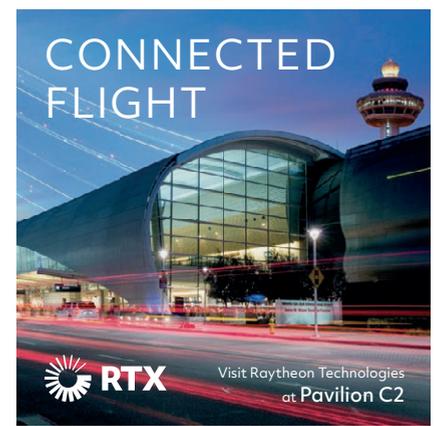


Issue

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54th INTERNATIONAL
PARIS AIR SHOW
LE BOURGET
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Lightning lights up the skies

The US Air Force F-35 Lightning II demonstration team took to the skies over Le Bourget on Monday and Tuesday, marking the fifth-generation fighter's return to the show. F-35 manufacturer Lockheed Martin projects there will be 600 or more of the single-engined jets permanently stationed in Europe by 2030. Notably, less than 10% of those aircraft will be operated by the USA, according to Lockheed's vice-president of integrated fighters JR McDonald, who stresses the benefits of such commonality across the NATO alliance.

BillyPix

More Indian ink

Flag-carrier becomes nation's second airline to make mega show commitment

Graham Dunn

The second day of the Paris air show ended with another massive Indian airline commitment, as Air India firmed its previously disclosed intent to place orders and take options for more than 500 aircraft.

The Indian carrier, which has

embarked on a major expansion plan following its privatisation and acquisition by Tata Sons, in February signalled its intent to acquire up to 290 Boeing jets and 250 Airbus aircraft. These commitments were confirmed yesterday at Le Bourget.

The Boeing portion of the order covers 220 firm aircraft, comprising 190 737 Max jets, 20 787s and 10 777Xs. It also covers options on 50

further Max aircraft and 20 more Dreamliners.

Air India's Airbus includes 140 A320neos, 70 A321neos, as well as 34 A350-1000s and six A350-900s.

Air India chief executive Campbell Wilson says: "Our fleet renewal and expansion programme will see Air India operate the most advanced and fuel-efficient aircraft across our route network within five years."

Taken together with IndiGo's order for A320neos announced on Monday, Indian carriers have accounted for more than 1,000 aircraft orders and options over the first two days of the Paris air show.

The Air India order confirmation capped another busy day of activity at the show, albeit no other deals were of the same scale.

Continued on page 5



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Embraer upbeat on sub-150-seat prospects

Embraer's latest market outlook forecasts 11,000 aircraft deliveries in the segment up to 150 seats during the 2023-2042 period, with the airframer's E195-E2 well-placed to meet strong demand for types covering the upper end of the range.

Outlining the airframer's projections at the show yesterday, Embraer Commercial Aircraft chief executive Arjan Meijer said regional aircraft would "complement narrowbodies, improve regional connectivity around the world, improve the flexibility of fleets and last, but not least, reduce emissions" over the next 20 years.

Meijer particularly highlights the demand potential from moves by operators of Airbus and Boeing narrowbodies to add regional types to their fleets, citing Scoot's and SalamAir's recent orders for E-Jet E2s as an example of a developing trend.

"If you go through a little bit of complexity with adding a new type, the E2 is great aircraft to do that; it has tremendously low unit cost and offers a nice gap to narrowbodies to play with from a network perspective," Meijer states.

He also says that while E2 jets are spearheading the airframer's offering, the previous-generation E175 "is still a great aircraft - we will build it as long as we have demand".

Expanding on the forecast numbers, Meijer says the 11,000 units would be split between 8,790 jets and 2,210 turboprops, with a total value of \$650 billion.

Around 6,500 of those aircraft would be in the 100-150-seat segment, which Meijer notes bodes well for Embraer's E195-E2 jet.

Some 43% of the deliveries would be for growth purposes and 57% for replacement of existing aircraft, Embraer forecasts, based on an average annual global passenger volume increase of 3.2%.

In terms of deliveries by region, Asia-Pacific leads with 29% of units, followed by North America at 28%, Europe at 26%, South America at 9% and the Middle East and Africa at 8%.

Boom makes room for big name suppliers

David Kaminski-Morrow

Boom Supersonic has revealed greater detail of its Overture aircraft design, including its Symphony engine, after selecting primary suppliers to produce the composite fuselage, wing and empennage of the Mach 1.7 jet.

Spanish aerostructures firm Aernnova will supply the wings, while Italy's Leonardo will provide the wing-box and fuselage sections. Boom has selected another Spanish entity, Aciturri, for the empennage.

The gull-wing design is critical to the Overture's performance, intended to provide low-drag cruise while also capable of supporting stable subsonic flight.

"Overture will be an extraordinary opportunity to provide our expertise in the design and development of aerostructures for the first sustainable supersonic aircraft," says Aernnova chief Ricardo Chocarro.

Leonardo will be the design and build partner for two major fuselage components including the wing-box, and will also lead fuselage structural integration. Overture's fuselage tapers from forward to aft, a profile intended to minimise shock-related wave drag at transonic speeds.

The aircraft's empennage has a horizontal stabiliser designed to enhance subsonic control, notably during take-off and approach. Supplier Aciturri's chief, Alvaro Fernandez Baragano, describes Overture as a "generation-defining project" and adds that the company will provide "decades" of aerostructures expertise to the supersonic programme.

Boom has unveiled details on the system architecture for the aircraft, including its flight controls and triple hydraulic system, plus avionics, fuel and landing-gear.

Boom will leverage FTT's "considerable experience" with supersonic engines, the manufacturer states, in the shift from design to production.

"We believe there is large market potential for both Overture and Symphony, which will be transformational for the future of supersonic travel," says FTT president Stacey Rock.

Boom states that Overture's main systems will take advantage of certified technology to de-risk the supersonic programme, adding that it is "on track" to secure the majority of major system suppliers by the end of this year.

"We are incredibly proud of the progress with Overture and Symphony from our global team of partners and suppliers who continue to operate at an accelerated pace toward the future of sustainable supersonic flight," says Boom chief Blake Scholl.

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Boom is showing off a 3D-printed one-third scale model of the bespoke Symphony engine, detailing the architecture, as it expands its partnership with engine design partner Florida Turbine Technologies.

The agreement involves assembly of initial production powerplants for ground- and flight-testing, as well as certification. Initial production will take place in Jupiter, Florida.

Symphony is a two-spool turbofan, which will generate 35,000lb (156kN) thrust with no afterburner. It has a 72in (183cm) fan, three low-pressure and six high-pressure compressor stages, plus a single high-pressure and three low-pressure turbine stages.

"Overture's fuel systems provide centre-of-gravity control during subsonic and supersonic operations, enable sustainable aviation fuel compatibility, and supply fuel to the engines," the company states.

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Airbus partners to conduct electric R&D

Airbus has signed an agreement with semiconductor specialist STMicroelectronics to co-operate on power electronics research and development in support of hybrid and full-electric aircraft.

The co-operation will focus on developing semi-conductors like silicon carbide and gallium nitride, which the partners say have "superior electrical properties" compared to traditional semiconductors.

Airbus chief technical officer Sabine Klauke says: "Leveraging their expertise and experience in power electronics for automotive and industrial applications with our record in aircraft and VTOL electrification



Klauke: Full electrification most relevant to projects such as CityAirbus Next-Gen

will help us accelerate the development of disruptive technologies required for the ZEROe roadmap and CityAirbus Next-Gen." Speaking during a press conference at the show yesterday, Klauke added:

"In the first place it will be about understanding each other and each other's world as well."

Airbus head of electrification Karim Mokaddem, referring to the potential development timeline, says:

"The only calendar that we have is to make decision by 2025-26.

"In order to do that we have to see how the technology will evolve, what kind of tests we will be able to perform together."

Klauke notes full electrification is most relevant to projects like its four-seat eVTOL, CityAirbus Next-Gen.

"As we have been talking about on the electrification roadmap from the beginning, we do think on the big aircraft there will be more hybridisation than electric," she says.

"Whereas on smaller vehicles, like our CityAirbus Next-Gen it could be 100% [electric]."

Kayat and Daher with a model of the EcoPulse



Daher steps up hybrid ambitions

Jon Hemmerdinger

Daher has partnered with a French technology start-up to develop power systems required for a hybrid-electric aircraft that the airframer intends to have available in 2027.

Daher chief executive Didier Kayat said yesterday that Toulouse-based Ascendance Flight Technologies has joined the project, which he describes as a shift by Daher towards reducing aviation's carbon output.

"We are going to work together on the technology," Kayat says. "The idea is to speed up our specifications, [which] we will need in order to have our own aircraft."

Founded in 2018, Ascendance specialises in design, modelling, integrating

and testing hybrid-electric power technologies. Its chief executive Jean-Christophe Lambert says his company is developing a 1MW electric propulsion system.

Daher, also a French company, has previously signalled its intention to develop a hybrid-electric aircraft and is now studying the technology under the EcoPulse demonstrator programme, alongside Airbus and Safran. Kayat says Daher's future production hybrid-electric aircraft will benefit from the EcoPulse research.

"I want to have a product launch in 2027," Kayat says. Much remains unknown about Daher's project. Kayat says it will be a modified version of an existing aircraft type rather than a clean-sheet design, though he adds: "We don't know which

aircraft it will be". Daher's current aircraft include TBM 900-series turboprops and, via its US subsidiary, Kodiak utility aircraft.

EcoPulse is a project under which Daher is developing a hybrid-electric variant of a TBM 900.

Daher supplemented the TBM's standard Pratt & Whitney Canada PT6 turboprop with six wing-mounted propellers, each driven by a Safran-supplied 50kW electric motor.

Kayat says Daher plans to complete flight-testing of the modified TBM by year-end.

Kayat was joined at the presentation by his chairman Patrick Daher, who is also chairman of the air show.

"We have decided that we had to invest heavily to decarbonise our aircraft," he says.

Continued from page 1

Boeing secured the next biggest order of the day, as lessor Avolon signed for 40 Boeing 737 Max 8s. The lessor already has 36 737 Max on order and expects to receive the new batch of Max 8s starting late this decade, says Avolon chief executive Andy Cronin.

"We are seeing consistent, resilient demand come back to the market. That gives us confidence to move forward," he says.

The airframer also disclosed Air Algérie has firming its plans to order eight 737 Max 9s. The deal comes one month after the Algiers-based carrier said it had reached an agreement to purchase the eight Boeing narrowbodies. That forms part of a wider fleet renewal under which it has also ordered A330 and A350 widebodies. It yesterday signalled its intention to acquire two 737 Boeing Converted Freighters.

Both the Avolon and Air Algérie orders were previously attributed to undisclosed customers by Boeing. The US manufacturer's business was completed for the day by China Airlines exercising options for eight

more 787-9s.

Airbus's other activity on Tuesday comprised a follow-on deal for nine more A220-300s from Qantas, Philippine Airlines firming its commitment for nine A350-1000s, and late in the day, Volaris disclosing an order for 25 more A321neos from a purchase agreement signed last October.

Meanwhile, regional manufacturers ATR and Embraer disclosed their first deals of the show.

Lessor Azorra was revealed as the customer behind a previously unidentified commitment for 15 Embraer E195-E2s, while Spanish regional carrier Binter Canarias is taking six more of the jets. American Airlines also ordered seven E175s for its regional unit Envoy Air.

At ATR, Taiwanese operator Mandarin Airlines firming an order for six 72-600s while Malaysia's Berjaya Air signed a tentative agreement for two all-business class 72-600s.

It means there have been 1,218 order commitments - all but 72 of which cover firm aircraft - announced over the first two days of the show.



Boeing's Stan Deal (left) with Andy Cronin of Avolon

Volocopter targets Olympic start

Volocopter is aiming to get European certification for its VoloCity electric vertical take-off and landing (eVTOL) aircraft in the second quarter of 2024, paving the way for operations to start in Paris, in time for the Olympic Games held in the city.

The disclosure by Volocopter chief Dirk Hoke at the show also means the company is likely to be the first in the world to begin flying air taxi operations.

Hoke says the company is "very convinced" it will be starting operations in 2024, and calls it a "big step" for the urban air mobility sector and a major milestone for the company, whose eVTOLs made its

maiden flight in late 2021.

It comes as the company reveals more details about its Paris operations in 2024. Volocopter says five vertiports will be built at the start of operations, with the first by September this year. Over the next decade, the company hopes to operate from more vertiports across the city.

"These first routes will bring the greatest insights into the [urban air mobility] market yet, allowing the public, partners, and stakeholders to familiarise themselves with this new form of mobility," Volocopter states.

It is also pursuing an air operator certificate with a fixed wing aircraft, and is hoping to get it by September.



Volocopter hopes to launch commercial service with VoloCity in time for the 2024 Paris Games

The world according to Al Baker

Qatar Airways colourful chief on repairing the Airbus relationship, supply chain snags, and future fleet



Al Baker: We have always been competing with the big airlines

Mark Pilling

Al Baker, one of the airline industry's most outspoken leaders, delivered his views on its relationship with Airbus, persisting supply chain problems, and the need to bolster the carrier's orderbook in a quickfire media roundtable at the Paris air show yesterday.

Al Baker is 45 minutes late, but that's because one of the most in-demand airline bosses is in constant meetings. "Sorry to keep you waiting so long, I hope my people took good care of you," he apologises.

The Qatar Airways chalet is just metres from the mammoth Airbus one, and the two companies are back on neighbourly terms following a settlement reached in February over an acrimonious legal clash concerning the airline's A350-1000 fleet. The dispute centred on the deterioration of skin paint on its widebodies.

"We are back on very good terms with them," states Al Baker. "We both know that they are an important supplier for us, and they know that we are an important customer of theirs."

"We never questioned

the safety of the Airbus airplane," stresses Al Baker. "We wouldn't be flying the remaining A350s if we felt that it was an unsafe aeroplane. What we were concerned about [was] the condition [of the A350-1000] and Airbus had to fix it. We came to an amicable settlement which is win-win for both sides."

With this remarkable feud behind it, Qatar Airways has returned to Airbus's backlog as its remaining 23 A350-1000s and 50 A321neo orders have been reinstated after being cancelled by the manufacturer.

"We lost our original delivery slots on both the A321neo and the A350, and this was of course part of our amicable settlement with Airbus," says Al Baker. The remaining 18 A350s will arrive from 2025 onwards, he adds.

Qatar Airways has taken some A350-1000s that needed repair back into service, while some with a "longer repair duration are being taken care of by Airbus. We hope that by February next year all the remaining 14 airplanes will be back in the air."

The carrier was a launch customer in 2013 for Boeing's much delayed 777-9

and is hoping to receive its first units in 2025. "If the certification process is expedited, we could get it in the early part of 2025 instead of the second half of 2025, but it's all wait and see," says Al Baker.

With 18 A350-1000s, 60 777-9s, and 18 787-9s still to be delivered, plus 25 737-10s and the A321neos, and considering its existing young fleet, Al Baker has plenty of metal to hand, and does not feel under pressure to boost its orderbook between now and the end of the decade.

"We will see how many of the current firm orders will really be taken up," he says. "The end of the decade is still seven years away and a lot of things change in seven years and there could be a lot of white tails in that period of time."

"I'm not pleased at all," says Al Baker, replying to a question about the response of the aircraft man-

ufacturers to supply chain challenges that are delaying deliveries.

His dismay is "because there is a lot of pressure on the supply chain, and I think the Covid pandemic really destroyed the supply chain of both the aircraft manufacturers. And I don't see how this will be coming back to what it used to be before Covid in the foreseeable future," he says.

Confidence on promised delivery dates is not high. "At the moment both manufacturers are committed to deliver those aeroplanes to us, and we will just keep our fingers crossed," he says. "But we know they will be under a lot of pressure to deliver us our planes on time."

Al Baker has some sympathy with the supply chain plight of the OEMs. "For us to see one of our main suppliers not getting their supply chain committed to them - what can you do? But they need to know that

they will have to then pay us penalties [for late delivery].

"This stress is going to continue for the foreseeable future for two reasons. One is the raw materials," says Al Baker, with the conflict between Ukraine and Russia affecting the supply of titanium, with Russia one of the main producers of this vital metal. "And second there's the expertise, the professionals that left the job that don't want to come and do the same job again."

