

# Airbus Group: A Story of Continuous Innovation

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## ABSTRACT

The 150<sup>th</sup> anniversary of the Royal Aeronautical Society offers an ideal opportunity to reflect on the spirit of innovation and collaboration fostered by the Society and its members over the past century and a half. Dr Jean Botti, an engineer with 31 patents to his name and Chief Technical Officer at Airbus Group, reflects on key innovation milestones for both Airbus Group and the industry as a whole. He also discusses the benefits of collaboration between the RAeS members and industry, and looks forward to an exciting new era of discovery – from electric flight (e-flight) to ‘smarter skies’ and the future development of new modes of flight which can only be imagined today.

**Keywords:** aeronautical history; development; Airbus



Figure 1. Airbus A380. (© British Airways).

## 1.0 ABOUT AIRBUS GROUP

Airbus Group is a global leader in aeronautics, space and related services. In 2014, the Group, which is comprised of three divisions – Airbus, Airbus Defence and Space, and Airbus Helicopters – generated revenues of €60.7 Bn and employed a workforce of around 138,600 in 170 locations worldwide. Under the auspices of Airbus Group Innovations (AGI), our group-wide corporate research and technology network, we are conducting the research and development today that will result in commercially viable solutions tomorrow.

“I have not the smallest molecule of faith in aerial navigation other than ballooning, or of the expectation of good results from any of the trials we heard of. So you will understand why I would not care to be a member of your society.” Lord William Thomson Kelvin, replying to an invitation to join the Royal Aeronautical Society, 1896

Today in 2016, when one can barely look into the sky without seeing an aircraft, it is worth remembering that even some 30 years after the Royal Aeronautical Society’s founding, some of the most enlightened minds of the day viewed the pursuit of air travel as mere folly. The progress in aviation made in the 20<sup>th</sup> century not only belies the dire predictions of ‘aerosceptics’ of the 1800s such as Lord Kelvin, but it also demonstrates the unimaginable speed of our advancement.

The power of innovation has taken us to the air, the stratosphere, Earth’s orbit, the moon, the other planets, the outer reaches of our solar system, and beyond. A rapid-fire succession of technological ‘firsts’ – the like of which had never been seen before – has propelled humankind forward at a dizzying speed. From the Wright Brothers’ first flight in 1903 to the Rosetta Mission’s successful November 2014 landing of the Philae lander on the comet Churyumov–Gerasimenko – which was moving at speed of 135,000 km per hour – humankind has gone further and faster than many ever thought possible.

None of this astonishing progress would have been possible without the international collaboration and global community originally fostered by the Royal Aeronautical Society

