Aeronaut

The magazine of the National Flying Laboratory Centre

Issue 2 2022

- Aerospace and aviation students: looking to the future
- The pilot Q&A

The future of flight

Cranfield University

National Flying Laboratory Centre

Welcome to Aeronaut!

Welcome to Cranfield and to the National Flying Laboratory Centre.

It's been a challenging year for everyone around the globe. No one has been spared the disruption and sadness that has accompanied the Covid-19 global pandemic. Yet as I write this I see amongst aerospace and aviation communities, and the Cranfield community, a sense of hope and people who are resolved to move forwards and address the challenges we face.

We can take hope from the fact that the sector has recovered from disruption before. When Cranfield alumni who have 'been there and done that' offer their advice to current and prospective students entering the industry, the overarching message is one of positivity and that the industry needs people just like you. Read their advice on page 18.

There is no doubt that it is one of the most interesting times to be entering the industry. New technology around propulsion, alternative energy, new materials, and autonomy offers new solutions, while the climate emergency poses unprecedented environmental challenges to the sector. Our 'Future of flight' cover story on page 20 explores the long-term challenges facing the aerospace and aviation sectors and how Cranfield is playing its part in working towards solutions, focussing on the "four 'A's" – aircraft, airspace, airport and airlines – of the future.

We also have an interview with Rob Harrison, Head of the National Flying Laboratory Centre (NFLC) and Saab 340B Captain, who talks about his time in the Royal Air Force (RAF) as a fighter pilot, the future of sustainable aviation, and his aviation inspiration. Read the interview on page 10.

Finally, from page 26 onwards you will see careers information from our corporate partners and supporters who have helped us to purchase and modify the new Saab 340B National Flying Laboratory and Classroom. This means we can support thousands of students in realising their ambitions to become aerospace engineers and aviation leaders. These organisations are also addressing the challenges we face, and we are both extremely grateful for their support, and proud to work with them to support their objectives.

I hope you enjoy this issue and take it with you on your journey into the future of flight.

Professor Dame Helen Atkinson DBE FREng,
Pro-Vice Chancellor, School of Aerospace, Transport and Manufacturing

Welcome from the Head of NFLC

The flying classroom is a vital national asset supporting thousands of students to realise their ambitions of becoming aerospace engineers and carrying out transformational research by providing them with a unique learning flight test experience.

The current flying classroom is a Saab 340B, call sign G-NFLB, which has recently replaced the beloved Jetstream. The new aircraft will enable us to extend our capability to carry out transformational research, give more students a flight test engineer experience, and enhance Cranfield's STEM outreach capability thanks to the 'global connected classroom'.

It is in this flying classroom that students from Cranfield and over 20 universities learn about aerodynamics and flight dynamics by collecting data while on board this specially-instrumented aircraft. On the seat-back screens you can see real-time information about the flight, such as airspeed, bank angle, g-force, or navigation information – this real-time flight data can be collected for analysis. As a laboratory, the aircraft also supports the development of technologies and operations needed for flight operations.

Cranfield is the only university in Europe to have its own airport, pilots, air navigation service provider, and its own aircraft. However, it is through the combination of teaching and research, close working relationships with industry partners, and the unique National Flying Laboratory Centre (NFLC) flying classroom that Cranfield has played a significant role in the education of thousands of aerospace engineers.

We were honoured to be awarded the 2019 Queen's Anniversary Prize, the highest award for a higher education institution in the UK, for the work of the National Flying Laboratory Centre in supporting the nation's aero-engineering students. The award is a fitting tribute to the work of the NFLC team, and Cranfield's aviation and aerospace research and education. We are continuing that work by flying more students in the flying classroom than ever before, engaging in STEM outreach with school children, and developing new capabilities in aircraft electrification, hydrogen propulsion, unmanned aerial vehicle technology, and urban air mobility.

We hope you enjoy your flight!

Rob Harrison,
Head of NFLC and Saab 340B Captain

Did you know?

Students are encouraged to have real flight test experience by the Royal Aeronautical Society (RAeS) for their accreditation for the Chartered Engineer qualification, this means that over 80% of all UK aerospace engineering students use the flying classroom.

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Editor
Kassia Gardner

Feature writers
Professor Graham Braithwaite, Professor Iain Gray, Rob Harrison, Kassia Gardner

Designers
Peter Gibbs, Alex Harrison

The next generation classroom

The Jetstream has served the National Flying Laboratory Centre (NFLC) for nearly 50 years but by 2018, as the number of aircraft in service dwindled, support was becoming harder to secure. A replacement aircraft needed to be identified and modified to continue its important role.

Selecting the right aircraft is never simple, especially when the flying undertaken by the flying classroom and laboratory is somewhat unusual. Part of the very special educational experience provided by the aircraft is its ability to climb rapidly to its operating altitude, fly a range of manoeuvres, and operate in poor weather. We needed increased seating capacity than the Jetstream to cater for increasing student numbers, and capacity to carry research equipment without the need to reconfigure between flights. Affordability, maintainability and the rapid turnaround were also key factors. Most importantly, the aircraft needed to perform in a way that allowed the flight crew to execute unusual manoeuvres safely.

The global regional turboprop market contracted significantly in the 1990s and early 2000s so there was a limited number of aircraft that could be considered. The final choice was a Saab 340B as market research and simulator testing suggested its performance and flying characteristics were ideal, and the University already had a strong strategic partnership with Saab. Cranfield became the first UK airport to operate a digital air traffic control centre with innovative technology supplied by Saab Digital Air Traffic Solutions, and Saab is also a partner in the Digital Aviation Research Technology Centre (DARTeC).

The Saab 340B is a popular regional aircraft. In 2018, over 240 of them were operated by 34 different operators, including Loganair in the UK. Excellent technical support is available from Saab in Linköping, where the aircraft was originally built and where aircraft are modified for special missions – such as the flying classroom and laboratory.

Cranfield chose an outright purchase rather than lease because of the required modifications and because Saab had a suitable aircraft for sale. It had previously operated as N456XJ for Meseba Airlines in the USA, operating regional routes until its retirement in late 2011. The aircraft was comparatively young – ship number 456 out of a total production run of 459 aircraft. However, as it had been operating in the US, modifications were needed to ensure it met European airworthiness requirements.

The freshly painted but unmodified aircraft was officially handed over to Cranfield University at a ceremony attended by Prof Graham Braithwaite and Prof Nick Lawson in Sweden on 14 November 2019 and at that point, the full modification programme could start under the watchful eye of Cranfield alumnus, Scott Carmichael (MSc Air Transport Management 2016), NFLC's Project Manager.

Design work for the instrumentation and sensors was undertaken by Cranfield Aerospace Solutions and the functionality was designed in collaboration with the NFLC team including its lead demonstrator, Dr Alastair Cooke, who had amassed years of experience with the Jetstream 31. Software for the tablet computers that would relay information from the various sensors on board the aircraft was developed by Scitek – an engineering consultancy specialising in research and development software.

An aircraft modification programme is challenging, but the onset of the global pandemic meant teams of engineers needing to work remotely and components becoming harder to source. This inevitably caused delays, meaning that completion was unlikely before the UK left the EU and airworthiness responsibility moved from the European Aviation Safety Agency (EASA) to the UK Civil Aviation Authority (CAA). A 'Supplemental Type Certificate' (STC) was required and this needed the aircraft to be moved to the UK under a 'Permit to Fly' in July 2021. This meant approval was required from each of the countries to be overflown so a routing was designed from Sweden, over Norway and the North Sea to Scotland and on to Cranfield. The Saab Test Pilots completed a shakedown flight and commissioning flight before it was ready to head for its new home. The aircraft behaved beautifully and NFLC's Captains Robert Harrison and Tim Kinvig were given the green light to bring the aircraft back to Cranfield on Friday 9 July.

