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Boom reborn

Developer reveals updated, four-engine design for supersonic jet it hopes to fly by 2026

Pilar Wolfsteller

Supersonic aircraft developer Boom yesterday unveiled a new design for its Overture aircraft, which it hopes to fly for the first time in early 2026.

"It's kind of like if Concorde and the 747 had a baby," says chief executive Blake Scholl.

The new aircraft design now features four engines, instead of the two originally envisaged. It also includes a higher aspect ratio "gull wing", longer wingspan and a contoured fuselage – wider in the front and slimmer towards the back. All of the changes are designed to improve aerodynamic efficiency.

Scholl says the company has gone through 50 design cycles, including windtunnel tests, since the company presented the first draft of Overture five years ago.

"We have learned so much over the last few years that we saw a real opportunity to improve the configuration," Scholl says. "Overture delivers not just on speed and noise, but also safety and sustainability."

The aircraft is slated to travel at Mach 1.7 over water, and M0.94 over populated areas, never creating a sonic boom. It will have a range of 4,250nm (8,056km) and will seat 64-80 passengers. From nose to tail the aircraft measures 61.3m (201ft) and 32.3m wingtip-to-wingtip.

First deliveries are planned for 2029, he says.

Boom has also added Collins Aerospace, Eaton and Safran to its top-tier suppliers for Overture. Collins will provide major aircraft systems and components, Eaton will develop fuel distribution, measurement and inerting systems, and Safran will build the landing gear for the supersonic aircraft.

Meanwhile, Boom is to partner with Northrop Grumman to develop a special mission variant of the supersonic Overture aircraft for the US government and its allies.

"Time is a strategic advantage in high consequence scenarios, from emergency evacuations to disaster response," says Scholl.

He says civil applications are only "half of the potential" for the aircraft, and that Overture brings "paradigm-changing capabilities" to military operations.

Some of those capabilities could include surveillance and reconnaissance, command and control as well as mobility and logistics missions such as emergency medical and troop transport.

"Pairing Northrop Grumman's airborne defence systems integration expertise with Boom's state-of-the-art Overture supersonic aircraft makes perfect sense," says Tom Jones, president of Northrop Grumman Aeronautics Systems.

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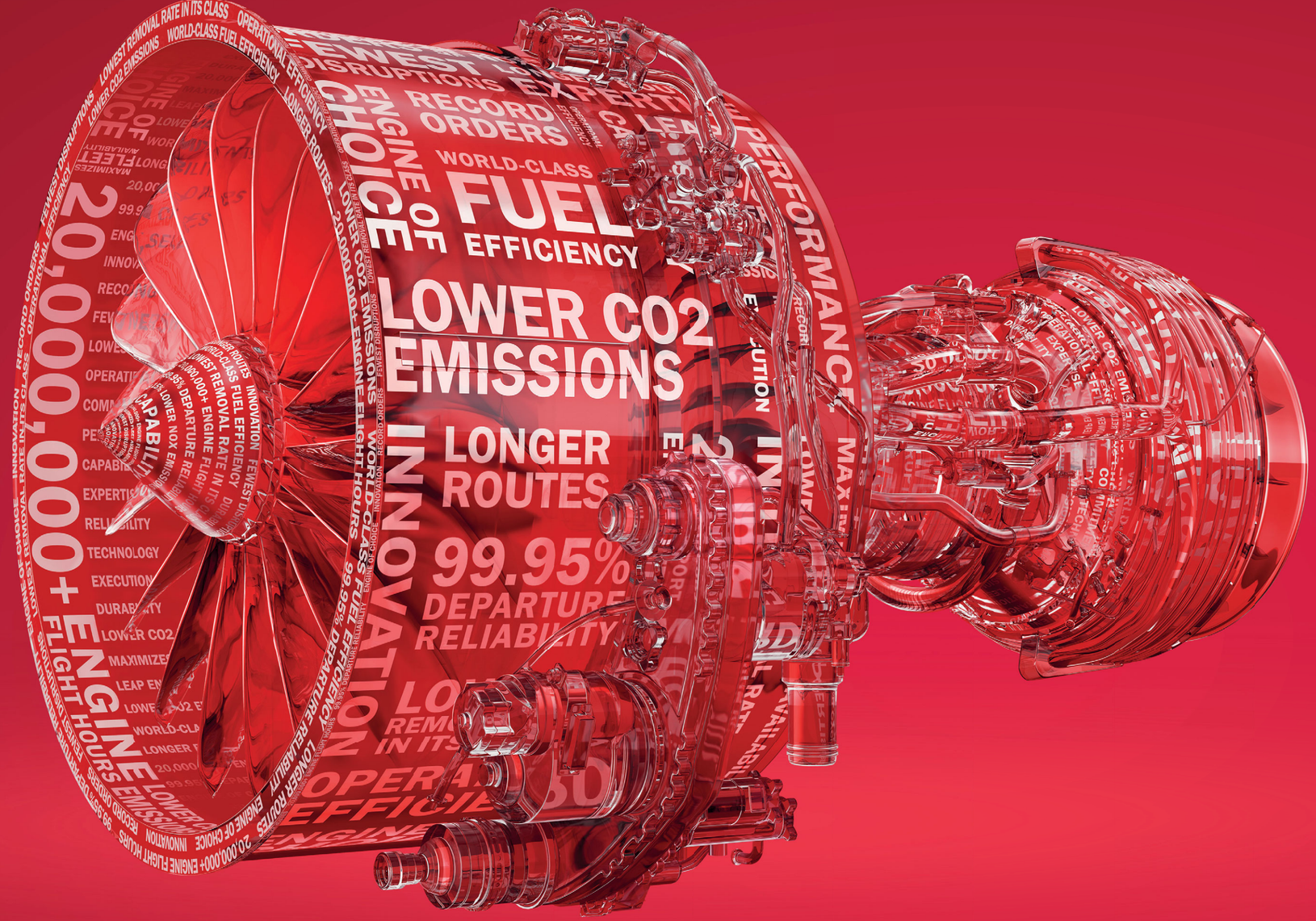

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***Compared to previous generation engines.**

BAE to market C-390 in Gulf

Craig Hoyle

Embraer has partnered with BAE Systems to promote its C-390 transport to potential customers in the Middle East, with Saudi Arabia as their initial sales target.

Signed at the Farnborough air show yesterday, their memorandum of understanding seeks to draw on the capabilities of the Brazilian-built twinjet and BAE's decades-long pedigree with partnering the Saudi military.

"It is an exceptional and exciting platform, and we want to take it into our market presence in the Middle East, with an initial focus on Saudi Arabia," says BAE Systems Air chief operating officer Ian Muldowney.

"Customers around the world including in the Middle East have got an ageing [Lockheed Martin] C-130 fleet, and we see the [replacement] opportunity arising," Muldowney says. "We want to be able to showcase what we think is an excellent and world-class product."

He adds: "It's not just about transportation, it's the ability to turn the C-390 into a special-mission aircraft with relative ease."

"Embraer brings to the market an unbeatable design able to perform different missions with the same platform, with very competitive maintenance costs and very low operational costs," says Embraer Defense & Security chief executive Jackson Schneider.

"We are able and open to offer more than a platform – we are open to offer partnership with Saudi Arabia," he says. "We are very flexible to do things together".

"It is by far the platform of the future," Schneider says of the C-390. "We are in a very good moment," he adds, pointing to the Netherlands' recent selection of the type to replace its aged Lockheed Martin C-130Hs. Embraer also counts Brazil, Hungary and Portugal as customers for the type.

Also at the show, BAE and Embraer strengthened their relationship on the Eve electric vertical take-off and landing aircraft. Exploring potential military applications for the type, the pair signed a non-binding letter of intent to potentially order up to 150 examples of the battery-powered platform.

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Schneider and Muldowney: Strengthening ties

CFM

Embraer

BAE stresses aircraft's potential as special-mission platform

RISE to fly on A380

Airbus will later this decade flight test the open rotor demonstrator engine being developed under CFM International's RISE programme aboard an A380.

RISE – or Revolutionary Innovation for Sustainable Engine – was launched in 2021 with the goal of maturing technologies for a new powerplant to enter service in the mid-2030s that will deliver a 20% fuel saving over current narrowbody engines.

Flight tests using Airbus's 'Flightlab' A380 (MSN1) will be conducted in the second half of the decade from the airframer's facility in Toulouse.

Ahead of that milestone, CFM – a joint venture between GE Aviation and Safran – will perform engine ground tests and flight-test validation at GE's site in Victorville in California.

"New propulsion technologies will play an important role in achieving aviation's net-zero objectives, along with new aircraft designs and sustainable energy sources," says Sabine Klauke, Airbus chief technical officer.

"By evaluating, maturing and validating open fan engine architecture using a dedicated flight-test demonstrator, we are collaboratively making yet another significant contribution to the advancement of technology bricks that will enable us to reach our industry-wide decarbonisation targets."

CFM

Pictured left to right: Mohamed Ali, vice-president engineering, GE Aviation, Sabine Klauke, Airbus chief technical officer, Francois Bastin, vice-president commercial engines, Safran Aircraft Engines

The partners say the tests will further their understanding of the integration between the wing and engine and aerodynamic performance as well as propulsive system efficiency gains. It will also help validate performance benefits from the open rotor architecture.

"The CFM RISE programme is all about pushing the technology envelope, redefining the art of the possible, and helping to achieve more sustainable long-term growth for our industry," says CFM chief executive Gael Meheust.

Airbus and CFM in February committed to conducting flight tests of a fuselage-mounted GE Passport business jet engine running on liquid hydrogen aboard the modified A380. Images released by the pair show the RISE engine in place of the superjumbo's Rolls-Royce Trent 900.

Aircraft orders pass 300

Boeing leads tally, with AerCap Dreamliner deal the only one for widebodies

Aircraft order commitments during the show passed the 300-unit mark with a string of new deal announcements today, almost all of which represented repeat business.

Those were again led by Boeing, which unveiled commitments from three aircraft lessors and investment firms.

The biggest of those came from investment firm 777 Partners, which signed for up to 66 Boeing 737 Max 8s.

AerCap's deal for five more Dreamliners is the only widebody order so far announced at the show.

777 Partners is already a strong customer for the Max, the latest agreement being its fifth for the type. The new deal, which includes a firm order for 30 Max 8-200s, will take its backlog for the Max to as many as 134 aircraft.

"We are excited about the possibilities the Max aircraft provide our growing group of carriers to facilitate and democratise low-cost travel around the globe while respecting our commitment to sustainable flying," says 777 Partners managing partner Josh Wander.

777 Partners' aviation portfolio includes the new Australian start-up carrier Bonza, which is aiming to commence services this year using Max jets. 777 Partners also has investment interests in Canadian low-cost operator Flair Airlines.

Aviation Capital Group also signed for a dozen more Max jets, taking its orders to 34. These aircraft were formerly listed in Boeing's orders and deliveries website, attributed to an undisclosed customer.

Another lessor, AerCap, ordered five more Boeing 787s – taking its Dreamliner commitments to 125. The order was also the first, and so far only, new widebody order announced during the first two days of the show.

In other announcements, Boeing disclosed that lessor BBAM has ordered nine more 737-800 converted freighters. That takes to 40 its commitments for the type.

