business", in which revenues more than halved to $3.4 billion and Spirit recorded a net loss of $870 million.

In the UK, Chinese-owned Gardner Aerospace revealed late last year that revenues for the first nine months of 2020 had fallen by 45%, pushing the previously profitable and fast-expanding aerostructures ❱

Boeing

Max's return to service has helped ease pain for many Boeing suppliers

company into a loss and prompting it to close plants and seek financial support from UK and French governments. Its most optimistic outlook sees a recovery to 2019 levels by 2024.

One of France's biggest tier one suppliers, Latecoere, was forced to shed 1,000 jobs during 2020 in a restructure designed to ensure its "long-term competitiveness". However, the Toulouse-based company pressed ahead with a commitment to buy Bombardier's Mexican wiring business for $45 million, closing the deal early this year.

Repercussions could have been worse for aerospace had it not been for government intervention and the hedging provided by sectors such as defence, space, and helicopters. This includes in the USA, where successive Covid-19 relief packages from the Trump and Biden administrations, coupled with other targeted assistance schemes, have helped keep companies afloat.

The pandemic on the heels of the Max crisis was a "double whammy" for US industry, but moves by the Department of Defense to expedite supplier payments, and this year's Aviation Manufacturing Jobs Protection Act, which offers payroll assistance to affected companies, have softened the blows, says Rich Efford, the Aerospace Industries Association's (AIA's) assistant vice-president for legislative affairs.

With Max deliveries having resumed and the domestic air travel market rebounding strongly, Efford says AIA members who rely on the commercial aviation sector see recovery ahead, albeit one that is "bumpy". Worries remain, however, about a still stagnant business and international air travel market, he adds.

North of the border, Ottawa has also promised its aerospace sector specific aid to the tune of C$2 billion ($1.6 billion) over the next seven years. Aside from manufacturers such as Bombardier and Airbus, the Montreal and Toronto regions are home to a host of aerospace suppliers such as Pratt & Whitney Canada, CMC Electronics, Heroux-Devtek and Magellan, as well as training giant CAE.

"Aerospace has been a driving contributor to Canadian prosperity for decades, providing nearly 235,000 highly-skilled, well-paying jobs and over $28 billion annually to our nation's economy," says Mike Mueller, chief executive of the Aerospace Industries Association of Canada. In addition to the C$2 billion package, he is calling for a government-backed "national plan" to lead industry recovery.

Government support

The BDLI's Thum pays credit to his government for helping companies retain key staff by funding part-time working. But he also attributes the sector's ability to ride out the crisis – he knows of just one firm that has gone bust – to a culture among family-run SMEs to own outright their machinery and buildings, and remain debt-free. "They have not been caught by fixed-cost payments," he says.

In France, a "charter" that emphasis OEMs' responsibility to support domestic SMEs, and a GIFAS initiative to identify and help at-risk suppliers have been crucial to keeping the supply chain intact throughout the crisis, believes Cador. Government loans of up to 25% of revenues, issued within four weeks and

repayable over five years, have also helped firms deal with cash shortages, he says.

Many UK aerospace companies have been shielded from the worst of the commercial aviation downturn by the defence, security and space markets, which have been "substantially more resilient", says Kevin Craven, chief executive of trade body ADS. In fact, according to the latest ADS member survey, combined industry turnover remained constant at £79 billion ($110 billion) in 2020.

However, despite a "cautiously optimistic" mood, UK aerospace suppliers have had to deal with an additional disruption: Brexit. Apart from some initial problems, the country's official withdrawal from the EU in January this year has not perhaps created the unmanageable tangle of red tape for importers and exporters that some predicted, suggests Craven.

But it does affect aerospace firms in Northern Ireland, and those in the rest of the UK doing business with them. Under a quirk of the Northern Ireland Protocol between the UK and EU, raw materials moving between the British mainland and the province are subject to tariffs in case they end up in the EU as a result of the "invisible border" with the Republic of Ireland, an EU member.

As a result, ADS estimates Northern Irish producers – they include Spirit AeroSystems (formerly Bombardier) and seating manufacturers Collins and Thompson, along with dozens of SMEs – could face additional costs of £65 million a year. Although rebates can be claimed if it is shown that raw materials were used solely for manufacturing, ADS expects that to add significant paperwork costs.