The arrival was kept low key, but the Cranfield team excitedly tracked the aircraft throughout its trip and it touched down safely at 1236 marking a new era for the NFLC. Once at Cranfield, the modifications were tested and approval gained from the CAA for the aircraft to operate. Then freshly upholstered seats with mounting points for the tablet computers were fitted, and in August the crew were able to start their line training in the aircraft before flying students in October 2021.

Cranfield NFLC aircraft specifications

SAAB 340B

Length:	19.73m
Height:	6.97m
Wingspan:	21.44m
Max cruise speed:	283 knots
Maximum range:	935nm
Max operating altitude:	25,000 feet
Engines:	2 x GE CT7-9B with 1870 shaft horsepower each
Maximum take off weight:	13,100 kg
Maximum payload:	3,400 kg
Maximum passengers:	33 (NFLC will typically fly up to 25 for operational reasons)

Slingsby T67M260 Firefly

Length:	7.48m
Height:	2.29m
Wingspan:	10.72m
Max cruise speed:	150 knots
Maximum range:	550nm
Max operating altitude:	10,000 feet
Max operating g-range:	-3.0g - +6.0g
Engines:	Lycoming AEI0-540-D4A5 with 260 shaft horsepower
Maximum take off weight:	1157 kg
Maximum payload:	300 kg
Maximum passengers:	2

Bulldog

Length:	7.08m
Height:	2.73m
Wingspan:	10.11m
Max cruise speed:	135 knots
Maximum range:	450nm
Max operating altitude:	10,000 feet
Max operating g-range:	-3.0g - +6.0g
Engines:	Lycoming IO-360-A1B6 with 200 shaft horsepower
Maximum take off weight:	1066 kg
Maximum payload:	280 kg
Maximum passengers:	2

NFLC interview series

Rob Harrison

Head of the National Flying Laboratory Centre and Saab 340B Captain

> "Flying the Jaguar on the front line... ...you had to be absolutely on top of your game, all the time."

Rob Harrison talks about his time in the Royal Air Force (RAF) as a fighter pilot, the future of sustainable aviation, and his aviation inspiration.

I was one of those little boys who built model aeroplanes when he was four, so I've always wanted to be a pilot.

Growing up I was in the Air Cadets and I wanted to join the RAF as a fighter pilot, so that's what I ended up doing. I studied astrophysics at University of Edinburgh, and joined the RAF after that. I spent nearly 20 years in the RAF flying aircraft such as the Jaguar on the front line, and then as a qualified flight instructor. When I left, I joined a company flying business jets around Europe for 10 years before coming to Cranfield.

I like the variety of the role – I can fly a larger aircraft as well as flying the smaller aircraft.

I was flying corporate aircraft for 10 years, it was nice to see places but I missed going upside down. The great thing about the little aeroplanes is that they're fully aerobatic, and I've really enjoyed instructing again in them with the Cranfield MSc students. It's also nice to fly as a crew with two pilots. There are different challenges to flying the Jetstream 31, and now the Saab 340B, as a flying classroom and demonstrating manoeuvres.

I remember the first time I flew an aircraft – I was 14, in the Air Cadets and it was a Chipmunk aeroplane.

I flew as part of the Air Cadets experience flight back at RAF Finningley, which is now Doncaster Sheffield airport. I remember flying in this little aeroplane with a parachute strapped to my back, holding on to the controls. It was fantastic! It was just the thought, that experience of being airborne for the very first time, was just terrific. And I thought yeah, this is what I want to do.

I have the most affection for the Jaguar because that was the aeroplane I flew on the front line and it was such a challenging aircraft to fly.

You just didn't have a moment to spare, and you had to be absolutely on top of your game, all the time. To be able to do that, is what you felt really good about because you knew it was hard work. It wasn't the best aerobatic aeroplane though, the one I enjoyed flying as an aerobatic aircraft was the Tucano, which was the RAF trainer. I spent three years flying it as I was instructing on it and I did a year as a display pilot with it.

The best flying advice ever given to me was, "Plan ahead."

When I was first flying at low level in the air force, my instructor said to me if you've got a moment to think, or think about something else, then you've forgotten something. It's all about anticipating and having a plan up your sleeve so that you don't get caught out.

When Cranfield MSc students fly in the small aircraft, I tell them to try and enjoy it.

Most of them haven't flown in a little aeroplane before – it's noisy, it's claustrophobic, it can be a bit smelly and it vibrates a lot. All these sensations can be a little bit overwhelming but we want to make sure the students enjoy the flying experience – and by and large, they really do.

I would say over those last 30 years, the biggest change I have seen in aviation is GPS.

GPS has transformed how we navigate and how we keep ourselves safely separated from controlled airspace. It's made our lives significantly easier because it's harder to get lost when you know where you are all the time. But it's also added complexity because as it's become easier to navigate the airspace, that airspace has become much more complex.

I think the future will be sustainable, environmentally friendly forms of propulsion.

The aviation sector is acutely aware that it needs to do its bit for the environment. I'm really excited about the hydrogen fuel cells, electrical power, and all these novel technologies that are coming through now. The climate emergency is accelerating that and I'm cautiously optimistic that we'll get to a sustainable, environmentally friendly aviation sector in the next decade or two.

As the Saab 340B has turbine engines we're looking to fuel it with sustainable aviation fuel when it comes on stream.

For the light aircraft, the Firefly and the Bulldog, they're not going to last forever so when we need to replace them, I'll be looking for sustainable, environmentally friendly aerobatic aircraft. There's not one out there that I can see at the moment, but there's lots

of designs just over the horizon. The idea of having electrically powered aircraft where students can go and fly and they can be recharged quickly is great.

Cranfield is already involved in in developing sustainable aviation technologies – we've been involved with the ZeroAvia project, there's a hydrogen fuel farm being built on campus, and we've got the DARTeC as a facility. All these things at Cranfield that will allow us to become a focal point for these technologies, and with the NFLC I want to get on board with that.

The RAF fighter pilots of World War Two were my aviation inspiration.

As a boy growing up that hearing about the Battle of Britain stuff, and then that morphed into the wider the era of fighter pilot – that was always something I aspired to be.

A student view of the Cranfield student flight experience

The light aircraft experience flight is a really important part of many of Cranfield's aerospace and aviation MSc courses.

Built upon the theories of aerodynamics, flight controls and the effect of gravity on the human body, the experience introduces you to the concepts of spatial disorientation, human factors in complex systems and how aircraft, airfields and airspace are organised to enhance the safe operation of aircraft.

But what is it really like?

Flying in a small aircraft is entirely different to travelling on a commercial aircraft – in fact it's hard to describe in words.

Feel the physics. You may not notice the takeoff in a commercial jet but as the National Flying Laboratory Centre's (NFLC), the Bulldog or Slingsby soars into the sky you will feel every bump as the dynamics of the air and other forces move the aircraft a little. It isn't uncomfortable or scary – it is fascinating and exhilarating!

Live the co-pilot experience. You'll be able to chat to your pilot, have the opportunity to control the aircraft, both on the ground and in the air, and talk to Air Traffic Control. Your pilot will also answer any questions you have in the post flight briefing.

See even more

With small windows on commercial airliners you have a restricted view, but from the cockpit of the Bulldog and Slingsby you'll experience a breathtaking panoramic view that allows you to take in the scenery from above.

> "During the flight, I was given the amazing opportunity to fly the aircraft, even without any previous experience or knowledge. In addition, I experienced the effects of gravity on my body and spatial disorientation. Peter, the pilot, also taught me what to do in case of a stall, and we then moved on to aerobatics with a barrel roll. It surely was one of the most incredible adventures I have ever had!"
>
> **Alice Cattaneo,**
> (Air Transport Management MSc 2021)

Student flight experience key facts

- Three-hour session, including approximately one-hour flight.
- Fly in either Cranfield's Scottish Aviation Bulldog or Slingsby T67 Firefly aircraft.
- Elements of the flight are tailored to the specific requirements of your Cranfield MSc course.
- Opportunity to take control of the aircraft and assist the pilot with lookout.
- Your flight will be recorded and the video files sent to you so you can share and relive your unique flight experience.