BBAM is also set to be the customer to take delivery of the first 737-800BCF completed at a Kelowna, Canada conversion facility operated by maintenance provider KF Aerospace.

While Airbus has so far remained unusually quiet on the order front, it did announce a follow-on commitment for a dozen A220-300s from Delta Air Lines. The US carrier, which on Monday opened the show with an order for up to 130 Boeing Max jets, now has orders for 107 A220s.

On the regional front, both ATR and Embraer announced orders at the show.

Embraer notched commitments for a total of 28 aircraft and 13 options from two North American carriers. Alaska Air Group placed an order for eight E175s as well as the 13 options. The aircraft will fly exclusively for Alaska Airlines under a capacity purchase agreement with regional subsidiary Horizon Air. It already operates 30 E175s.

Porter Airlines meanwhile ordered 20 new-generation E195-E2s. It takes the Canadian regional carrier's orders for the type to 50 firm and 50 options.

ATR secured commitments for 10 ATR 72-600s from newly formed leasing platform Abelo, which also reaffirmed a commitment for 10 short take-off and landing versions of ATR 42-600s from Elix Aviation.

Abelo was formed from the merger of Elix with Adare Aviation Capital, disclosed in May with the aim of further investing in turboprops.

It has signed a heads-of agreement covering 10 ATR 72-600s. Deliveries will begin next year.

ATR followed an earlier tentative deal from Feel Air with an order for one ATR 42-600 from another Japanese operator, Oriental Air Bridge.

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Boeing's Stan Deal (*left*) signs the Max 8 deal with 777 Partners' founder and managing partner Josh Wander

CAE electrifies training

Canadian training specialist CAE will join Piper Aircraft to develop a conversion kit for the popular Archer trainer aircraft, and bring an electric variant option to market.

The Montreal-based company also said at the show yesterday that it will convert two-thirds of its training fleet to electric propulsion and develop a curriculum to train pilots on the operation of electric aircraft.

"The development of this technology is a first for CAE," the company's chief executive Marc Parent says.

"CAE is uniquely positioned to make electric-powered flight a reality at our flight schools and beyond."

"Piper Aircraft is excited to support CAE's development of an electric aircraft modification conversion kit," adds Piper Aircraft chief executive John Calcagno. "Piper Aircraft is focused on aviation's commitment to greenhouse gas reductions and as such, we look forward to collaborating with CAE on the integration of an electric propulsion system for the Piper Archer."

Swiss battery and propulsion supplier H55 will provide the battery system for the electric aircraft. The company also supplied the Solar Impulse aircraft, the first solar-powered aircraft to circumnavigate the globe in 2016.

The engine for the conversion kit – the 100kW ENGINEeUS 100 – will be supplied by Safran Electrical & Power.

About 28,000 of the single-engine piston aircraft are in global service, and are often used for initial flight training.

Al Baker's not backing down

David Kaminski-Morrow

Qatar Airways' single-aisle fleet modernisation remains in limbo after group chief executive Akbar Al Baker confirmed that a tentative Boeing 737 Max order had lapsed, and the situation with Airbus – which cancelled the airline's A321neo agreement – remains unresolved.

Speaking during a briefing at the show yesterday, Al Baker said the memorandum of understanding for 50 737 Max 10 jets, disclosed in January this year, has "lapsed", adding: "We couldn't agree to a lot of terms and conditions on the Max."

Al Baker states that he does not know whether the airline will go back to Boeing in a bid to revive the agreement.

The provisional deal for 737 Max 10s followed Airbus's sudden cancellation of 50 Qatar A321neos just days earlier.

This cancellation was directly linked to Qatar Airways' refusal to accept further deliveries of Airbus A350s over a skin-paint deterioration issue – an issue which Al Baker claims amounts to a safety concern, after the Qatari civil aviation authority grounded several A350s.

While Airbus has accepted that a number of Qatar A350s have experienced skin-paint problems, it vehemently rejects the regulator's justification for the grounding, insisting that the matter is one of cosmetics and not safety.

Airbus, which is challenging the Qatar Airways safety claim through legal channels in the UK, says it would prefer a settlement outside of court.

But Al Baker indicates that he is sceptical about the airframer's overtures.

"Airbus has publicly said it is trying to find solution, but this is only for public consumption," he argues. "When you really want to have a settlement, you need to come with a realistic settlement."

He says the carrier is "open" to an approach "provided that it is fair", considering the damage inflicted on the airline by the grounding.

"Airbus has not made a concerted effort," insists Al Baker. "They've said it in public. But to have a settlement you need also a concerted effort to resolve a problem."

No other aviation regulator has expressed doubts over the A350's safety, and the judge in the legal case remarked in May that Airbus and the airline should work "pro-actively together" to convince the Qatari civil aviation authority to reverse its grounding decision – even if this hurt Qatar Airways' case.

But Al Baker maintains that the exposure of the lightning-protection is a serious issue.

"Unlike other regulators that rely on the airlines to do their checks – and certify those checks – the [Qatari authority], after checks were complete on our aircraft, sent inspectors to make sure we're fully compliant," says Al Baker.

"They are the people who will decide, after inspecting the conditions, if it is a safety issue or not."

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Qatar could not agree to terms on the Max

Sizing up the Airlander

Hybrid Air Vehicles is partnering with a group of potential customers to define the design of a larger sibling to its Airlander 10.

The Airlander 50 will be capable of carrying a payload of approximately 50t, five times that of the Airlander 10. The larger variant has not been launched yet, but the Bedford-based company is hoping to kick-off the programme in 2024, with feedback from the companies contributing to the final specifications. It envisages a 2030 service entry.

Three partners have been announced: infrastructure provider AECOM, Scottish Highlands and Islands airports operator HIAL, and fruit grower and importer Blue Skies Holdings.

HAV says other companies are welcome to join the group without committing to purchasing the hybrid aircraft, which the company is likely to pitch largely at the oversized freight market for cargoes such wind turbines, particularly to remote areas lacking in ground infrastructure.

At the start of the show, HAV held an event on its stand with Air Nostrum, the Spanish regional airline that is the first named customer of the Airlander 10.

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Pictured left to right: Tom Grundy, chief executive of HAV, and Jeff Woodward, global market sector leader, energy, for AECOM

P&W catching up with PW1100G shortfall

Pratt & Whitney aims to catch up with delayed deliveries to Airbus of PW1100G engines for the A320neo family "no later than early next year".

Airbus has this year been building so-called gliders – completed aircraft absent their engines – thanks to a shipment shortfall from its propulsion providers.

But speaking at a media event at the Farnborough air show to introduce the new leaders of the company yesterday, Rick Deurloo, president of commercial engines, said PW1100G output was beginning to stabilise.

Although he acknowledged deliveries had been below target, particularly in the first quarter, "our intent is to try and climb that back this year".

"I would tell you that if I had a range, it would be no later than early next year for... Airbus," he says.

Airbus plans to take A320neo-family production to a rate of 75 aircraft per month by 2025, prompting questions of whether its narrowbody supply chain will be able to cope with those rates.

Given current demand for new aircraft, Deurloo says P&W does not "question rate 75" or P&W's ability to achieve such an output, but would like a slower ramp to the higher production level.

"I think Airbus would like to get us in sooner than we think we would be capable of. But I think we'd like to hit that rate sometime in the 2026 timeframe, maybe not a full calendar year, but we'd like to at least try and hit it during [that year]."

Negotiations with Airbus continue of the pacing towards rate 75, he says, adding: "Obviously they are pushing us to do better, but we are obviously being balanced with the knowledge that we have the [GTF] Advantage engine coming in."

PW1100Gs are an option on A320neo-family jets alongside the CFM International Leap-1A.

UK commits to Jet Zero

Lewis Harper

UK secretary of state for transport Grant Shapps has warned that the aviation industry will lose its "permission to fly" if it does not act to address its environmental footprint.

Shapps was speaking at the Farnborough air show yesterday, where he launched the UK government's "pitch to get to net-zero CO2 emissions" with its new Jet Zero Strategy.

That strategy commits, among other things, the country's domestic aviation sector to achieving net-zero emissions by 2040, and for the entire industry to immediately stay below pre-Covid levels of CO2 emissions on its journey to net-zero for all flights by 2050.

Asked whether airlines in particular are right to be concerned about the potentially higher costs and taxes that might come from the net-zero effort, Shapps was unequivocal that the industry has no alternative but to act.

"The cost of not doing it is hugely higher because we will essentially lose permission to be able to fly if we don't do this," he says.

"It will be basically unacceptable to have an entire sector of the economy where people are just pumping out CO2 without any thought," Shapps continues. "Over time that is going to become less and less socially and probably legally acceptable.

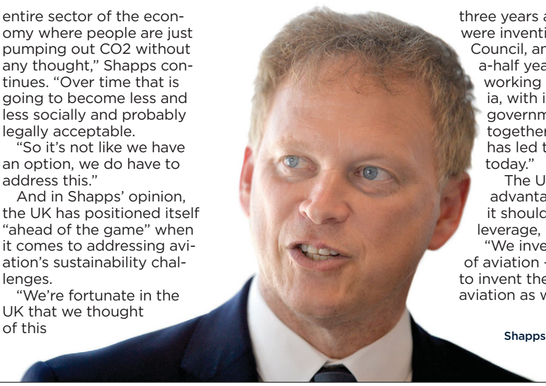
"So it's not like we have an option, we do have to address this."

And in Shapps' opinion, the UK has positioned itself "ahead of the game" when it comes to addressing aviation's sustainability challenges.

"We're fortunate in the UK that we thought of this three years ago when we were inventing the Jet Zero Council, and for two-and-a-half years we have been working with academia, with industry, with government very closely together, which is what has led to the strategy today."

The UK's early-mover advantage is something it should continue to leverage, he suggests.

"We invented so much of aviation – it's time for us to invent the next phase of aviation as well."



Shapps: Industry must act

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Deutsche sees sunny outlook for D328eco

Jackson: Aircraft making steady progress

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Deutsche Aircraft has seen no "adverse reaction" from potential customers to the recently announced delay to service entry for its D328eco twin-turboprop.

The German manufacturer revealed in June that it had pushed back service entry of the D328eco until the second half of 2026, from a previous target of 2025.

Speaking at the show yesterday, acting chief commercial officer Nico Buchholz said the hiatus was due to feedback from its customer advisory panel and an analysis of the aircraft's supply chain.

"When we looked at the programme, there were certain things that didn't add up, particularly on the supply chain," he says.

"There were two suppliers who were definitely behind and were on a critical path that was not recoverable."

Buchholz – a former Airbus and Lufthansa executive – says there has been "no adverse reaction" from customers.

Changes incorporated as part of the update include how the lavatory system is integrated in the cabin and consideration whether to include avionics provider Garmin's emergency descent Autoland system in the baseline aircraft.

"[The delay] gives us time to understand with the airlines what should we put as standard equipment," says Buchholz.

He hopes to sign the first orders for the D328eco – a stretched and modernised Dornier 328 turboprop – "by the end of the year".

Deutsche Aircraft chief executive Dave Jackson says the aircraft is making steady progress, having passed the preliminary design review milestone earlier this year. In addition, rebranding from its 328 Support Services predecessor continues. "We are very pleased with how this has been received," he says.