Craven also hopes a government pledge to create a net-zero economy by 2050 will boost the industry. "There is a genuine opportunity for the UK aerospace sector to be a world leader in terms of new technologies, and an emerging alignment between us and the government on the roadmap to get us there," he says. "It won't be instant, but it may be an element that will help recovery."

However, last November, European trade body ASD highlighted another risk of a prolonged slump in revenues and profitability. Chinese and other state-backed investors could see it as a chance to expand their influence in Europe's aerospace sector with acquisitions, with implications for sovereignty and security. The organisation wants a "European fund" to "stabilise the supply chain".

> "Cutting costs and reducing business size is often the easy bit. You can take drastic measures to save costs. Growing again is what's very hard."
>
> **Alex Krutz** Patriot Industrial Partners

Avoiding disaster

The world's aerospace sector may have, by and large, avoided disaster over the past year-and-a-half, but the rebound from a crisis can be just as problematic for companies as a downturn, suggests Alex Krutz, who runs the Patriot Industrial Partners consultancy. Chief among the risks is liquidity – finding the cash to invest in machinery and increase production when reserves are at rock-bottom.

Other challenges include inflationary pressures on raw materials, equipment and staff costs, he says. And, after a period of retrenchment, where many seasoned employees have been laid off, bringing workforces back up to strength is not always straightforward, as many of these skilled and experienced staff will have retired or moved to other sectors.

"Cash is king and is definitely risk number one," he says. "Lead times for the likes of castings can be nine to 15 months, so when the ramp-up does happen, that cash outlay will be a challenge." He adds: "Cutting costs and reducing business size is often the easy bit. You can take drastic measures to save costs. Growing again is what's very hard."

Hart at UK SME MEP agrees. After an effort to manage costs, the company has managed to remain profitable through the first three quarters of its current financial year, and he plans to keep it that way. "We have seen an increase in demand [from the commercial sector]. All our team members are back working five days," he says.

"We are reasonably confident that in the latter part of 2021 and through 2022 we will continue a very gradual growth. We don't expect to be back to pre-Covid levels for some time, but for us it's not about wanting a massive increase as that would create its own set of problems. We are happy to manage for now with our current staff, and keeping an eye on our cash flow."

The aerospace supply chain has survived the initial onslaught of Covid-19 but, as airliners return to the skies, recovery may be cautious, especially when it comes to investment and rehiring. Demand for flying will come back, but long-term changes to travel habits prompted by the pandemic are still to be understood. For suppliers, there are many months, perhaps years, of uncertainty ahead.

Latecoere

French tier one Latecoere is one of many large suppliers forced into making drastic job cuts

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

Must-have Mustang

The North American P-51 Mustang was a scourge of the Luftwaffe in the Second World War. Now, the first serial example of a German-designed 70% scale replica of the type has flown for the first time.

ScaleWings says its SW-51 is a near-perfect copy of the iconic fighter, down to the hand-riveted finish, and a modernised version of the 1940s cockpit. However, although the structure looks like the polished aluminium of the original, it is in fact 100% composite.

Aircraft 001 completed a 35min sortie from Mlada Boleslav airport in the Czech Republic on 20 May. It followed a flight of a proof of concept version seven years ago.

Since then ScaleWings has been working on industrialising the programme at a plant in Poland, capable of producing 60 examples a year, and pitching the Rotax-powered ultralight to the leisure and aerobatic markets. It is priced at up to €300,000 ($355,000). The SW-51 is also available in kit form.

The Bavarian company is also looking for investors to launch the aircraft stateside this year, with the rallying call: "Let's bring the Mustang home to the US!".

ScaleWings

Back to the future

Motorbuch Verlag

Going nowhere

An invite from the group Sustainable Aviation to the launch of the UK aviation sector's first decarbonisation targets notes that "since making its net zero pledge in February 2020, the UK aviation industry has continued to make exciting progress towards decarbonising aviation".

Presumably, the fact that much of its fleet has been sitting idle since March 2020 has helped.

Comeback quads

Lufthansa plans to bring five of its furloughed Airbus A340-600s back into service, citing expected buoyant demand for first-class and other seats on long-haul routes from Munich next year.

The German carrier retired the quadjets from service at the start of the pandemic, saying it was highly unlikely they would make a return.

Should we call that a lack of four-sight?