"I think that both the manufacturers have taken into consideration the supply chain constraints," says Al Baker. "This is why now if you go to order an aeroplane, they will not give it to you for the next eight years. Normally they would ramp up and promise you an aeroplane earlier. Now they can't because there is no ramp up because there is no supply."

"None," says Al Baker, when asked whether he has concerns about new entrants such as Saudi Arabia's Riyadh Air. "We have always been competing with the big airlines, both within the region and outside. I think that will continue and I think that there is enough business for everybody to go around."

"We are back on very good terms with them," says Al Baker on his airline's relationship with Airbus

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Belgium eyes role in FCAS

Craig Hoyle

Airbus Defence & Space has welcomed Belgium's confirmation as an observer to the European Future Combat Air System (FCAS) programme, with its involvement concerning information sharing around research and technology. "I think it's positive that Belgium joins," says Jean-Brice Dumont, Airbus's head of military aircraft. "It is a European programme and we are talking about European sovereignty, so having more European countries in principle is good news." Announcing the step at the show, Belgian defence minister Ludivine Dedonder said: "By joining this project we allow our companies to stay at the forefront of innovation while having a positive impact on employment, and we are strengthening European defence." Speaking at the Paris air show, Dumont notes: "We have Phase 1B and Phase 2 [FCAS] contracts signed

with three nations, so we are going to execute [industrially] with three nations. The role of Belgium will need to be defined politically first, between the nations, and then industry."

The current phase of the French-German-Spanish FCAS effort kicked off earlier this year, and Dumont says "Our engineers are working. It is much more positive than it was during the intense phase of negotiation."

FCAS aims to deliver a broad range of advanced combat systems for operational use after 2035, with Dassault Aviation acting as platform lead for a New Generation Fighter.

Dumont also notes that "the journey continues" for

the Eurofighter Typhoon, with planned further orders for Germany and Spain and a Long-Term Enhancement (LTE) package – still being discussed by the programme's four European partner nations – to serve as "export-enablers".

He expects a Phase 4E contract to be signed later this year covering so-called Tranche 4 Eurofighters, and adds that on the contents of LTE there is "a pretty good level of convergence" between Germany, Italy, Spain and the UK.

"There are export prospects before LTE," Dumont says. "There can be Tranche 4 exports, and there can be even more Tranche 5 exports."

Meanwhile, Jean-Brice Dumont, Airbus Defence & Space's head of military aircraft, says discussions continue with its European customers for the A400M tactical transport regarding annual production plans.

"We are discussing a steady production plan, efficiency in support, and cost of operation and availability of the A400M," he said at the Paris air show on 20 June. "These are challenges at the moment with the nations and with [procurement body] OCCAR."

Airbus currently delivers eight A400Ms per year, and he notes: "It is a common interest to preserve that number. Stability on that front can only make us stronger to face the export

market," he adds. "There are other prospects – we have quite a few."

"We need to have a combination of home nation and export deliveries, and this is the mix that we are cooking at the moment, with OCCAR and the nations, to be sustainable."

However, he notes: "We are secure for the three or four years [of output] to come", due to the programme's complex supply chain."

Airbus in late May delivered the UK Royal Air Force's 22nd and currently final A400M, although London is still interested in potentially boosting the size of its Atlas fleet via a follow-on acquisition.

Belgium also will take its final example of the A400M this year, while a first export example for Kazakhstan recently entered production, with its delivery scheduled for during 2024.



The New Generation Fighter design was unveiled at 2019's Paris air show and returns to this event

Aerorelease springs for Alice

Miami-based leasing company Aerorelease has signed a letter of intent (LoI) for 50 of Eviation's in-development Alice all-electric commuter aircraft.

"In the four years since the last edition of the Paris air show, Eviation has achieved the world-first test flight of the Alice, and secured over \$4 billion in orders," says Gregory Davis, Eviation chief executive. It now claims a backlog for over 500 aircraft.

"The leasing community has an important part to play in creating a long-lasting future for our industry, and we are delighted to work with Aerorelease," he says.



Davis (left) and colleague Eddie Jaisaree complete the virtual signing with Aerorelease

Based in Washington state, Eviation is working to bring Alice through certification, aiming to start valida-

tion test flights in 2025 and to deliver the first aircraft later this decade. The initial prototype made an 8min

maiden sortie in September 2022 but has not flown since.

Alice is to fly at speeds of up to 260kt (482km/h) and have range of about 250nm (463km) in visual flight conditions, plus an additional 30min reserve. The aircraft is currently powered by twin Magnix 700kW Magni650 motors.

"We work with major airlines around the world, and we know from many conversations that sustainability is a major concern," says Aerorelease managing partner Jep Thornton.

"New projects that address sustainability are key to our future strategy and we are excited to be work-

ing with Eviation to offer our global customers a zero-emission solution that is good for the planet and provides an exciting means of opening up new regional routes."

He says the two key attractions of the Alice are the Magnix motors and its sustainability: "It looks like a really good project to be involved in."

Thornton, who could not be at the show because of a leg injury, attended the signing virtually via a video conferencing link.

Eviation has secured purchase commitments for the Alice from customers including Mexican regional airline Aerus, Air New Zealand, Australian's Northern Territory Air Services, Germany's Evia Aero, DHL and US carrier Global Crossing Airlines.

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FLRAA win chimes for Bell

Ryan Finnerty

Aircraft are not all that is taking flight these days at helicopter maker Bell.

Optimism is soaring at the Textron subsidiary, which in April finally secured its win in the US Army's Future Long-Range Assault Aircraft (FLRAA) competition. The service selected Bell's V-280 Valor tiltrotor as successor to Sikorsky's UH-60 Black Hawk, a deal that represents tens of billions of dollars to Bell over several decades.

"It's going to absolutely change the future of army aviation," says chief executive Lisa Atherton.

Atherton, who earlier in her career headed Bell's military business, succeeded Mitch Snyder as chief executive in April with a mandate to deliver the V-280 as a production combat aircraft. Snyder retired from

the company following the FLRAA win, after nearly a decade in the top role. His efforts to pivot Bell toward the future of aviation through investments in digital manufacturing, advanced design and simulation facilities, and expanding customer support services are widely credited within Bell for securing the FLRAA contract.

"The work that Mitch did... for the last 10 years was to secure the future," Atherton says. "The only way to make sure that we keep that future secure is to hit every single mark on this contract, as needed for the army."

While Bell is taking this year's Paris air show as an opportunity for a victory lap, the focus in Fort Worth has already shifted to scaling up V-280 production.

"It's all about execution. That's the name of the game," says Bell's head of military programmes Keith Flail.

The company is ramping up staffing, purchasing long-lead materials and lining up critical subcon-

tractors ahead of the critical Milestone B decision planned for 2024, when army will formally enter FLRAA procurement.

Until then, the army and Bell are remaining tight-lipped regarding the timeline for fielding of the V-280. However, the service has said it is targeting 2030 for a potential first delivery.

Bell is also competing against Sikorsky for the army's next aircraft development programme - the Future Attack Reconnaissance Aircraft (FARA).

Both firms say they are nearly complete with FARA competitive prototype aircraft, with first flights expected in 2024.

That milestone has slipped roughly two years from the original programme timeline - the result of engine production challenges at GE Aerospace, whose T901 Improved Turbine Engine will power both experimental aircraft.



The US Army selected Bell's V-280 Valor tiltrotor as successor to Sikorsky's UH-60 Black Hawk

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Monte firms ZeroAvia MoU

ZeroAvia disclosed during the show that it has firmed a purchase agreement for up to 100 of its hydrogen-electric engines with the UK's Monte Aircraft Leasing.

The advanced powertrain developer, which has operations in the UK and USA, says that the deal converts its existing memorandum of understanding dating from June 2022, with Monte to firm orders. The agreement "represents an important commercial milestone with the first ZA600 build slots being secured by Monte", ZeroAvia says.

As it begins planning to build production facilities, ZeroAvia notes that a "good proportion of its initial manufacturing capacity is now under commitment" thanks to the Monte deal.

The developmental ZA600 powertrain is designed for nine- to 19-seat aircraft, with the Cessna Grand Caravan planned as the "launch airframe". The company says it has completed the first phase of flight testing and that the powertrain is on track to be certificated in 2025.

"We are making enormous commercial progress, which means that operators will be able to fly lower cost, truly clean aircraft," says James Peck, chief customer officer at ZeroAvia.

The deal also strengthens Monte's position in the emerging zero-emission regional turboprop market and boosts its ability to offer operators pathways to fleet decarbonisation, the lessor says. On the first day of the show, ZeroAvia said it had identified "clear applications" for its hydrogen-electric technology to power regional jets, such as the Bombardier CRJ series of aircraft.

Engine titans team for new heli venture



Left to right: Olivier Andries, Lars Wagner and Cedric Goubet, chief executives of Safran, MTU Aero Engines and Safran Helicopter Engines, with MTU chief programme officer Michael Schreyogg

Dominic Perry

Two of Europe's leading propulsion specialists are joining forces to develop a clean-sheet helicopter engine to equip a future European heavy military rotorcraft that could enter service in the 2040s.

The subject of a memorandum of understanding signed at the Paris air show yesterday, the new high-power turboshaft will be developed by a joint venture between Safran Helicopter Engines and MTU Aero Engines.

Cedric Goubet, chief executive of Safran Helicopter Engines, says the venture's ambition is to deliver "a totally European solution".

"It is a matter of sovereignty, it is a matter of strategic autonomy," he adds.

Goubet says it is "premature" to speculate on the size of the engine to be developed, pointing out that it will depend on customer requirements.

"But we will be ready if we need to develop a very powerful engine," he says; it is likely to be in excess of 4,000shp (3,000kW) but could even extend to a 6,000shp-class turboshaft.

Initial technology maturation work should enable first ground runs of a new engine by the middle of next decade, says Michael Schreyogg, chief programme officer for MTU.

Technologies to be incorporated will include 3D-printed parts and other advanced materials, plus higher levels of hybridisation.

Details of the workshare on the joint-venture are still being hammered out, but Schreyogg points out that Safran Helicopter Engines is

a "leader in turbine technology, while MTU has good competencies on the compressor side".

The partners hope to formalise the joint venture "very, very fast – not within years but months", says Schreyogg. It will be based at Safran's facilities in Pau, France, but with a German chief executive.

Safran Helicopter Engines and MTU previously worked together to develop the MTR390 powerplant for the Airbus Helicopters Tiger, also in partnership with Rolls-Royce.

Goubet says the venture is seeking additional partners from across Europe to drive the sovereignty agenda.

Europe is shaping the requirements for a future next-generation rotorcraft through two parallel projects: the industry-led ENGRT effort seeks to ma-

ture technologies supporting that development and involves companies, including Airbus Helicopters and Leonardo Helicopters, from eight nations; while a PESCO initiative, led by France, is a four-country grouping.

Additionally, a NATO-led project called Next Generation Rotorcraft Capability is seeking to design and develop a new heavy helicopter for service entry in the 2035-2040 period. Its core grouping is comprised of five EU members, plus the UK; Canada will also join shortly.

Olivier Andries, Safran chief executive, says the new agreement builds on the pair's joint venture to develop a new engine for the Future Combat Air System for France, Germany, and Spain.

His MTU counterpart Lars Wagner praises the partners' "very long history of working together".

Volaris goes for GTFs

Volaris has selected Pratt & Whitney PW1100G geared turbofan (GTF) engines to power more of its Airbus

A321neo twinjets. The deal covers 64 of the Mexican low-cost carrier's incoming A321neos.

"The additional GTF-powered A321neo aircraft will drive our growth while being mindful of our environmental footprint," says Enrique Beltranena, chief executive of Volaris.

When in-service and ordered jets are considered, Volaris' GTF commitments cover 217 aircraft – comprising A321neos and A320neos – including a previously announced

selection for 153 jets. Volaris operates 70 GTF-powered A320neo-family aircraft and 53 International Aero Engines (IAE) V2500-equipped A320ceo-family jets.

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Airbus to trial hydrogen power on an A330-200

David Kaminski-Morrow

Airbus is to modify an A330-200 to explore the potential for hydrogen fuel cells to power systems other than those directly related to the main engines.

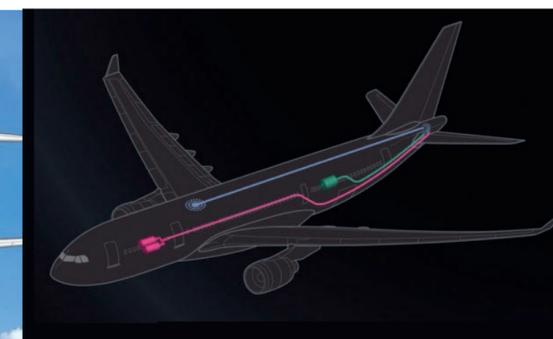
Lighting, avionics and air conditioning are driven by the auxiliary power unit. But Airbus chief technical officer Sabine Klauke believes 5% of the fuel consumption on aircraft could be saved if replaced by hydrogen-based electrification.

"Powering using fuel cells could be promising," she says. Airbus future technology initiative UpNext is to develop a new demonstrator, based on a modified A330-200, to test architecture for non-propulsive energy.

Two air compressors will be fitted in the forward fuselage, with three gaseous hydrogen tanks in the aft, and



HyPower will have forward compressors and aft hydrogen tanks, with fuel cells in the tail cone



the APU will be replaced by a hydrogen fuel cell system, feeding a power distribution network.

UpNext chief executive Michael Aguello says the demonstrator is branded 'HyPower' and will look to reduce emissions and noise generated by conventional APUs.

The three-year programme

involves design and integration work in the first year, ground-testing the A330 in the second, and flight tests in the third.

"Ultimately we want to fly fast and we need to have permits to fly," says Aguello. "This is a great exercise to learn, as well, the certification efforts that we require

to get hydrogen safely into civil aviation."

Airbus will undertake certification work with the European Union Aviation Safety Agency to secure approvals to fly the modified jet. The aircraft will use 10kg (22lb) of gaseous hydrogen and conduct flights of 1h under realistic conditions, at

altitudes up to 25,000ft.

UpNext will obtain a production system for renewable hydrogen with which to supply the A330.

Aguello says HyPower will be led from UpNext's facilities in Spain, and it is co-operating with the Spanish government and other partners on the programme.

Bright Spark

Czech aerospace company PBS has introduced a new auxiliary power unit (APU) designed for helicopter applications.

The Spark 40 APU can be used aboard medium- and heavy-lift helicopters of up to 10t, according to PBS. The company says it is both lighter and more powerful than the company's previous APU model.

Moreover, the Spark 40 produces greater electrical power than the company's previous APU models. It features a digital control unit, and an "advanced fuel measuring pump" that ensures a regular fuel supply.

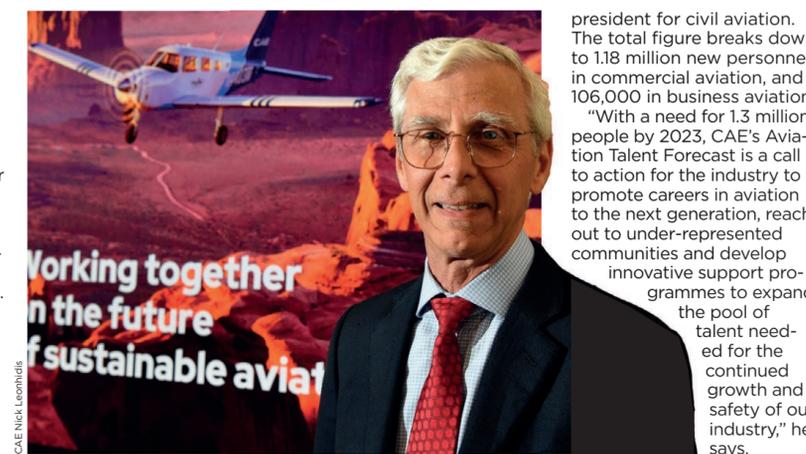
PBS adds that it is among the few companies in the world that has design approval to produce APUs.