Embraer reports surge of interest in turboprop

Embraer has letters of intent for "well above 250" of its planned turboprop aircraft, the company's commercial aircraft chief executive Arjan Meijer said at the show yesterday.

Embraer is still to formally launch the programme, but has been considering development of a modern turboprop for several years, a move that could significantly disrupt a market dominated by ATR and De Havilland Canada. Both those airframers' aircraft are based on decades-old designs.

The manufacturer has indicated its new turboprop would share a fuselage with its E-Jet regional jets, so that customers will get a familiar feel from the new aircraft. The company is planning two variants, one with 70 and another with 90 seats.

Embraer expects to launch the programme in 2023, and begin deliveries in 2028.

While Meijer is cagey about naming the parties that have signed the tentative deals, he says that it is a "global spread of customers in almost all continents and a very diverse mix of operators". Network carriers as well as point-to-point operators are among the potential customers.

"We want to see what the user says about it first," Meijer says. "And at this show we have more customers showing a real interest in the turboprop."

Embraer has said that it sees the 70-seat variant as ideal for the US market, which would likely outfit such an aircraft with only 50 seats, in two classes. They would use it to replace ageing 50-seat regional jets, with the 90-seater likely be more popular in other regions.

It anticipates that in the next twenty years the market for turboprops is 2,280 units worldwide.

Just over 40% of that is in Asia-Pacific, with nearly 22% in Europe, 17.5% in North America, 8.8% in Africa, 7.9% in Latin America and 1.8% in the Middle East.

Wisk hails next-gen air taxi

Jon Hemmerdinger

Air taxi developer Wisk Aero expects this autumn to unveil the production-conforming version of its electric vertical take-off and landing (eVTOL) aircraft – the sixth generation of its air taxi – which it will bring through US Federal Aviation Administration (FAA) certification.

Although that aircraft is not at Wisk's display at this year's Farnborough air show, the next best thing is: the company's fifth iteration of its design, a two-seat model called Cora.

Executives from Wisk and Boeing – which part owns the start-up – are quick to note that their team is among only a few to have cracked the complicated problem of developing an aircraft capable of taking off and landing vertically, and transitioning into forward flight.

"Doing that is a very difficult flight-control problem. There are only a few that can design a plane that can take-off vertically and fly horizontally," says Brian Yutko, chief engineer for sustainability and future mobility at Boeing, Wisk's majority shareholder, alongside Kitty Hawk.

BillyPix

The Cora on display

Cora has 12 wing-mounted lifting fans and one aft-mounted pusher propeller. A typical take-off involves ascending vertically to about 40ft, then transitioning to forward flight, a process taking about 25s, says Wisk chief executive Gary Gysin.

He says California-based Wisk is flying test aircraft "almost every day", and that its fleet has logged some 1,600 test flights.

The aircraft at Wisk's Farnborough chalet has flown about 400 times but has since been decommissioned as a flight asset.

Wisk in September plans to reveal its sixth-generation aircraft – a four-passenger design it hopes to bring through FAA certification. "We will be flying the new aircraft soon," Gysin says.

The six-generation prototype will likewise have lifting wing-mounted lift-fans, but Gysin declines to say if it will also have a pusher propeller.

Wisk and competing developers of eVTOL aircraft utimately see their designs becoming autonomous. While its rivals see a need for piloted variants initially, Wisk's aircraft will be autonomous from the start, Gysin says.

"We will certificate the first passenger-carrying autonomous aircraft," adds Yutko

Due to technical requirements associated with full autonomy, Wisk is not saying when it hopes to achieve certification, freeing engineers to focus on safety-of-flight considerations.

Gysin describes Boeing's backing as critical. "We are able to tap their aerospace expertise," he says.

Wisk has some 500 people working on the eVTOL project, including about 100 Boeing engineers. Activities are being performed at sites in California, St Louis and Virginia, and elsewhere in the eastern USA.

Wisk has not said where it expects to produce its air taxi, but Gysin says: "It won't be in California – it's not the lowest-rent district in the world."

He anticipates Wisk could build up to 2,000 eVTOL aircraft within five years of service entry.

Unlike some competitors, Wisk intends to also operate its air taxis, at least at first, says Gysin. "That doesn't mean its going to be forever."

KF-21 makes first flight

Korea Aerospace Industries

As the company exhibits here at the show, the first prototype of the Korea Aerospace Industries (KAI) KF-21 has conducted its maiden flight from Sacheon, South Korea.

According to South Korea's defence ministry, the fighter took off at 15:40 local time and landed at 16:13 on 19 July. It gave no other details other than to state that the flight was "successful".

During the sortie the jet was accompanied by a T-50 advanced jet trainer with a photographer in the back seat. According to KAI, the aircraft did not retract its landing gear during the flight.

"This first flight was the realisation of the domestic development capability of the 4.5th-generation advanced fighter," says South Korea's Defense Acquisition Program Administration (DAPA).

"It symbolises a new leap forward in domestic aviation technology and a leap forward into a high-tech powerhouse."

DAPA adds that it aims to conduct 2,000 flight tests. These will expand the flight envelope, perform a range of checks, and assess the fighter's air-to-air weapons. This work will be undertaken by a prototype fleet comprising six aircraft.

KAI has consistently said that the fighter's first flight would take place by the end of 2022, following the aircraft's roll-out in April 2021.

Anticipation of a maiden sortie mounted recently when footage of the aircraft conducting ground tests emerged in South Korea.

Powered by two GE Aviation F414 engines, the KF-21 will replace the McDonnell Douglas F-4 Phantom and Northrop F-5 in Republic of Korea Air Force service.

Development of the aircraft is to be completed by 2026, followed by service entry.

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Building a world that works

GE reaches all new heights with hybrid

Lewis Harper

GE Aviation has provided additional detail of the testing planned for its megawatt-class and multi-kilovolt hybrid-electric propulsion system.

The manufacturer demonstrated performance of the system's components – including electric generators, power converters, power transmission and power control systems – in a replicated flight environment, simulating single-aisle commercial aircraft operations at 45,000ft. That will allow the research programme to move on to flight-testing in the coming years.

Testing was completed earlier this year at NASA's Electric Aircraft Testbed (NEAT) facility in Ohio, but only announced at the Farnborough air show on 19 July.

Future trials will be conducted as part of NASA's Electrified Powertrain Flight Demonstration (EPFD) project, which was launched by the agency in September 2021, using a hybrid-electric system connected to GE's CT7 turboprop engines.

Ali: Making hybrid electric flight possible for everyday travel

Lewis Harper/FlightGlobal

A CT7-powered Saab 340B will be used for flights tests of the hybrid-electric system later this decade.

Boeing is partnered with GE to support the flight tests for the EPFD, providing the aircraft, modifications, integration and flight-testing services.

GE Aviation describes the milestone as a world-first achievement.

"We're making aviation history by developing the technology to help make hybrid-electric flight possible for everyday commercial air travel," says Mohamed Ali, vice-president and general manager of engineering for GE Aviation.

"GE is proud to be a long-standing partner with NASA for development of new aviation technologies. Together, we just passed a key milestone by successfully concluding the world's first test of a high-power, high-voltage hybrid-electric system at altitude conditions."

GE describes the system as a "building block" for future propulsion programmes, with entry into service forecast in the mid-2030s.

EASA certificates IAI 737 freighter

European regulators have certified the Boeing 737-800 freighter conversion offered by Israel Aerospace Industries, potentially opening the modification to additional customers.

Two aircraft have already been delivered to a Spanish operator under the new approval, and a third is undergoing conversion.

The aerospace firm says it has obtained the 737-800BDSF supplemental type certificate from the European Union Aviation Safety Agency (EASA). IAI chief executive Boaz Levy says the EASA clearance will allow the company to offer a response to increased market demand for the narrowbody freighter.

"[We have] a number of conversion sites globally, and will now be able to provide potential customers with increased access to our world-class conversions," he adds.

EASA approval follows similar regulatory clearance from the US Federal Aviation Administration and the Civil Aviation Administration of China, plus the Israeli civil aviation authority.

Rolls-Royce gets disruptive

Rolls-Royce has announced two significant collaborations on disruptive propulsion projects. The UK engine-maker will work with Hyundai Motor Group on an effort develop and fly a fuel cell-powered aircraft by the middle of the decade.

Meanwhile, EasyJet and Rolls-Royce are partnering on hydrogen combustion technology in a project that will see the UK budget carrier "directly invest" in the newly named H2ZERO test programme.

Under the memorandum of understanding with Hyundai, signed at the show, the partners will work together to bring full-electric propulsion and hydrogen fuel cell technology to the advanced air mobility (AAM) market.

It will leverage Rolls-Royce's aviation and certification capabilities and Hyundai's fuel cell expertise, plus the automotive giant's industrialisation capability.

East (*left*) marks the Hyundai deal with Euisun Chung, executive chair of Hyundai Motor Group

Rolls-Royce

Key aims detailed in the agreement include: the development of power and propulsion systems, including fuel cells, for Hyundai's AAM and regional air mobility products, and the wider market; and the industrialisation of Rolls-Royce electric propulsion technology for AAM. In addition, a joint fuel-cell electric aircraft demonstrator is envisaged by 2025.

Jaiwon Shin, president of Hyundai's AAM division, says: "Hyundai has successfully delivered hydrogen fuel cell systems to the global automotive market and is now exploring the feasibility of electric and hydrogen propulsion technologies for aerospace integration."

President of Rolls-Royce Electrical Rob Watson adds: "This collaboration supports our joint ambitions to lead the way in the AAM market."