From the archive

100 75

1921 Shackleton's scout

When shortly the *Quest*, the ship in which Sir Ernest Shackleton and his companions are about to set out on their journey of exploration, slips her moorings near London Bridge, she will carry under her bridge a small two-seater seaplane, which it is intended to use for photographic survey work on the Antarctic journey. That the seaplane offers great possibilities for this class of work is not to be doubted. It provides a platform from which many miles of country (or sea) can be surveyed, and it is able to cover distances in as many hours as previously took weeks with dog-sledges. It appears to us that it might be found useful, when the ship approaches ice-floes, for sending out to find, like a sort of modern dove from the ark, open "lanes" through which the ship may proceed.

1946 Research investment

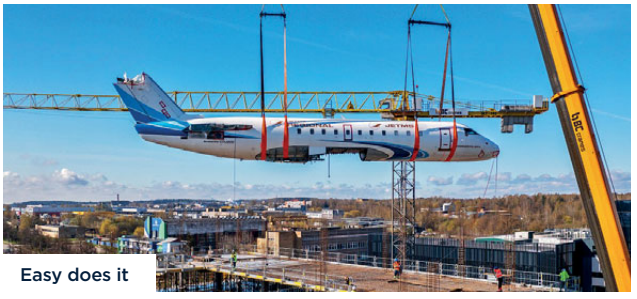
There is cause for a good deal of satisfaction with the plans for the new National Aeronautical Establishment near Bedford. The estimated cost of £20 million will possibly appear high to many, but it may well prove inadequate. Aeronautical research has never been generously treated here, but if this country is to retain a leading position in the air (and unless it does it is finished as a world factor), it is vitally necessary that the numerous problems which now beset the aircraft designer be solved as soon as possible. Fortunately, those responsible are, we believe, fully alive to this fact, and our scientists will, if given the necessary support, ensure that the new National Aeronautical Establishment shall have the technical means for giving the designer the answers to his queries.

Not too big to fail

Vertical landing

Visitors to the new offices of aviation group Avia Solutions in Vilnius, Lithuania will spot an interesting feature in its entrance hall – a Bombardier CRJ200.

The decommissioned regional jet was lowered by crane into in the atrium of the eight-floor complex, during its construction, by Avia's maintenance, repair and overhaul subsidiary JET MS. It might give rise to a local riddle: what building is square, but has two wings?



Avia Solutions

Easy does it

Leahy's late verdict on A380

We take our hats off to Andreas Spaeth, who has managed to pin down an interview with former Airbus sales supremo John Leahy for his new book on the A380.

Leahy – rarely out of the headlines during his long stint in Toulouse – has kept a low profile since his retirement in 2018 and move to Miami.

A champion of the superjumbo, who at least once persuaded his board colleagues to offer the largest ever airliner a stay of execution, Leahy says certain customers and the engine manufacturers contributed to its commercial failure.

Operators including Singapore Airlines "interfered with the design," he tells Spaeth. "Too much weight was built into the airplane", based on the premise that Airbus would launch a stretched A380-900.

"That was clearly a design mistake that we made," he says.

He adds that Airbus was "blindsided" by the engine manufacturers, who promised that it would be 10 years before new powerplants offered a step-change in efficiency.

However, three years after the A380's launch in 2000, the Boeing 787 was launched with GE Aviation and Rolls-Royce powerplants offering a 12% improvement on the A380's engines. "Can you imagine the success of the A380 if it had 12% better fuel burn?" asks Leahy, ruefully.

Unfortunately, non-German speakers will have to wait until towards the end of the year for an English version of the book, whose sub-title translates as "the last giant".

With 224 pages in the German edition, the 1kg coffee table tome is a genuine heavyweight, just like its subject.

50 25

1971 Moving on the Moon

Perhaps the most impressive aspect of the day was the outstanding amount of work achieved by the astronauts. This is thought to have been facilitated by a combination of factors. Most effective were the resting periods offered by the rover. Knowledge of economic movement on the Moon acquired from previous missions was thought to be an important contributor and certainly the new space suits, with their more flexible joints, did much to alleviate strain. Nevertheless, both Scott and Irwin were fatigued at the end and were found to have used some 17 per cent more oxygen than anticipated. It was feared that the second EVA would have to be trimmed by half-an-hour because of this. "Well," responded Scott, "I'll breathe a little less tomorrow."