Industry will need 1.3 million new professionals, says CAE

Training company CAE says the global aviation industry will require 1.3 million new professionals across numerous work groups in the coming decade in order to keep up with the ever-growing demand for commercial and business air travel.

The company presented its 2023 Aviation Talent Forecast at the show yesterday, in which it outlined the ambitious staffing estimates.

About 284,000 pilots, 402,000 maintenance technicians and 599,000 cabin crew will be needed to support the expected growth in the markets between now and 2032, says Nick Leontidis (pictured), CAE's



president for civil aviation. The total figure breaks down to 1.18 million new personnel in commercial aviation, and 106,000 in business aviation.

"With a need for 1.3 million people by 2023, CAE's Aviation Talent Forecast is a call to action for the industry to promote careers in aviation to the next generation, reach out to under-represented communities and develop innovative support programmes to expand the pool of talent needed for the continued growth and safety of our industry," he says.

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Tarmac's many happy returns

Jon Hemmerdinger

Aircraft storage and recycling company Tarmac Aerosave has passed the milestone of returning 1,000 aircraft to service, and is planning to ramp-up hiring in Europe as airlines clamour for more jets.

Demand for recycled aircraft of various types, including the largest widebody jets, has taken off following a slower period in recent years, Tarmac said at the show yesterday.

The company, which has offices in France and Spain, has received 1,500 aircraft since 2007, of which 1,000 are now back in service. "Since the end of 2022, the rate of returns to service has been particularly brisk and now includes all aircraft types," it says.

The company has returned eight Airbus A380s to service since 2022 and plans before year-end to release

another five. It has also recycled nine A380s, using parts from those jets to support the in-service fleet.

Other widebody types, including A340s, A330s, Boeing 747s and 777s, "are following the same trend, returning to airlines' fleets after being stored for long periods, thus maintaining flight conditions", Tarmac says.

Soaring demand has prompted it to ramp hiring at its three sites, one in Spain and two in France. The company aims to recruit 100 mechanics, technicians and logisticians this year, after having added 90 new employees last year.

"The increase in requests for transition [cabin modifications and reconfigurations], re-commissioning and the expansion of our sites mean that we will need to increase our workforce from 500 to 600 in 2023," says Tarmac chair Alexandre Brun.



Piloting a perfect 10

Captain Justin Carlson, Boeing's chief pilot for the Boeing 737 programme, is pilot-in-command on the airframer's 737 Max 10's flying displays at this year's show. The yet-to-be-certified aircraft, the largest

version of the airframers narrowbody family, is Boeing's answer to Airbus's A321neo. So far, the company's three Max 10 test aircraft have accumulated 400 flights and about 850h as part of the test pro-

gramme. Boeing says it hopes to begin validation flights for the Max 10 this year and is aiming to achieve an amended type certification in 2024, but that timeline could be pushed back.



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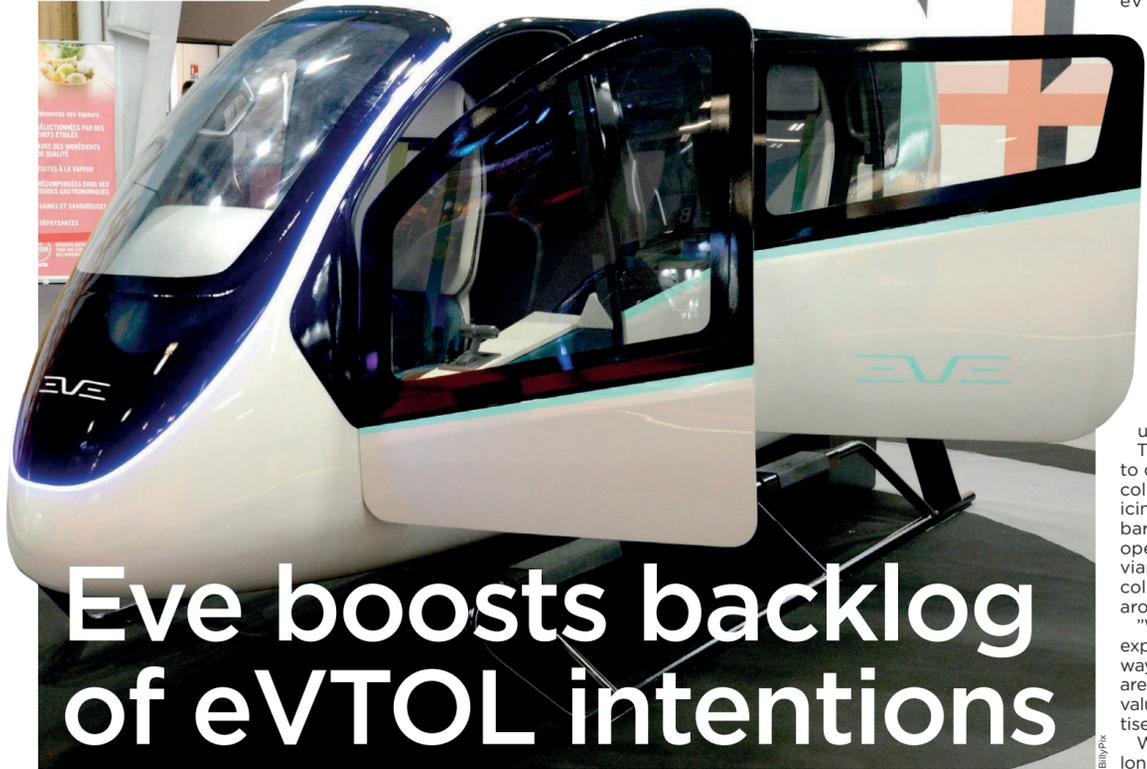
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Eve now 2,770 orders for its aircraft, a cabin mock-up of which is on display at the show



Eve boosts backlog of eVTOL intentions

Howard Hardee

Electric air taxi developer Eve Air Mobility has secured letters of intent from two aviation companies to purchase a total of up to 120 of its in-development electric vertical take-off and landing

(eVTOL) aircraft.

The Embraer-backed company said yesterday that Brazil's Voar Aviation signed a letter of intent (LoI) to purchase 70 air taxis, while Norwegian air mobility incubator Wideroe Zero signed its intent to purchase up to 50 vehicles.

The deals bring Eve's

backlog of eVTOL orders to 2,770 aircraft – all under letters of intent, rather than firm orders. Eve says that general aviation company Voar intends to use Eve aircraft to expand operations in several regions throughout Brazil, including large urban areas such as Sao Paulo, Belo Horizonte and Brasilia.

"This partnership reinforces that Voar is ready to open the doors to future air mobility and contribute the necessary infrastructure for the operation of this new way of transportation," says Alessandra Abrao, Voar's chief executive.

Eve's agreement with Wideroe builds on a mem-

orandum of understanding signed by the two companies in 2021 to develop eVTOL operations in Scandinavia.

"This additional LoI reinforces our commitment to introducing sustainable, safe and affordable urban air travel to the region," says Andre Stein, co-CEO of Eve. "Together, we will drive this transformation and pave the way for a more accessible transportation ecosystem for Scandinavian communities."

Eve will also provide Wideroe with training, MRO services, spare parts, battery lifecycle management and data integration solutions under the agreement.

The companies also plan to develop safety protocols for flying eVTOLs in icing conditions – a major barrier for electric air taxi operations in Scandinavian countries and other cold-weather regions around the world.

"Wideroe's extensive experience operating in Norway, where icing conditions are prevalent, will provide valuable insights and expertise," Eve says.

Wideroe is pursuing a long-term plan of electrifying Norway's domestic short-haul flights, including a "substantial portion" of its regional fleet by 2030.

Earlier at the show, Embraer and Japanese electric motor specialist Nidec said they were forming a new joint venture called Nidec Aerospace, which will provide electric propulsion systems for Eve's project.

United enlists support for more SAF start-ups

United Airlines Ventures (UAV) is in "active discussions" with airlines, lessors and major oil companies to join the Sustainable Flight Fund, a venture capital fund launched and managed by United in February aimed at supporting start-up firms with technology to increase the production of sustainable aviation fuels (SAF).

"We already have investments from GE, Honeywell and Air Canada, and we have another seven or eight that we're about to announce in the coming month or two," Mike Leskinen, president of UAV, told *Flight Daily News* during an interview at the show.

The fund started with \$100 million in investment

from United and its inaugural partners, which also include Boeing and JPMorgan Chase, and it will grow up to \$300 million as more partners invest, he explains.

"We are writing cheques from \$5 million to \$25 million for start-ups that are doing everything from micro algae that can be used to boost sustainable aviation fuel to companies like Svante that does point-source capture of carbon dioxide," says Leskinen.

The fund is open to all players and airlines, including competitors to United, stresses Leskinen.

"If we just tried to make this about United or tried to make this a competitive advantage for United, we're not going to change the

industry," he says.

"And if we don't change the industry, flight shaming is only going to get worse in Europe and it's going to come to the US. This is about decarbonising this business in a real way, in-sector, and taking responsibility for our emissions," says Leskinen.

After kicking off by supporting start-ups, the UAV Sustainable Flight Fund will likely move on to sign SAF offtake deals as the manufacturers build their production capability, says Leskinen.

United has already invested in the future production of three billion gallons of SAF, which it claims is the most of any airline in the world.



United Airlines Ventures president Mike Leskinen



SWITCH consortium representatives (l-r): Jean-Baptiste Manchette, Airbus; Graham Webb, Pratt & Whitney; Dr Claus Riegler, MTU; Henrik Runnemalm, GKN; and Marc Holme, Collins

Dominic Perry

Partners in an EU-backed project to validate engine technologies that could help deliver a 25% fuel-saving over current-generation powerplants are deep into their initial design work as they eye later ground- and flight-test programmes.

Working through the SWITCH (sustainable water-injecting turbofan comprising hybrid electrics) consortium, the partners were in September 2022 selected by the EU's Clean Aviation body as one of 20 projects to share over €700 million (\$764 million) in phase-one funding.

Led by Germany's MTU Aero Engines, the project also includes significant contributions from Pratt & Whitney, Collins Aerospace, GKN Aerospace and Airbus, alongside other partners from research institutes and academia.

Their design marries the Water Enhanced Turbofan (WET) – a concept champi-

oned by MTU – with a P&W geared turbofan that has been boosted with a pair of Collins-supplied electric-motor generators.

Dr Claus Riegler, MTU chief technical officer, says that since the project's February kick-off meeting, the team has been "continuously optimising" the SWITCH configuration.

There has been "a lot of focus" on the "integration of the engine concept" with partner Airbus "working intensively" on such studies, he told a Paris air show briefing to unveil the consortium's new logo on Monday.

As two "significant heat exchangers" are included in the WET architecture, presenting "volume, weight and size" challenges, "smart integration [of the engine] under the wing is very important" to minimise potential drag penalties.

Describing maturation of the engine as a "big challenge" which is "pushing the boundaries a little", Jean-Baptiste Manchette, Airbus head of propulsion of tomorrow, says consortia

like SWITCH are vital "to find out what's the best way of integrating the technology".

Riegler says MTU has also begun examining "special operating cases" – such as rejected take-offs or go-arounds – "and we are learning a lot about how the configuration reacts compared with a more traditional configuration".

Using residual heat from the engine's exhaust gas, WET technology uses a heat exchanger to vaporise water, which is then injected into the combustor, increasing engine efficiency through heat recovery, slashing greenhouse emissions, and reducing contrail formation.

In the SWITCH concept, further efficiency gains are driven by a 0.5MW motor generator on the high-pressure spool and a similar 1MW unit on the low-pressure system. Cooling for both motors will be supplied by air taken from the fan stream.

The motors will allow energy to be added to or extracted from the engine, enabling optimisation of the gas turbine for efficiency

in high-power flight phases such as cruise and take-off, says Graham Webb, P&W chief sustainability officer.

Marc Holme, senior director, engineering at Collins, says it is developing the requirements for the system and working on the engine integration with sister company P&W. Collins recently confirmed the power output of the IMW motor in tests.

Integration is also being aided by GKN, says vice-president of technology Henrik Runnemalm, which will also develop the high-voltage wiring system and provide test rigs at its Trollhattan facility in Sweden to "prove the concept will work".

By 2025, initial ground testing of the hybrid-electric system will have been carried out using a modified PW1100G geared turbofan. Technology and component tests for the WET engine will also be performed, alongside aircraft integration studies for the combined system.

Dependent on securing funding from Clean Avi-

ation's second phase, to start in 2026, flight tests of the hybrid-equipped GTF could also take place within the context of the SWITCH consortium.

Initial predictions suggested the SWITCH engine would be 50% heavier than a current-generation powerplant, but Riegler says it has seen a "significant" mass reduction, down to 40%, as the project has progressed. "Right now it is going in the right direction – the engine is also a little bit shorter as well."

WET technology is one of several concepts being considered by P&W for its Gen2 geared turbofan, an engine it sees as potentially equipping a next-generation narrowbody to enter service in the mid-2030s.

As well as further increasing the fan size, taking the bypass ratio to around 15:1 from 12:1 at present, Webb says technologies to improve the thermal efficiency of the engine, such as ceramic matrix composites, are being readied, alongside improved aerodynamics.

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SCAN ME

Greg Waldron

Turkish Aerospace Industries (TAI) sees a big international market for its Hurjet advanced jet trainer, as the airframer presses ahead with ambitious developments of fixed-wing aircraft, helicopters and unmanned air vehicles (UAVs).

President and chief executive Temel Kotil believes there is a total market for 400 Hurjets over the next two decades: 100 for the Turkish air force and 300 for export customers.

Powered by a single GE Aerospace F404 engine, the Hurjet is still on the hunt for its first international order, following a maiden flight in April 2023. It lost out to the Korea Aerospace Industries FA-50 in a Malaysian requirement for 18 aircraft.

TAI also intends to deliver 20 Kaan fighters to the Turkish air force by 2028 in an initial Block 10 configuration, says Kotil. As the aircraft – which is due to make its first flight in late 2023 – matures, subsequent deliveries will be to the new Block 20 standard.

The Kaan is powered by a pair of F110 engines, but the company is “working on” an indigenous powerplant for the type. TAI is showing several mock-ups in its static display, including a new 11t civilian helicopter designated the T925, which is based on a developmental military helicopter that Kotil refers

Chief executive Temel Kotil foresees total market for 400 of the trainer



TAI has high hopes for Hurjet

to as the “general purpose two” helicopter; the company already produces the T625 Gokbey, a 6t utility helicopter.

A key driver behind the development of the 11t military helicopter is the Turkish navy, which requires the ability to transport up

to 18 troops, as opposed to 12 carried by the T625. The new rotorcraft shares significant commonality with the in-development Atak II attack helicopter, including the transmission, engines, avionics, and other systems. Meanwhile, the first flight

of the Anka III unmanned air combat vehicle (UCAV) is planned in the next two weeks. The system uses a flying-wing configuration, and a model of the UCAV in the company's chalet shows it carrying a range of precision munitions.

The UCAV is powered by a single turbofan engine, but TAI declines to specify the powerplant used.

Asked about the broad range of ambitious programmes that the company is undertaking simultaneously, Kotil says he has an experienced management team leading large numbers of young, ambitious engineers.

Longer term, he says the company aims to be among the top 10 defence contractors in the world. For now, Kotil says the company is ranked around “fifty plus”. Key to achieving this goal will be significant exports across the company's full range of products.

Ten abreast for A350-1000s

Philippine Airlines is to fit 10-abreast seating to the economy cabin of its Airbus A350-1000s, taking advantage of recent interior upgrades to the variant.

The carrier is configuring the twinjets with 380 seats in three classes, including 24 in the premium-economy cabin and 42 in business.

Airbus has introduced a new standard for the -1000 with modifications including a wider interior which enables a 10-abreast layout.

Chief executive Stanley Ng says the carrier – which took its first Airbus, an A300B4, more than 40 years ago – is considering other changes to its fleet.

He states that the airline is “exploring options” to replace its A330-300s, of which it has 10, “in about three or four years' time”.

The A350s will gradually replace Boeing 777-300ERs as they arrive over the course of 2025-2027.

Taiwanese operator Mandarin Airlines has firming an order for six ATR 72-600s, with deliveries set to run from the end of this year through 2025.