At the discretion of your flying instructor, you may also get to experience a number of aerobatic manoeuvres such as:

- barrel roll,
- integrated loop and roll manoeuvre,
- stall turn,
- loop,
- noddy stall manoeuvre.

Nothing compares to the adrenaline rush – some students describe it like the feeling of riding a rollercoaster.

The Student experience flight at Cranfield University is a unique experience that is cherished by our students. It gives you a practical understanding of the theory of powered flight and an appreciation of the controls of an aircraft.

> "One of the most fascinating takeaways was me forgetting my fear of heights as we continued to fly... we consecutively performed the stall turn, barrel roll, loop and a unique noddy stall manoeuvre."
>
> **Hari Venkitaraman,**
> (Aerospace Vehicle Design MSc 2021)

> "I experienced several enlightened moments and the flight definitely helped me understand some of the topics better. For me, the NFLC student experience flight was great fun with a big learning outcome."
>
> **Dominic Schmid,**
> (Aerospace Dynamics MSc 2020)

Come and join us

To find out more about MSc courses that include the student experience flight visit:

www.cranfield.ac.uk/studentexperienceflight

Cranfield's global research airport

A national asset for the UK

Multi-User Environment for Autonomous Vehicle Innovation (MUEAVI)

This instrumented transport corridor runs through the middle of the campus and is used for the development of intelligent and autonomous vehicles. Sensors include lidar (laser scanners that can measure distance), radar that can detect pedestrians and cyclists at up to 200 metres, and thermal imaging cameras.

Digital air traffic control centre

Housing the UK's first operational remote air traffic control tower, the centre provides air traffic services for the airport.

Operational December 2018

Boeing 737

Donated by British Airways, the aircraft is used for research and teaching and is an important part of DARTeC.

Gas turbine power and propulsion laboratories

Living laboratory

Sensors around the airport monitor air quality, soil moisture, temperature and noise levels, including sound from wildlife. Other sensors monitor water quality and levels, and runway and ground movements.

Aviation Innovation and Technology Entrepreneurship cluster (AVIATE+)

Aerospace Integration Research Centre (AIRC)

Major research facility with Airbus and Rolls-Royce dedicated to future aerospace integration challenges.

National Flying Laboratory Centre (NFLC) including the SAAB 340B Flying Test Bed

The NFLC's 'flying laboratory' provides a viable alternative to flight test and research work using simulators, wind tunnels, or more expensive turbine aircraft, often testing new parts and equipment for industry partners. The NFLC also has other light aircraft used for research.

Air Park

Future

National Facility for Beyond Visual Line of Sight (BVLOS) Research (NFBR)

Designed to enable drones and unmanned aircraft to fly in the same airspace as manned aircraft, NFBR will open in phases as surveillance systems are approved. The first NBEC test flights were undertaken in February 2019 in collaboration with the CAA innovation team and Blue Bear Systems.

FAAM Airborne Laboratory

Dedicated to the advancement of atmospheric science, the specially-modified BAe-146 research aircraft is owned and run by the Natural Environment Research Council (NERC). This is used by many UK and overseas universities and by the Met Office.

Holographic radar

State-of-the-art Aveillant drone detection radar for research as part of DARTeC

Hydrogen refuel point

Digital Aviation Research and Technology Centre (DARTeC)

A unique centre addressing the global challenges of digital systems integration across aviation.

HyPER Hydrogen Production

'Smart' car park connected to MUEAVI

Data from MUEAVI is relayed into the **Intelligent Mobility Engineering Centre (IMEC)** control room. Within IMEC there are vehicle workshops, vehicle electrification and autonomous vehicle research capabilities.

Fire station

Cranfield Aerospace Solutions Ltd

A partner company specialising in aircraft prototyping, modifications and approvals located at the heart of the Cranfield campus.

Solar power farm

Clean, renewable energy for the airport flows from a solar power farm located on the other side of the airfield.

Aviation is in our DNA

1937

College of Aeronautics opened on 15 October and received its first students. It had four departments: Aerodynamics, Aircraft Design, Aircraft Propulsion and Flight. The NFLC is created as part of the Department of Flight.

1946

RAF Cranfield established.

1952

Sir Fredrick Handley-Page becomes Chairman of the Board of Governors.

1953

HRH The Duke of Edinburgh visits the College of Aeronautics.

1955

Department of Aircraft Materials created.

1958

New departments of Aircraft Electrical Engineering and Maths created.

1969

College awarded Royal Charter and becomes Cranfield Institute of Technology.

1993

Cranfield Institute of Technology adopts the name Cranfield University.

2006

Cranfield replaces Jetstream Mark 1 flying classroom and laboratory with Jetstream 31.

2008-2014

NFLC supports major flight trials for ASTRAEA (Autonomous Systems Technology Related Airborne Evaluation and Assessment) with BAE Systems.

2019

£3 million fundraising campaign to purchase and modify a Saab 340B is launched.

Aerospace alumni reunion for those who studied at Cranfield between 1946 and 1979.

2020

Presented the Queen's Anniversary Prize for Cranfield's work supporting the nation's aero-engineering students.

2021

Our new Saab 340B flying classroom aircraft touched down in the summer of 2021.

2022

Saab 340B brought in to full operation.

What does the future look like and where is my place in it?

It's natural to feel worried about the future of aerospace and aviation. There are a lot of unknowns about how the industry will recover from Covid-19 but we can be reassured that it has recovered from previous disruptions. While after the September 11 attacks airports and flights felt very different as the world adjusted, it also provided a catalyst for change and innovation.

With that in mind we asked Cranfield alumni what advice they would give to current and prospective aerospace and aviation students.

"The most critical recoveries during flight, such as from the spin and the stall, are not 'pull back' manoeuvres but rather 'push forward' ones. The aviation industry needs to 'push forward' to recover from the super-slump and emerge into the super-boom. The industry also needs to thrust itself forward with environmentally conscious aviation to overcome this barrier and emerge supersonic. Our tag line should be 'Planet First'."

Dr Sarah Qureshi,
CEO, Aero Engine Craft (Private) Limited,
Cranfield University Distinguished Aerospace Alumna Award 2020,
(Aerospace PhD 2016)

"It's all about timing, the industry will bounce back, so invest in yourself now, be job ready and diversify your skills."

Nigel Fanning,
Head of Pricing and Revenue Management, Jetstar Airways,
(Air Transport MSc 1999)

"This is a tough time to go into the aviation industry, but there are opportunities around solving aviation's challenges: developing alternative fuels for existing aircraft, for example; designing future battery-powered or hydrogen-powered aircraft; or improving the commercial systems, many of them many decades old, on which airlines rely to make money. I think it'll still be possible to have a successful and fulfilling career in aviation, but it will likely require more out-of-the-box thinking and more course changes than was the case in the past."

Patrick Edmond,
Managing Director, Altair Advisory,
(Air Transport MSc 2000)

"Aviation is taking a real beating right now and it and it's going to take some time to pick up again. The Covid-19 crisis will, however, mean that changes, perhaps good ones, can be made and it is up to us to think outside what we thought was normal and try to bring new ideas to the table."

Jason Lawley,
First Officer – Boeing 777, British Airways,
(Air Transport Management MSc 2004)

"Enjoy it every day and be flexible. Times and the aviation industry change all the time."

Ricard Querol,
General Manager Airports and Tourism Organisations, Jet2.com,
(Airport Planning and Management MSc 2012)

"This is a very exciting industry, full of innovations. For example, right now we are at the beginning of electric aviation, not to mention all the unmanned vehicles that are coming. So be curious and enjoy what you do."

Asok Ghoshal,
Retired, Director, Simulator Training Equipment Support, American Airlines,
(Air Transport Engineering MSc 1974)

"These days it is a tough time for aviation, but it will pick up again. People always need and want to travel. Getting from A to B by air is very often the only choice one has. I suggest to never lose focus and follow one's goals; it will pay off in the end – sooner or later."