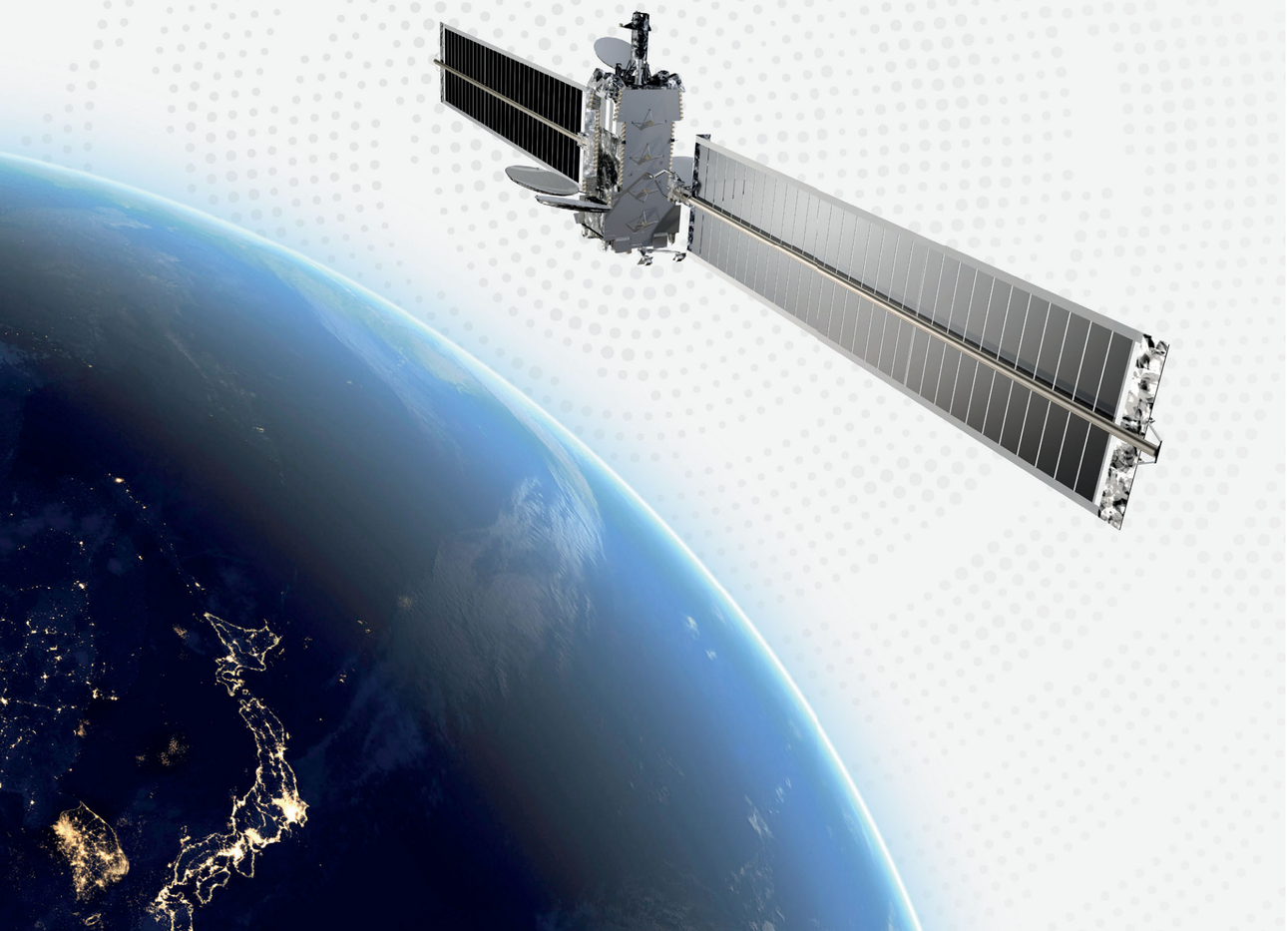
Hyundai's US-based Supernal unit is aiming to begin commercial services of urban air mobility vehicles in the USA in 2028 while RAM services are envisaged in the 2030s. Fuel cell power is seen as important for the latter mission due to the longer ranges envisaged.

In the hydrogen combustion trials agreement with EasyJet, Rolls-Royce will run its AE 2100 turboprop on liquid hydrogen fuel.

Subsequently, ground runs of a hydrogen-burning Pearl 15 business jet engine will take place with the firm still considering whether it will take the powerplant to flight test. However, the pair say they have a "shared ambition to take the technology into the air".

EasyJet will contribute its operational knowledge and experience to the H2ZERO effort and will also directly invest in the test programme, the partners say. The agreement announced yesterday follows a research project that both companies began in 2021, developing market analysis, driving specifications, investigating infrastructure and regulatory requirements to support the use of hydrogen in aviation.

EasyJet has previously signed agreements to explore next-generation powertrain technologies with companies including Wright Electric and Cranfield Aerospace Solutions.



Apollo veteran's plea to youth

David Kaminski-Morrow

Apollo 16 astronaut Charlie Duke highlighted the importance of inspiring youth to pursue careers in aerospace at the Farnborough air show, with a remark directed at NASA administrator Bill Nelson.

"I was the youngest guy on the Moon," he said, referring to his April 1972 lunar mission. "I'm 86 and I'm still the youngest guy on the Moon."

Duke was speaking at the opening of the USA Pavilion, to a delegation that also included US ambassador to the UK Jane Hartley and US secretary to the Air Force Frank Kendall.

He concentrated on the theme of 'inspiration', using his own experience. "It's funny how little things affect our careers," he said, recalling an observation in 1950 when he was 15 years of age.

Duke: Be an inspiration, whoever you are

BillyPix

"I saw a contrail go over," he said. "I thought, 'Man, I'd like to make a contrail'."

He followed his father into the navy but an astigmatism in his right eye prevented him from pursuing a career in naval aviation. Duke says he was told: "You don't qualify for naval aviation but the air force will take you!"

This led to his progression to test pilot, mission control, and astronaut.

Duke mentioned reading a book, *On Beyond Zebra*, to his young children, in which a character learns the existence of new letters past the end of the alphabet.

He has worked to help encourage young people to think similarly, and consider careers as explorers and engineers through the Endeavour Scholarship, continuing the legacy of late Apollo 15 astronaut Al Worden.

"Be an inspiration," Duke told the audience at the event. "No matter where you are, or what you're doing."

FAC links up with Ohio

Farnborough Aerospace Consortium – a trade body for aerospace companies largely in the south-east of England – has signed a memorandum of understanding at the show with the Ohio Aerospace Institute (OAI).

The OAI is a collaboration between businesses, universities and other entities based in the state, including the NASA Glenn Research Center.

Alan Fisher, chief executive of FAC, says: "Part of our role is to help our members win new business.

"This partnership will enable us to build strong links with businesses and other aerospace organisations in Ohio.

"It will help forge new relationships and we know that international collaboration is fundamental in keeping aerospace moving forward.

"While most of our members are from the south and south-east, we have members from across the country and around the world.

"As aerospace is a truly global industry we must look to all areas of the world to benefit our members, which in turns benefits the country."

John Sankovic, president and chief executive of Ohio Aerospace Institute, says: "We are a collaboration between government, academia and industry.

"After 33 years we are moving further afield because aerospace is global. One of our biggest aerospace trade partners is the UK so this partnership with FAC is logical."

Morocco picks H135

Morocco has selected the Airbus Helicopters H135 for military primary training missions. No order quantity has been disclosed, but the Royal Moroccan Air Force currently operates five Bell 206s in the trainer role.

"We are proud that the [air force] has selected the H135 for their training missions. It is a reliable, cost-efficient multi-role helicopter that is ideally suited to transitioning to more complex aircraft," says Arnaud Montalvo, head of Africa and Middle East at Airbus Helicopters.

The contract also covers an extensive support package including the delivery of flight training devices and the training of instructor pilots and maintenance crews.

Over 130 H135s are in use as military trainers globally for 12 customers, including Australia, Germany, Japan and the United Kingdom.

Recycling the news

FlightGlobal has been doing our bit to cut our carbon footprint and keep the show tidy. Our GE Aviation-sponsored Recycling Team has been collecting any discarded copies of *Flight Daily News* – and other publications.

BillyPix

BAE plans to fly a testbed example of the T-650 unmanned air vehicle

BAE Systems

How electric investments could charge BAE's future

Craig Hoyle

While BAE Systems' production role on the Eurofighter Typhoon and development activities as part of the UK's Team Tempest are well documented, the company also is increasingly exploring the promise of emission-free flight technologies.

The UK government has committed to the nation achieving net zero carbon emissions by 2050, but in the military realm companies like BAE face a much stiffer challenge, with the Royal Air Force (RAF) aiming to hit the environmental target no later than in 2040.

At BAE Systems Air's Warton site in Lancashire, modest early examples of its exploration work are breaking cover.

A Pipistrel Velis Electro was delivered to Warton in May, with the company having bought the compact, 600kg (1,320lb) aircraft to conduct research. This comes as it eyes emerging requirements including an RAF aspiration to field an all-electric type for use during air experience flight, university air squadron and elementary training activities.

Registered as G-EPWR – and nicknamed "E-Power" – the lightweight two-seater was poised to commence flight testing ahead of the show.

"Our aim is to learn about the aircraft," says BAE test pilot Neil Dawson, whose preparation for operating the 50min-endurance type included five training flights performed at Pipistrel's home in Slovenia.

BAE earlier this year signed a memorandum of understanding with Pipistrel – which has subsequently been acquired by US giant Textron Aviation – to explore the potential for jointly developing a future military trainer.

Dawson notes that an operational electric-powered trainer would need to be "significantly larger" than the European Union Aviation Safety Agency-certificated Velis Electro, which also lacks the aerobatic capability required for a role with the RAF.

Neil Appleton, head of electronic products at BAE Systems Air, says the purchase from Pipistrel represents just part of the company's current exploration of sustainable flight technologies.

Another example is a joint study into potential military applications for the Embraer-backed Eve electric vertical take-off and landing (eVTOL) urban air mobility product. The pact with the Brazilian company was initiated last December via what Appleton describes as a "modest investment".

BAE also plans to fly a testbed example of Malloy Aeronautics' electric-powered T-650 unmanned air vehicle at Warton "towards the end of this summer". Appleton says the activity will focus on assessing the battery technology and lift capability of the type, which will be able to carry a 300kg (661lb) payload.

Potential maritime applications include resupply, search and rescue and even anti-submarine warfare – BAE displayed a model of the type carrying a Sting Ray torpedo on announcing the pact with Malloy at last September's DSEI exhibition in London. Entry into service could come as soon as the middle of this decade, Appleton believes.

"This is not just a bit of 'greenwashing'," BAE Systems Air chief operating officer Ian Muldowney says of the company's investments. "We see a real opportunity in electric products and sustainable aviation, whether that's in the basic trainer market, eVTOL, heavy-lift, or unmanned applications."

And the company also intends to draw on its extensive experience with developing and testing autonomous systems – including to the Taranis unmanned combat air vehicle demonstrator first flown in 2013.

"We haven't stopped on the back of Taranis," Muldowney notes, with BAE investing in the safe use of "scalable autonomy".

CAE gets women flying

Pilar Wolfsteller

Bisma Petafi from CityJet, Cindy Wong of AirAsia and Lauren Beam from Southwest Airlines

BillyPix

Training specialist CAE is expanding its Women in Flight ambassador programme in order to create more opportunities for women who aspire to become flight crew.

The Montreal-based company is opening the programme to airlines with which it does not have training contracts.

CAE launched its Women in Flight programme at the show in 2018, and it was initially limited to five scholarship flight students per year, one each from the five airlines for whom CAE trains pilots; Aeromexico, Air Asia, American Airlines, CityJet and Southwest Airlines.

The firm invested a total of C$1 million ($770,000) to support the flight students for the entirety of their training. But as airlines struggled through the pandemic, CAE was looking to broaden its reach.

Now, the company will support candidates with existing airline scholarships, including at carriers who do not have training contracts with the company.

"We are encouraging airlines to come up with a scholarship on their own, and we'll match that amount," says Nathalie Siphengphet, head of marketing and strategy at CAE. "We are committed to pursuing this programme and expanding it as much as we can."

The first additional partner airline to join the expanded programme is UK-based low-cost carrier EasyJet, which is targeting training 1,000 new pilots in the next five years.

At the end of 2020, CAE said it expects the commercial aviation industry will need more than 260,000 additional pilots worldwide by the end of the decade.

At the time, with the airline industry still in the depths of the pandemic, its optimistic forecast was treated with scepticism in some quarters. However, the ensuing pilot shortage – as carriers struggle to re-staff their cockpits to meet fast recovering demand for flying – suggests CAE's prognosis will be broadly accurate.

Three Women in Flight ambassadors – previous recipients of the scholarship – spoke about their experiences at an event in the CAE chalet on Monday.