The deal – signed at the show yesterday – came as ATR chief executive Nathalie Tarnaud Laude (pictured) expressed confidence that the airframer can grow its orderbook over the rest of the year.

Laude says ATR “has a lot more in the pipeline”.

“We are very confident that we will be able to announce more orders by the end of the year,” she says.

ATR has so far this year netted orders for 22 turboprops – including the Mandarin commitment – with options for another two.

That compares with 26 firm orders in 2022 and 35 in 2021.

The company saw a decline in gross orders during the pandemic, but Laude says that with major markets – especially the Asia-Pacific – recovering, ATR is “already seeing the results of... markets picking up”.

She cites the Mandarin order as an example of the Asian recovery, calling it “a



ATR boss upbeat on orders

great sign of rebound”.

ATR forecasts airlines globally will require 2,450 new turboprops over the next 20 years, and Laude notes that carriers are gradually shifting to focus on fleet growth as the pandemic impact subsides.

“We are seeing a growth market now, and more so in

2024,” she adds.

Laude also reiterates the company's target to return to annual production of more than 80 aircraft by the second half of the decade, even as the wider sector faces a supply chain crunch.

Acknowledging that those supply-chain issues will remain “most likely for the

rest of 2023 to early 2024”, Laude says the Airbus/Leonardo joint venture is “well on track” to deliver 40 aircraft this year. That figure compares with 25 deliveries in 2022, a total Laude admitted in an earlier interview with FlightGlobal was “below where we wanted to be”.

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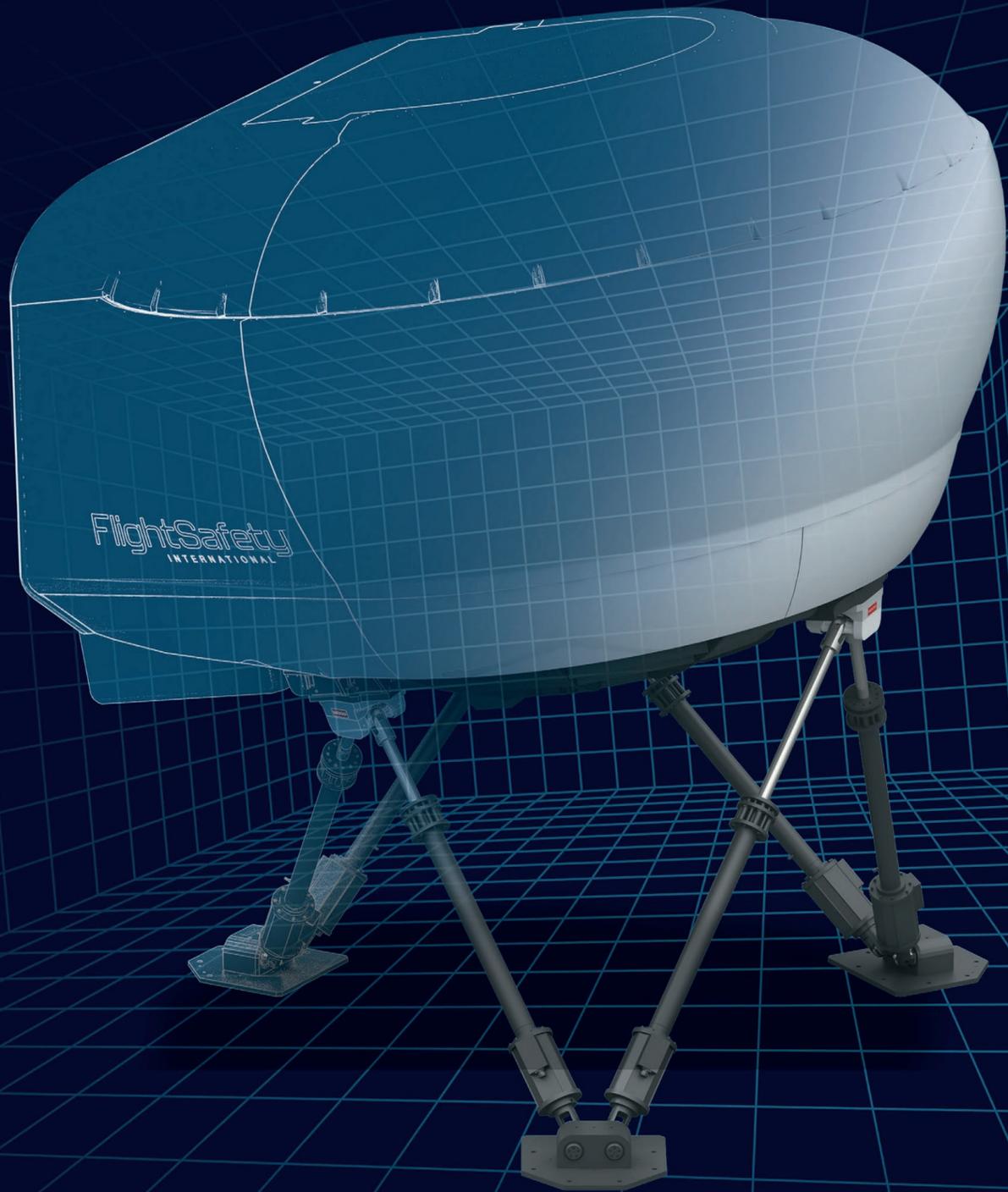
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Diehl Aerospace gets teeth into Tiger

Diehl Aerospace has secured a contract for the development, production and customer support of the new armament computer and its operating system for the Airbus Helicopters Tiger MkIII upgrade programme.

"The computer offers outstanding processing power and meets the highest requirements on the availability of the system," says Diehl Aerospace, a joint venture between Diehl Aviation and Thales.

The Tiger Armament Computer (TAC) controls the helicopter's various weapons, such as its gun, missiles, and rockets.

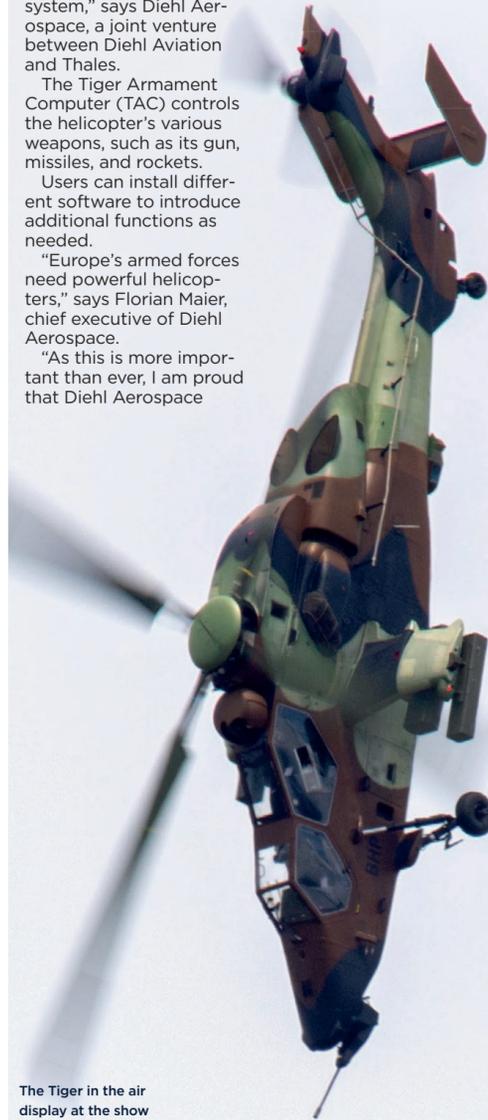
Users can install different software to introduce additional functions as needed.

"Europe's armed forces need powerful helicopters," says Florian Maier, chief executive of Diehl Aerospace.

"As this is more important than ever, I am proud that Diehl Aerospace

contributes in equipping the Tiger MkIII with the best armament computer. I consider it exemplary how Airbus Helicopters and Diehl Aerospace prove European co-operation in such an important helicopter upgrade programme."

France and Spain are to modernise their in-service fleets of Tiger attack helicopters via the MkIII effort.



The Tiger in the air display at the show



The Cavorite X7 is designed to carry one pilot and six passengers

Horizon puts faith in hybrid

Howard Hardee

Though much of the emerging vertical take-off and landing (VTOL) sector is focused on fully electric vehicles, Canadian developer Horizon Aircraft is taking a different tack with its proposed Cavorite X7.

Co-founder and chief executive Brandon Robinson says that the Cavorite X7 is designed to "fly 98% of the mission like normal" with a hybrid-electric propulsion package that will burn jet fuel during forward flight.

"There is only enough battery power on board to enable the vertical take-off, and the rest of the time it is a normal airplane burning

sustainable aviation fuel or kerosene jet fuel, which is 20 times more energy-dense than even the best batteries," he says.

Robinson, a retired fighter pilot, notes that the conceptual aircraft could be converted to a fully electric propulsion system if battery technology matures enough to power short-haul operations.

The Cavorite X7 is a step forward from Horizon's first iteration, the X5, which was designed to carry one pilot and four passengers. The eventual production aircraft will be capable of short take-off and landing operations, needing only "a couple hundred feet" of space, Robinson says. Featuring a fan-in-wing design, it will cruise at 200kt (370km/h), with

a range of 500nm (926km) and a 1,500lb (680kg) payload capacity. The aircraft is designed to recharge its batteries mid-flight, allowing for quick turnaround times.

The company envisions that the Cavorite X7 initially will be used for special missions such as hauling cargo, medivac operations and fire-fighting applications, such as guiding water bombers to drop locations. Eventually, operations could be expanded to regional passenger transport.

Ontario-based Horizon is currently conducting windtunnel testing on a half-scale prototype of the Cavorite X7. It plans to test a full-scale prototype next year and achieve type certification in 2026 or 2027.

ARC Linx to past with gyroplane

UK air taxi developer ARC Aerosystems has unveiled plans to produce a new eVTOL aircraft called the Linx P03, which the company touts as an "historically proven concept" amid uncertainty about certification pathways for electric air taxis.

ARC - formerly Samad Aerospace - says it has acquired the intellectual property rights and type certification for the Pegasus gyroplane, previously held by Pegasus Rotorcraft, for the design of a "fully FAA-certified VTOL gyroplane".

"One of the stand-out advantages of the Linx P03 is its utilisation of an existing certified platform," the company says. "By building upon a proven framework, ARC Aerosystems has accelerated the development process, saving time and resources, and expediting the delivery of the aircraft

to market." The Linx P03 will seat one pilot and two passengers, cruising at 81kt (150km/h), with a maximum range of 60nm (111km), plus 10min of reserve.

"We firmly believe that this aircraft will redefine urban air transportation and offer a safe and efficient mode of travel," says Seyed Mohseni, founder and chief executive of ARC. "We are excited to witness the positive transformation it will bring to society and people's lives."

The company does not specify when it intends for the aircraft to enter service, but adds that it is "accepting orders from operators and private purchasers".

ARC is developing a range of vertical take-off and landing passenger aircraft, including the nine-seat Linx P9.



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Jet2 leaps for Leaps

UK leisure carrier Jet2 has chosen CFM International Leap-1A engines to power more of its incoming Airbus A320neo-family jets.

The latest commitment covers the 35 firm orders and 36 options that Jet2 announced in October last year.

In total, the airline now has Leap-1A commitments covering 97 firm A320neo-family jets, plus a further 48 options – its entire orderbook with Airbus.

It has one Leap-1A-powered A321neo in service after the type made its Jet2 debut in May.

Some 62 of the carrier's outstanding firm aircraft are A321neos, with the remainder being the smaller A320neo.

Pilar Wolfsteller

Joby Aviation and GKN Aerospace have signed a multi-year agreement to supply the air taxi developer with thermoplastic flight control surfaces.

"We are very excited to be joining forces with GKN Aerospace," says Joe Ben Bevirt, founder and chief executive of Joby. "Their remarkable experience in aerospace manufacturing, combined with our innovative approach, will play an important role in making sure we deliver the best possible aircraft for this exciting new market."

GKN has been working closely with Joby on the application of the concept, specifically tailored to the Joby electric vertical take-off and landing (eVTOL) aircraft.

"The flight control surfaces will be composed of a lightweight thermoplastic structure assembly, manufactured using an advanced out-of-autoclave production method," GKN says. "This cutting-edge manufacturing process will enable high-rate



Joby hails GKN's fantastic plastics

production while delivering on the high-performance requirements of Joby's aircraft."

The development and initial production work will be carried out at the company's global technology centre,

in Hoogeveen, the Netherlands, before transitioning to GKN Aerospace's facility in Chihuahua, Mexico.

Hot stuff

GE Aerospace and Clemson University have secured government funds to develop materials capable of holding up in the ultra-hot temperatures associated with high-speed flight.

The funds come from the US Air Force Research Laboratory, which has author-

ised \$10 million to support the project.

"Today's announcement represents a major milestone in the development of next-generation materials that will push the boundaries of what is possible in flight," Tom Mathis, chief executive of GE's advanced research arm GE Edison Works, said at the show yesterday. "The research we are conducting will grow

the US innovation ecosystem, particularly in the area of advanced materials."

They are collaborating on the project with the Missouri University of Science and Technology, and developing "ceramic-matrix composite materials that would be lighter and better able to withstand extreme temperatures than metal alloys currently in use".

Such materials can bene-

fit national security, enable improved engine efficiency, "enhance structure safety of the fuselage and revolutionise the time required to travel by air from one location to another", GE and Clemson say.

University president James Clements says the partnership "will drive innovation in advanced materials and help maintain US competitiveness".

FLIGHT DAILYNEWS

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Liebherr expands in France

Liebherr-Aerospace's air systems business in Toulouse will start work this September on a new 12,000sq m (129,000sq ft) factory at its Campsas, Tarn-et-Garonne site.

The facility, near its current plant, will open in 2025, doubling its current capacity, and is needed to support "strong growth projected for 2030", says the Swiss-owned company.

The existing factory employs 200 people and specialises in machining high-precision mechanical parts, including turbine and compressor wheels and high-temperature valve bodies that are integrated in bleed air and air conditioning systems.

The new building will specialise in the production of heat exchangers, which



An illustration of the new site, which will 'support growth' for the company

is presently carried out at the company's Toulouse site. Once opened, it will add another 200 to the workforce.

The space freed at Tou-

louse will "enable a significant increase in industrial capacity" for other equipment for air systems, according to the company.

Liebherr-Aerospace says the €30 million (\$33 million) investment illustrates its "determination to continue developing its expertise in France".

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When it comes to aviation reducing its carbon footprint, much of the focus has been on aircraft, engines and fuel. But optimising operations also has a major role to play, argues industry IT specialist SITA

Graham Dunn

SITA sees the impetus to cut aviation emissions as helping to drive the deployment of operational tools as well as an opportunity to bring change to air traffic control.

While SITA has for many years developed in-flight connectivity solutions for passengers, SITA for Aircraft chief executive Yann Cabaret sees product aimed at operational gains driving much of its future opportunities.

"We are advancing our efforts slightly more to the front of the aircraft and the belly of the aircraft," Cabaret told FlightGlobal in an interview ahead of this week's air show. "The front of the aircraft is really around the pilots and how do we equip pilots to meet the demand that they have from their management and their passengers. So typically on-time performance, fuel efficiency, weather turbulence avoidance. That's really where we see IT plus telecom joins up pretty well and where SITA has a role to play.

"The other bit we focus on is back to the OTP, turnaround on the ground," he adds.

"So how do you manage the turnaround, how do you manage an aircraft that has been re-routed to a different airport and how do you co-ordinate activities around the aircraft. That is really where we see our core of investment."

Crucially, he believes moving of sustainability up the agenda – for regulators, the public and the aviation industry – provides greater impetus for take-up of some of SITA's solutions.

"It is not like 10 years ago we didn't know that sustainability wasn't a topic, but socially and economically, all this is changing. So the drivers are more present today," Cabaret says.

He says while much of the sustainability focus is on the role of new aircraft, engines and fuel types in driving net-zero ambitions,



SITA has a product to optimise take-off and flight plans in-flight and further projects include using historical data to better predict the top of descent

the industry can make gains in the nearer term by optimising operations.