Raffael Gyoergy,
First Officer, Lauda Europe,
(Air Transport Management MSc 2009)

"Be patient, and never stop learning. Be efficient and effective at working in the grey since there are never clean-cut/black and white solutions. Thrive to understand the operational side of the mission you support as an engineer. If you can fly...do it!"

Luc Sabourin,
Senior Director Technical Services Germany, Top ACES Inc.,
(Aerospace Vehicle Design MSc 2001)

Want to be featured in the next issue?

People come to Cranfield from all over the world and we'd love to see where your journey takes you – whether it's back home or somewhere new.

Tag us on our social media channels and use **#FlyingClassroom** and **#CranfieldAlumni** to be featured in the next issue.

/cranfieldalumni

@cranfieldalumni

Cranfield University Official Alumni Network

The future of flight

Cranfield University's Director of Transport Systems, Professor Graham Braithwaite, and Director of Aerospace, Professor Iain Gray, discuss the future of flight as we enter a revolution in air travel – with challenges facing engineers and airlines but opportunities for digital technologies and putting the customer at the heart of the future of flight.

Founded in 1946 as the College of Aeronautics, Cranfield is a unique University. Built on its own airport and operating aircraft, air traffic control and an engineering organisation capable of building prototype aircraft, the University has been at the heart of aerospace research for 75 years. For Iain Gray and Graham Braithwaite the exciting challenge about how they can integrate these things across different disciplines, in what they call the 'four 'A's' – aircraft, airspace, airport and airlines – and how they all join up to influence the future of flight.

Aircraft of the future

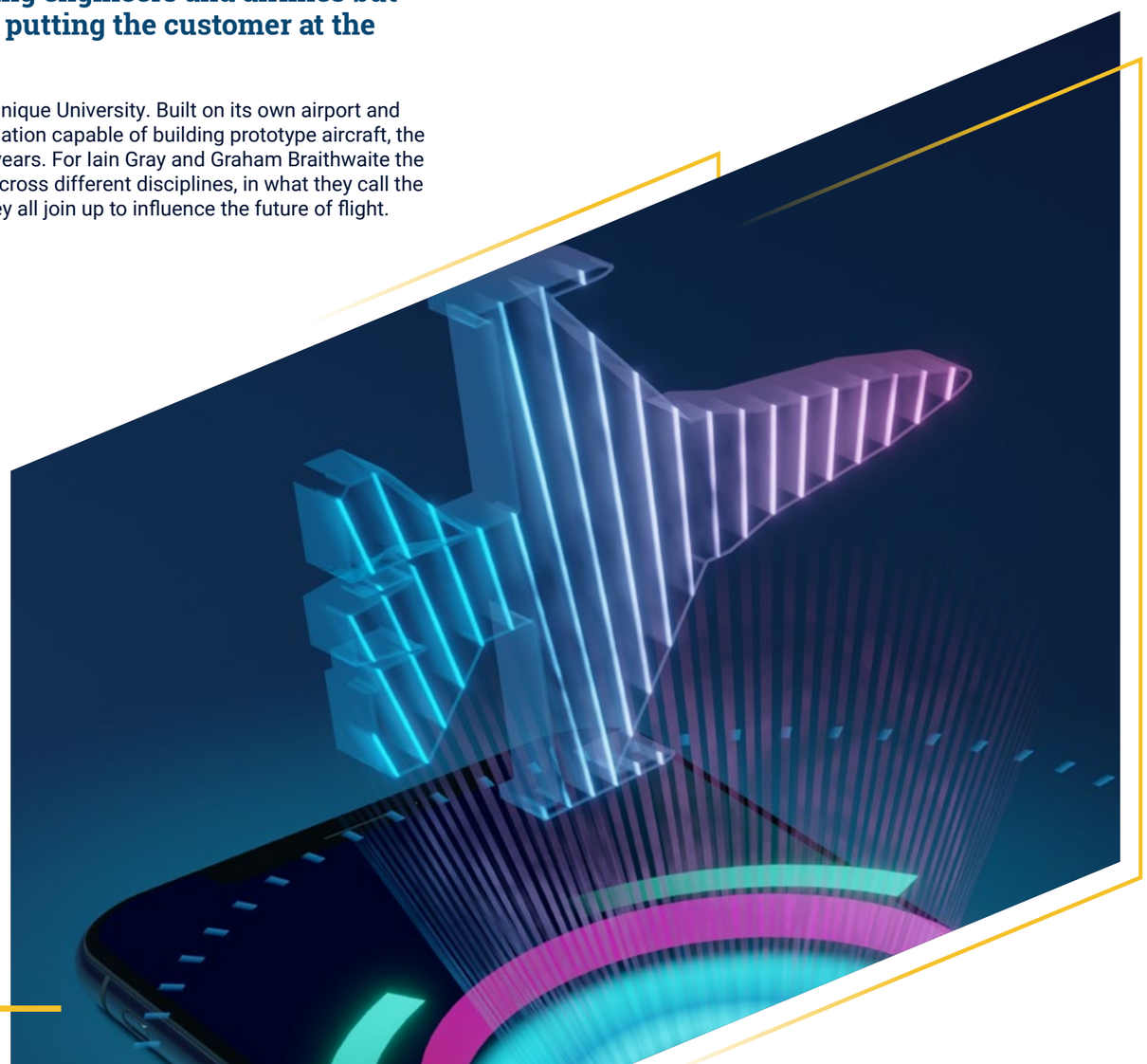
> "Having our own airport and being industry-facing means that we can do things that other universities cannot. That doesn't take anything away from them – in fact we work with many universities – but it allows us to be a key resource for the aerospace and aviation sectors."
>
> **Professor Graham Braithwaite,**
> Director of Transport Systems

Cranfield's close-to-business strategy and interdependency with organisations is demonstrated in the Aerospace Integration Research Centre (AIRC) which was opened in 2017. Funded by Airbus, Rolls-Royce, Cranfield and the Higher Education Funding Council for England (HEFCE), the £35m activity explores ways of integrating advanced technologies to reduce the time from academic innovation to industrial application.

Current research ranges from manufacturing techniques, to air traffic management concepts and from flight deck design to novel flying vehicle design. The key differentiator of this research centre is the focus on systems integration and how best to overcome some of the constraints created by the existing ways of doing things. For example, the Centre for Structures, Assembly and Intelligent Automation is working with Airbus to best understand how the benefits of robots in manufacturing can be realised while ensuring the benefits of highly-skilled operators are maintained and their safety assured. A large laboratory allows experimentation on a full-sized A320 wing, using a variety of eye-tracking and motion capture tools to simulate collaborative industrial work with automated systems and analyse human-robot interactions.

At the 2018 Farnborough International Airshow, Cranfield University and its subsidiary company, Cranfield Aerospace Solutions, unveiled 'Volante' with industrial partners Rolls-Royce and Aston Martin – a vertical take-off and landing (VTOL) concept for urban air mobility. The three-seat hybrid-electric vehicle represents a step-change in technology – both in terms of its autonomous operation and how it interacts with the airspace in which it will fly.

Such developments are the focus of the UK's Future Flight Challenge – a four year £125m Industrial Strategy Challenge Fund programme aimed at developing and demonstrating "…integrated aviation systems enabling the introduction of new classes of electric and/or autonomous air vehicles".



Cranfield is also working with large technology primes and 'disruptor' SMEs on projects ranging from swarming drones to electric regional aircraft. Our Boeing 737-436 ground demonstrator (generously donated by British Airways) allows us to test Integrated Vehicle Health Management (IVHM) solutions at scale, as well as test non-destructive inspection techniques and future maintenance, repair and overhaul (MRO) concepts.