FLIGHT DAILY NEWS

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Green light for L-39NG

Aero Vodochody

Type has been ordered by Hungary and Vietnam

Ryan Finnerty

The Czech Republic's latest domestically manufactured jet, the L-39NG, is cleared for European skies following approval from the country's military regulator.

Announced on 18 July, the validation from the Czech Republic's Military Aviation Authority was carried out in line with continent-wide NATO/European Defence Agency standards.

Aero says it has already secured two sales agreements, with Vietnam and Hungary, to provide each country with 12 of the single-engined L-39NGs. All Vietnam's jets are the training variant, while Hungary has opted for eight trainers and four in a reconnaissance configuration.

The NG will ultimately be available in three variants: trainer, reconnaissance/patrol and light-attack.

Aero says it expects to begin deliveries to Vietnam in July 2023, with Hungary's jets arriving the following year. A separate deal with the Czech air force is also being worked on, the manufacturer says.

Meanwhile, Aero says it has signed a memorandum of understanding with its first USA-based partner, Patriots Global Training. The California-based company offers military pilot training services using eight legacy L-39 jets.

"Through this collaboration... we have a unique opportunity to establish the presence of Aero in the US market," says chief executive Viktor Sotona.

David Patrick, Patriots chief executive, lauds the L-39NG as "an incredible flight-training solution", adding: "Today solidifies and expands our ability to provide cost-effective, advanced pilot training in the United States."

Patriots says it intends to offer its L-39NG trainer services under the USA's Foreign Military Sales programme.

Aero says the L-39NG incorporates significant improvements over the legacy model, including composite materials, a 15,000 flight-hour service life and an embedded virtual training system.

For the roughly 700 legacy L-39s still in service with 60 countries around the world, Aero says it can offer a modernisation package involving engine and avionics upgrades.

Sotona, who arrived as chief executive less than a year ago, notes that his current business strategy is to focus on converting customers already using the L-39 to the NG airframe. "Our sales strategy is to address the existing markets," he says.

In brief...

Training Air Astra

Bangladesh airline start-up Air Astra has selected L3Harris as its pilot training provider. The US company will deliver type-rating and recurring certifications for Air Astra flightcrew through 2026 at its Bangkok training centre. Air Astra's web site portrays ATR 72-600 aircraft.

TechOps signs for Leap

Delta TechOps has become the first MRO provider in North America to sign a Leap-1B CFM Branded Services Agreement.

The engineering firm will become of part of CFM's maintenance, repair, and overhaul network for Leap-1B engines. The latter powers Boeing 737 Max aircraft, which Delta signed up for 100 aircraft of on the first morning of the Farnborough air show.

Sikorsky upbeat on S-70 UK chances

Sikorsky is optimistic about the S-70M Black Hawk's chances in the UK's New Medium Helicopter (NMH) requirement for up to 44 examples, pointing to the rotorcraft's pedigree and possible industrial benefit to the nation.

Leon Silva, interim vice-president at Sikorsky for global commercial and military systems, points to the S-70M's long heritage, with the Lockheed Martin unit closing on the 5,000th delivery.

He says the Black Hawk is in its "third generation" and has seen continuous improvements since the arrival of the original UH-60A in the 1970s.

"Visually it might look very similar to you, but technically it is quite evolved. There have been literally thousands of improvements based on the experience that the team has had over that period."

Silva: Technically the Black Hawk has evolved

Greg Waldron/FlightGlobal

But with the helicopters proposed by Sikorsky for London due to be built by its Polish unit PZL Mielec, there have been questions about the offer's industrial and employment benefits for the UK.

Silva notes that Sikorsky has a long history in the UK, stretching back decades to its work with Westland – now Leonardo Helicopters.

Its proposal around industrial participation can be scaled, and will be a "pillar" of Sikorsky's offer, he adds. "We're open to very strong collaboration here, and we think that there's an important economic aspect of balance that has to be achieved."

As to what UK industrial participation might look like, Silva says he could foresee PZL Mielec building the helicopters to a certain baseline, with completions and other customer-specific work undertaken in the UK.

In addition, GE Aviation's Portsmouth overhaul site will maintain the fleet's T700 engines should the S-70M be selected for the NMH requirement, where it faces competition from the Airbus Helicopters H175M and Leonardo AW149.

Cranfield's hydrogen dream

Dominic Perry

Cranfield Aerospace Solutions

Company is working on Britten-Norman Islander conversion under Project Fresson

Cranfield Aerospace Solutions (CAeS) believes it can become the first company for nearly a half century to develop a new commercial aircraft in the UK if its plans for a clean-sheet hydrogen-electric-powered design come to fruition.

The Cranfield University spin-off is already working on the conversion of a Britten-Norman BN2 Islander to run on fuel cell power using gaseous hydrogen under the UK-government backed Project Fresson.

Service entry for the Islander conversion is anticipated in 2025, but CAeS is already progressing its next steps.

A second-phase project will see the modification of an existing 19-seat aircraft with a liquid hydrogen fuel cell-based powertrain, which is set to arrive in 2027. That will be followed in 2029 by a clean-sheet design, again sized to carry 19 passengers.

"That will be the first new aircraft to be designed and manufactured in the UK for probably four decades," says Paul Hutton, CAeS chief executive.

"That's crazy – if any country should be confident and capable of making aeroplanes it's the UK."

Hutton argues that the development of electric propulsion technology, and the cost-savings and operational benefits it promises, has "given us an opportunity to re-enter that market".

"Suddenly there is the window of opportunity for the UK to take control of its whole aircraft destiny – to not just be a 99% aerospace supply chain industry," he adds.

Analysis of several turboprop types is under way in partnership with an undisclosed US fractional operator to determine the best candidate aircraft for the phase two conversion programme.

"We are trying to get their understanding of the market to make sure we choose and aeroplane that is the most commercially viable," says Hutton; a workshop will be held with the operator at the Farnborough air show on Thursday.

CAeS has already been working with UK budget carrier EasyJet to study the requirements of a next-generation aircraft in passenger operations; another "large airline" is also lined up to come on board shortly.

"What we are seeing is increasingly large airlines that you think wouldn't be interested in this segment of the market but which want to be ready for when the larger [zero-emission] aeroplanes arrive."

The second airline partnership is likely to see the carrier order a number of Britten-Norman conversions, and its future plans will also help determine the second modification programme, Hutton adds.

CAeS in March attracted a £10.5 million ($12.5 million) investment from Safran Corporate Ventures and HydrogenOne Capital Growth as part of a Series A funding round. However, further financing under that same round will be closed by mid-August, almost doubling the money pledged. Series B funding will then kick-off in September, taking six to nine months to complete, Hutton adds.

No firm figure has yet been determined for the Series B investment, he says, but it must be sufficient to finalise the initial Fresson programme, reach the preliminary design review stage on the follow-on aircraft, and the concept definition of the all-new model.

Hutton sees CAeS's role as an overall aircraft integrator rather than a technology developer in its own right and has signed agreements with potential partners on the project.

Despite the Safran investment, there is "no obligation" to use equipment from the French aerospace giant in any of its programmes, stresses Hutton.

Turkish and Vietnam tie up on cargo

Shutterstock

Turkish Airlines has signed a memorandum of understanding to co-operate with Vietnam Airlines, initially focusing on cargo.

Under the agreement, struck yesterday at the Farnborough air show, the two carriers will co-operate more closely on cargo operations with a view to initially implementing a codeshare in 2023.

Star Alliance member Turkish is also studying a potential codeshare with SkyTeam partner Vietnam Airlines covering passenger flights linking Istanbul with Hanoi and Ho Chi Minh City.

Turkish Airlines chief investment and technology officer Levent Konukcu says: "Recovering from the crisis that the pandemic brought to the aviation sector, we all became aware of the crucial need of co-operation. We attach importance to expanding our co-operation with Vietnam Airlines both in passenger and cargo operations."

ZeroAvia Dash 8 kit has Ravn raving

US regional operator Ravn Alaska is looking to retrofit its De Havilland Canada Dash 8 turboprop fleet with hydrogen-electric propulsion systems from ZeroAvia.

The provisional agreement covers acquisition of 30 of ZeroAvia's ZA2000 powertrains – a high-power version of the development, delivering 2,500MW – to replace the stock engines and enable zero-emission flights.

Ravn uses Dash 8-100 and -300 variants on local Alaskan routes. Its network includes such locations as Dutch Harbor, Kenai, Cold Bay and Dillingham.

"We want to be at the forefront of adopting zero-emission aviation once [US] FAA-certified technologies come to market," says Ravn Alaska chief Rob McKinney.

"The state is an important strategic target for early adoption of hydrogen-electric flight routes," says ZeroAvia.

It says Alaska depends strongly on aviation for interstate travel and its renewable energy resources offer the potential to generate 'green' hydrogen.

ZeroAvia is looking to introduce the ZA2000 powertrain, intended for 40- to 90-seat aircraft operating across 500nm (926km) of range, from around 2026.

It will complement the 600kW powertrain, aimed at nine- to 19-seat aircraft, which will enter service two years earlier.

NASA outlines green mission

NASA is looking to forge partnerships to fight global warming, the agency's deputy administrator said yesterday.

Pam Melroy, a former astronaut who piloted two Space Shuttle missions and commanded a third, says that the space agency aims to work with industry as well as the US Department of Defense (DoD) to develop and test new technologies that will help NASA reduce its own emissions, as well as work on future civil aviation projects.

"The really tough thing is that our aircraft are operating at the highest part of the atmosphere, the thinnest part of atmosphere so our emissions have a disproportionate amount of impact," Melroy says. Contrails, which are associated with non-CO2 emissions, are gaining prominence as having a hitherto untold impact on global warming.

Though manufacturers are building ever-faster aircraft – which usually translates into more emissions – Melroy is confident that in the future the use of sustainable aviation fuels will mitigate those effects.

"We have to optimise to solve more than one problem at once," she says.

Battery power is another area where NASA sees potential for its own aviation applications. The limited range of current battery technology means that hybrid propulsion systems may be more useful than pure electric aviation solutions.

"This is one of those things that will settle out in a while," she says. "We are still so battery limited. I really think there's a place in this world for all-electric aircraft. But I look at aviation and one of the things that's concerned me is the lack of regional air mobility, which has an impact on rural areas," Melroy says. Electric-only aircraft may not be the solution.

Hydrogen propulsion systems, currently being pursued by numerous companies, are an ambitious new field in which NASA hopes to also play a part. But there too, several problems need to be solved at once

"Demonstrating that you can run an engine on hydrogen, is not the only part. You have to be able to store it, have a depot, transport it. The other challenge with hydrogen is scaling. When you are getting to long-haul [distances] hydrogen can be a big challenge," Melroy says.

Gulfstream goes big

Jon Hemmerdinger

Gulfstream has an impressive line-up of business jets at this year's Farnborough air show, and has its latest and largest aircraft, the G800, parked nearby at the company's Farnborough airport service centre.

The Savannah-based airframer flew the in-development G800 to Farnborough despite the aircraft having only completed its first flight on 28 June.

"There's a lot of market activity," said Gulfstream senior vice-president of worldwide sales Scott Neal, speaking at the service centre on 19 July, and it is seeing "significant interest in the Gulfstream product line".

Gulfstream has four models on static display at the show: the G500, G600, G650ER and G700.