"It is a trendy example, but it is a real example. We have a product called SITA Optiflight, which provides recommendations to pilots in terms of speed and altitude to save fuel. The reality is every aircraft has a different performance profile. And we are not even talking types of aircraft, we are talking tails, because of its history and its own performance.

"So we use technology, we use flight data from each and every tail, to analyse performance, and then based on the weight of the aircraft or weather conditions, for each and every flight, we provide recommendations for speeds and altitudes," Cabaret explains. "And by applying those, pilots and airlines will save fuel."

As an example he cites work SITA does with Star Alliance carrier Singapore Airlines.

"On average they save 150kg of fuel on every take-off. In the big scheme of things that may not be huge, but actually 150 kilos of fuel on every flight is something we can do today with currently technology, you don't have to wait for SAF or new aircraft, or new engines, you can do it today."

SITA has a product to optimise take-off and flight plans in-flight and further projects include using historical data to better predict the top of descent. "That is in our roadmap for 2023. Optimising top of descent allows you to do continuous descent operations and you have massive fuel savings there," he says.

Helping make these solutions more practical today are advances in the data collected from the global fleet and machine learning capabilities.

"What has changed in the last 10 years is the generation of data from aircraft," Cabaret says. "The availability of aircraft performance data has increased and will continue to increase. And everything that relates to machine learning, the tools have become more available, in terms of machine learning tools and frameworks around using data."

One area SITA believes technology can make a difference to is air traffic control.

"Today, many of us – SITA and other providers – have solutions that are available to the pilots in the cockpit, or the OCC, the dispatcher. But what nobody really links is air traffic control, which is an area

where IT has not moved. Having that link between dispatcher, pilot and ATC, there is one vision that I have for SITA, which is decision-making tools for all these people to work together."

He believes an impetus to change in the way ATC operates will be preparing the ground for urban air mobility platforms.

"Whether it comes in 10 years, 20 years or 40 years – everyone can have their own opinion of this. But what we know for sure is that the controller looking at the radar screen is not the future of air traffic control. There will still be controllers, but if you don't help them, that's not going to work well. So air traffic controller automation is another driver for change. This is going to drive the ATC world to different steps."

Cabaret sees a possible pathway to development coming from the way the second screen in the cockpit has offered an easier way of providing more information to pilots without the bigger tasks of integrating it into the cockpit. "The question is can we do that in ATC? Can we put a second screen and somehow force that market to evolve?"

"I don't want to be cynical. I think they also want to evolve, there is a willingness to move," he adds, flagging for example how it is working with Swiss ATC SkyGuide's IT arm.

"We have done a prototype with them, where we take to the recommendations we provide to pilots and we provide that in real time to control, so that they can make better decisions as well," Cabaret says. "That is how we push the ATC world to move a bit." ▶

Air Freight Evolution: Next-Gen P2F Conversions

A330-300BDSF and B777-300ERSF "Big Twin" Ushering in a New Era in Air Freight

In the ever-evolving world of aviation, freight transportation has undergone significant transformations. IAI, the industry leader in Passenger-to-Freight (P2F) conversion, stands at the forefront of these changes. The conversion process developed by IAI is based on an exclusive design approved by Supplemental Type Certificates (STC) from CAAI, FAA, EASA, and other Civil Aviation Authorities. Over 300 aircraft (narrow, mid and wide body) have been converted by IAI thus far at many locations worldwide, from China and Israel to Mexico, Abu Dhabi, Italy, Serbia and Ethiopia. These aircraft have logged over 2,500,000 flying hours with very high reliability and customer satisfaction.

The current focus of the conversion lines is on the B737-700/800 and B767-200/300 models. However, a shift is imminent with the upcoming certifications for B777-300ERSF and A330-300BDSF conversions. These new conversions are strategic responses to the industry's need to replace the fuel-intensive 747-400 and MD11 aircraft with more fuel-efficient twin-engine, modern avionic systems wide-body platforms.

New Mid-Size Freighter on the Horizon

Boasting lower operating costs than similar platforms, 20 percent less fuel consumption, and up to 30 percent more payload and volume, the A330-300 aircraft stands out as the most cost-effective on the market. This conversion design's key focus is maximizing



Credit: IAI

payload capacity by enabling various flexible loading configurations and utilizing a lightweight Cargo Loading System (CLS). The IAI A330-300 conversion includes a low-weight CLS to minimize operating and maintenance costs, a Z-shaped 9G Rigid Cargo Barrier, additional

loading position and a large side door to enhance the aircraft's loading/unloading's turnaround time and versatility. Other changes include fuselage reinforcement and floor structure replacement to accommodate heavier loads. The development of the A330-300BDSF is underway, with STC approval expected by the end of 2024. With over 1000 units of feedstock for conversion expected to be available in the next 20 years, the IAI A330-300BDSF is positioned to become a success.

Big Twin Setting New Standards for Heavy Lifters

The upcoming 777-300ERSF, another model set for P2F conversion, is anticipated to replace the B747-400 and MD11 freighters being phased out of air cargo services. Due to enter service in 2023, the 777-300ERSF is the ultimate big twin-engine freighter. With twin-engine efficiency that burns 21% less fuel per tonne than the 747-400 freighters and big-cargo capability that sees 25% more volume than the 777-200F, the production freighter manufactured by Boeing. The aircraft converted by IAI retains 90% commonality with its smaller twin. With improved volume capacity, lower operating costs, and enhanced range and payload, the 777-300ERSF, nicknamed 'BIG TWIN,' represents the future of the freight industry. IAI provides the BIG TWIN conversion as part of its partnership with AerCap – a globally renowned aircraft lessor, to offer aircraft feedstock and conversion capability solutions, with GE Aviation providing ongoing engine support for those planes.

Summary

P2F conversions pave the way for more efficient and cost-effective air freight services. Introducing new aircraft models into the conversion lines signifies the shift towards fuel-efficient, high-volume freight transportation, promises reduced operational costs, enhanced versatility, and improved efficiency.



Credit: IAI



Cabaret: Sees a chance to support air traffic control

The supplier returns to Le Bourget with a new leadership team charged with advancing a growth strategy that leans on expanding sales of the high-tech electric systems it produces for aircraft of all classes

The Curtiss-Wright stuff

Jon Hemmerdinger

Few companies around today can claim to have attended the inaugural Paris air show, in 1909 at the Grand Palais, but Curtiss-Wright is among them.

The Wright Flyer was at that event, which occurred 20 years prior to Curtiss-Wright's founding with the merger in 1929 of companies owned by the Wright brothers and aviation legend Glenn Curtiss.

"You can't get any more aviation than us," says Curtiss-Wright chief operating officer Kevin Rayment. "We were at the first Paris air show."

North Carolina-based Curtiss-Wright is back again, arriving at Le Bourget with a new leadership team charged with advancing a growth strategy that leans on expanding sales of the high-tech electric systems it produces for aircraft of all classes.

"Our strategy is... pivoting the organisation to real growth," says Rayment.

He notes that in recent years Curtiss-Wright had slowed its expansion while focusing on strengthening its financial foundation. "We sort of went to the gym for a few years and strengthened our position across the group."

In the nearly 100 years since its founding, Curtiss-Wright has established itself as a top supplier of a variety of components found on modern aircraft, though it has expanded into non-aviation markets. The company has some 8,100

employees (including about 1,800 engineers), serves customers in some 90 countries and generated \$2.6 billion in revenue last year. Commercial aerospace sales accounted for \$277 million of that figure (or 11%), while aerospace defence products accounted for \$480 million (19%). The company also sells products for naval applications and to the power-generation industry.

Curtiss-Wright makes a range of components found under the skins of all manner of aircraft. Its products are on helicopters (such as Boeing CH-47 Chinooks and Bell OH-58 Kiowas), military jets (Lockheed Martin F-35s and F-22s, Boeing KC-46 tankers and Eurofighter Typhoons), and business jets made by Bombardier, Gulfstream and Textron Aviation.

Curtiss-Wright also has a large presence in the commercial airliner sector, supplying components for all major Airbus and Boeing passenger jets, and for ATR, Embraer and De Havilland Canada regional aircraft.

Broadly, Boeing jets carry Curtiss-Wright actuators, sensors, flight-control components and surface treatments (which help prevent metallic aircraft components from premature fatigue and wear).

It has traditionally supplied sensors found on Airbus jets, and provided the European manufacturer with surface treatment services. But Curtiss-Wright has recently won other Airbus work, including a deal to produce actuation systems for Airbus's "eXtra Performance Wing" programme - an effort to develop an advanced wing demonstrator.



Kevin Rayment became chief operating officer of Curtiss-Wright in 2021

Additionally, Curtiss-Wright is supplying electro-mechanical actuators for the main-deck cargo door of Airbus's in-development A350 Freighter, which is scheduled for service entry in 2026.

"We... provide the actuation system which opens and closes the door - the lock and the latch," Rayment says. He calls the A350F win notable because Airbus historically relies heavily on European suppliers. "We are starting to make some inroads there."

Curtiss-Wright's sensors include "linear variable differential transformers" (LVDTs), which provide precise measurement of, for instance, the position of fuel valves, thrust reversers and flight control surfaces.

"If you've... flown on many commercial airplanes, you will have had probably one of our LVDTs on that airframe," Rayment says.

While its current LVDTs can operate at temperatures up to 200°C (392°F), Curtiss-Wright is developing new sensors capable of operating at much higher temperatures - up to 371°C. Such LVDTs can help support the aerospace industry should it transition to aircraft powered by hydrogen-fuelled engines, which run hotter.

Curtiss-Wright also makes "ruggedised" computers designed to operate in harsh environments, and flight data recorders (FDRs) and cockpit voice recorders (CVRs). It has partnered with Honeywell to offer a new FDR-CVR system that meets the European Union Aviation Safety Agency's new requirement for large aircraft to have voice recorders that capture 25h of audio. The companies say they also designed the system to be capable of streaming flight data in

real time to operators.

Other Curtiss-Wright products include aircraft arresting systems and a variety of electric technologies, including flight-test instrumentation. Indeed, Curtiss-Wright on 12 June said it won a \$24 million contract to provide flight-test instruments to the US Air Force in support of the service's effort to update F-35 hardware and software.

"If a [manufacturer] is changing anything on the airframe and they have to do a flight test to confirm, we provide the data acquisition that connects the sensors on the aircraft," says Rayment. "It records and transmits data to the ground so that they can test the airframe... That goes across both commercial aircraft [and] military applications."

Curtiss-Wright is now leveraging its electronics expertise to capitalise on the aerospace industry's broad shift toward electrification.

Aircraft manufacturers have been working to replace heavier mechanical systems with electric actuators. Meanwhile, engine makers are developing hybrid-electric aircraft propulsion systems and studying means of extracting more electricity from future aircraft engines.

"We... do a lot around electrification," Rayment says. "There's a big move... in the market for these types of platforms."

Notably, Curtiss-Wright supplied "high-power-density electromechanical actuators" to all-electric aircraft developer Eviation, for use on its commuter aircraft prototype Alice.

"We make the primary flight controls for that," says Rayment. The technology replaces "traditional mechanic [and] hydraulic actuation systems".

Like other aerospace manufacturers, Curtiss-Wright has struggled with supply chain troubles and a tight labour market.

"We haven't been immune, certainly [for] electronic components... We've all been impacted," says Rayment. But, he adds that supply troubles are improving and predicts "further recovery" into 2024.

Rayment, who previously worked for Curtiss-Wright UK subsidiary Penny & Giles, became chief operating officer in 2021 amid a broader executive shake up that saw the company hire Lynn Bamford as chief executive, and Christopher Farkas as chief financial officer.

"This new change in the C-suite has... given us more impetus and energy, into growing the top line of the business," Rayment says. ▶



Curtiss-Wright uses its "laser-peening process" to strengthen components on Lockheed Martin F-35s

US Air Force

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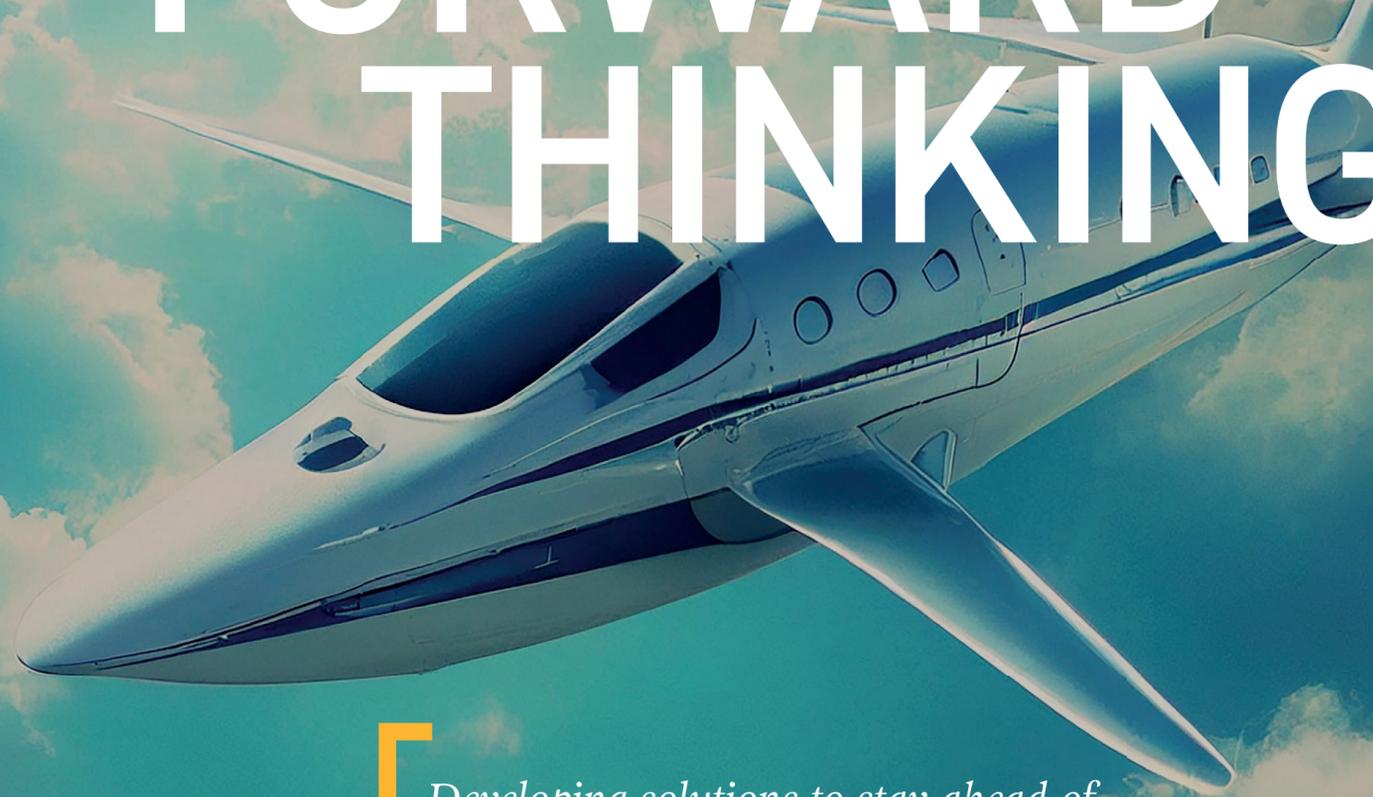
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With spares in high demand, Ireland-based EirTrade recently scrapped the first two 787s to be parted out – but determining how to dispose of their composite structures is a work in progress



The 10-year-old airframes were originally operated by Norwegian

Dream ending?

Howard Hardee

In an operation somewhat resembling a reverse-motion assembly line, two 10-year-old Boeing 787-8s – the first of the type to be retired from commercial service – were recently reduced to a pair of bare fuselages, stripped of components.

The used serviceable material from the jets has already generated “huge interest” amid a global shortage of aircraft parts, says Irish aircraft management and trading company EirTrade Aviation, which performed the tear-downs.

Since these were the first 787s ever to be disassembled, close to zero used parts had previously been available for operators of Boeing’s flagship Dreamliner.

“It is no secret that the 787 market has supply chain issues,” Paul Gleeson, vice-president of sales for EirTrade, tells FlightGlobal. “It is difficult to find MRO slots, before you even get to the materials that are available for getting stuff repaired.

