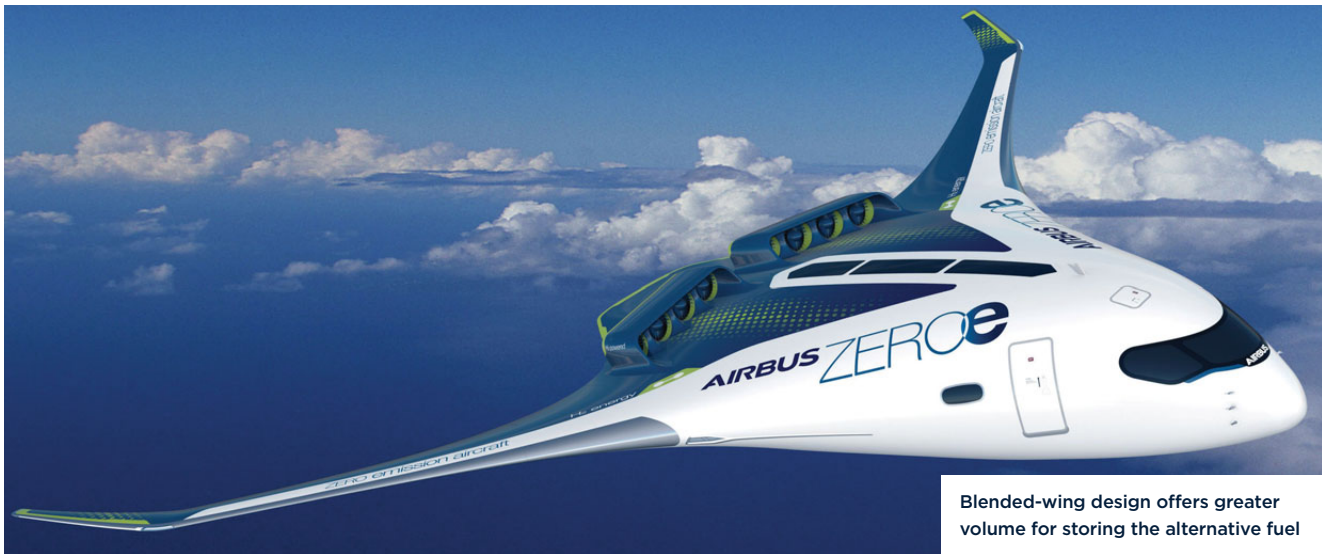

Airbus

Blended-wing design offers greater volume for storing the alternative fuel

Hydrogen fires Airbus imagination

Airframer sees gas-powered engines as best placed to meet energy density and emissions goals for commercial aviation

David Kaminski-Morrow London

Airbus is considering hydrogen as a primary propulsion source for future aircraft development, because of concerns that battery technology will not advance rapidly enough for adaptation to large airliners.

The airframer unveiled three conceptual designs in mid-September – two based on conventional twinjet and turboprop airframes and the other featuring a blended-wing fuselage design – and committed itself to exploring a hydrogen-based zero-emission aircraft for potential service entry in 2035.

Glenn Llewellyn, the company's head of zero-emission aircraft, says Airbus has seen a "decoupling" between the speed of battery technology progression and this 15-year timeframe.

"Batteries are not improving at the rate needed to achieve that ambition," he says.

As the coronavirus-driven air transport crisis forced a rethink on investment priorities earlier this year, Airbus curbed its E-Fan X hybrid-electric demonstrator programme, before the modified BAE Systems Avro RJ100 made its first flight.

While batteries are "still interesting" for smaller vehicles, such as urban air mobility platforms, hydrogen has a far greater energy density than even the best batteries – and is closer to the levels demanded by commercial aircraft, Llewellyn says.

He adds that a transition to a hydrogen ecosystem is necessary to provide the power to generate liquid synthetic fuels, and points out that Airbus aircraft are already certificated to take fuel blends with a 50% synthetic component. Such "e-fuels", he says, provide a "very big lever" for reducing carbon dioxide emissions, and have "a lot of potential".

Integration flexibility

The propulsion model involves a gas turbine combusting hydrogen in a similar manner to the combustion of jet fuel. This turbine would have an electric motor, driven by fuel cells, capable of injecting power into the shaft of the turbine.