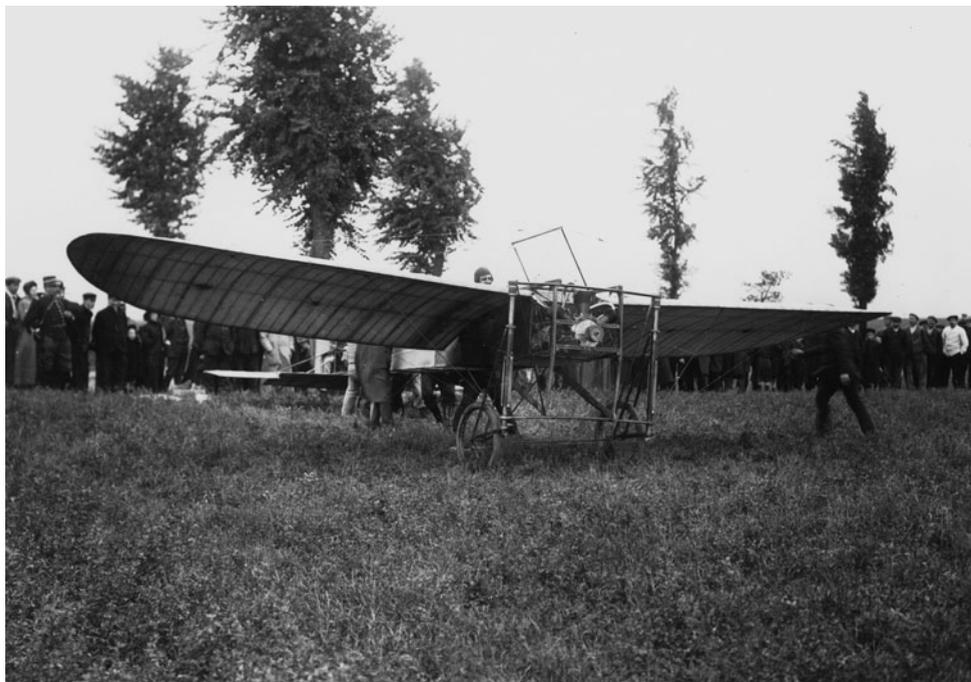


Figure 2. French pilot Louis Blériot during his cross-channel flight on 25 July 1909.

(© Airbus Group Corporate Heritage).

(RAeS). As an engineer myself, I can attest to the fact that this spirit of innovation and discovery in which the Society was launched is as alive today as ever – 150 years later, we are in the midst of another huge innovation renaissance. Rock-star astrophysicists like Neil deGrasse Tyson, inventors like Solar Impulse's Bertrand Piccard and Airbus Group's very own electric aircraft team have reignited the public's passion for science and technology.

Nowadays, however, innovation is less about the derring-do bravado of early pioneers risking life and limb to be the first to perform some amazing feat. Instead, our work today with the RAeS and other partners around the globe is a more holistic cooperation, focused on developing innovative and sustainable solutions for the very real challenges of the 21<sup>st</sup> century: human, environmental and technological.

## 2.0 AT THE FOREFRONT OF INNOVATION

At the time of its founding, with the noble aim to 'further the advancement of aerial navigation and for observations in aerology connected therewith', the Society was the first of its kind, and the science of aeronautics was in its infancy. In the mid-1800s, the dream of human flight still seemed the sole purvey of science fiction writers like Jules Verne and inventors such as

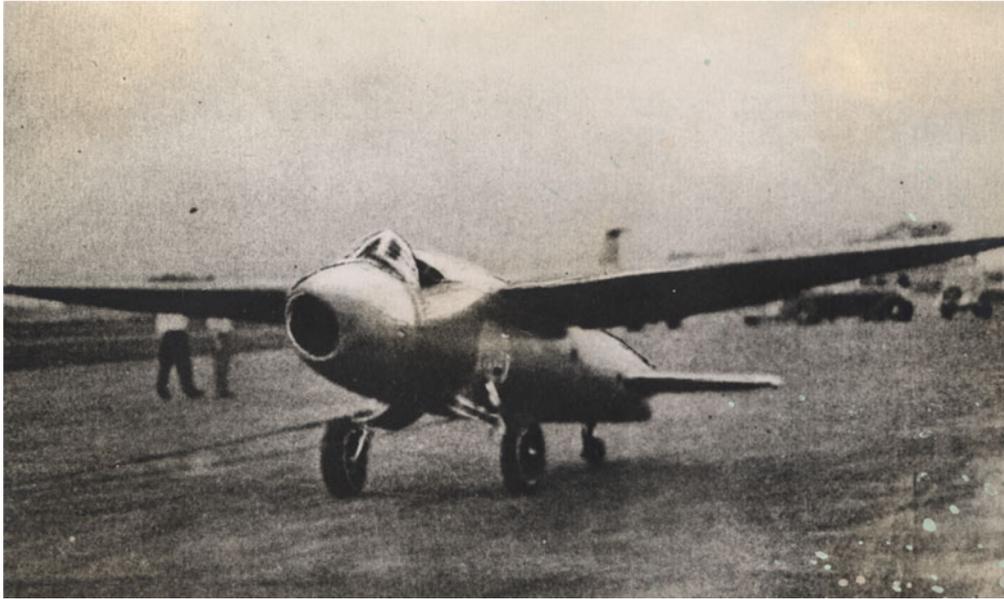


Figure 3. A Heinkel He 178. The first jet-propelled aircraft in the world. (© Airbus Group Corporate Heritage).

France's Montgolfier brothers, who conducted the first recorded example of 'air travel' in a hot air balloon in 1782.