Airspace of the future

> "One of the major challenges in aerospace at the moment is the ever-increasing congestion of airspace. As new user communities take to the skies, radical shifts in technology are required, while ensuring that safety standards are maintained, if we are to overcome the two extremes in terms of air traffic management capacity.
>
> "These two extremes are those locations where the high capital cost of traditional Air Traffic Management (ATM) solutions inhibits the use of air transport, and those where capacity is so constrained that growth cannot be sustained."
>
> **Professor Iain Gray,**
> Director of Aerospace

Remote tower technology provides the opportunity to enhance capacity at a reduced cost, especially where traffic levels allow multiple towers to be controlled by a single centre. Cranfield has worked closely with Saab Digital Air Traffic Solutions to bring the UK's first operational digital air traffic control centre to Cranfield, which opened in December 2018. Research carried out within the Safety and Accident Investigation Centre helped inform the human performance assessment of the digital tower, building on work into controller attention distribution in single and multiple remote towers with organisations such as the Irish Aviation Authority.

Accelerating ambitions regarding remotely piloted and fully autonomous unmanned air vehicles (UAV) requires advances in surveillance technology and unmanned traffic management (UTM). The Digital Aviation Research and Technology Centre (DARTeC) opened in 2021. The £67 million project is co-funded by Research England and industry partners Aveillant, Boeing UK, Boxarr, Etihad Airways, Heathrow, Inmarsat, IVHM Centre, SAAB, Spirent Communication and Thales.

Advanced surveillance technology, including Aveillant's holographic radar, will play an important role in the work of the centre including providing support for the National Beyond Visual Line of Sight Experimentation Corridor (NBEC) – which provides a safe, managed environment for UAV experimentation. Supported by the UK CAA's Innovation Team and partners, Blue Bear Systems, Thales and Vodafone, the work being undertaken plays an important role in developing UTM.

The National Flying Laboratory Centre (NFLC) at Cranfield operates three aircraft for the University and until its recent retirement, a flying testbed aircraft for BAE Systems. The aircraft flew as a surrogate UAV as part of the ASTRAEA (Autonomous Systems Technology Related Airborne Evaluation and Assessment) programme and more recently in 'sense and avoid' trials. Recent research conducted in NFLC's light aircraft includes spatial disorientation experiments in collaboration with the Dutch research organisation, TNO.

Airport of the future

"Whatever our reasons for flying, we all have to go through the pain of queuing, checking in, security checks, and waiting around before our flight. Imagine if that experience could be hassle-free."

Professor Graham Braithwaite,
Director of Transport Systems

"If we make the passenger the key focus and bring together all the aspects that the passenger has to pass through on the way to and from the aircraft, you can turn negative experiences into positive experiences."

Professor Iain Gray,
Director of Aerospace

The University has been engaged in several projects focused on how changes ranging from passenger demographics to aircraft electrification may affect airports. Work with Heathrow Airport has assessed the needs of older passengers and those with reduced mobility, as well as the impact of electrification on airport infrastructure. Work with Theia Immersive, specialists in advanced visualisation techniques and human factors principles, has led to the development of a virtual airport which is helping to improve wayfinding and navigation provision for passengers with additional mobility needs, including those with unseen disabilities.

The Advanced Vehicle Engineering Centre is working with industrial partners to leverage their collective expertise on specialist electric and autonomous vehicles to develop clean, connected and autonomous airside vehicles. Development work takes place on the University's Multi User Environment for Autonomous Vehicle Innovation (MUEAVI) – a highly instrumented test track environment which encapsulates airport apron, road and off-road surfaces.

Airline of the future

"The economics of the aviation industry are prone to great extremes, as the current global pandemic shows. Add to this the increased focus on environmental performance – and the importance of developing safe, secure and sustainable air transport becomes clear.

"For example, Cranfield is actively involved in developing alternative fuel and propulsion technologies including hybrid electric and hydrogen, such as through the Horizon 2020 sponsored Enable H2 project. It is also looking at how secure data sharing technologies such as Blockchain may increase system efficiency without compromising commercial competition."

Professor Graham Braithwaite,
Director of Transport Systems

As with all innovation in aviation, the implications for safety must be considered. The University works closely with the UK Civil Aviation Authority (CAA) and the European Aviation Safety Agency (EASA) to develop regulatory capabilities in areas ranging from technical (such as work on advanced vibration monitoring technologies and gearbox lubrication, following a series of helicopter accidents in the North Sea) through to the strategic. Regulators have a particular challenge, not only in terms of the expectations of the public and the entities that they oversee but also to remain one step ahead of the sector. Rapid developments especially around air traffic management, UAVs and alternative fuels, as well as in terms of the approach that organisations are taking towards safety management, require different skillsets within the regulator.

Next generation aviation professionals

Cranfield is proud to be a member of Alicanto – the International Association of Aviation and Aerospace Education, which works to support the International Civil Aviation Organisation's Next Generation of Aviation Professionals (NGAP) initiative. Working with industry partners and other universities, we aim to prepare our graduates for the requirements of a fast-changing aviation sector. Our teaching is informed by research and real-world, practical experience.

The future of flight will depend on managing complexity – integrating technologies, engineering, design and passenger behaviours for an improved passenger experience, and at Cranfield we are proud of the role we play in the global aviation community.

"What is important is that we don't just link the 'four 'A's' together, but we integrate the aircraft, airspace, airport and airlines of the future. To do that we need to bring the skills and expertise to deliver the individual element and draw everything together. The sectors need high-value skills if we are to influence the next generation of aircraft, airspace, airport, and airline design."

Professor Iain Gray,
Director of Aerospace

Women in aviation

Most of us have probably heard about Amelia Earhart, but have you heard of Blanche Scott and Bessie Coleman?

Blanche Scott not only became the first woman to drive across the U.S., but the first female pilot to fly in America. Her instructor, Glenn Curtiss, inserted a block of wood beneath the aircraft's throttle pedal so that Scott could learn to manoeuvre the plane, but only on the ground. During a lesson, the block 'inexplicably' dislodged, sending Scott off on a short first 'hop' of a flight, making history and demonstrating that women were perfectly capable of piloting an aircraft.

Bessie Coleman became the first black female pilot and the first Native American woman pilot in 1922. Prior to her success as a pilot, her brother teased her about not being able to learn to fly, which only fuelled Coleman's desire to do so. Unfortunately, aviation programs in the U.S. denied her for being both African American and a woman. Keeping her head held high, she was eventually accepted into the Caudron Brothers' School of Aviation in France, where women could learn to soar the skies. She also took French classes, to learn the language and prepare her for training.

But it's not just as pilots that women have made an impact on aviation. In 1906 Emma Lilian Todd began designing her own airplanes, initially studying dirigibles before she moved onto designing airplanes. Todd's first plane flew in 1910 and was piloted by Didier Masson. In more recent times, during WWII women stepped in to fill gaps in aviation and were trained to be pilots, air traffic controllers and undertook flight simulation training.

However, gender diversity continues to be a hot topic in the aviation industry. According to Women in Aviation: A Workforce Report, by the University of Nebraska at Omaha Aviation Institute, women in aviation are underrepresented primarily in technical and leadership roles and overrepresented in low income, low profile positions. Of each of the areas of aviation, women make up:

- 1.5% of airline captains and 5.1% of all pilots,
- 2.4% of mechanics,
- 3% of CEOs, COOs, and other key leadership positions,
- 16% of airport managers and air traffic control,
- 40% of TSA screeners,
- 79% of flight attendants,
- 86% of travel agents.

With just 3% of C-suite level roles in the aviation industry being held by women, the sector continues to have one of the poorest gender balances. A lack of female leaders as role models has been identified as one of five primary inhibitors to obtaining greater representation of women in the aviation industry. The others included challenges associated with bias, organisations failing toprioritise or promote diversity, and policies and practices that close off potential career paths. A lack of opportunity and a belief that female voices aren't heard is another hurdle to overcome.

But it's not all bad news. A global study on gender diversity in the aviation and aerospace industry by the International Aviation Womens Association (IAWA) and Korn Ferry, the Soaring Through the Glass Ceiling report, tells a story of an industry that has made important progress in improving the diversity of its workforce – though it still has a long way to go.

What do we need to do?