1996 Behind blue ice

British Airways hopes to slash the cost of implementing US airworthiness directives concerning the formation of "blue ice" on aircraft, with a testing device developed by Aaxico Industries of the UK. The FAA ADs, which initially apply to the McDonnell Douglas DC-10 and Boeing 727, require that toilet-drain and flush-fill valves are regularly tested for any leakage of sewage. Blue ice forms when leaking fluid freezes at cruising altitude, breaking off in lumps as the ambient temperature rises during descent. This poses a safety hazard to the aircraft's structure and engines, and people and property on the ground. Aaxico's Blister (blue-ice tester) is designed to eliminate the expensive need to pressurise aircraft on the ground to check for leaks.

Regular volcanic eruptions put vast amounts of CO2 into the atmosphere

Francesco Campo/Shutterstock

Emissions: impossible?

It is an interesting time, with your magazine reporting on all these creative technological challenges to engineer more fuel-efficient turbofan and open rotor engines (*Flight International*, July 2021), develop hydrogen- and electric-powered aircraft, create less carbon-based synthetic fuels, and so on, all designed to lower CO2 emissions and help reduce global warming.

However, without any help from us, last year 73 active volcanoes were reported erupting, and this year 42 are erupting right now. That is putting more CO2 and sulphur dioxide in our atmosphere than humans have generated since we discovered fire.

Maybe the UN's Paris Agreement participants should include nature when looking to tackle climate change?

Peter Parsons
via email

Editor's reply: The pandemic and associated massive reduction in flying has given us all pause for thought about the environmental impact of our life choices, including air travel. Managing tectonic activity and associated volcanic emissions are clearly beyond our control, so we will continue to focus on the exciting developments and innovations that appear poised to change the industry much sooner than we all might have previously expected.

Danger money

After reading about the pending arrival of Alitalia's successor (FlightGlobal.com, 15 July 2021), I was left asking myself the question: Will the ITA pilots still be paid 'danger money'?

The very outdated bonus that was previously included in Alitalia's pilot remuneration survived well beyond its sell-by date, and must have contributed to its financial woes.

Dr Peter Sander
Hythe, Kent, UK

Massimo Insabato/Shutterstock

Still a risky business?

Outdated view

I was surprised you published the letter 'Family first' (*Flight International*, June 2021). I thought it should have appeared elsewhere in the issue, within the Straight & Level section's 'From the archive' column: perhaps from 1946?

Women are put off from careers in aviation by such sexist, misogynistic and out of date views.

Most children have fathers as well as mothers, and these days fathers often share child-rearing duties.

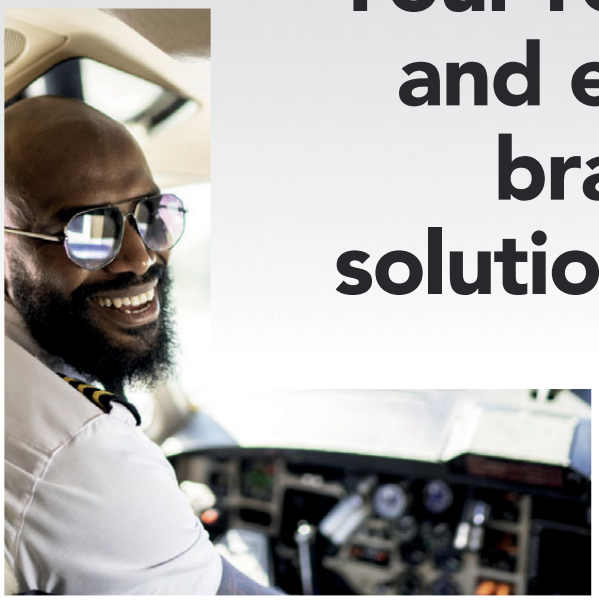
Name and address supplied

Editor's reply: Our disclaimer text at the foot of this page states that published correspondence does not necessarily represent the views of the editor. It is not our intention to censor opinions. While the views expressed in this instance would not be held by all, they are unlikely to be unique – and serve to illustrate the very real challenges that remain as the industry strives to address its gender imbalance.

We welcome your letters about our coverage, or any other aerospace-related topic. Please email flight.international@flightglobal.com, or write to: The Editor, Flight International, 1st Floor, Chancery House, St Nicholas Way, Sutton, Surrey, SM1 1JB. Letters should be no longer than 350 words in length, and supplied with the correspondent's name and location. Letters may also be published on FlightGlobal.com, and do not necessarily represent the views of the editor.

