

IT FLIES USA

# Winning aircraft design comes from Manchester

IT FLIES USA was held in April at The University of Dayton, Ohio. This year there was a truly international mix of students – all sharing the same passion – aerospace. The University of Dayton is so lucky to have the Wright Patterson Air Force Base close by and, this year we had four test pilots to fly and assess the aircraft designs and three judges from the Society of Flight Test Engineers to evaluate the students' project presentations.

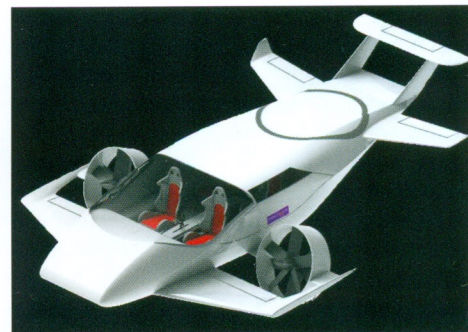
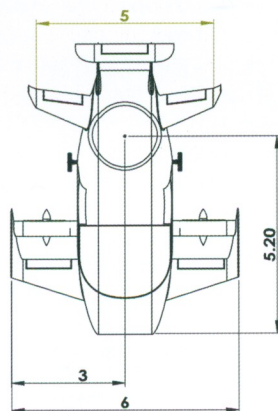
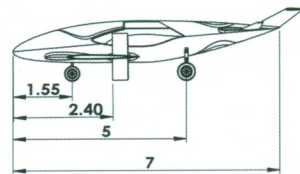
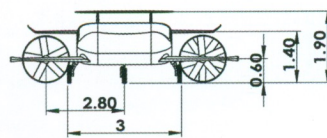
The winning aircraft design came from The University of Manchester – Ana Gea, Thomas Moissinac and Yufei Jin – their prizes were \$1,000 and a year's membership of the Royal Aeronautical Society. Their design was flown and assessed in Dayton's MP521 simulator by Brad Fairfax, a US Naval Test Pilot. They then had the added bonus of having their winning UK IT FLIES design flown after the event by Gary Konnert, Lead Test Pilot over at Dayton for the competition. The same team had designed a blended wing aircraft and Gary is an ex B-2 Test Pilot – he had fun – and the team learnt a great deal. Below is the write-up from two of the Manchester students on their trip to the USA:

The Flight Simulation Society (FSSoc) [www.fssoc.co.uk], is an innovative, student run, engineering society within the School of MACE (Mechanical, Aerospace and Civil Engineering) at the University of Manchester. The main aim of the society is to teach aircraft design to students which are then tested and tuned in the Merlin flight simulators.

This year, the Society entered two teams into the Merlin IT FLIES USA competition held at the University of Dayton on Saturday 8 April. The teams consisted of three 2nd year aerospace engineering students.

All six members have spent hundreds of hours of their own free time to design, build and simulate their aircraft models. This year the Society has gone 'green' and the two teams have designed an electric-powered VTOL air taxi and a hybrid passenger jet.

At the beginning of our second year, we started discussing concepts and ideas that we considered too complex for the knowledge we had in first year. Most of the ideas we wanted to focus were fictional aircraft in different movies to investigate their real feasibility. Originally, we started some calculations on a variable-forward sweep aircraft based on a science fiction movie. Through extensive calculations and some initial simulation we concluded that this design was

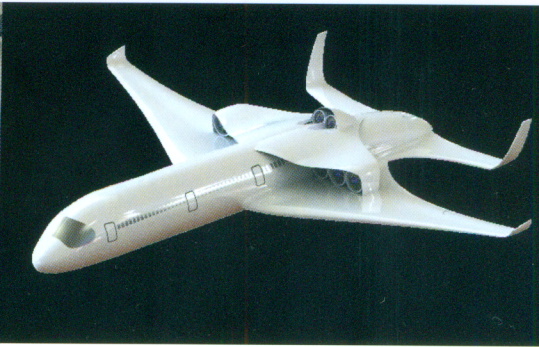
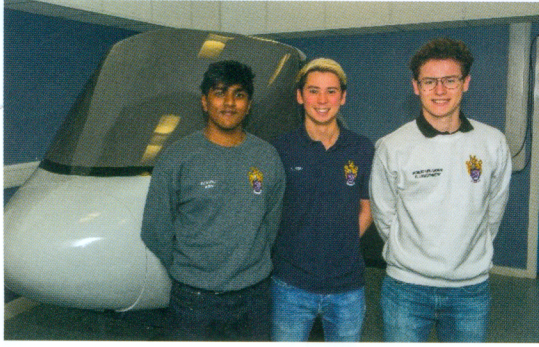


Above: Elektron, an electric-powered VTOL air taxi, won first place.