The Soaring Through the Glass Ceiling report highlighted five activities and actions that aviation and aerospace organisations have undertaken which have contributed the most progress in diversity and inclusion.

1. Publicly recognise and highlight female role models.
2. Ensure unquestionable senior leadership commitment to diversity and inclusion.
3. Level set expectations with individual contributors and management.
4. Ensure more women have a seat at the table.
5. Invest in more inclusive talent management and success processes.

We all have a part to play and the report sets out a range of things organisations, business leaders, HR leaders and individuals need, and continue, to do. This includes encouraging mentoring, having diverse candidates for roles, profile and celebrate female success stories, and communicate that gender diversity is an organisational priority.

The stakes are high for the aviation and aerospace industries and diversity is crucial to business success. By promoting diversity and inclusion, organisations will be in a better position to recruit the best talent, retain top performers, build higher performing teams, develop creative solutions to new challenges and opportunities, and ensure sustainable growth.

Want to discover more?

You can listen to our Leadership on-the-go podcast with Cranfield alumna and winner of the Distinguished Aviation Alumna of the Year Award 2020, Dr Sarah Qureshi (PhD Aerospace 2016), Founder and CEO of Aero Engine Craft.

Listen at: **www.cranfield.ac.uk/alumnipodcast**

Introducing our supporters: Opportunities in aviation and aerospace

The purchase and modifications of the new Saab 340B aircraft National Flying Laboratory Centre (NFLC) flying classroom has cost about £3 million. This includes the modifications to the aircraft to place sensors on the flight surfaces, the fuel tanks and the engines, to feed the data from those sensors through to the cabin and to fit the equipment to process that data and to be able to transmit it down to the ground via satellite communications. In addition, we have funded the training of our pilots to be type-rated to have full Civil Aviation Authority approval to fly the new aircraft.

Cranfield University itself has made a major contribution to this cost. We have done this because we see aviation and aerospace as absolutely at the heart of what we do and who we are. Almost all the universities who teach aerospace undergraduate students across the UK have also contributed because they see the flight test experience on the NFLC as so crucial to giving students insight into how theory translates into reality – many students talk about the NFLC experience as being a highlight of their whole course.

The Royal Commission for the Exhibition of 1851 and the ERA Foundation have both made huge contributions to this activity and would like to highlight, in these following pages, the opportunities they provide for those who are developing their careers. The Kirby Laing Foundation, the Reece Foundation, the Air Pilots Trust, the Virgin Atlantic Foundation, and ISTAT (International Society of Transport Aircraft Trading) have all contributed, particularly because they see the NFLC as a powerful tool, through its global connected classroom capability, for STEM outreach to school children.

A series of corporate partners have made significant contributions because the NFLC experience really illuminates the career opportunities in aerospace and aviation but also because it is critical that aerospace designers understand the physicality of flight. Our corporate partners include: Airbus; BAE Systems; Boeing; Dowty Propellers; GKN Aerospace; HR Smith Group; Meggitt; Rolls-Royce; Safran; and Spirit AeroSystems Europe. We are particularly proud that the RAF is involved.

Friends of Cranfield and many Cranfield alumni have supported the campaign for the NFLC. We deeply appreciate their generosity and active support to ensure we can provide the NFLC flying classroom experience to future generations of students.

We are hugely grateful for all the contributions we have received so far to enable this iconic facility to continue to inspire. I also want to personally thank the Cranfield team and our wide network for all their support with this campaign to enable the NFLC activity to thrive and flourish.

Professor Dame Helen Atkinson DBE FREng,
Pro-Vice Chancellor, School of Aerospace,
Transport Systems and Manufacturing

"For aerospace students at Cranfield and over 20 UK Universities, the flying classroom provides an inspiring educational experience that is never forgotten. It makes a tremendous difference to their understanding of the theory of flight and is an important part of their accreditation as aerospace engineers.

"We highly appreciate the generosity of the trusts and foundations, partners, and our alumni and friends in providing support for this iconic Cranfield facility. Each gift, regardless of size, helps to ensure we can provide that experience to future generations of students. Together, the difference we can make for them is huge."

Professor Graham Braithwaite FRAeS,
Director of Transport Systems

Taking you to new heights with an industrial PhD

For over 100 years, the Royal Commission for the Exhibition of 1851 has funded some of the most inventive and ambitious students and researchers in the UK.

With the profits of the world-famous Great Exhibition, Prince Albert established the Commission and entrusted it with ensuring that science and the arts would continue to influence British industry into the future. Now, with grants amounting to over £3 million every year, our prestigious awards programme enable Masters students, PhD candidates and early-career researchers to explore science, engineering and design projects that have great industrial potential.

The Commission is proud to count 13 Nobel Laureates among its alumni – including Professor Peter Higgs – as well as more than 150 Royal Society Fellows and over a century's worth of innovative, talented professionals and academics who have made a huge impact in their fields. The network of nearly 1,000 alumni spans the entire globe, from Canada to New Zealand, and maintains an active community that allows networking and ideas-sharing to flourish.

accelerate your career

If you are looking to continue in higher education, pursue a PhD while getting industry experience, or even start a company, there are a range of Scholarships and Fellowships that could suit you.

Industrial Fellowships provide funding for students pursuing a doctorate in industry, allowing PhD research to be conducted while continuing to work at a sponsoring company. With a grant that contributes to your university fees and salary, as well as supporting travel and training, the Fellowship is awarded to outstanding graduates whose projects have the potential to make a significant impact – such as a new patent or product – in their given industry.

Marta Ferran Marques, Industrial Fellow 2018

Industrial Design Studentships are awarded to science and engineering graduates pursuing a master's degree in industrial design – unlocking your design capabilities and enabling you to extend your technical training into effective product concepts.

Enterprise Fellowships, awarded in partnership with the Royal Academy of Engineering, provides business funding, mentoring, and training for entrepreneurial graduate engineers looking to make a difference with their innovation – enabling you to successfully commercialise your idea.

We also offer **Research Fellowships** to early career scientists or engineers of with 3 years or less post-doctoral research experience to conduct a project of their own instigation.

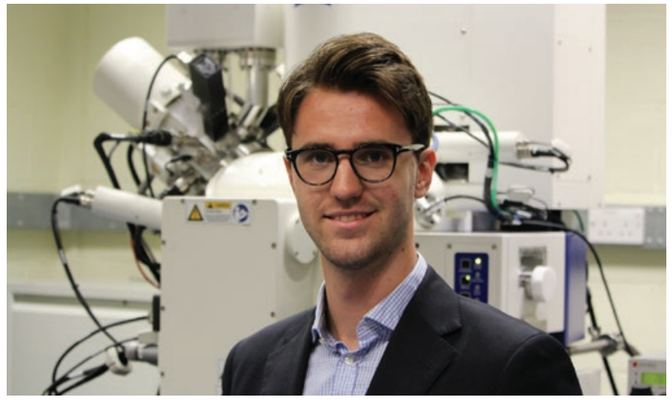
Supporting efforts to make aerospace travel safer

Wanting to make a direct impact on the aerospace industry with his research, Chris Magazzeni started his 1851 Industrial Fellowship in 2018. Working with Rolls Royce and The University of Oxford, his DPhil project set out to investigate fatigue in jet engines, with the overall aim of making aerospace travel safer.