Meanwhile, EASA has granted steep approach and landing approvals for the G600 and G650ER, meaning those jets can operate into more airports, including London City.

The 8,000nm (14,816km)-range G800 and the slightly larger, 7,500nm-range G700 – both powered by Rolls-Royce Pearl 700 turbofans – are Gulfstream's flagships and both remain in development.

In recent months, Gulfstream said certifications for both types are running up to six months late due to a more intense review by the US Federal Aviation Administration of the jets' software.

That means the G700's service entry could come as late as mid-2023, with the G800 following in early 2024. Gulfstream opened its Farnborough service facility two years ago as part of a broader expansion by the company of its support offerings.

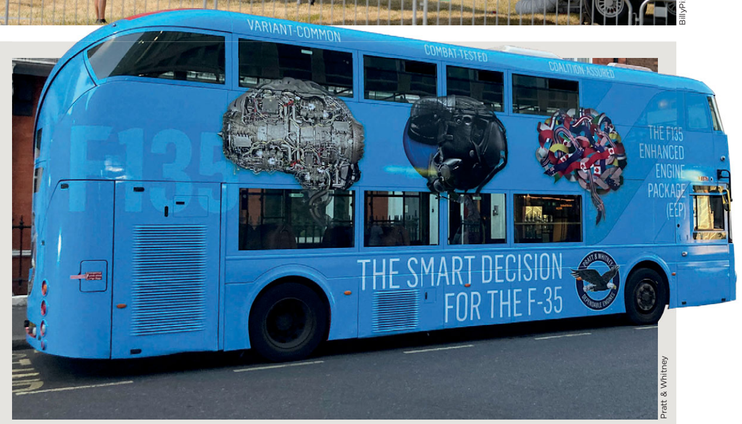
Heads or tails? Airframer's show line-up

BillyPix

BillyPix

The bus choice for F-35

Pratt & Whitney is taking an unusual route to persuading Farnborough air show attendees visiting London that the F135 is still the best choice for the Lockheed Martin F-35, even if a new engine option emerges for the fighter. It is running these all-over advertisements on the capital's Routemaster buses, on routes 59, 24, 27 and 159.



Pratt & Whitney

BAE makes light work of HUD

Murdo Morrison

BAE Systems believes it can make the job of commercial pilots easier by making head-up displays (HUDs) commonplace in the airline cockpit.

The defence company is giving visitors to its exhibit a glimpse of its latest HUD, LiteWave, which it claims is lighter and more compact than both its predecessor and rivals on the market.

BAE, which is marketing the product to commercial and business aircraft manufacturers as well as its traditional military customers, says the fact it is 30% the size of a traditional HUD means the unit can be installed in the smallest flightdecks.

"LiteWave can be fitted into virtually any cockpit in the world," says Lee Tomlinson, director of HUD products at BAE Systems' Rochester-based Electronic Systems unit. "It has the potential to revolutionise the market and make HUD technology far more accessible."

A patented "waveguide" technology and the largest eye-motion box on the market means pilots can move freely in their seat without losing sight of the display, claims BAE. The display can also be matched with night vision views to improve situational awareness.

LiteWave is an evolution of LiteHUD

BAE Systems

It can also be folded away when not required during cruise phases of flights.

LiteWave has not yet secured a launch application, but BAE says the product is available for flight trials and that pilots have already sampled it a simulator at its Rochester site and been impressed.

Rochester has been producing HUDs since the late-1950s and has delivered more than 15,000. They are on service on military aircraft including the Eurofighter Typhoon and Lockheed Martin F-16, as well as some Boeing 737s.

LiteWave is an evolution of LiteHUD, which has been on the market since the late 2010s and was BAE's first digital HUD. It is fitted to the BAE Systems Advanced Hawk as well as the Turkish Aerospace Hurkus-B trainer among others.

In brief...

Elbit goes Dutch

Elbit Systems has been awarded a contract to provide self-protection equipment for use on the Royal Netherlands Air Force's (RNLAF's) incoming Gulfstream G650 VIP transport. Announcing the deal just ahead of the show on 14 July, the Israeli company said it will supply its J-Music direct infrared countermeasures and Infra-Red-based Passive Airborne Warning System, or IR-PAWS, for installation on the long-range business jet. The combination will provide "high levels of protection and redundancy", it adds.

Neo Nacelles

Safran Nacelles has delivered its 200th Airbus A330neo nacelle, just ahead of the show. The 3.65m-diameter nacelle will be fitted to a Rolls-Royce Trent 7000-powered A330neo for Virgin Atlantic. Safran delivered its 100th A330neo nacelle in September 2019 and Vincent Caro, president of Safran Nacelles, says the latest milestone is "a sign of recovery for the production volume rate on long-haul aircraft nacelles".

SS White's flexible friend

Its flexible rotary shafts are fitted to most of today's production aircraft engines, but Farnborough exhibitor SS White believes there is a much wider industrial market for its technology.

Flexible shafts are devices for transmitting rotary motion between two devices that are not otherwise connected, and comprise a rotating wire coil which is flexible but has torsional stiffness. SS White's products are used to transfer power to thrust reverser actuators on all CFM International Leap engines, as well as the Pratt & Whitney PW1000 series and the Rolls-Royce Trent 1000.

The Florida-based company, which also has a UK subsidiary in Milton Keynes, is a supplier to nacelle manufacturers, including Collins Aerospace and Safran. It also provides its components to the medical industry.

"We've been very successful in the aerospace market, but there are a host of engineering applications out there," says Steve Grimes, who runs the UK business.

Other uses for flexible rotary shafts include everything from handheld rotary tools to automotive speedometer cables.

The company, which has a pod on the Midlands Aerospace Alliance stand, is showing a working application of one of its products. "We want to tell the story in a visual way of what it can do," says Grimes.

Lockheed tunes into Collins HF-9500 for the C-130J

Lockheed Martin has selected the Collins Aerospace HF-9500 high frequency (HF) airborne communications system for all future foreign military sales of C-130Js. The HF-9500 replaces the ARC-190 previously offered with the Super Hercules to overseas customers. The HF-9500 comprises a receiver-transmitter, antenna coupler and radio control and has been "designed with retrofits in mind", says the Raytheon Technologies company.

"HF communications are a critical alternative to satcom when operating in contested environments," says Ryan Bunge, vice-president and general manager, communication, navigation and guidance solutions. "Making this technology standard for global C-130J operators ensures that pilots are equipped with the most reliable, long-range HF communications systems needed for successful missions."

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Headlines


Airbus Defence & Space C295


Heli Operations Sea King

Leonardo Helicopters AW149 shows off weapons pylon


De Havilland Canada DHC-6 Twin Otter


Hot Herc: upgraded US Air Force C-130H

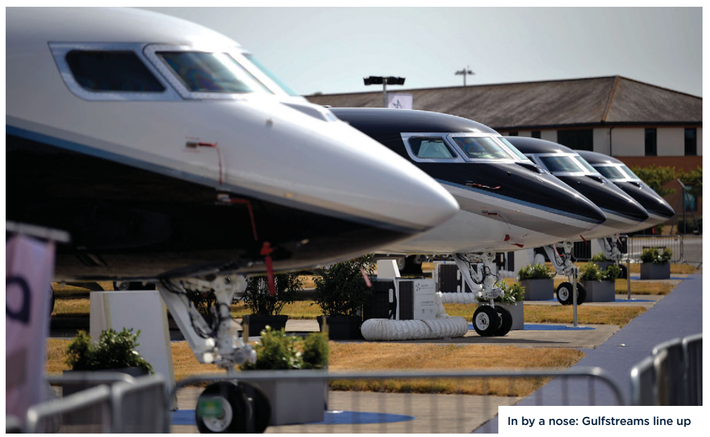

F-16, AH-64 Apache and CH-47 Chinook in US corral

Up close and personal

The static display at Farnborough gave visitors the chance to see a spectacular array of civil and military aircraft

Qatar hero: Gulf carrier's 777 big-twin

Embraer's pride: E195-E2 in Tech Lion livery


In by a nose: Gulfstreams line up


Atlas all areas: RAF A400M on display

Photography: BillyPix

His Excellency Ahmad Al-Ohali is governor of Saudi Arabia's General Authority of Military Industries, responsible for regulating and promoting the nation's emerging local defence sector. He is part of the Saudi presence at the show this week

Kingdom of opportunity

General Authority of Military Industries

Q GAMI and other Saudi entities are at Farnborough for the first time. What are you hoping to achieve?

A We are expanding our footprint in global defence through strategic partnerships and localisation initiatives. We spent the past few years developing a comprehensive strategy to localise more than 50% of our expenditure on defence by 2030. As our nation opens its doors to global investment, we are reaching out to investors and partners all over the world through events like the Farnborough International Airshow to establish a dialogue of collaboration to achieve our strategic goals.

Q What is the role of GAMI and how is the defence sector structured in Saudi Arabia?

A GAMI's chief responsibility is to regulate, localise, and enable the defence sector in the kingdom. We make sure we collaborate with other government stakeholders including ministries within the defence ecosystem, as well as private sector players and OEMs. Our overarching goal is to enable strategic partnerships and investments to localise more than 50% of our defence spending by 2030.

Q Who are some of the biggest overseas investors in the Saudi defence market? Why is Saudi Arabia a good place to invest as an aerospace company?

A Most of the large global OEMs are currently investing in Saudi Arabia. Our mission is to attract many more investments to the kingdom, and create rewarding opportunities for both global and local players. Our air domain focuses on three main sub-domains to build local capabilities in technology, industry, MRO, and human capital, which are fixed-wing aircraft, rotary-wing aircraft, and unmanned aerial systems. Our localisation objectives can be achieved through proactive activities that ensure the highest percentage of industrial participation to support the local companies working within our domain, and to ensure effective engagement with the international OEMs.

Q What progress is being made to become self-sufficient in defence by 2030 and what are the aspirations beyond 2030?

A We set in motion a carefully calculated strategy to make sure our defence sector is the flagship of our nation's strategic autonomy. This strategy envisions the implementation of initiatives like the supply chain programme and human capital development to assure that our localisation goals are sustainable. Our supply chain programme alone offers more than 74 investment opportunities worth billions of dollars. In addition, the establishment of the National Academy of Military Industries will also take us forward in localising the know-how pursuant to becoming self-reliant in defence.

Q The inaugural World Defense Show took place in Riyadh in March. Why is it important for Saudi Arabia to have its own global event in this sector, and when will it next take place?

A The World Defense Show is a great example of Saudi Arabia's contribution to the global defence ecosystem. This year's WDS brought together 600 defence and security exhibitors from 42 countries, and boasted over 65,000 visitors, resulting in an estimated $8 billion in deals. The deals signed during WDS covered manufacture of platforms, defence equipment, military attire, armored vehicles, munitions, and support services. National companies accounted for 46% of the aggregate value of these contracts. WDS is a central part of our vision to become a global defence hub. We are excited to welcome the global defence sector in Riyadh again from 4-8 February 2024.

Q The Military Industry Human Capital (MIHC) strategy has been a big focus for GAMI. Why is this strategy important?

A Skilled local workforce is essential to achieving our localisation goals. We are not just building factories to manufacture equipment, but also partnerships to train and educate a generation of innovators and industry leaders. Our MIHC strategy aims to build an ecosystem ripe for developing the necessary human capital, constructed on the basis of our localisation strategy.