FlightJobs

Your recruitment and employer branding solutions partner



These are exceptional times. When you're ready to discuss your next recruitment campaign the FlightJobs team will be here to help you.

Take advantage of our **25% discount offer** that runs until 30 September 2021.

Get in touch now by emailing recruitment@flightglobal.com
or visit recruiters.flightglobal.com

@flightjob
@flightglobaljobs
FlightJobs

EDITORIAL

1st Floor, Chancery House, St Nicholas Way, Sutton, Surrey, SM1 1JB, UK

flight.international@flightglobal.com

Editor Craig Hoyle
+44 7795 486691
craig.hoyle@flightglobal.com

Deputy Editor Dominic Perry
+44 20 8912 2164
dominic.perry@flightglobal.com

Head of Strategic Content
Murdo Morrison FRAeS
+44 20 8722 8389
murdo.morrison@flightglobal.com

Consulting Editor David Learmount
+44 7785 901787
david.learmount@ntlworld.com

Contributing Editor Mark Pilling
markpilling55@gmail.com

Magazine Enquiries
flight.international@flightglobal.com

AIR TRANSPORT TEAM

Executive Editor Graham Dunn
graham.dunn@flightglobal.com

Editor – Airline Business Lewis Harper
lewis.harper@flightglobal.com

Air Transport Editor David Kaminski-Morrow
david.kaminski-morrow@flightglobal.com

AMERICAS

Americas Managing Editor
Jon Hemmerdinger
+1 617 397 2809
jon.hemmerdinger@flightglobal.com

Americas Air Transport Editor
Pilar Wolfsteller
+1 510 634 3496
pilar.wolfsteller@flightglobal.com

Aviation Reporter Garrett Reim
+1 571 216 5327 garrett.reim@flightglobal.com

ASIA/PACIFIC

Asia Editor Greg Waldron
+65 9489 4153
greg.waldron@flightglobal.com

Reporter Alfred Chua
+65 9643 4228 alfred.chua@flightglobal.com

FLIGHTGLOBAL.COM

Online Content Manager Amber Elias
+44 7816 991648
amber.elias@flightglobal.com

EDITORIAL PRODUCTION

Group Production Manager Isabel Burton
Art Editor Tim Noonan
Layout Copy Editor Tim Norman
Consulting Technical Artist Tim Hall

DISPLAY ADVERTISEMENT SALES

1st Floor, Chancery House, St Nicholas Way, Sutton, Surrey, SM1 1JB, UK

EUROPE

Business Development Manager
Victoria Hadden
+44 7818 160613
victoria.hadden@flightglobal.com

Sales Support Gillian Cumming
+44 20 8092 4082

NORTH & SOUTH AMERICA

Vice-President, North & South America
Rob Hancock +1 703 795 5155
robert.hancock@flightglobal.com

Sales Director, USA & Canada Brett Ryden
+1 630 450 1164 brett.ryden@flightglobal.com

ITALY

Sales Manager Riccardo Laureri
+39 (02) 236 2500 media@laureriassociates.it
Laureri Associates SRL, Via Alessandro Volta, 40, 22100 Como, Italy

ISRAEL

Sales Executive Asa Talbar +972 77 562 1900
Fax: +972 77 562 1903 talbar@talbar.co.il

Talbar Media, 41 HaGiva'a St, PO Box 3184, Givat Ada 37808, Israel

RUSSIA & CIS

Director Arkady Komarov
Tel/Fax: +7 (495) 987 3800
komarov@worldbusinessmedia.ru

World Business Media, Leningradsky Prospekt, 80, Korpus G, Office 807, Moscow 125190, Russia

RECRUITMENT

Business Development Manager
Joseph Henrit
+44 7503 644895
joseph.henrit@flightglobal.com

Business Development Manager
Lauren Cooper
+44 20 8092 4085
lauren.cooper@flightglobal.com

CLASSIFIED

Business Development Manager
Victoria Hadden
+44 7818 160613
victoria.hadden@flightglobal.com

ADVERTISEMENT PRODUCTION

Production Manager Sean Behan
+44 20 8092 4078

DATA

Data cited in Flight International is sourced from Cirium, a data and analytics company in the wider travel industry.
For Cirium's data team, contact:

Trevor Mountford
trevor.mountford@cirium.com

PUBLISHING MANAGEMENT

Managing Director Andy Salter

Commercial Director Publishing
Sophie Wild
+44 7715 364765
sophie.wild@flightglobal.com