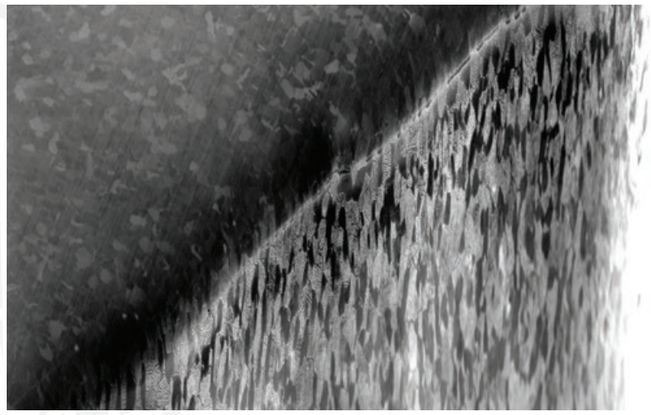
The lifecycle of aerospace components can be unpredictable – most engineering failures occur because of damage from accumulated stress on materials. Yet the causes are complex difficult to pinpoint. Using advanced techniques to understand the source of failure in 3D printed parts, Chris' research is illuminating how advanced manufacturing methods could be impacting the reliability of aerospace materials, with the potential to apply this to space travel and military research. Now 2.5 years into the Fellowship, the project has evolved into an even more detailed, broad exploration of material fatigue and 3D printing, bringing the problem down to its fundamentals by mapping the properties and microstructure of materials. Advancing our understanding of the factors at play when fatigue occurs is crucial – every few weeks there is an incident in the aerospace world involving a component failure.

The Industrial Fellowship provided unique opportunities to network with other Fellows and allowed Chris to take a cross-disciplinary approach to his research. Chris encourages anyone involved in aeronautics to consider doctoral studies.

> From the beginning to the end of a PhD there is so much you could do – as the exploration into 3D printing shows, the aerospace industry is already changing, and is ripe with potential for new ideas to come in and transform the field



Christopher Magazzeni, Industrial Fellow 2018



Edge of titanium in electron microscope

Arnau Garriga Casanovas

Industrial Fellow 20 16 with Imperial College and Rolls-Royce

Looking into 'snake-robots' to perform on-wing inspections of jet engines

Prototype of snake robot used for testing

"The Industrial Fellowship has given me some freedom to do what I considered was most relevant to investigate and develop, and it has also helped open doors... It allowed me to do a placement at Tokyo Tech, in the Suzumori Endo lab, which is a world-leading lab in soft robots, a type of robots that I was using in my snake-robot."

> Being part of such a prestigious institution is an honour, and when there is a long day at work, it serves as a motivation boost to keep working

For more information visit www.royalcommission1851.org

The ERA Foundation

The ERA Foundation is a non-profit organisation which provides significant support to engineering and innovation skills development in the UK as well as encouraging the commercialisation of new technologies.

We work closely with a range of partner organisations to achieve this, including the Royal Academy of Engineering, the Royal Society, the 1851 Commission and other industry and specialist STEM skills providers.

We have a special focus on supporting young people to take up careers in engineering through our Born to Engineer programme.

How We Work.

We work with organisations which share our principles to do everything from generating new policy ideas; developing, funding or delivering skills programmes; supporting engineering engagement activity; or coordinating the sharing of skills and knowledge between partners.

Partnerships are at the heart of the Foundation works to achieve its aims. Our partners range from prestigious national institutions, STEM skills delivery organisations and large corporate institutions to local community groups.

If you, your organisation, investment or programme could benefit from working with us, get in touch.

How We Can Help.

We award a number of Scholarships and Awards each year alongside supporting Lectures, Debates, Reports And Prizes.

For those starting their Engineer Careers we support Arkwright Scholarships for A-level STEM students who aspire to be future leaders of the Engineering Profession alongside Smallpeice courses like "Physics into Engineering" and the "Girls Into Engineering" Residential Course.

Our Born to Engineer campaign promotes engineering and supports the UK's next generation of engineers. We have reached half-a-million people through our series of short films and offer unique careers resources which help navigate the complex career pathways open to Engineers to tens-of-thousands of people each month through our website.

Our Clark Prize recognises the important role those involved in education play in inspiring young people. The prize seeks to reward exceptional teachers, technicians or educational advisors who have gone the extra mile in motivating young people to consider engineering as a profession and career.

The ERA Fellowship programme supports those working in the electro-technology sector and is awarded to selected, exceptional graduates with the potential to make an outstanding contribution to Industry for a programme of doctoral-level research.

ERA
FOUNDATION

erafoundation.org

Engineers Mimi Isabella Nwosu, Ebony Allison and Minal Patel prepare to film a Born to Engineer round-table video

CHOOSE ENGINEERING

Born to Engineers mission is to drive community-engaged learning, promote engineering and support the UKs next generation of engineers.

RESOURCES

Are you are a student, teacher, parent or carer? Do you want to get started with a career in Engineering but don't know where to start? Explore our website for resources on everything from how to write the perfect CV to Engineering reading inspiration

FILMS

Our 'Born to Engineer' series of films explore all the amazing types of opportunities that Engineering offers. Discover the stories of how people are using Engineering to transform lives for the better.

www.borntoengineer.com

THE FUTURE. NOW UNDER CONSTRUCTION.

WE MAKE IT FLY

Whether it's integrating cutting-edge technology to reduce our environmental impact, driving innovation to improve society or ensuring we operate ethically throughout our entire supply chain, Airbus is committed to developing a sustainable future for our business, our stakeholders and the planet. That's why we embrace the UN's Sustainable Development Goals. It's not only what we make; it's what we're made of.

Sustainability. We make it fly.

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AIRBUS

Accelerate your career where it counts

This is a place for pioneers. Go-getters, smart thinkers, curious minds. This is where you'll find yourself, surprise yourself, become an expert in your field. This is somewhere you can make a difference.

Here, your ideas help to protect the world. You'll learn from the best, do the right thing. Play your part in something that really matters. This is where your career begins. This is where you'll make an impact.

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BAE SYSTEMS

Employer profile

BAE SYSTEMS

At the end of each day, you'll go home knowing you've made a difference where it counts

Who we are

At BAE Systems, our advanced defence technology protects people and national security, and keeps critical information and infrastructure secure. We search for new ways to provide our customers with a competitive edge across the air, maritime, land and cyber domains.

We employ a skilled workforce of 87,800 people in more than 40 countries, and work closely with local partners to support economic development by transferring knowledge, skills and technology.

Roles on offer

- Business
- Consulting
- Engineering
- Finance
- Human Resources
- Management
- Technology

Location

UK wide

Salary

- Graduate – starting at £28,000-£30,000
- Internship – £16,800 pro rata
- Placement – £18,000 per annum

Please see website for details.

What we're looking for

Students and graduates with drive and enthusiasm to work with cutting-edge technology and help the business stay ahead. If you have the potential, we'll support you all the way – because your success drives ours.

Training and development

Graduates will receive structured learning and personal development which complements their professional role: offering functional and technical skills as well as developing strategic business acumen, setting them up for a successful and fulfilling career.
At the end of each day, they go home knowing they've made a difference where it counts.

Application process

If you think you have the vision and talent to make one of our opportunities your own, submitting an application is your first chance to show us how good you really are. We receive thousands of application forms every year, so give plenty of time and thought to making sure that yours stands out.

You can apply online at **www.baesystems.com/graduates**

Closing date

This varies by function, with multiple intakes throughout the year for the graduate programme.

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BOEING

Cranfield
Aerospace Solutions

Cranfield Aerospace Solutions (CAeS) is at the centre of a number of market-leading sustainable aircraft projects.

A unique UK aerospace SME with the capability to design, build and fly a whole new aircraft concept, it holds CAADesign Organisation (DOA) and Production Organisation (POA) Approvals.

The company, a wholly-owned subsidiary of Cranfield University, aims to accelerate the world's transition to innovative, sustainable air vehicles.

Project Fresson

Project Fresson is a UK Government backed project to design, manufacture and integrate a hydrogen fuel-cell propulsion system into a 9-seat Britten-Norman (B-N) Islander aircraft, which is typically used on short flights such as island-hopping routes. The grant is provided through the ATI Programme: a partnership of the Aerospace Technology Institute (ATI), the Department for Business, Energy & Industry Strategy, and Innovate UK to maintain and grow the UK's competitive position in civil aerospace design and manufacture.

The Project Fresson team includes UK businesses Ricardo, who will be supplying the hydrogen fuel cell system and and Britten-Norman, the aircraft OEM (Original Equipment Manufacturer) providing aircraft data/design support and who intend to incorporate the technology into their Next Generation Islander. CAeS's parent Cranfield University will be researching key technology solutions vital for the project.