“Ultimately, it came down to a maths equation. We had been seeing massive demand from our customers for this type of material, and that made it a natural progression for EirTrade to start targeting next-gen aircraft, with the 787 being the first one we got our hands on.”

EirTrade has been “inundated” with requests for 787 components from its customers, making disassembling the jets to sell the parts a “no-brainer”, Gleeson says.

But what to do with the carbon composite material from the 787s’ wings and fuselages is less obvious. In an emerging issue for the airline industry, best practices for recycling and repurposing advanced materials used to build next-generation widebody jets – such as the 787 and Airbus A350 – have yet to be established, says Sam O’Connor, interim executive director of the Aircraft Fleet Recycling Association (AFRA), a trade organisation that provides guidance and oversight for aircraft dismantling operations.

Burning issue

Composite materials from aircraft, cars and industry are often incinerated or buried in landfill, but these are not viable long-term solutions for the disposal of major airframe components. The 787-8 is 57m (186ft) from nose-to-tail and has a wingspan of 60m.

And such material is difficult to recycle.

“There are few accepted technologies... to break down that material to be usable,” O’Connor says of carbonfibre composites. “These existing technologies can be costly and limited in facilities that have the ability to recycle composite materials. Right now, it has the

potential to end up in landfill.

“When you cut up fibrous materials such as composites, it turns to dust and gets in the air, so there are potential environmental concerns,” O’Connor adds.

How to handle advanced aircraft materials stripped from next-generation jets is a problem that has the attention of major aviation companies, he says: “This is something that the industry realises needs to be done. We are just really trying to figure out the best way to do it.”

The recently dismantled Dreamliners – serial numbers 35304 and 35305, both built in Everett, Washington and originally operated by Norwegian’s long-haul business – would have been due for 12-year checks and landing-gear overhauls, making them good candidates to be parted out, EirTrade says.

Cirium fleets data shows that the Rolls-Royce Trent 1000-powered pair were delivered to Norwegian in June and August 2013, originally registered as EI-LNA and -LNB. Each had a 291-seat, two-class cabin configuration.

Taking parts

Based at Ireland West airport in Knock, EirTrade’s bread-and-butter is disassembling narrowbody jets, having completed projects on 737- and 757-series aircraft. But in early 2020, the company became the first to take apart a twin-aisle, double-

decker A380. That process helped EirTrade prepare for taking on the 787s.

The company says it is “no stranger to disassembling new technology” as it was also “one of the first companies to disassemble the [CFM International] CFM56-7BE engine”, which powers 737NG narrowbodies.

“We are always on the hunt for ways to really shake things up, and it is great to be the first to market on any of these assets,” Gleeson adds. “It is an exciting project for us – everybody wants to be a part of it.”

The 787s were disassembled at Prestwick airport near Glasgow, Scotland, and the tear-down process itself took about 60 days. But EirTrade spent much of the past year planning how it would take apart the pair of 787s and distribute their parts to airline and MRO shop customers, Gleeson says.

The company has “routed quite a lot of the [787] parts to MROs to get tagged, and so far, so good, in terms of getting serviceable units back”, Gleeson says.

With strong demand for commercial aircraft parts and different pinch points in the supply chain arising “almost weekly”, he adds, it is an ideal time to capitalise on the market for 787 components.

The pair of widebody jets getting dismantled well before the limit of their design life does not suggest the global Dreamliner fleet will

Exit service sooner than expected, Boeing tells FlightGlobal.
 “787s have been designed and built to operate for decades in service,” the company says. It adds that a “backlog of more than 500 airplanes, including more than 250 orders and publicly announced commitments since late 2022, show its strength in the market.”

It is not unusual for aircraft to be cannibalised to keep others in service, and observers agree there is no indication the 787 is headed for an early retirement.

“The reason you part it out is because there is a business case,” Jonathan Berger, managing director of Alton Aviation Consultancy, told FlightGlobal during the MRO Americas conference in Atlanta on 19 April. “Someone needs the engines, someone needs the landing gears, someone needs the avionics... It is just math, not like a deficiency in the Dreamliner.”

More than 1,000 787s are currently in service worldwide, according to Cirium fleets data. Boeing says it has unfilled orders for a further 592 of the type.

When it entered service in 2011, the 787 was the first commercial aircraft with major sections – the fuselage, tail and wings – manufactured with composite material. The aircraft is 50% carbon composite by weight, Boeing says.

Introduced by Airbus in 2015 as a response to the 787, the A350 is also manufactured with major composite sections.

Composite material is high strength and low weight, making it ideal for use in airframes. “It is more durable, it doesn’t corrode or fatigue and [it has] better maintenance cycles and much better design possibilities,” says Lane Ballard, vice-president and general manager for the 787 programme.

Polymer problem

Despite its benefits, the material is difficult to recycle because it cannot be melted down and reformed like scrap metal. It is made from long carbon fibres fixed within a polymer and cured at high temperatures and pressures. While the polymer can be burned off or dissolved with chemicals to recover the fibres, known processes are cost-prohibitive.

“We need to figure out how we can separate the material from



The 787’s structure is 50% carbon composite by weight

other bonding materials,” O’Connor says. That is the catch with carbon composites in airframes: “Its carbon footprint is lower, but we did not think long-term about what happens when this aircraft is no longer in service. What are we going to do with it?”

Boeing says that “composite recycling was considered early in the design process for the 787”. In 2008, it helped establish AFRA, which “brings together OEMs, airlines, lessors, dismantlers, recyclers and research institutions to enable an end-of-service ecosystem”, the airframer says.

AFRA’s research and development committee is working to develop new methodologies to recycle, repurpose and re-use composite material. “We are going to start in the coming months figuring out ways to best break down the composite fibres,” O’Connor says.

“The industry is challenged with finding a solution for recycling carbon composites at the end-of-service,” says Christin Datz, an associate technical fellow of product lifecycle sustainability for Boeing. “While technologies for fibre recovery from production excess are applicable, the industry also faces challenges that include

dismantling, material preparation and separation processes – and matching predictable supplies to future market demand.”

Fresh purpose

Datz says Boeing is working with universities and aviation companies to find ways to recycle aerospace-grade composite waste – including for use in railway undercarriages, laptop cases and car parts.

To better understand end-of-life issues for next-generation jets, AFRA has taken possession of what is left of the recently-retired Dreamliners, including the carbon composite fuselage and wing-tips, and some engine components, O’Connor says. The fuselages were cut into smaller sections and shipped to ECube, an aircraft dismantling company in Wales that has agreed to store the material for one year.

“Then we will be seeking out additional entities that may like access to the composite material to start doing research and development on it,” he says.

AFRA is working to ensure that whatever is discovered regarding the disposal of composite material as a result of the Dreamliner dismantling process will be published information.

“What we are requiring, once we provide that material to them, is that this intellectual property is made available to the world,” he says. “We want to say, ‘OK, this is what we found out and this is the information that we are going to relay so everyone can start doing it the same exact way.’”

“It is not something that we’re looking to seek any type of monetary gains from,” he adds. “It is for the betterment of our planet.”

Boeing says it has worked with AFRA to ensure that “sections of interest” from the 787s will be preserved to study end-of-service for advanced materials.

The elegantly curved wings from the 787s were sent to the National Manufacturing Institute of Scotland, nearby where the jets were dismantled. Some of the carbonfibre material removed from the pair of Dreamliners has been

returned to Boeing, which will use the recovered material for research and development purposes.

Better understanding how to handle carbonfibre composites will only become more pressing as more aircraft are produced with such components. It is possible that Boeing’s next narrowbody jet will be designed with a mostly composite airframe, though that decision is years away, as chief executive David Calhoun says its next clean-sheet aircraft will likely be introduced in the middle of next decade.

“It is hard for me to imagine us not taking full advantage of everything we have learned on advanced composites,” Calhoun said during a 30 May press conference at the company’s 787 assembly plant in North Charleston, South Carolina.

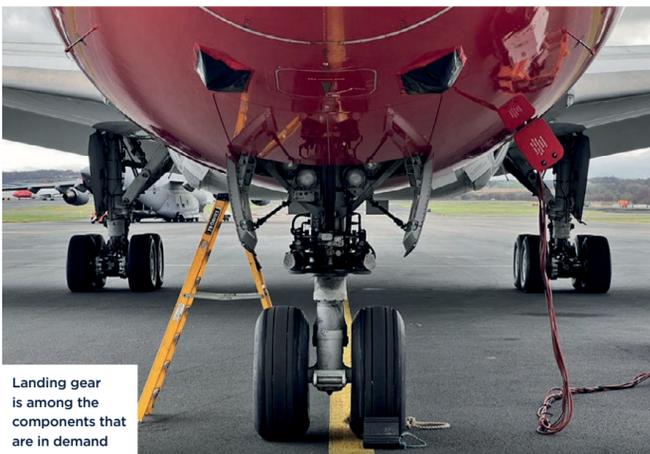
“I have no doubt that will play a significant role,” he adds. “We are simply going to continue to progress with the technologies we have available to us.”

Other sectors, including developers of electric vertical take-off and landing aircraft for the advanced air mobility market, are also making widespread use of the technology.

Boeing’s 787 programme has suffered a series of high-profile setbacks, including a roughly 22-month delivery pause that ended in August 2022 after the airframer addressed manufacturing quality issues involving sections of the composite fuselage and pressure bulkhead – calling into question whether producing thousands of narrowbody jets with carbonfibre airframes is feasible.

But as more next-generation jets are manufactured and retired in the decades to come, it will become critical to establish best practices for handling high-tech aircraft components at the end of their useful lives, O’Connor says.

“How are we going to take these [materials] when they are at the end of service, and not put them in a landfill? We need to start designing that aspect at the very beginning of the process. We need to consider how we are going to be able to dispose of this stuff.”



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Audible aircraft emissions have fallen dramatically since the first jets appeared. However, it remains a problem for the aviation industry to confront

Tony Harrington

Despite enormous reductions in aircraft noise since the dawn of the jet age in the late 1950s, the issue is once again amplifying as a critical challenge for the airline industry.

The problem is not so much the noise created by modern aircraft, which continues, but has been reduced by some 90% since the deafening days of the Boeing 707, Douglas DC8 and Vickers-Armstrong VC10.

It is the rapid and staggering increase in the number of flights, as airlines return to and build upon their pre-pandemic growth trajectories. Passenger volumes are projected by the IATA to double from four billion in 2024 to eight billion by 2040.

The flashpoint for new tensions was the announcement by Amsterdam's Schiphol Airport, one of Europe's busiest hubs, that it would reduce flight movements as early as the coming winter season and follow-up proposals to ban most midnight-to-dawn flights and to scrap plans to build an additional runway.

It cited a desire to reduce the noise created by aviation. Instead, it caused the reverse.

The uproar from airlines was so loud that it could be heard across Europe, the Atlantic, and the entire air transport industry, with major operators serving Amsterdam collectively claiming they were blindsided by the announcement, and others pre-emptively protesting for fear that success at Schiphol would become a dangerous precedent for similar cutbacks elsewhere.

The Dutch Government, the airport's biggest shareholder, had already publicly floated a staged reduction of Schiphol's flights from 500,000 to 440,000, prompting the move for a first-step reduction to 460,000 starting later this year.

Airlines loudly disagreed. "We're astonished by this unilateral decision," spluttered the airport's biggest and most affected operator, the KLM Group, which accounts for 60% of aircraft movements at Schiphol.



Steve Mann/Shutterstock

Noises off

Together with other airlines and IATA, KLM sought, and won, a court injunction against the airport and the government for, at the very least, failing to consult, as required, before declaring such an impactful change.

However, whether their stay of imposition is approved or overturned, the episode is a big red flag for an airline industry that has been totally focused on survival, reconstruction, and how to meet steep and growing expectations to achieve net zero carbon emissions by 2050.

A brawl over aircraft noise would

be a big additional problem for airlines – but not a new one.

Noise has been both a delicate and bitter issue for almost 75 years, since Britain's De Havilland Comet jet first took to the air, the pioneer and catalyst for long-range, high-speed air travel.

Next came the long-haul 707s, DC8s, and VC10s, the medium-range 727s and Tridents, the DC9s and BAC1-11s, the supersonic Concorde, ever-larger widebodies, and many more, including assorted noisy offerings from former Soviet bloc airframers.

Each jet's introduction incrementally delivered new social and commercial connectivity within and between nations. But for those living near airports or beneath flight paths, that progress came at a price.

With increased aircraft noise came worsening political headaches, and generations of mitigations including flight curfews, restrictions and exclusions of the noisiest jets, aircraft movement caps, airspace redesigns, and rapid technological evolution, from modifications to all-new airframes, powerplants and components.

ICAO says that since the introduction of jets, huge and continuous investments across the airline and aerospace sectors have

reduced the noise of modern aircraft by 90% compared to their ancestors.

But success at Schiphol could threaten the very fragile peace which the industry long believed it had achieved, after earlier tough battles over noise.

No matter how much airlines, airframers and engine manufacturers argue, with strong evidence, that technology has significantly silenced aircraft, they have not silenced those impacted by noise, whose voices once again are being raised as the number of flights grows.

Anti-noise campaigners question how aviation's recovery and deployment of many more aircraft can possibly occur quietly, arguing that increased volumes of flights will create higher volumes of noise.

IATA fears the new rumblings could elevate aircraft noise well beyond battles at local levels to potentially impact flight connectivity and international agreements including bilateral air traffic rights and open skies policies. They could even ignite trade wars.

"The technology has only gotten better. But the 'curfew science' is based on the 707," says Neil Hansford, chairman of Australian consultancy Strategic Aviation Solutions.

Hansford is a veteran of aviation's noise wars. In the 1980s, he

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Brisbane remains a curfew-free airport

Suman Charabreser/Shutterstock

It was one of the architects of an audacious strategy by freight company TNT to introduce night freight flights in Europe without breaching stringent noise limits at key airports.

TNT jointly-owned Australian domestic carrier Ansett, which operated passenger versions of the British Aerospace 146, then billed as the world's quietest jet. Seeing potential for cargo, TNT worked with British Aerospace to develop the 146QT (Quiet Trader), then ordered and optioned up to 72 - the entire production line for up to five years. "We saw the way things were going as far as aircraft noise," says Hansford. "What sold the 146 was its short runway performance and its low noise. So we went with it."

Marnix Fruitema is chair of the Board of Airline Representatives in the Netherlands (BARIN), a group which represents all airlines operating there. It is caught in the eye of the Schiphol storm, which it warns could extend to other markets in Europe. "Noise has not significantly increased," he says. "For many airlines it has even decreased due to the introduction of new types of aircraft and engines."

"After Covid and its silence, resuming flights has led to an increase in perceived noise. We have also seen a more and more active role by environmental groups, and those representing citizens living around airports. A very small percentage of those complaining is responsible for the majority of total complaints. Some complain, for which we have an established platform, more than 20 times a day."

The German Aerospace Federation, BDL, reports the same trend. "More and more individual complainants are submitting thousands of automatically-generated complaints, thereby distorting the picture of actual noise exposure."

It says every five years the German Federal Environment Agency assesses the impact of aircraft noise across the country. In 2018, when the last research was undertaken, the agency found that during the day, 8.7 million people were affected by street noise, 6.4 million by rail noise, and 800,000 by aircraft noise.

"While the objectively measurable exposure to aircraft noise is decreasing, the number of people who feel subjectively annoyed by aircraft noise is increasing," the federation says.

As well as expediting the



Schiphol airport more than doubled passenger numbers to 52 million in 2022

introduction of new, low-noise fleets, it says "a responsible residential settlement policy in the vicinity of airports is also necessary in order not to increase the number of people affected by aircraft noise."

Between its 1958-model 707 and the first 787 Dreamliner in 2011, Boeing said it had cut noise by 60 decibels, and reduced aircraft 'noise footprints' by 90%.

As well, between its 737NG series, launched in 1993, and today's 737 Max, Boeing claimed it had roughly halved that footprint, and, like all manufacturers, was striving to cut noise even more as part of its sustainability programme.

During Covid, as part of its ecoDemonstrator programme, Boeing used a 787-10 testbed equipped with 200 external microphones, and monitored by another 1,000 on the ground, to assess the noise of the airframe, aircraft systems, and even modified landing gear.

