

4. SUSTAINABLE ALTERNATIVE FUELS

THE E-FAN PROJECT

BY AIRBUS GROUP

From the A320 family, to the superjumbo A380 and the newest member of the Airbus commercial fleet, the A350 XWB, Airbus Group and its divisions have endeavoured to remain at the forefront of innovative R&D into developing the sustainable aviation of the future.

Alongside innovative technological R&D into areas such as biofuels from renewable resources, lightweight materials and designs aimed at reducing aircraft weight and fuel consumption, Airbus Group has established an E-Aircraft Roadmap to guide its development of electric and hybrid propulsion systems of tomorrow – today. An all-electric two-seater technology demonstrator called the E-Fan is one of the key trailblazers along our path to electric flight and aviation's next frontier.

The E-Fan project originated during the 2011 Paris Air Show as a follow-up to the initial cooperation of Airbus Group Innovations with Aerocomposites Saintonge on the Cri-Cri – the world's first fully-electric four-engine aerobatic aircraft. Using the Cri-Cri as a flying laboratory, numerous performance tests allowed engineers to gain experience with the integration of batteries and energy management, while also focussing on energy recovery by varying the propeller pitch.

The E-Fan technology demonstrator was developed initially as an all-electric, two-seater aircraft with covered fan engines. Small electric aircraft are seen as a key step towards introducing electric propulsion on larger airplanes – up to the size of a 100-seat-category regional airliner. As a highly innovative technology flying testbed, the E-Fan demonstrator is stimulating research in electric propulsion and also helping to promote the certification of electrical flight concepts.

The E-Fan's two electric motors deliver a combined power of 60kW, each driving an aft-mounted ducted, variable pitch fan. Electrical energy for these motors comes from the aircraft's battery system, for which capacity has been increased by 60 percent since its first flight in 2014.

In its original configuration the E-Fan utilised a series of lithium-polymer batteries located inside the wings, where fuel tanks would be on a traditional aircraft. The E-Fan team has since changed to a more powerful lithium-ion battery system, which was a key upgrade that enabled the technology demonstrator aircraft's flight across the English Channel. Comprising 2,982

cells with a capacity of 2.8 amperes per hour each, the lithium-ion battery system retains the same location as the previous lithium-polymer cells with E-Fan's wings.

With its crossing of the English Channel in July 2015, the E-Fan demonstrator became the world's first all-electric, two-engine aircraft to take off by its own power to cross the Channel. This historic flight followed in the footsteps of one of Airbus Group's "founding fathers," Louis Blériot, who crossed the Channel in 1909, showing that the pioneering spirit and ingenuity demonstrated by Blériot and the other early aviators is still alive today. We hope that this flight and the E-Fan project will capture the imagination of the next generation of aviators and engineers.

But it didn't just prove the viability of electric flight – it also set the stage for the next project phase: launching the commercial production of an all-electric, two-seat E-Fan 2.0. The E-Fan project has allowed the Airbus Group to perform extensive characterisation and testing of the electrical propulsion unit and other technical parameters for certification purposes ahead of industrialisation of the E-Fan 2.0 in 2018. This ambitious project

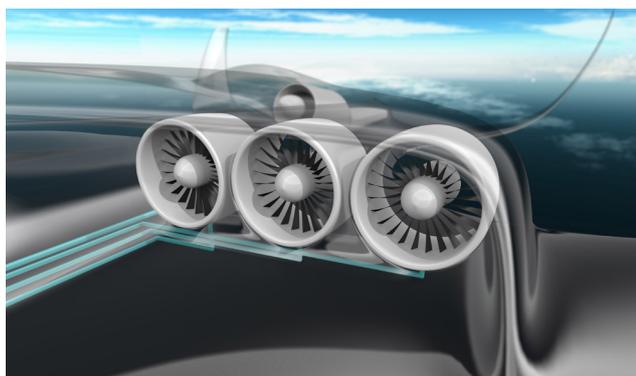


Figure 1. Airbus E-Thrust e Concept view B1

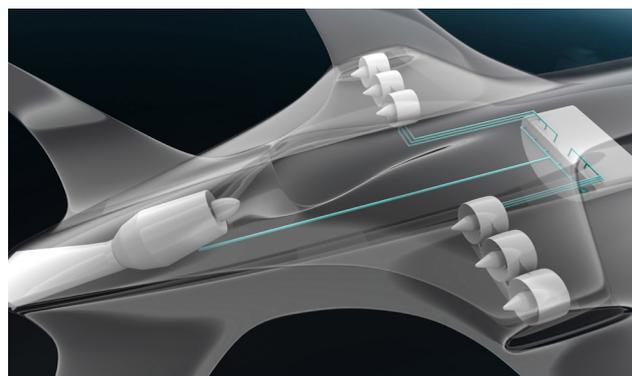


Figure 2. Airbus E-Fan

aims to achieve technology breakthroughs in several areas, such as energy storage of 180 Wh/kg, adapted for a charge regime of less than one hour. It also brings together partners from across the industry and research sector, working together with Airbus on a common goal of next generation of flight with minimal impact on the environment.

Electric and electric-hybrid flight represent some of the biggest industrial challenges of our time, aiming at zero-emissions aviation.