It would be four decades from the Society's launch before the world saw the first flight of a powered aircraft by America's Wright brothers, and a further 67 years before the creation of Airbus Industrie in 1969. From its very outset, the Society and its members championed the visionary, 'sky's the limit' thinking that would challenge and encourage aeronautical engineers to dream the impossible.

Francis Herbert Wenham, a British marine engineer, gave the Society's inaugural lecture on the topic of, as he called it, 'aerial locomotion'. He hypothesised that aerial locomotion – or manned flight – could be achieved by means of wings placed one over the other. Wenham's theory would prove to be hugely influential, and his discoveries would later be incorporated into the designs of the Wright brothers, among others. It is this spirit of innovation that has created a global aerospace industry that has gone far beyond the flying machines imagined by even the Society's founders.

The history of European aviation has been one of increasingly ambitious achievements – many of them driven, in part, by the conflicts that defined the first part of the 20<sup>th</sup> century. By 1940, the Society had decided to establish a technical department in response to the wartime need to expand the aircraft industry and support the Allied forces. By bringing together the best available industry knowledge and presenting it in an authoritative and accessible form, the department also acted as a store of technological knowhow for future developments. It was partly a result of the breakthroughs made possible by the Society's technical expertise, among other sources, that Airbus – a European industrial and aerospace powerhouse forged by men and women who fought on both sides of the conflict – was born.

### 3.0 AIRBUS GROUP – BUILDING UPON A TRADITION OF INNOVATION, FROM RADAR TO E-FLIGHT

At Airbus Group, we have a rich history of innovation to look back on. Radar technology, the first jet engine, Maglev trains, the airbag, medical lasers, supersonic jet aircraft and the first twin-engine wide body jet are just a few of the technological advances and diverse products brought to market by the group and its predecessor companies. Over the long course of their history, the companies consolidated into what has become the Airbus Group have consistently charted new territory in the field of aeronautics:

- 1915: German aircraft manufacturer, Junkers, produced the first all-metal aircraft – the Junkers J 1 – revolutionising aircraft design and moving away from wood and canvas structures.
- 1939: The first jet-powered aircraft took to the skies, the Heinkel He 178.
- 1957: The FS24 Phoenix became the first fibreglass glider – a materials milestone and huge step forward in aircraft design.
- 1976: The Concorde entered commercial service and became an instant aviation icon, setting a new standard in advanced aerodynamics and supersonic flight.
- 1988: the first A320 narrow-body aircraft was delivered incorporating revolutionary digital fly-by-wire flight control systems.
- 2007: The A380 “super jumbo” entered into service with Singapore Airlines. It marked a new era in the age of flight.
- In 2015, Airbus’ latest and most advanced aircraft, the A350 XWB, which extensively uses composite materials to reduce weight, entered into service.

All of these trailblazing aircraft developments have resulted from our dedication to promoting innovation and technologies that will change our industry, surpass our customers’ expectations and improve people’s lives.

### 4.0 TACKLING THE ISSUES OF THE 21<sup>ST</sup> CENTURY WITH A GLOBAL INNOVATION NETWORK

The challenge for Airbus Group today is to move towards means of transport that are more environmentally friendly, less reliant on fossil fuels and use energy more efficiently. We are taking steps in this direction with the development of electric aircraft – e-aircraft – and the use of hybrid propulsion systems, which combine electric power with traditional jet engine technology. Our aim is to develop technologies that will enable civil aviation to meet its target of halving carbon emissions by 2050.

Through Airbus Group Innovations, our group-wide corporate research and technology network, we’re conducting the research and development today that will result in commercially viable solutions tomorrow. Airbus Group Innovations also works in partnership with institutes, universities, research centres and industrial partners – bringing unique



Figure 4. Airbus A350 XWB.

perspectives and capabilities through expertise and cultural diversity. Our 800-strong team is spread across the globe to enable our vision of a world that is more mobile, secure and eco-efficient, support the Group's divisions and ensure that Airbus Group continues to be at the forefront of innovation.