Q What is Saudi Arabia's national defence strategy built upon?

A Our national defence strategy is built on three pillars: military acquisition, military industry, and military industry development and technology support. These three pillars contribute to our ultimate goal of achieving sovereignty via enhancing spending efficiency and enabling localisation of technical capabilities. It will also contribute to increasing transparency in the sector, thus paving the way for more strategic partnerships.

The UK company – about to be absorbed by Parker-Hannifin – says its expertise and willingness to invest in 'key technology areas' has set it apart

Meggitt's magic

Murdo Morrison

With its takeover by Parker-Hannifin set to complete, this Farnborough is likely to be Meggitt's last as an independent UK manufacturer of aircraft and engine components. On 28 June the UK secretary of state for business said he was minded to accept undertakings from the US corporation over competition and national security concerns that were the last hurdles to the £6.3 billion ($7.5 billion) merger going ahead. A consultation period ended on 13 July.

However, at this year's show Meggitt and its soon-to-be owner are exhibiting separately, with the former keen to stress some of the reasons it was so attractive to its suitor. "Our whole strategy is to deliver products that other people find hard to make," says Hugh Clayton, the company's head of engineering and strategy. Some 80% of our products are sole-source. It is stuff that others find difficult to make that drives the value in our company."

Along with Cobham – until its partial break-up under new owner Advent International – Meggitt was one of two diversified billion dollar plus turnover aerospace technology groups in the UK, behind a range of complex parts found in engines, fuel systems, brakes and electrical power systems. It has a strong presence in commercial and military aviation, with its 2021 revenues of just under £1.5 billion split roughly equally the two sectors, with a tenth or so coming from non-aerospace customers.

Meggitt, ranked 44 in the latest FlightGlobal Top 100 aerospace businesses by sales, will be focusing on innovation in seven "key technology areas" at Farnborough: thermal, safety, electrical and braking systems, optical sensing, composites and additive layer manufacturing.

"One of our key thrusts is in differentiating technologies and spotting these future trends," says Clayton. "This is the decade where the sector is going to decarbonise, and we feel we can play our part in that."

However they are fuelled or powered, the next generation of engines will require improved thermal management, and Meggitt's expertise in additive manufacturing can play a big part in achieving that goal, believes Clayton. "By using additively manufactured heat exchangers and novel composite ducting, you can come up with different ways to move heat through the cowling," he says. "It means you can make shapes you couldn't make in any other way."

Clayton: Our whole strategy is to deliver products that others find hard to make

Meggitt

Meggitt's strategy also builds on its strong position in heat exchangers, sensors and other instrumentation, and data systems that collect and feed into the full-authority digital engine control or FADEC, he maintains. "The next generation of sensors will be fibre-optic. That's a radical departure. Until now they were largely a metallic structure, but fibre-optics can withstand much higher temperatures," he says.

On-board aircraft fires are thankfully rare, but every airliner has to be fitted with a fire suppression system, and even here Meggitt has an environmental edge, says Clayton. The company has developed a product called Verdagent that can be used in place of halon 1301 as a fire extinguishing agent and is 5,000 times less damaging to the environment. Halon has been banned on future aircraft types, but Meggitt is working on a retrofit solution for current types.

Parker-Hannifin's offer for Meggitt last August for £6.3 million in cash would have seen the larger US entity almost double the size of its aerospace business. The move has been subject to a number of conditions. Although there is little overlap in product areas, Parker was compelled by European regulators to sell its Ohio-based wheels operation to Kaman for $440 million, a divestment that was concluded two months ago.

Coventry-based Meggitt – which has extensive industrial operations in the UK and USA as well as in continental Europe and Asia, employing around 9,000 people – had been subject to a rival bid by TransDigm, an acquisitive US group that has been one of the industry's fastest growing in recent years. However, Meggitt's board opted to recommend the Parker bid to shareholders, who approved it in September 2020.

The UK government's latest set of security-related conditions include honouring existing UK defence ministry contracts and maintaining a UK-based board of directors comprising British citizens – standard requirements for the foreign takeover of a defence contractor. With the already completed divestment of the US wheels business a further requirement, the takeover of another major UK aerospace player appeared a done deal on the eve of the show.

Commercial engine manufacturers have their sights firmly set on developing the technologies needed to meet the industry's challenge of delivering sustainable flying

R-R's UltraFan demonstrator features 'the building blocks that will go into a next-generation engine'

Rolls-Royce

A clean future

Mark Pilling

Today, every aerospace engine manufacturer has a roadmap charting its course towards achieving net zero carbon emissions by 2050. Important waypoints include a massive increase in the use of sustainable aviation fuel (SAF), and making decisive progress on "disruptive technologies" such as hydrogen.

As Eric Dalbies, senior executive vice-president research & technology and innovation at Safran, told the EU's Clean Aviation Summit in March: "For the coming decade the focus is on ultra-efficient aircraft... reducing fuel burn is a no-regret choice."

The speed at which sustainability has rocketed to the very top of the aerospace agenda is astonishing, especially because the shift in focus took place amid a global pandemic that saw the air transport industry grind to a halt.

Design issues

From late last decade, each of the big three engine manufacturers had encountered design issues and in-service problems, as supply chains were stretched in the face of bulging aircraft order books and steep production ramp-ups.

By 2019, Rolls-Royce was getting to grips with the premature turbine blade deterioration problems affecting its Trent 1000 engine, which is an option for the Boeing 787. Similarly, Pratt & Whitney's Geared Turbofan (GTF) – the manufacturer's big bet on returning to the narrowbody market – was, after three years in service, overcoming its early high-profile issues.

At GE Aviation the story was different, but no less troublesome. Having been selected as the exclusive choice for the 777X in 2013, issues with components in the GE9X's high-pressure compressor came to light in 2019, forcing a redesign that delayed first flight. While GE has fixed the issue, Boeing now expects the lead 777-9 to enter service in 2025, largely due to expanded certification requirements.

Despite these hiccups, engine makers entered this decade in good health, with record order books and strong aftermarket revenue flows. But that changed abruptly with the onset of the pandemic in March 2020. As revenues from all-important service contracts fell off a cliff, the manufacturers shed staff, raised liquidity, and restructured their businesses to cut losses and preserve cash.

After two years of eye-watering losses and unprecedented business trauma, the recovery in air travel means revenues are flowing again as flying hours rise and maintenance shop visits return.

But as business revives, the strategic landscape has changed for the propulsion experts, with the climate crisis and decarbonisation challenge becoming an overwhelming obligation.

While the manufacturers had already been deeply absorbed in R&D to find more efficient, lower emissions engines prior to Covid-19, that occupation has turned into an obsession. The technologies under scrutiny include electric, hybrid-electric, and the use of liquid hydrogen or hydrogen fuel cells.

Speaking at GE's investor day in March, Mohamed Ali, vice-president of engineering, highlighted the introduction of composite fan blades to replace metals on the GE90, the creation of highly durable ceramic components for the Leap, and the use of additive manufacturing to produce hitherto "impossible-to-make" lightweight parts.

Pratt & Whitney Canada is partnering with De Havilland Canada to equip a Dash 8-100 turboprop with hybrid-electric propulsion

De Havilland Canada

Future advances

"We are excited about building our arsenal of technologies for the future with sustainability as our north star," Ali says. These advances will reduce fuel burn by more than 20%, whether the fuel is kerosene, SAF or hydrogen, he adds.

The key component of GE bringing its roadmap to fruition will be a batch of "breakthrough technology demonstrators", with ground and flight tests to show technology readiness this decade, says Ali. This is the critical timeline to meet Airbus's and Boeing's ambitions for next-generation aircraft using "disruptive" technology being in service from 2035.

GE has three demonstration programmes lined up. The first is a partnership with NASA and Boeing, with BAE Systems recently added to provide electricity management systems. Through NASA's Electrified Powertrain Flight Demonstration project, hybrid-electric configurations will be tested on a modified Saab 340B turboprop with GE CT7-9B engines. Full hybrid-electric flight tests will take place by the mid-2020s.

"Anybody can do a motor – a hybrid-electric motor or an electric motor and test it on the ground," says Ali. "Anybody can fly perhaps even up to 10,000ft. Above 10,000ft, high-voltage electric machines behave very differently. We are testing at the NASA facility a Megawatt electric motor in a 40,000ft environment... and we believe we have the technology to enable that."

In February, Airbus and GE/Safran joint venture CFM International announced one of the most significant moves by the aerospace majors to date on the hydrogen front. The airframer will use an A380 prototype as the demonstrator for a future hydrogen-fuelled engine. The aim is for first flight by the end of 2026, says Sabine Klauke, chief technical officer at Airbus.

CFM will modify the combustor, fuel and control system of a GE Passport turbofan to run on hydrogen. The engine will be mounted on the rear fuselage to allow emissions, including contrails, to be monitored separately from those powering the aircraft.

The physical property of hydrogen means it has many challenges to become a viable liquid fuel for either gas turbine combustion engines, or to make electricity in a fuel cell. However, many players in aviation believe it has a future role in the decarbonisation picture.

"There are only a limited number of ways of getting to net zero emissions," explains Arjan Hegeman, general manager advanced technologies at GE. "Hydrogen combustion does get to zero carbon emissions, so it is a logical thing to look at."

Collaborative effort

GE's third demonstrator – using technology called adaptive cycling – is already running. This is being conducted in collaboration with the US Air Force to develop the XA100 as a potential option for the Lockheed Martin F-35. The latest phase of tests began in March at the Arnold Engineering Development Complex in Tennessee.

"An adaptive cycle means the engine actually changes its geometry depending on which part of the mission it is in to maximise the fuel burn advantage," says Ali. It has the potential to give the "best of both worlds", switching between delivering 10% more thrust or 25% better fuel efficiency than today's engines.

He adds: "We are going to be taking all of these technologies and putting them in what we call the RISE [revolutionary innovations for sustainable engines] demo." This demonstration programme, launched in June 2021 by CFM, aims to develop open-fan powerplants that can be fuelled by 100% SAF or liquid hydrogen and include hybrid-electric capability for the next generation of single-aisles.

"There is a lot more work and study to be done, but we look at hydrogen as a promising fuel"

Graham Webb **Chief sustainability officer, Pratt & Whitney**

The target is to reduce fuel consumption and carbon dioxide emissions by more than 20%, with a flight demonstration engine planned for mid-decade.