"Noise is back as an issue to address mainly due to population growth, increasing demand in air travel as we come out of the pandemic, and continued expansion of the commercial fleet," says Graham Webb, chief sustainability officer at Pratt & Whitney.

"Although noise reduction has emerged as a critical factor in engine design and development, the battle against climate change still gets the lion's share of attention

from customers, environmentalists, and regulators. But it cannot be done at the expense of increasing noise.

"Most noise comes from the fan, generated by the tips of the fan blades breaking the sound barrier," says Webb. To address the problem, the company's new GTF engine uses a fan drive gear system, developed over 20 years at a cost of \$10 billion, to enable the fan to work at a lower speed, keeping blade tips subsonic.

Rival manufacturer CFM International, a joint venture between GE Aerospace and Safran, is concurrently progressing its RISE (Revolutionary Innovation for Sustainable Engines) programme, which features open, or exposed, engine fans, to increase efficiency, and reduce both CO2 and noise levels to below those of today's best ducted engines.

"A key enabler that we have in our toolbox now for designing new engines, that we didn't have before, is supercomputing capability," says Arjan Hegeman, general manager of Advanced Technology at GE Aerospace. "This gives us the ability to model noise sources with high fidelity for next-generation engine development."

But while noise reduction technology evolves, regulations don't, often persisting to guard against noise from aircraft types no longer flying.

One of the toughest examples is in Sydney, Australia's largest air hub, where long-term restrictions eclipse much of what Schiphol is proposing.

When a new parallel runway was commissioned in the mid-1990s, the political price of approval included a ban on most flights between 11pm and 6am, an hourly 'slot cap' of 80 arrivals and departures, and an aircraft 'movement cap' between 6am and 11pm, measured in 15-minute blocks, and documented by staff hired purely to count aircraft.

In a recent submission to a government white paper, Australia's Aircraft Noise Ombudsman also flags the need for more stringent oversight of airport planning to help minimise noise nuisance.

"The impact of aircraft noise on overflowed communities is an inevitable result of airport operations," said the ombudsman,

"and discussion of aircraft noise management should begin with regulation on the planning and approval processes of airports."

The observation is timely, as the issue of aircraft noise has just exploded in another Australian city, Brisbane, which opened a new parallel runway just as the pandemic took hold. Now, as air traffic returns to the city, so do public protests about noise - including in areas not previously impacted.

The Brisbane Flight Path Community Alliance, a lobby group opposing flight paths to and from the new runway, surveyed 2,000 residents across 81 areas of the city, concluding that 80% of those questioned were not impacted by aircraft noise before the new runway opened.

The sample group was small. But the issue demands delicate handling, not only because of increased complaints about noise, but because Brisbane Airport is curfew-free, and desperate not to lose this designation - particularly as the city will host the 2032 Olympic Games, and the airport has huge growth plans.

Following an initial independent review, Airservices Australia has been trialling Simultaneous Opposite Direction Parallel Runway Operations (SODPROPS), in which more of Brisbane's arrivals and departures are flown over water, not houses, with expansion of the programme planned by year's end.

The trial will be closely watched, not only in Brisbane, but in other cities facing new or intensified resistance to increased flights.

In Amsterdam, despite their initial win in court, airlines are nervous about what will happen next. A Dutch Government appeal will be heard this week. KLM meanwhile has submitted proposals to the government, based around the use of more efficient aircraft and operations, which it says will meet the night-time noise reduction targets as soon as 2024.

BARIN's Marnix Fruitema adds: "The industry wants to reduce noise, but via different means. We don't need to reduce flights to reduce noise. Many EU countries outside the Netherlands are following closely what's happening. It's a possible threat for other countries if the shrink scenario continues." ▶



The noise each aircraft makes has fallen dramatically since the early jet age

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Amid growing confidence about the strength of the airline industry's recovery, carriers have been boosting their line-ups with aircraft variants and types that are fresh to their fleets

New kit on the block



Qatar Airways

Qatar Airways adds Max jets

Qatar Airways has been introducing Boeing 737 Max 8s into its fleet this year, and is due to be operating nine of the type by the end of July.

The Middle Eastern carrier took delivery of its first example in mid-April after taking advantage of an opportunity to introduce a batch of the CFM International Leap-1B-powered twinjets.

"Utilisation of the [Max 8s] will add capacity to help drive future growth, especially in short-haul markets," says the carrier.



ITA Airways

ITA takes first A330-900

ITA Airways took delivery of its first Airbus A330-900 on 26 May at a ceremony in Toulouse, the fourth new Airbus type the Italian carrier has introduced since its launch in October 2021.

The carrier's first A350-900 entered service in summer 2022, followed by its first A220-300 in October, then its first A320neo in February this year.

The Rolls-Royce Trent 7000-powered A330neo, which is being leased from Air Lease, was due to enter service in June.



TransNusa

ARJ21's international first

The Comac ARJ21 entered commercial service internationally in April, with Indonesian low-cost carrier TransNusa using the aircraft on the Jakarta-Bali Denpasar sector.

Flight tracking web sites show that on 18 April the aircraft (PK-TJA) operated the Bali-Jakarta route. It has more recently been operating the Jakarta-Denpasar route. Comac delivered the General Electric CF34-powered ARJ21 to TransNusa in December 2022. The aircraft has 95 seats in an all-economy layout and is leased from China Aircraft Leasing



Starlux

Starlux A350s go transpacific

Starlux Airlines entered the long-haul market with the Airbus A350-900 in April, having taken delivery of its first example in October last year.

The Rolls-Royce Trent XWB-powered aircraft debuted on the Taipei-Los Angeles route on 26 April.

By late May, Cirium fleets data shows Starlux had three A350-900s in its fleet, with 15 more on order.

Starlux's A350s first flew operations within the Asia-Pacific region, before stepping up to transpacific services.



Vistara

Vistara welcomes A321LRs

Vistara took delivery of its first Airbus A321LR in February, as it focuses on building up its international network.

By late May it had taken delivery of another three A321LRs, according to Cirium fleets data, bringing its A321neo-family line-up to 10 jets, all powered by CFM International Leap-1A engines.

Vistara is India's first A321LR operator. The carrier is in the process of being integrated into Air India, following the purchase of the latter by Tata Group.



ATR

ATRs land in the Maldives

Indian ocean carrier Maldivian took delivery of its first two ATR 72-600s at the turn of the year.

The Pratt & Whitney PW127XT-powered turboprops are replacing ageing aircraft in the carrier's fleet.

The regional operator has since taken delivery of its first ATR 42-600.

The carrier's fleet of more than 20 aircraft includes 11 De Havilland Canada DHC-6-300 Twin Otters and nine De Havilland Canada Dash 8-family turboprops.



Sky Express

A321neos head to Sky Express

Greek carrier Sky Express took delivery of its first Airbus A321neo in early April. It is powered by CFM International Leap-1A engines and is being leased via Aviation Capital Group. Sky Express is set to take another A321neo later this year, adding to a fleet of more than 20 aircraft that is dominated by A320neos and ATR turboprops. The carrier highlights the A321neo's role in enhancing its service on routes to London and Paris.



CityJet

CityJet flying larger CRJs

Irish-based wet-lease operator CityJet introduced its first Bombardier CRJ1000 in early April, complementing its 21 CRJ900s.

CityJet is due to take five CRJ1000s this year. The General Electric CF34-powered aircraft was originally delivered to French regional carrier Brit Air in 2011.

It is being used to "support our wet-lease business", CityJet says, and has been assigned to operations on behalf of Lufthansa Group.



EgyptAir

A321neo debut at EgyptAir

EgyptAir received the first Airbus A321neo for the African continent in late February, following delivery of its latest twinjet at the airframer's Hamburg Finkenwerder plant. The airline has introduced the variant with a two-class configuration comprising 16 business-class and 166 economy-class seats.

Airbus identified the first airframe as SU-GFR, which is powered by CFM International Leap-1A engines. EgyptAir has since added a second example - both leased from Irish firm AerCap, which is due to deliver a further four to the carrier.



Atlas Air

MSC arrives with 777-200F

MSC Mediterranean Shipping stepped into the air cargo industry in late 2022 as its operating partner Atlas Air took delivery of a Boeing 777-200 freighter, which Atlas is operating on behalf of MSC.

The aircraft was delivered as part of a long-term ACMI agreement between the purchasers, New York-based Atlas and MSC, headquartered in Geneva, Switzerland.

It is the first of four new General Electric GE90-powered 777-200Fs that Atlas will operate for MSC.

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-Henry Maier, President and CEO, FedEx Ground

In 1923, a Ukrainian immigrant to the USA founded a company that would fundamentally change the nature of aviation. In 2023, the eponymous manufacturer, now owned by Lockheed Martin, is marking its centennial at the forefront of rotary aviation and looking to the next stage in its development

Sikorsky's century



A Sikorsky HH-60G Pave Hawk lands at an undisclosed location in Africa for casualty evacuation exercise in 2018

Ryan Finnerty

Ninety years on, Sergei Sikorsky still remembers his first flight.

"I sat on my father's lap," the 98-year-old recalls. "I watched the world suddenly come below me. I will never forget that moment."

The father in question was one Igor Sikorsky, the Ukrainian engineer who emigrated to the United States following World War One, and forever changed the nature of aviation with his radical machines capable of vertical take-off and landing.

The company that bears his name, now a subsidiary of American military airframer Lockheed Martin, is marking its centennial anniversary this year.

Among the firm's historic accomplishments over the past 100 years are the development of the first practical helicopter, the world's

first production helicopter, the first service helicopter for the US military and the first non-stop transatlantic helicopter flight - from New York to the Paris air show in 1967.

Two Sikorsky HH-3E Jolly Green Giants belonging to a US Air Force search and rescue squadron made that flight to Le Bourget, spanning more than 30 hours and nine in-flight refuellings by a Lockheed HC-130P tanker. Both Igor and Sergei Sikorsky met the aircraft in Paris when they arrived on the first day of June.

Igor Sikorsky was already an accomplished aerospace engineer when he arrived in America from Kyiv in 1919, fleeing the Russian Civil War. At 24 years old he had in 1913 built the world's first multi-engined airplane in czarist Russia; a four-engined passenger biplane called the S-21 Grand.

Sikorsky's American aerospace venture began in 1923 on small chicken farm east of New York City.

The fledgling enterprise soon moved to Queens and started producing seaplanes in 1926.

The flight Sergei Sikorsky remembers so vividly launched from the Long Island Sound in 1934 aboard one of the company's S-38 pontoon aircraft. The younger Sikorsky recalls at age six or seven watching ground mechanics work the hand crank engine start on an S-40 Clipper flying boat.

"You can never forget that sound and that sight," he says. "The whine of an inertial starter engine, and then the barking and the smoking and the belching, and the blue smoke coming out."

The young Sergei turned to his father and asked if he could have a job "cranking up" engines when he was older.

While he would eventually become a pilot, the junior Sikorsky reveals in the present day that he never got a job hand starting engines. The reason was the invention of the

electric starter, whose creator Sergei jokingly describes with an expletive in the present day.

"I lost my first job before I even had it," he laments.

By that time, the Sikorsky Aircraft Corporation had settled in its present day home of Stratford, Connecticut and been purchased by United Aircraft and Transport - a holding company that at the time controlled both Boeing and Pratt & Whitney.

By 1938, the Sikorsky enterprise had achieved some commercial success, particularly with the S-38 and S-40, which were operated by Pan American Airways. Igor, however, saw the future elsewhere, and began seriously pursuing his concept for vertical flight.

Reorganised as Vought-Sikorsky after a corporate restructuring, the company soon began work on fabricating its founder's outlandish vision for a small aircraft using a top-mounted rotor to generate both vertical lift and horizontal airspeed.]

By 1939, the first VS-300 prototype helicopter was lifting off from a field in Connecticut.

In contrast to the almost mundane nature of vertical flight today, it was clear even to the young Sergei that the aerospace establishment of the time was not onboard with his father's vision.

"When he would speak about the helicopter, it was evident that there was a great deal of scepticism", Sergei recalls. That incredulity, he notes, extended to many of the engineers working at Sikorsky.

"There is no doubt that it was built in spite of the prevailing opinion at the time," Sergei says of the company's early prototype.

Despite the prevailing attitude, Sergei says Igor Sikorsky always remained adamant the helicopter would be a transformative and successful technology. He was particularly certain of the concept's potential for emergency medical response.

"The helicopter will prove to be a unique instrument in the saving of human lives," Sergei recalls his father saying during those early development efforts.

The younger Sikorsky, who went on to serve in a US Coast Guard experimental helicopter squadron during World War II, admits there were periods of frustration when solving early engineering problems, such as excess vibration.

However, he says the "glacier-like mind" of Igor always managed to scour away any obstacles to his vision, whether technical or financial.

"Once he outlined a problem, he was going to solve that problem no matter what," Sergei says. "Even the experts can be wrong," he adds with a chuckle and the benefit of hindsight.

Sergei's first look at the helicopter came in 1939, during testing of the VS-300 prototype. War had just erupted in Europe, he recalls, when he went out to a field on Sikorsky's industrial campus in Stratford.

After spending the afternoon watching a VS-300 conduct a series of take-off, hover and land manoeuvres, "I was frankly very much impressed", he says.

In a move that would likely horrify aviation safety regulators and child welfare officers today, Sergei soon took his first helicopter ride by



US Army medical evacuation variant Sikorsky UH-60 Black Hawks supporting military operations against the Islamic State terrorist group in Iraq and Syria in 2022

hanging on the exterior landing strut of the VS-300.

By that time, the younger Sikorsky was pursuing his own fixed-wing pilot's license. He remembers thinking how his father's invention was seemingly in direct defiance of a flight instructor's urging that horizontal airspeed was essential to maintaining lift.

"Here was my father once again confounding the sceptics and literally hanging in the air," Sergei says today.

During the war, the son of Igor Sikorsky made his own milestone contribution to rotary aviation.

Sergei's New York-based Coast Guard squadron was experimenting with how the new helicopter technology could be applied for military uses. While there, the unit's commanding officer - Commander Frank Erickson - conceived of and built the first helicopter mounted rescue hoist.

Erickson is credited by the US Naval Institute as the first designated helicopter pilot in naval

aviation history. At 18 years old, Sergei Sikorsky played what he describes as a "very minor role" in proving its utility.

"Frank Erickson thought that it would be a good idea to generate confidence in the rescue hoist by having Igor Sikorsky's son demonstrate by hanging underneath the helicopter," he says with pride in his voice.

It was a fitting way for the younger Sikorsky to carry on the family legacy. Of all Igor Sikorsky's engineering and entrepreneurial achievements, Sergei notes his father was most proud of the role the helicopter assumed in medical rescue.

Rotary aircraft took on a prominent role as a medevac platform during the 1950-1953 Korean War, with the Sikorsky S-51 seeing combat service with the US Army and US Marine Corps. Many will be familiar with the importance of rotorcraft in evacuating battlefield casualties to field hospitals in that conflict from the opening credits

of the 1970s comedy drama series M*A*S*H.

After the war ended, Sergei says his father took great pride in the helicopter's part in the conflict. Whenever a former pilot visited the Sikorsky plant in Stratford, Sergei notes, Igor would invite them to his office above the factory and "ask literally for every possible detail" of their medevac missions in Korea.

"He was literally beaming with pride and with satisfaction, as he listened to these pilots describe their medevac missions and the lifesaving of the helicopter," Sergei recalls of his father, who died aged 83 in 1972.

Igor Sikorsky would then no doubt be pleased with the legacy of his namesake company. Sikorsky produces the UH-60 Black Hawk, whose many variants and derivatives have filled search and rescue and medical evacuation roles for the USA's armed forces for the past 40 years.

Under the umbrella of Lockheed Martin, Sikorsky is also under

Igor Sikorsky built and made the first flight of his VS-300 prototype helicopter in 1939, in Stratford



Igor Sikorsky, right, and Sergei Sikorsky, second from left, met the US Air Force flight crews of two Sikorsky HH-3E helicopters that completed the first non-stop transatlantic helicopter flight in 1967

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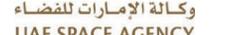
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A US Marine Corps Sikorsky CH-53K sling loads a truck in Twentynine Palms, California



contract to deliver the HH-60W Combat Rescue Helicopter to the US Air Force; the Pentagon's first purpose-built medevac rotorcraft.