## 5.0 THE E-FAN: A TECHNOLOGY DEMONSTRATOR AIRCRAFT PROVES THE VIABILITY OF ELECTRIC FLIGHT

Leading our research into e-aircraft and e-propulsion systems is the E-Fan programme. The fully electric E-Fan technology demonstrator is a two-seater demonstrator aircraft we began developing in 2011, and which took its first flight in 2014. The E-Fan is a crucial step on Airbus Group's journey toward all-electric aviation and is a key part of our e-aircraft roadmap. This roadmap is our strategy for a step-by-step approach to our group's short, medium and long-term development of electric planes. We launched our electric aircraft journey back in 2010 with our work on a one-seater, electric Cri-Cri aircraft.

2015 was a year of important milestones for Airbus Group's e-aircraft programme: On 10 July 2015, the E-Fan demonstrator made a historic crossing of the English Channel from Lydd, England, to Calais on the French coast in just 36 minutes. The E-Fan's successful Channel flight echoed that of French pilot Louis Blériot in 1909 when he became the first person to make the crossing in an aircraft, and we hope that the E-Fan will capture the imagination of and inspire a new generation of aviators in the same way as Blériot.

The Channel crossing was not just clear proof of the viability of electric flight. It also underlined the rationale for the next phase of the programme. In early 2015, Airbus Group



Figure 5. On 10 July 2015, Airbus Group's E-Fan demonstrator made a historic crossing of the English Channel from Lydd, England, to Calais, France (© Airbus Group).



Figure 6. Airbus Perlan Mission II's Perlan 2 glider. (© Airbus Group).

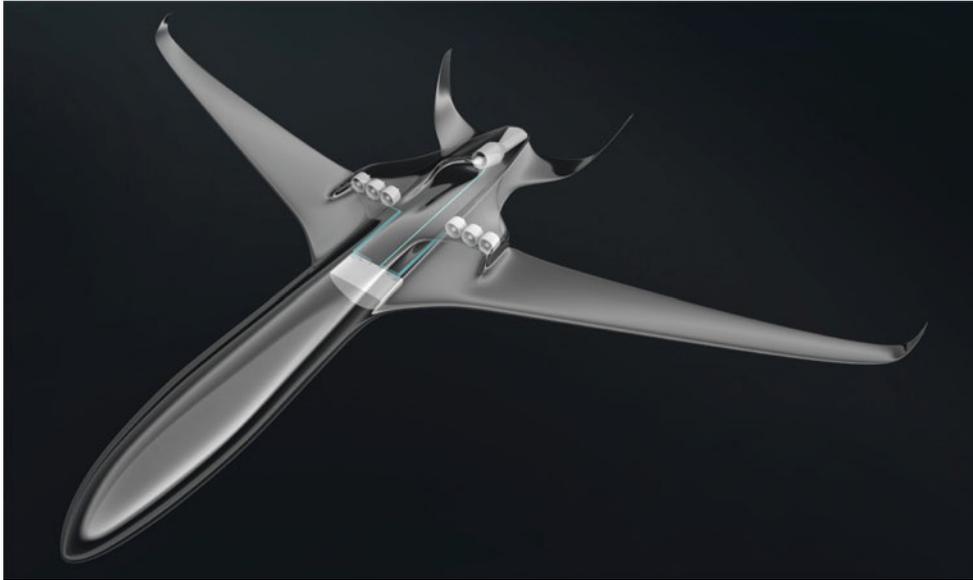


Figure 7. E-Thrust concept.

announced that it would industrialise the programme and launch the commercial production of an all-electric, two-seat E-Fan 2.0 aircraft. Construction of a production facility in the city of Pau in France's 'Aerospace Valley' technology cluster is slated to begin mid-2016. The E-Fan 2.0's entry into service is set for late 2017. The development of a hybrid-electric, four-seater E-Fan 4.0 is set to follow the development of the E-Fan 2.0.

## 6.0 E-THRUST – AN INTERNATIONAL COLLABORATION

Airbus Group Innovations and Rolls-Royce, with Cranfield University as a partner and funding by the U.K.'s technology strategy board, Innovate UK, have worked together in recent years to research distributed electrical aerospace propulsion. This research has focused on developing key innovative technologies that will enable improved fuel economy and reduced exhaust gas and noise emissions for future aircraft designs by incorporating 'Distributed Propulsion' (DP) system architecture.