SUBSCRIPTIONS

Flight International Subscriptions,
Abacus, 107-111 Fleet Street,
London, EC4A 2AB

Subscription Enquiries

If you have any subscription queries, please contact customer service: +44 20 8955 7034
FlightGlobal@abacusemedia.zendesk.co.uk

To purchase a FlightGlobal Premium subscription, visit FlightGlobal.com/subscribe

Print & Digital Subscription Rates
(best rates are quoted)

1 year: £212.50/€229/$293.25 Save up to 15%
2 years: £450/€484.50/$621 Save up to 10%
3 years: £600/€645.85/$828 Save up to 20%

Digital Subscription Rates
(best rates are quoted)

1 year: £187/€205.78/$263.50 Save up to 15%
2 years: £396/€435.80/$558 Save up to 10%
3 years: £528/€581/$744 Save up to 20%

Only paid subscriptions available.
Cheques payable to Flight International

Flight International is one of FlightGlobal's (publishing, events and FlightJobs) products and services.

CIRIUM

FlightGlobal uses data and analytics sourced from Cirium. www.cirium.com

Flight International welcomes unsolicited contributions from readers but cannot guarantee to return photographs safely.

Registered at the Post Office as a newspaper Published by DVV Media International Ltd, 1st Floor, Chancery House, St Nicholas Way, Sutton, Surrey, SM1 1JB, UK.

Newstrade distributed by Marketforce (UK), 2nd Floor, 5 Churchill Place, Canary Wharf, London, E14 5HU, UK. Tel: +44 20 3787 9001

Classified advertising prepress by CCM.
Printed in Great Britain by William Gibbons and Sons

Flight International published monthly 12 issues a year.

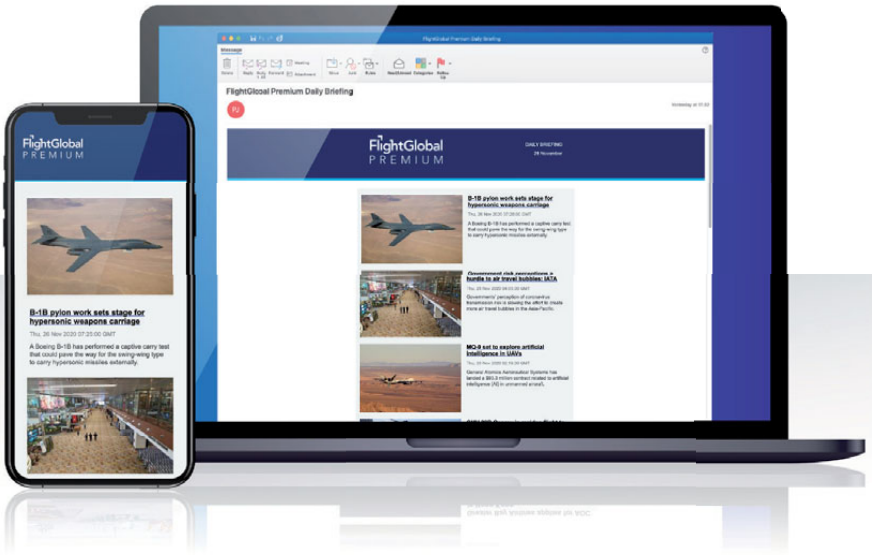
ISSN 0015-3710 (Print)
ISSN 2059-3864 (Online)

DVV Media International

FlightGlobal
PREMIUM

The Premium Daily News Alert is just one of the benefits of a FlightGlobal Premium subscription. Subscribe today and the latest aerospace and aviation stories to be making the headlines will be emailed to you every Tuesday to Saturday.

Take a look for yourself...



"Featuring the latest on major developing stories and key insight into the issues impacting the aviation industry, the Daily Briefing provides must-read insight from our team of global journalists into the most important stories every day."

Graham Dunn, Content Director

SAVE UP TO 15%

SUBSCRIBE TODAY

Alongside the Premium Daily News Alert, you'll also secure these subscriber-only benefits:

- Unlimited access to all FlightGlobal content, including our webinar series
- Flight International magazine in print or digital format
- Exclusive interviews with industry thought leaders
- Unrestricted access to the FlightGlobal news archive

FlightGlobal
PREMIUM

FlightGlobal.com/subscribe

*Images included are for illustrative purposes only.