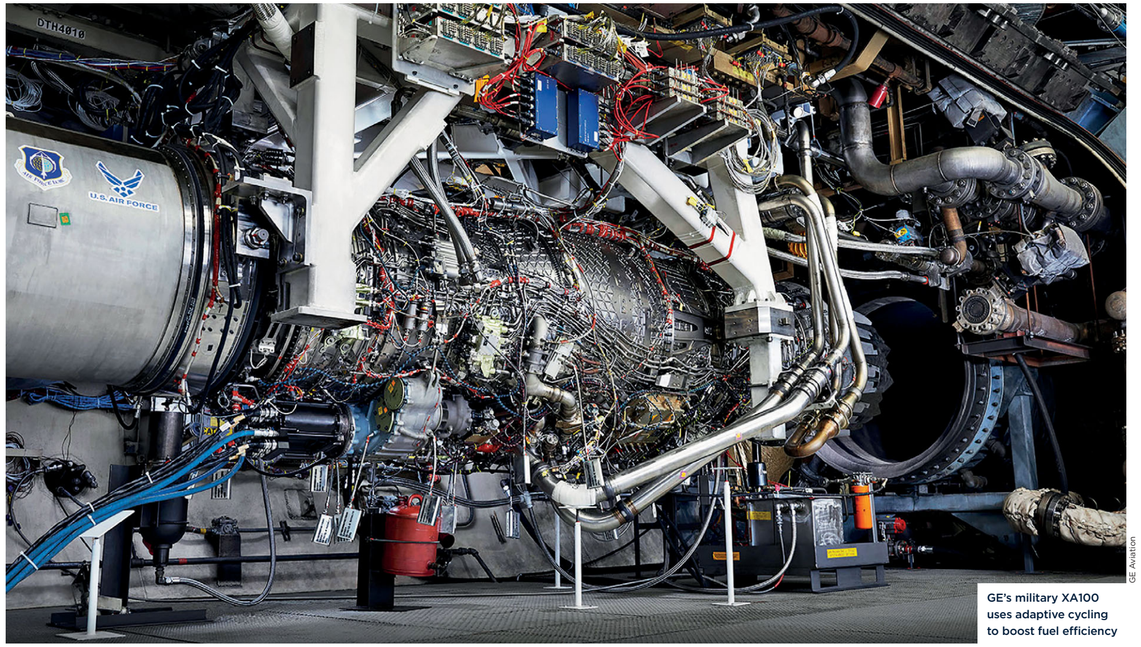
P&W, meanwhile, has identified three core themes in its roadmap to net zero: smarter technology; clean fuels; and greener business.

The company was selected by NASA in October 2021 for the Hybrid Thermally Efficient Core (HyTEC) project, to develop advanced high-pressure turbine technologies for next-generation single-aisles.

These include ceramic matrix composite (CMC) materials that are capable of operating at higher temperatures than current CMCs, environmental barrier coatings, advanced cooling, and aerodynamic approaches that will make new component designs and efficiencies possible, according to P&W.

20%

Reduction in fuel burn GE Aviation claims it will achieve using advanced manufacturing techniques



GE Aviation

GE's military XA100 uses adaptive cycling to boost fuel efficiency

HyTEC is part of NASA's Sustainable Flight National Partnership, which aims to enable breakthrough innovations and help accomplish the industry's decarbonisation goals.

Using a raft of advanced fan technologies, new core development, increased use of hybrid-electric power to augment the engine, and more efficient propulsion-airframe integration, P&W will build the future GTF, chief sustainability officer Graham Webb explained at the Sustainable Skies World Summit, which was hosted by Farnborough International Airshow in early April.

Last December, P&W launched the GTF Advantage configuration. After completing a year of ground and flight testing it will be available for A320neo-family aircraft from January 2024, offering greater thrust and a 1% increase in fuel efficiency via technology enhancements throughout the core.

P&W's key demonstrator in the hybrid field is work led by Pratt & Whitney Canada, which is partnering with De Havilland Canada to equip a Dash 8-100 turboprop with a hybrid-electric propulsion system developing 2MW. P&W's roadmap sees such technology coming into service from 2030.

Ground tests are planned this year, with flight-testing scheduled to start in 2024, says Webb. The target is a 30% reduction in fuel burn and CO2 emissions compared with today's turboprops. Collins Aerospace is providing the electric motor and controller.

P&W says this project will provide technology and component learnings that will directly feed into larger applications. The idea is to marry an electric engine capable of delivering 18MW with the GTF, to "enhance the flight operations" of a single-aisle, says Webb.

The company's roadmap sees it as ready to field a hydrogen-fuelled engine for a 100-plus-seat airliner from 2035. In February, it was awarded a US Department of Energy project called the Hydrogen Steam Injected, Inter-Cooled Turbine Engine. This is described as a revolutionary hydrogen combustion system that uses water vapour recovered from the exhaust stream to increase engine efficiency, promising a reduction in narrowbody fuel consumption of 35% compared with the GTF.

Further study

"There is a lot more work and study to be done, but we look at hydrogen as a promising fuel," says Webb.

The industry's drive to increase SAF use also is critical to achieving net zero. In March, P&W tested the GTF Advantage configuration with 100% SAF, in what it describes as a key milestone. Today, SAF is approved in blends of up to 50% with regular kerosene.

For R-R, the three big themes are a step change in the efficiency of gas turbines; leading SAF demonstrators and adoption; and developing third-generation technologies, chief technology officer Grazia Vittadini explained at the Clean Aviation Summit. "Engines are at the core of the decarbonisation challenge... and are the most impactful," she says.

Of the engine majors, R-R is exploring the widest range of potential power and propulsion technologies and applications, from small propeller aircraft and advanced air mobility vehicles to widebody airliners and large business jets.

All-electric power will be viable for smaller aircraft with short range requirements and is a relatively mature technology, says R-R. Last November, it flew the Spirit of Innovation, a high-speed demonstrator that set two new world speed records for an all-electric aircraft.

This effort was part of the UK government's Accelerating the Electrification of Flight project, and the advanced battery and propulsion technology developed has applications for the advanced air mobility market, says R-R.

On the electric front, the company is the engine partner for Italy's Tecnam on the 11-seat P-Volt. The utility aircraft will feature two electric powerplants of 320kW each, with Norwegian regional airline Wideroe set to take the first examples in 2026.

R-R has created a division dedicated to furthering its efforts in the electric engine space. Another key programme is providing the technology to power Vertical Aerospace's four-seat VX-4 vertical take-off and landing vehicle, due to be certificated in 2024.

> "We are excited about building our arsenal of technologies for the future with sustainability as our north star"
>
> **Mohamed Ali**
> **Vice-president of engineering, GE Aviation**

The UK company's research into potential propulsion pathways encompasses hybrid-electric, hydrogen fuel cells, and gas turbines burning hydrogen, with likely applications scaled up to regional and narrowbody aircraft. But as aircraft move up to widebody size, the gas turbine remains the clear favourite.

"There is still life in the gas turbine. Whether fuelled by kerosene, SAF or hydrogen, we need to invest in the basic efficiency of the gas turbine," Alan Newby, R-R's director of aerospace technology & future programmes, said at the Clean Aviation Summit.

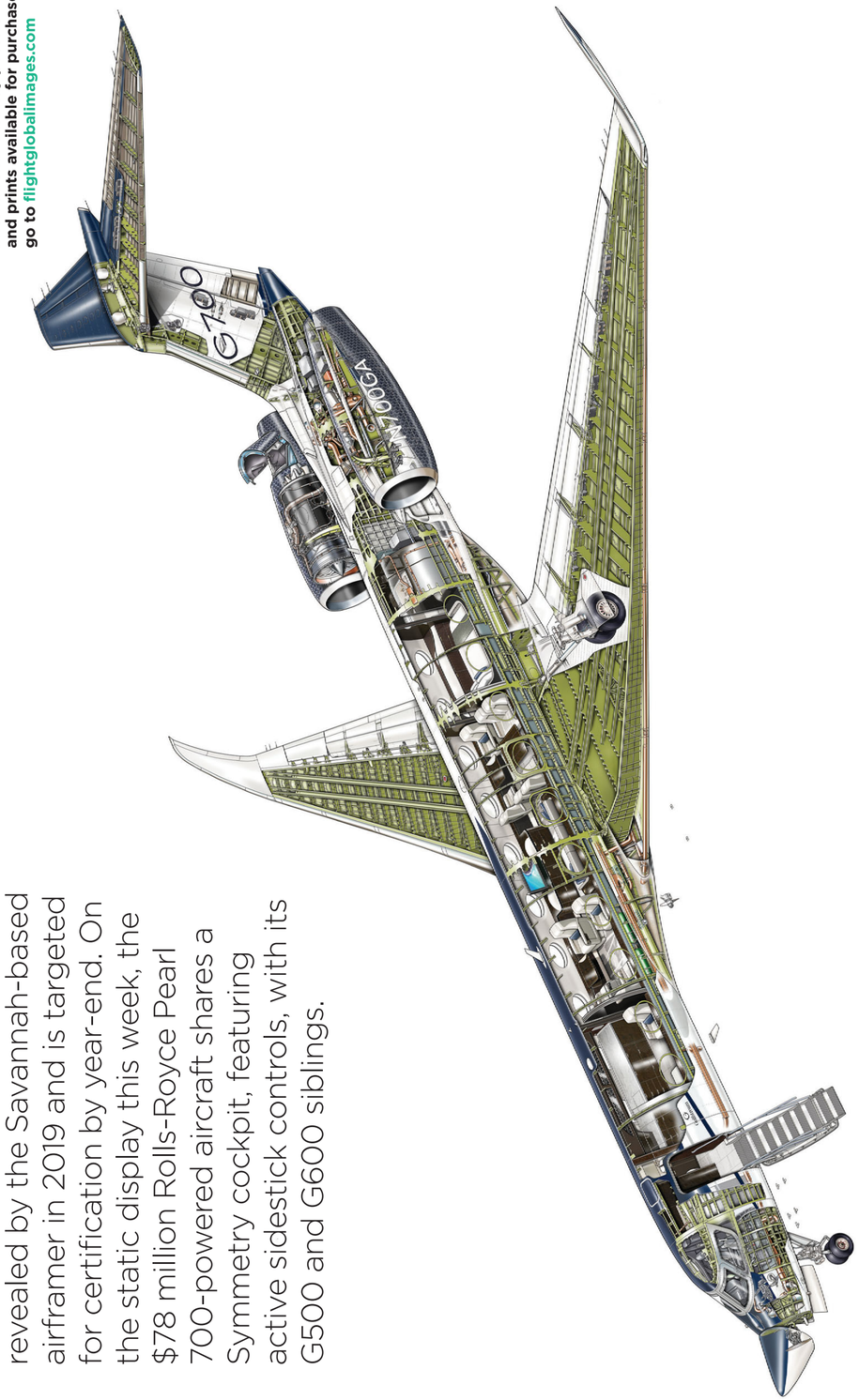
Its key demonstrator is UltraFan, which features a new architecture, power gearbox and material to prove "all the building blocks that will go into a next-generation engine". Engine UF001 is now being built and will be tested with 100% SAF this year, says Newby.

R-R says the engine will be available in the second half of the 2020s and will be 25% more fuel efficient than a first-generation Trent. Although initially sized for a widebody jet, UltraFan would be scalable for narrowbody aircraft.

Summing up the efforts of engineers, Vittadini describes the technologies being explored as a "buffet" from which engine makers will choose to meet the low-emission aircraft applications coming down the line. "Revolutionary breakthroughs are required," she says. "There are a series of daunting challenges."

The biggest unknown is whether "disruptive" technologies such as hydrogen will be one of the ingredients, or if super-efficient gas turbines burning SAF will be the right choice.

Gulfstream G700



The 7,500nm-range twinjet was revealed by the Savannah-based airframer in 2019 and is targeted for certification by year-end. On the static display this week, the $78 million Rolls-Royce Pearl 700-powered aircraft shares a Symmetry cockpit, featuring active sidestick controls, with its G500 and G600 siblings.

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