Left: The winning design team, Ana Gea, Thomas Moissinac and Yufei Jin, came from The University of Manchester.

not possible due to physical limitations and some found in the simulation. The variable sweep would require a morphing wing shape, as the trailing edge would become a leading edge, meaning that the aerodynamic forces on the wing would shift significantly. After this setback, we investigated the concept of short-range electric aircraft, basing it on the Airbus E-Fan concept aircraft. The idea of an electric aircraft comes from the growing market of environmentally friendly and sustainable transportation systems, similar to the Tesla cars.

The main difficulty we encountered in the process was power calculations, due to lack of information on batteries. Considering the date when such batteries would become more efficient and produce more power to sustain VTOL capabilities. We spent many hours completing complex calculations, as well as performing many test flights



Left: Voltic, a hybrid transatlantic aircraft, won the prize for most innovative design. Far left: Its design team also comes from The University of Manchester.

using the university's simulators. From these tests we were able to improve our model through the addition of VTOL, as this will make the air taxi a more desirable product.

During the competition, we had the chance to talk to multiple test pilots and hear their different flight experiences. We stood next to our test pilot, to guide him through some of the procedures, which were more unconventional than a normal aircraft. The VTOL was one of the capabilities he focused on, as it is what differentiates our aircraft from the rest. It was very interesting to hear his thoughts while flying it, as well as some ideas for future developments of the aircraft after the testing.

The other aircraft which competed was Voltic. The concept behind Voltic is that of a hybrid transatlantic aircraft. The main purpose being to save fuel, through extensive calculations we estimated to be able to save 75% of the total fuel costs to undertake a transatlantic flight. With its six electric engines on top of its wings and two gas turbines at the rear, it truly was an unconventional design. Some of the main difficulties were again the battery calculations but also how to maintain enough lift when all these engines are on the wing. We achieved this by simply increasing the area and changing the overall shape and, therefore, the aspect ratio of the wing.

Although competition was tight, both Manchester teams won numerous prizes. The VTOL air taxi won first place and the best presentation award and the hybrid passenger jet won the prize for The Most Innovative Design.

While in Dayton we took the opportunity to visit the National Museum of the US Air Force at at Wright-Patterson Air Force Base. Here we got a chance to see all types of commercial and military aircraft. The museum is divided into sections, the first is the beginning of aviation, where we could read about and see the earliest aircraft. In this section we attempted to guess which aircraft was the parent to common aircraft that we have studied or that we know. The middle hangar, the largest, had a B-2 aircraft, this is one of the most impressive machines to see up close. It was amazing to see such a large aircraft and think of its impact it would make to see it fly, as well as the number

of missions it has completed. A very fun hangar to visit was the one that contained the Presidential aircraft, as you could walk through them and see the development of the interior configurations with different Presidents. After the competition, we took advantage of being in the US to visit New York for a few days, as some of members had never been. This part of the trip was very interesting and we were able to visit a few museums, such as the American Museum of Natural History, as well as walk down the High Line during the sunset. Speaking in the name of all the members, it was an amazing experience through which we became better friends, team mates and improved our overall aviation knowledge.

We hope to see many more innovative and realistic concepts through the journey of the Flight Simulation Society's future. Throughout the journey we learned and attained many new skills, we made new friends and were able to speak to test pilots and hear their opinion on our ideas. All of this knowledge we will be able to apply in our future careers in not only aircraft design but also project management and conceptual aircraft design developments.

We would like to thank all the staff at the School of MACE and the Manchester Student's Union for their continued support, and Merlin Flight Simulation Group for organising the competition.'

**Ana Gea and Charles-Antoine Lassonnery**  
2nd Year Aerospace Engineering Students,  
University of Manchester



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Below: Former static test article of the Northrop Grumman B-2 Spirit in the National Museum of the United States Air Force. Clemens Vasters.