FlightClassified

Calls may be monitored for training purposes

TEL +44 (0) 208 092 4087 **EMAIL** sophie.wild@flightglobal.com

Hangarage

Equipment, maintenance and service

Chief pilot at oil and gas sector operator Bristow Helicopters' Aberdeen and Sumburgh bases **Christina Brun** explains how rotary-winged flight drew her to the cockpit from a career in IT

Offshore role a perfect fit

Dominic Perry London

It was the "fluidity and freedom" of helicopter flight that grabbed her, says Captain Christina Brun; the fact that "you can pick them up or put them down wherever you want" without relying on a runway.

"I was never really interested that much in fixed-wing flying – it was always helicopters that fascinated me. I did a trial lesson and I was hooked," she says.

Brun is chief pilot for Bristow Helicopters at its Aberdeen and Sumburgh bases in Scotland, dividing her time between flying oil and gas crew-change missions and all the tasks required to manage the 85 pilots in her charge.

Hailing from leafy Buckinghamshire in England's Home Counties, a location far removed from Aberdeen, the UK's oil and gas capital, Brun had no familial links with aviation. But with a keen interest in golf as a child, her attendance at one tournament provided the inspiration for her later career choice.

"It was really sparked when one of the players arrived in a helicopter – that was just a 'wow' moment."

IT girl

But becoming a helicopter pilot was not her first choice. Instead she felt it was "more sensible to go into business" and ended up with a job in the IT sector. But once lodged, that "spark never leaves you", she says, spurring a decision to switch careers.

Brun gained her private pilot's licence in parallel with working in her IT role, then moved to the written element of a commercial licence. Eventually she reached a point of no return: the flying portion of the ATPL required her to quit, to dedicate herself to the effort.

A year later, she had a job as a first officer at Bristow. There was always an aim to work in the North Sea region, says Brun, and early on she had made contact with Bristow's head of training. "There was no doubt in his mind what my goal was," she says.

Although Brun says that obtaining an interview and the subsequent job offer were partly thanks to a combination of "persistence and timing", as the cliche goes: you make your own luck.

With its regular departures, operations in support of the oil and gas industry are the closest thing the rotorcraft sector has to a scheduled airline operation, albeit everyone is wearing a survival suit and although passengers are on business, there is no business-class.

For Brun, the appeal was "the structure, the training and the progression" promised by Bristow: "From the point at which you start until you get your command it is so structured and defined; it says where you have to be and the standards and exams you need to attain," she says. "That's what you want as a pilot."

She did consider search and rescue (SAR) work at the beginning of her career, but even though oil and gas work requires early starts, "I know myself, and it wouldn't suit me to be woken up and called out".

Of course, the crew-change routine does not suit everybody – "some people would hate the regularity you get with the oil and gas operation", Brun says – not least her husband, who is a SAR pilot at Bristow's Stornoway base.

Part of the structure alluded to is the career progression pathway within Bristow: there are clear milestones and assessments in place to guide a pilot from first officer, to senior first officer and ultimately to commander.

"I was never really interested that much in fixed-wing flying – it was always helicopters that fascinated me. I did a trial lesson and I was hooked"

Bristow Group

Christina Brun says she was "incredibly lucky" because she could carry on flying during Covid

But what that process does not necessarily provide for – although it might prepare a candidate – is the shift to a more managerial post.

Brun had been a commander for a couple of years when she approached management asking to be considered if a vacancy for a deputy chief pilot opened up. Within six months a suitable role in Aberdeen appeared, to which she was appointed. Then, in 2014, Brun was promoted to chief pilot, covering both the mainland site and a second base in Sumburgh, Shetland, off Scotland's north coast.

Crucially, though, Brun divides her time equally between flying and desk-based work: "It's never boring," she notes.

Ultimately, a chief pilot's role is the "safe execution of the flying programme". Brun is in charge of the 85 flightcrew across the two bases and is responsible for "everything that is involved in managing that group of pilots". But she also performs another vital function – acting as a conduit between management and those in the cockpit. In this respect she sees strong similarities with her previous career, where she was "bridging between the client and the company".

"It's the same with a chief pilot: you are bridging a gap between the pilots and the higher levels of the company." There is also a requirement to liaise with customers, particularly if there has been an incident offshore, whether safety- or staff-related.