In January, Sikorsky delivered the 5,000th example of its iconic Black Hawk type.

"The Black Hawk and all of our other products represent an incredible culture of innovation that's been with us since the company started by our founder, Igor Sikorsky, over 100 years ago," president Paul Lemmo said during a ceremony in Stratford to mark to occasion.

Sikorsky is also producing the S-70 direct commercial sale variant of the H-60 at its PZL Mielec facility in Poland, and in an interview Lemmo says the company soon expects to deliver the 100th model to European customers.

Orders from Europe and elsewhere are taking on increasing importance for Sikorsky, following the loss of the US Army's Future Long-Range Assault Aircraft competition to rival Bell earlier this year.

"We still have very strong product lines, obviously," Lemmo tells FlightGlobal. "Led by the Black Hawk, which we see as having a pretty solid future."

Sikorsky is currently producing UH-60s under the company's tenth multi-year contract with the US Army. That deal covers up to 255 aircraft through 2027, for both the Pentagon and foreign military sales customers.

Lemmo says there is currently "robust demand for the Black Hawk around the world", citing an order this year from Australia covering 40 aircraft. Spain and Norway have also expressed their intent to acquire the maritime variant of the type - Sikorsky's MH-60R Seahawk.

"I think that many militaries are looking for a proven platform that has stood the test of time through various conflicts," he adds.

The US Army has also floated the possibility of extending production of new UH-60s through 2033. At the Army Aviation Association of America

conference in Nashville, Tennessee in April, service leaders indicated the army plans to continue flying its Black Hawks until at least 2060.

All that means not just continued new orders for Sikorsky, but major modernisation work to keep legacy UH-60s in the air and capable of operating alongside the next generation of army rotorcraft currently being developed.

"We think there's a strong future for Black Hawk, as well as the S-70," Lemmo says.

Sikorsky is also charging toward full-rate production of the heavy-lift CH-53 King Stallion helicopter for the US Marine Corps, and continuing advanced prototyping on the Raider X design the company is competing for the US Army's Future Attack Reconnaissance Aircraft (FARA) contract.

Intended to replace the mothballed Bell OH-58 Kiowa scout helicopter, FARA once again pits

Sikorsky against Textron-subsiary Bell. As for FLRAA, Sikorsky is pitching a FARA design based on the company's radical X2 line of compound coaxial rotorcraft.

Lemmo remains confident in what he calls the "transformative" nature of the X2 design, and its ability to deliver upon the army's FARA performance requirements.

"The feedback we received from the army let us know that the agility, stability and scalability of our X2 can be extremely useful in contested areas, particularly the survivability of [the aircraft]," Lemmo said in April, following the FLRAA decision.

Elsewhere, the company is staying true to the boundary-expanding dreams of its founder, pursuing two lines of effort Lemmo describes as revolutionary.

Partnering with the secretive Defense Advanced Research Projects Agency, Sikorsky have developed prototype helicopters

capable of flying autonomously, without a pilot.

In 2022, Sikorsky completed multiple pilotless flights of a UH-60 using the company's Aircrew Labor In-Cockpit Automation System and Matrix flight control software. Those flights included a simulated casualty evacuation, battlefield resupply and cargo sling load.

The autonomous technology will also be deployed on another Sikorsky project: a hybrid-electric demonstrator the company is developing in collaboration with GE Aerospace. Dubbed Hex, the platform will pair a GE CT7 turboshaft engine with a 1MW generator.

Lemmo says the goal is to produce an "S-76-class aircraft" that will prove the utility of hybrid-electric propulsion for conventional vertical lift uses.

"What we want to do is build something that has dual use purpose for military and civilian," he says, noting Sikorsky does not believe current fully-electric propulsion technology is ready for the rigors of military operations.

The Hex demonstrator could fly as early as 2026, with a range of some 500nm (926km) and a maximum gross weight of 3,175kg (7,000lb).

Lemmo thinks the coming advancements in both capable electric propulsion and autonomous flight signal big changes across the industry.

"There is definitely a revolution going on in vertical lift right now," he says.

Igor Sikorsky would no doubt be pleased to see that spirit of innovation alive and well at the company bearing his name, and the aerospace industry writ large.

"Nothing can equal the work of free men," he is quoted as saying, in the company archives.

Sergei, who retired from Sikorsky in 1992 as vice-president, special projects, paraphrases a different one of his father's quotes when trying to distill the life of the pioneering engineer and aviator who raised him.

"If there is such a thing as a legacy, the legacy of Igor Sikorsky is the ability of a human being to dream up a new machine," he says. ▶



The first or two Sikorsky HH-3E Jolly Green Giant rescue helicopters arrives in Le Bourget after completing the first-ever non-stop transatlantic helicopter flight from New York to the Paris Air Show in 1967



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Governor Ned Lamont explains why aerospace and defence are critical to the Connecticut economy and how re-shoring trends and proximity to major US and Canadian cities are helping attract new investors

Connected Connecticut

Q Why is it important for the State of Connecticut to be represented at the Paris air show?

A The aerospace and defence industry accounts for one-third of state exports or nearly \$30 billion of the Connecticut economy. With companies such as Pratt & Whitney, Sikorsky and many others, Connecticut has the highest defence contract spending per capita of any state in the USA. Simply stated, the sector is critical to our state economy.

We attend the Paris air show to support our aerospace and defence companies and their export efforts. We are also there to attract new companies to our state, capitalizing on broader re-shoring trends across the supply chain and the innovation going on in the sector.

Q Connecticut is where Sikorsky and Pratt & Whitney are based. What other major aerospace companies call Connecticut home?

A We have a long list of companies such as Kaman, the Lee Company, and Collins Aerospace, but more recently Whitcraft Group and Paradigm Precision merged to form Pursuit Aerospace, the largest aerospace component manufacturer in the USA.

Connecticut's population is only 3.6 million people, yet we have over 1,000 advanced manufacturing companies in our state, which employ more than 75,000 people.

The state has demonstrated strength in the aerospace sector – as it provides the second highest per capita aerospace employment in the USA.

Q What are you doing to encourage more companies to come to Connecticut and, for those already here, to invest and grow?

A We meet with our aerospace companies regularly to ensure that we are aware of their challenges and are offering them solutions. Connecticut is also making significant investments in workforce development and training to meet their hiring needs.

Connecticut sees this industry as part of our DNA. The first functional helicopter was designed and made in Connecticut, so we take great pride in our past and are investing heavily in the future of aerospace in our state.

Our investment comes in the form of ensuring our workforce is world class and our supply chains have the right mix of companies required by



Pratt & Whitney is a major aerospace player in the state



State of Connecticut

Q What are Connecticut's other main industries, and what role does aerospace play in the wider economy?

A Aerospace, defence, and advanced manufacturing are key industries for us, as are life sciences, financial services, and technology.

Connecticut is a headquarter location with two Fortune 100 and 15 Fortune 500 companies located in our state. We are known as the Insurance Capital of the World, which has given birth to a rapidly growing insurtech industry.

Advanced manufacturing is another area where we excel. General Dynamics Electric Boat was awarded contracts to build the next generation of nuclear submarines in Connecticut, employing thousands of people.

We best describe our manufacturing industry as high-value, precision manufacturing. Connecticut core competencies include model-based definition design, high value precision machining, surface finishing technologies and optimized special processes for mission critical aerospace and defence applications and components. ▶

Raytheon Technologies

our large employers.

Our workforce is our coveted asset. Connecticut has 40% more engineers than the national average, including 2.2 times more aerospace engineers than most states.

We also have 2.3 times the national average of machinists and tool and die makers, and based on data from Lightcast, Connecticut is ranked the number one most productive state for aerospace workers in the USA.

Q What are the main strengths of the state in terms of its geographic location?

A Connecticut's location on the Eastern seaboard of the USA is one of our greatest assets.

Within 500 miles (800km) of Connecticut are states comprising over 29% of the US population, 30% of businesses, 31% of jobs, and 32% of GDP. We are also within 500 miles of 67% of Canada's population, 62% of Canada's businesses, and 66% of Canada's employment.

We are a highly connected state, with easy access to rail and airports that connect globally. We are also central to two of the largest cities in the USA, New York and Boston, not to mention within driving distance of Montreal and Toronto.



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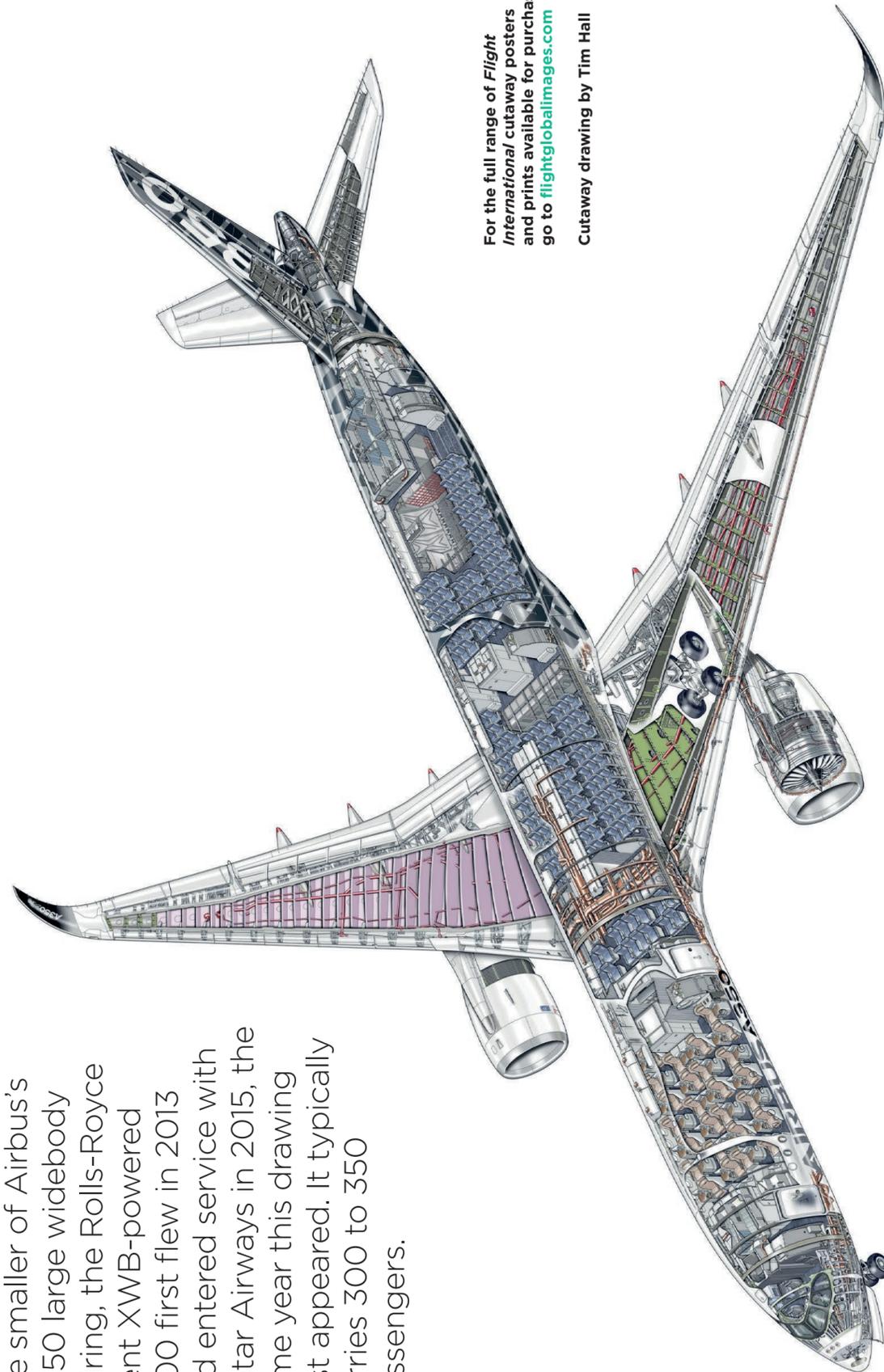
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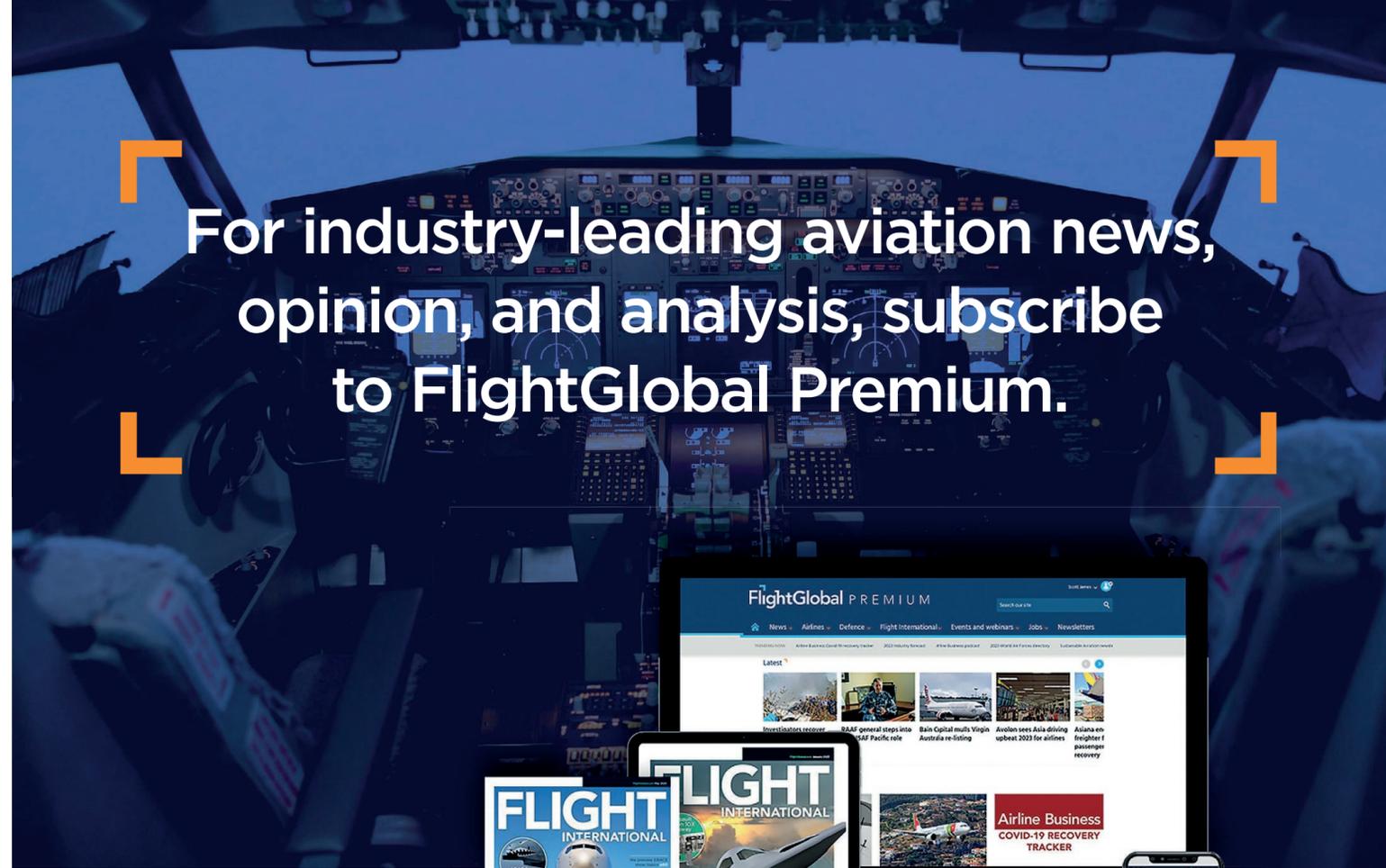
Airbus A350-900

The smaller of Airbus's A350 large widebody pairing, the Rolls-Royce Trent XWB-powered -900 first flew in 2013 and entered service with Qatar Airways in 2015, the same year this drawing first appeared. It typically carries 300 to 350 passengers.



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Cutaway drawing by Tim Hall



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