### 6.1 Zephyr and Perlan

With our Zephyr project, we have designed a solar-powered, high-altitude 'pseudo satellite' to fly within the stratosphere – above the weather and conventional air traffic. The Zephyr fills a capability gap between orbital satellites and unpowered aerial vehicles (UAVs) and will conduct functions including surface observation and communications. Airbus Group is playing a key role in the Perlan programme – a joint venture with project partners in the U.S. state of Oregon – in the development of a glider capable of harnessing the air currents and thermals generated along mountain ranges to propel itself without the use of extra fuel to the very edge of space. The year 2016 will see a succession of flights as the Perlan team prepares for Airbus Perlan Mission II, to soar the aircraft to the edge of space at 90,000 feet in July 2016 in Argentina. This flight is expected to exceed even the altitudes achieved by the U-2 and the SR-71. The

Perlan 2 glider will be used to harvest invaluable data about the causes behind the depletion of the ozone layer.

## 6.2 Smarter Skies

Our Airbus division has launched a ‘Smarter Skies’ concept programme that imagines a future of disruptive technology and intelligent aircraft. In this future, aircraft are powered by alternative fuels and will use assisted take-off to embark on continuous ‘eco-climbs’, fly in formation along express skyways and self-select routes. The endgame of such concepts is to make air travel safer, shorter, more environmentally friendly and more sustainable.

## 6.3 A trusted partner for the future

As Airbus Group works to make these concepts a reality, it is with the knowledge that the RAeS will remain a trusted partner that will promote the discussion, learning and knowledge sharing, which is vital for the future of our industry.

Through its ‘Cool Aeronautics’ programme, it is encouraging to see the Society looking to further the study of STEM subjects – science, technology, engineering and math – in schools. We have adopted a similar initiative called ‘Fly Your Ideas’ and many other initiatives that encourage university students from around the world to innovate and help us map out the future of aviation. The construction of the Airbus Business Suite at the Royal Aeronautical Society’s Mayfair headquarters in 2013 demonstrates our continued commitment to this vital institution. It provides a space where members from around world – from supply chain companies to government representatives – can get together to share know-how, discuss industry events and forge collaborations and partnerships.

## 7.0 CONCLUSION

The pace of change in the aerospace industry is increasing exponentially: In the first century following the advent of commercial aviation, some 65 Bn people travelled the globe by air. It will only take 15 years for us to hit the next 65 Bn passenger milestone – and there is far more to come.

Jeremy Rifkin, the renowned US futurologist, cites three areas of technology that decisively influence our everyday lives: communications, energy and transport. Today, we are seeing changes in all these areas – and all three come together in the aerospace industry. Eric Schmidt, the chairman of Google, has identified mobility and transport as two fields which, while benefiting from new ideas, have yet to be truly revolutionised by ‘disruptive’ technology.

Such exciting developments have the potential to inspire a new generation of young and curious minds and encourage them to pursue a career in the aerospace industry. And it will be their creative thinking that will achieve the scientific breakthroughs that takes the industry to the next level. At Airbus Group, we pride ourselves on being not just a company built on high technology, but a company made up of such ‘high’ technologists. Half of our workforce is made up of scientists, mathematicians and, by far the largest component, engineers.

For the industry to continue to flourish, such collaborations should never just be about the ‘big ideas’. They also need to include programmes aimed at achieving incremental improvements, such as the recently announced Airbus research initiative to remove wing imperfections. This is an exciting time for the aerospace industry. At Airbus Group, we are exploring radical new technologies – such as 3D printing, the development of biofuels created

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using algae, and ‘smart’ factories that rely on digital assembly techniques – which promise to change the way we manufacture aircraft.

However, we can only be truly visionary if we cultivate environments that allow knowledge sharing and foster innovation. This is why our links to the Royal Aeronautical Society will continue to play a key role in Airbus Group’s success and the industry as a whole. For the aerospace industry to continue to innovate, we need organisations like the Royal Aeronautical Society, which support members from around the world and provide a forum for knowledge sharing and expertise.

On its 150<sup>th</sup> anniversary, we at Airbus Group want to thank the Society for everything that it has helped achieve. We can only imagine what Leonardo da Vinci, Blériot, the Wright brothers and even Lord Kelvin would think if they could see just how far we’ve come today. The journey to the future has just begun, and we look forward to working with you for another 150 years and beyond – as we continue to make it fly.