Those skills were put to the test in 2016 when an Airbus Helicopters H225 flown by another operator in Norway crashed with the loss of all 13 on board after its main rotor separated in flight.

The H225, like the Sikorsky S-92, was a mainstay of the offshore sector. Its subsequent grounding for oil and gas operations slashed capacity at a stroke.

People first

While this posed obvious logistical problems – how to maintain a service to clients and the need for pilots to qualify on other types – those were easily dealt with. The larger challenge was one of reassurance and outreach. "Your primary function is to make sure your crews are okay," she says. And while crews are "fact-based" and would understand that a different aircraft type is unlikely to have the same issue, passengers who are "just travelling to work" are less likely to have the same depth of knowledge.

Bristow had to address the "hearts and minds" of passengers so they "wanted to get on board a helicopter again", she says.

While Brun participates in numerous initiatives to encourage women into aviation, sparking interest in a career as a helicopter pilot remains a challenge. During a recent recruitment round, just 2% of applications were from women, although Brun is hopeful that Bristow's newly announced sponsored cadet programme will see greater female participation.

The Covid-19 crisis of the past 18 months has forced everybody to adopt new working patterns, with those in office jobs having to carry out their role from home.

Although 50% of Brun's time is in the cockpit, the other half usually involves face-to-face contact – something which is hard to replicate from a distance.

Of course, "as pilots, we can't really fly remotely", she says, which, in the depths of lockdown, was a rare bright spot. Flightcrews were "incredibly lucky because we got to come in and fly", she says. "That was a godsend – interacting with other human beings."

FlightGlobal

Airlines 2021

Rebuilding the UK's role in global aviation

22 November 2021 | London

Book your place at Airlines 2021. Join leading industry and Government figures who'll be addressing the extreme issues, challenges and solutions facing the sector as we start to emerge from a Covid impacted world.

HEAR FROM OUR KEYNOTE SPEAKERS

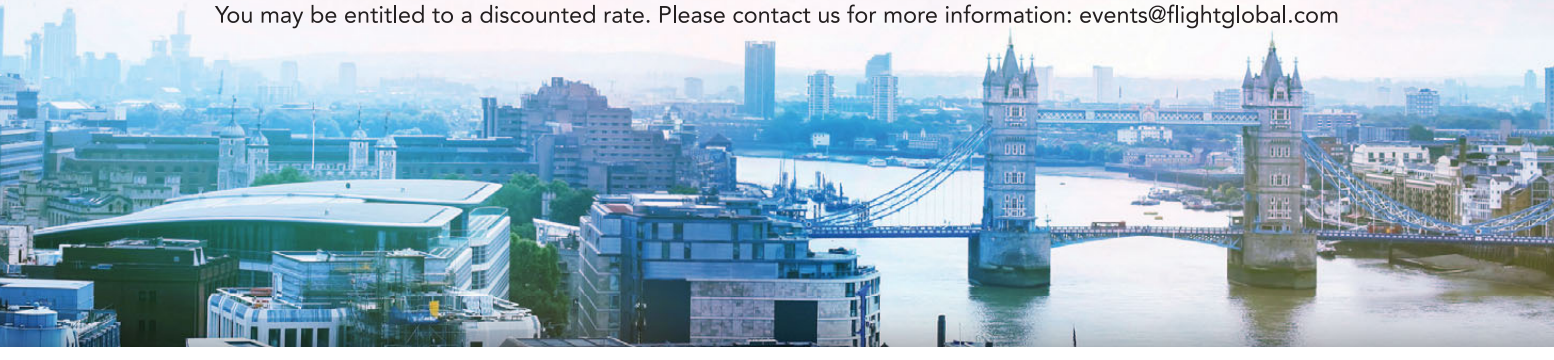
LUIS GALLEGO
CEO
International Airlines Group (IAG)

GRANT SHAPPS
Secretary of State for Transport
UK Government

SHAI WEISS
Chief Executive
Virgin Atlantic

Book your early bird ticket today to save 20% at
FlightGlobal.com/Airlines2021

* Is your organisation a member of Airlines UK, BAR UK or IATA?
You may be entitled to a discounted rate. Please contact us for more information: events@flightglobal.com



This event is brought to you by

AIRLINES UK
THE ASSOCIATION OF UK AIRLINES

BARUK
BOARD OF AIRLINE REPRESENTATIVES IN THE UK

IATA

FlightGlobal