"Concepts show we can do this with rather conventional aircraft configurations," says Llewellyn. "But we know from our analysis [that] we may achieve a better performance with a more disruptive aircraft design."

Airbus's blended-wing fuselage proposal has more volume, he notes, since one of the challenges of using hydrogen is its greater volume per unit energy compared with jet fuel.

"Blended-wing bodies inherently have more volume," he says. "[They're] already adapted to that."

The "ZEROe" aircraft designs envisaged will remain "in the realms" of current types in terms of passenger capacity, but will possibly feature higher maximum take-off weights, given the need to accommodate larger-volume tanks.

Llewellyn says the "race is on" between the different aircraft concepts, with Airbus yet to select the most likely candidate for a hydrogen-powered airframe.

The company is aiming to reduce the number of conceptual models to fewer than the three unveiled by around 2022-2023, and – depending on the level of readiness – have a mature technological proposal by 2024-2025, opening the way to a potential programme launch.

Llewellyn says the airframer wants to have demonstrators for different kinds of hydrogen propulsion system flying before 2025, but that a full prototype is not likely to emerge until the end of the decade.

He stresses that the hydrogen production would be sourced from renewable energy, mainly wind and solar power.

"What we're already seeing in 2020 is the beginning of exponential growth in terms of those energy production methods," he says. The cost of such processes has "gone down significantly", with less subsidy and increasing

competitiveness against fossil fuel, he notes.

Airbus is "encouraged" by efforts from the transport sector and heavy industry to bring down emissions, he says, and renewable hydrogen power will become a "bigger part" of daily life.

"We're going to see trucks, parts of shipping, buses, running off hydrogen," he says. "There's no other means for society to meet the [Paris agreement climate-change commitments] without hydrogen."

However, the technological advancement and parallel overhaul of the ecosystem required to shift to hydrogen-based aviation will pose substantial challenges.

"It's very unusual for Airbus to be talking about a programme ambition, a commercial aircraft entry-into-service 10 or 15 years before we plan to do it," says Llewellyn. Unveiling its proposal is "not only about Airbus", he adds, but about "driving change" in the energy and aviation sectors.

A hydrogen-based aviation strategy will need to develop regulatory and safety procedures alongside the infrastructure, transport, and storage capabilities.

Llewellyn is confident that the industry will be able to cope with the specific safety considerations for hydrogen fuel, through such technological modifications as double-walled insulated tanks for storage. "[That's] quite different to the way we store kerosene," he says.

"We, as an industry, have essentially created engine designs, fuel system designs, refuelling operations and usage which make kerosene – which is not inert – have an incredible safety record, one which, as an industry, we can be extremely proud," he says. "We need to achieve the same sort of level of safety, or better, when talking about introducing hydrogen on board."

Boeing

US manufacturer is making incremental progress via ecoDemonstrator tests

Driving change will pose a big challenge, Boeing cautions

Jon Hemmerdinger Tampa

Boeing's top product developer doubts that hydrogen-powered airliners will be viable in the near future, because of technological uncertainty and regulatory hurdles.

Speaking the day after rival Airbus had unveiled a trio of hydrogen-powered future airliner concepts, Boeing's commercial vice-president and general manager of product development, Michael Sinnett, expressed doubts about the short-term prospects for the fuel, despite its "unique promise".

Sinnett says hydrogen fuel production and storage challenges will take significant time to work through, and that government regulators must be able to work at a pace matching such technological development, which he does not consider to be a sure bet.

"I don't think it's something that's right around the corner," he adds.

While the aerospace industry has many decades of experience in understanding the use, storage and transportation of kerosene fuel, he notes that the same cannot be said of hydrogen.

"We have to ensure there [is] no back-pedalling on those levels of safety," he says. "That means there is a lot to learn."

Sinnett points to short-term improvements being assessed via Boeing's ecoDemonstrator programme activity.

A recent series of test flights involving an Etihad Airways 787-10 trialled optimised flight routing, acoustic research – including tests to measure noise-reducing nose- and main-landing gear enhancements developed by Safran Landing Systems – and the use of a 50:50 sustainable fuel mix.