Airbus Group is committed to meeting the environmental standards set by ICAO for noise and emissions and there are strong incentives for the Group and its divisions not only to develop innovative, eco-efficient propulsion and lightweight material solutions – but ultimately bring them to market quickly as more stringent carbon emissions regulations come into effect.

Meeting the ambitious environmental goals set for aviation by the European Commission's Flightpath 2050, which calls for a reduction of aircraft CO₂ emissions by 75%, NO_x emissions by 90% and noise levels by 65% compared to year 2000 levels is another key driver.

The E-Fan project is just one element of our overall E-Roadmap: April 2016 saw the official ground-breaking ceremony on the E-System House at the Group's site to the south of Munich. The E-System House is set to go online in 2018, and will focus on R&D into the development of technologies for electric and hybrid aircraft propulsion. This internal research and development facility will be jointly operated by Airbus Group and its three divisions. April 2016 also saw Airbus Group join forces with Siemens in a collaboration aimed at developing hybrid-electric propulsion systems for different aircraft architectures and sizes in another step towards emissions free aviation.



Figure 3. Airbus E-Fan into graphics

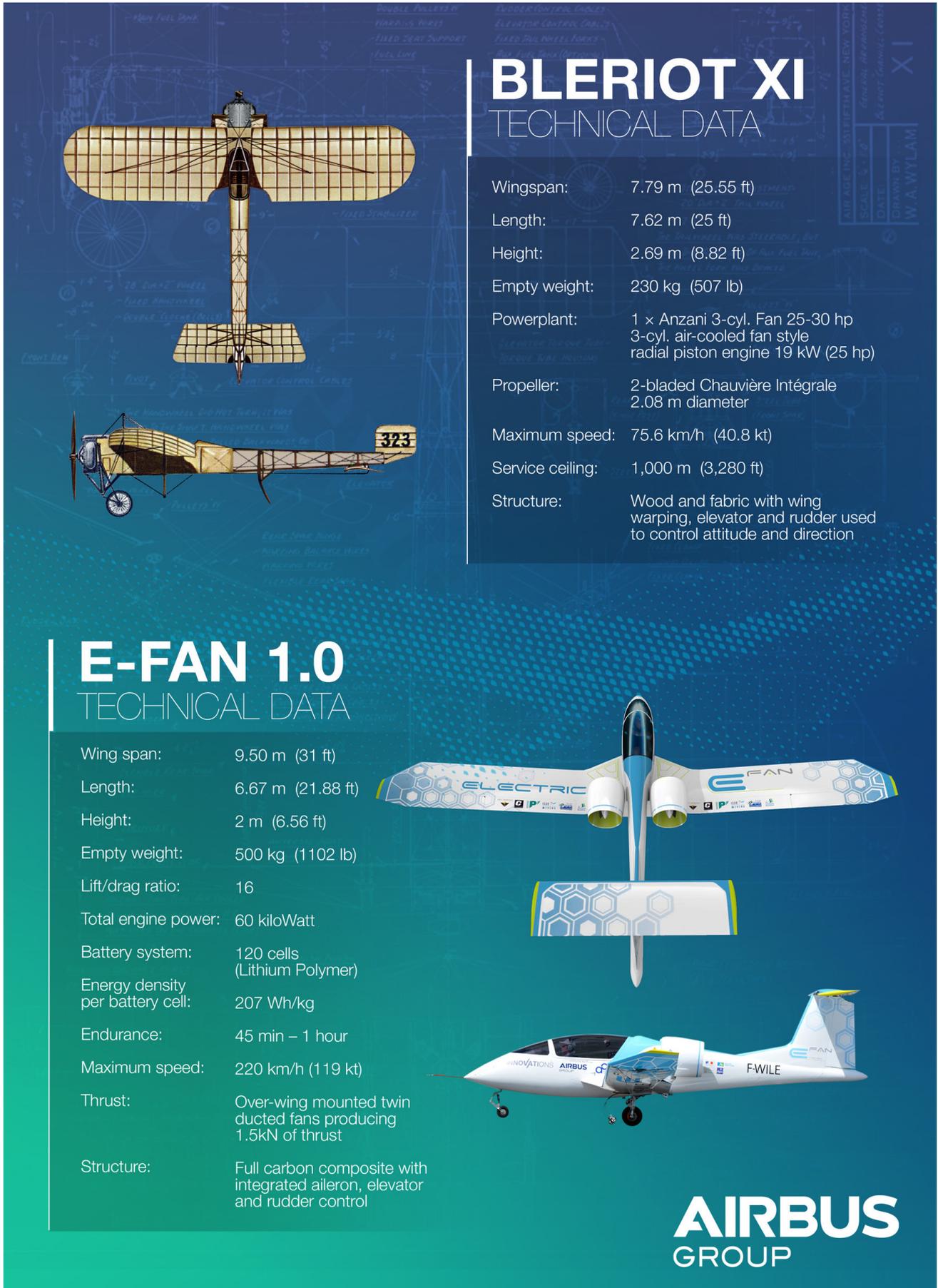


Figure 4. Airbus E-Fan Bleriot XI comparison