

September 2020

### Zero-Emission Aircraft (ZEROe)

Airbus has the ambition to put the world's first climate-neutral, zero-emission commercial aircraft into service by 2035.

#### Narrative

Aviation has given all of us so much over the years, an invaluable asset that has enabled us to:

- Bring down borders for a safer and more united world
- Explore all four corners of our planet
- Connect with our family and friends, as well as different cultures
- Feel the thrill of seeing our world from 30,000 feet above
- Build a worldwide air transportation network

However, air travel also comes at a cost. At present, aviation accounts for between two and three percent of the world's man made emissions of carbon dioxide (CO<sub>2</sub>), and about 14 percent of the CO<sub>2</sub> emissions from transportation at large. As an industry leader and Europe's key aerospace manufacturer, the onus is therefore on Airbus to work towards reducing aviation's impact on citizens and the environment.

At Airbus, the reduction of CO<sub>2</sub> emissions and the improvement of our aircraft's environmental performance has long been **an important requirement for the design and manufacture** of any new aircraft and it has always been **an essential part of Airbus' incremental product innovations**. But while we have a great track record for reducing emissions, we are aware that this will not be enough. **Our ambition is to bring the world's first zero-emission aircraft to market by the mid-2030s**. And we are convinced that climate neutral, zero-emission aviation is not only possible, but achievable within our lifetime.

Our work in electric flight and hydrogen fuel cells has laid the groundwork for a future climate neutral zero-emission commercial aircraft. As has the extensive research and development (R&D) work that we have been pressing ahead with over the last two decades.

Our approach is ambitious and multifaceted. Climate neutral zero-emission aviation represents a seismic shift for our industry. We believe this is a bold and necessary move in order to **disrupt and subsequently accelerate the aviation industry's transition to a sustainable future**.

As of today, a number technological pathways and aerodynamic configurations are being explored in order to support Airbus' ambition to lead the way in the decarbonisation of the entire aviation industry.

Hydrogen has emerged as a clear game-changer because it ticks all the right boxes: it's safe, versatile, lightweight and storable as either compressed gas or liquid. It has a high energy density that is nearly three times superior to jet fuel.

Moreover, hydrogen also emits no CO<sub>2</sub> emissions when burned: water and vapor are the main by-products. This fact alone solidifies hydrogen's reputation as an exciting "zero-emission" technology pathway.

In fact, hydrogen is likely to be the solution for climate-neutral targets for several industries, not just aviation, as it has the potential to contribute >50% towards reducing aviation's climate impact through synthetic fuel and hydrogen-powered aircraft.

On top of this, declining costs for renewable energy are set to drive cost reductions, making hydrogen increasingly cost-competitive with existing options, such as jet fuel and sustainable aviation fuels.

To this end we're are working on three different hydrogen-powered concept "ZEROe" aircraft:

- **A turbofan design** (120-200 passengers) with a range of 2,000+ nautical miles, capable of operating transcontinentally and powered by a modified gas-turbine engine running on hydrogen, rather than jet fuel, through combustion. The liquid hydrogen will be stored and distributed via tanks located behind the rear pressure bulkhead.
- **A turboprop design** (up to 100 passengers) using a turboprop engine instead of a turbofan and also powered by hydrogen combustion in modified gas-turbine engines, which would be capable of traveling more than 1,000 nautical miles, making it a perfect option for short-haul trips.
- **A "Blended-Wing body" design** (up to 100 passengers) concept in which the wings merge with the main body of the aircraft with a range similar to that of the turbofan concept. The exceptionally wide fuselage opens up multiple options for hydrogen storage and distribution, and for cabin layout.

All three ZEROe aircraft are exciting concepts and offer a lot of advantages for future air travel. Over the next few years, we will refine each concept to make sure we have matured the technology enough to deliver on our zero-emission ambition.

However, in order to evaluate, mature and validate these new technological pathways as viable future products we are pursuing several hydrogen flight demonstrators which will be announced formally over the coming months. These flight demonstrators will be a key part of our ambition to mature the technology by 2024/2025 when we make technology and product launch decisions.