"Following on from Project Fresson, the Islander conversion will be industrialised and certified for flight, meaning that, by 2025, passengers could be boarding the world's first zero-carbon passenger aircraft.

"To this end, the UK consortium involved in Project Fresson is singularly focussed on delivering a technology demonstrator with a clear route to passenger-carrying service. It is not enough for the technology to work; it must be commercially viable.

"It is only by getting new technology to market that we will really make a difference. That is our mission. That is WHY we do what we do".

Jenny Kavanagh,
Chief Strategy Officer, Cranfield Aerospace Solutions

"The strength of the industrial partners involved in this project are underpinned by the world-class aerospace/manufacturing research capabilities of Cranfield University. This is going to accelerate our green transport revolution."

Paul Hutton,
CEO of Cranfield Aerospace Solutions

Cranfield
SIMULATION

Cranfield Simulation (a division of CAeS)

Cranfield Aerospace Solutions are also the market leader in g-motion cueing simulation technology, having sold 100s of high fidelity simulation training seats to the world's military organisations for use in jet-fighter simulation training.

The g-motion cueing technology using haptic cues to trick the brain into thinking that it is feeling a g-force, making it the most realistic and immersive training experience on the market.

CAeS has now taken that technology and applied it to motorsport, creating Cranfield Simulation, a division of Cranfield Aerospace Solutions, delivering very high specification automotive simulators to race teams and private individuals for training or just for fun.

Dowty Propellers

Mission-proven propeller systems

When Royal Air Force C130Js touch down at an improvised landing zone to deliver humanitarian aid, Dowty Propellers are there. During a challenging sea rescue off Japan's coast, Dowty Propellers provide the power for US-2 amphibious aircraft to operate in high waves and swells. In Africa, Dash 8-400 regional airliners equipped by Dowty Propellers provide vital services to communities that otherwise would not be linked via mainline routes.

For over 80 years, Dowty Propellers has maintained its industry leadership in developing, producing and supporting propeller systems for civil and military aircraft, along with marine hovercraft. The company continually invests in technologies, production capabilities and human resources to produce propeller systems that are safe, efficient and reliable.

Its history of firsts-to-market include pioneering the all-composite propeller blade and introducing the full-authority digital propeller control. More than 25,000 advanced composite blades have been delivered to date by Dowty Propellers, with the lead propellers logging some 50,000 hours of flight time.

A great place to work

Dowty Propellers' more than 300 employees provide the expertise, knowledge and skills that maintain the company's role as a propeller systems supplier of choice.

They bring the full range of skills for Dowty Propellers' design, development, production and support of its products, covering such areas as aerodynamics, acoustics, mechanical design, stress analysis, reliability/maintainability and flight test, backed by a fully-staffed team for in-service support and commercial activities.

Employing a highly skilled workforce at its Brockworth manufacturing facility and headquarters, Dowty Propellers' in-house production expertise includes resin transfer moulding processes for composite blades, which are continuously evolved and perfected; and the use of braiding machines that rapidly and accurately apply the blades' fibre outer layers.

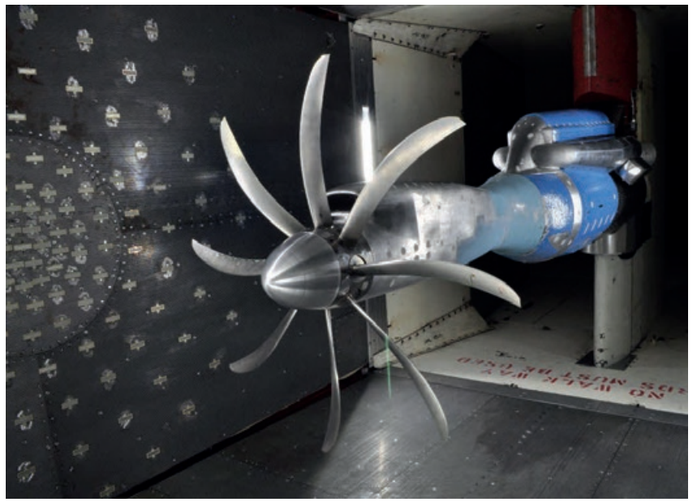
As a General Electric (GE) company, Dowty Propellers offers internships, apprenticeships and graduate programmes, along with the opportunity to move and grow within the GE organisation. As an example, GE's "Edison programme" has been around for over 100 years, developing graduates into future leaders and decision-makers.

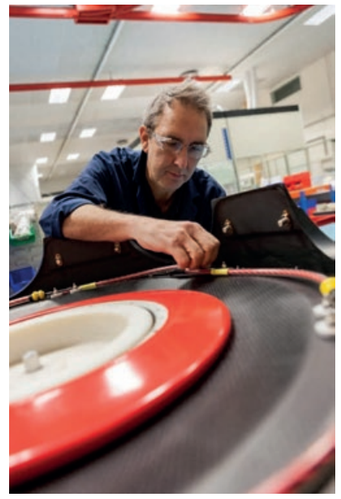
Looking to the future

With the aviation industry facing a period of rapid evolution in hybrid propulsion systems and new urban air mobility solutions, it is an exciting time to be developing propeller technologies. Dowty Propellers is currently working on bringing its industry leading reliability, low maintenance costs and noise reduction capabilities to these new platforms.

Continuous improvement is critical to competitive advantage, and Dowty Propellers is spearheading several research projects looking at advanced propeller blade designs, the use of the latest materials, and full propulsion system optimisation through the use of advanced modelling and analytics tools.

One of the company's focus areas is bringing together the propeller, engine, nacelle and related systems into more integrated propulsion systems. Its research on advanced propeller blade designs includes novel spacing concepts for noise reduction, while advanced manufacturing techniques and the use of graphene and nano material-enhanced products are under evaluation as well.





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4100 Hurricane Road
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Brockworth, Gloucester GL3 4AQ
Website: www.dowty.com

GKN AEROSPACE

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Manufacturing Locations
48

Countries
14

Sales in 2019
£3.85 bn

GKN Aerospace is the world's leading technology supplier to the aerospace industry. As a truly global company, GKN Aerospace serves all of today's leading aircraft and engine manufacturers.

We design, develop and manufacture innovative smart aerospace systems and components.

Our technologies are used in aircraft ranging from the most used single aisle aircraft and the largest passenger planes in the world to business jets and the world's advanced 5th generation fighter aircraft. Every day, around the world, we help aircraft fly further, faster and greener- improving the performance and efficiency of more than 100,000 flights every day.

Our technology is enhancing aircraft performance – improving aerodynamics, reducing weight, increasing fuel burn efficiency and lowering emissions.

Lightweight composites, additive manufacturing technology, innovative engine structures, wiring systems to drive electrification and smart transparencies all help our customers to improve sustainability - shaping the aviation industry of the future.

GKN Aerospace is the original aerospace innovator. For decades, GKN Aerospace technologies have inspired and industrialised the aerospace industry, combining engineering excellence and technology leadership. Today we are truly global, with 17,000 employees in 48 manufacturing locations in 14 countries around the world. All major aircraft and engine manufacturers rely on our advanced technologies.

By working closely together with universities, knowledge institutes, suppliers and customers, we lead the industry in developing new technology to improve aircraft efficiency: lowering aircraft cost, weight and emissions. As market leaders in aerostructures, aero-engines and special technologies, we are already significantly contributing to the reduction of the environmental footprint of air traffic with better products that burn less fuel and better processes consuming less energy and resources. GKN Aerospace is well positioned to engineer a more sustainable aerospace future.

ENABLING THE EXTRAORDINARY

Take a look around you, rumour has it that on any aircraft you are rarely more than 5 feet away from a Meggitt product.

We design develop and manufacture one of the largest portfolios of aviation components in the industry. Offering nose to tail technology, our systems and solutions can be found on over 73,000 aircraft worldwide, enabling safe, efficient and reliable flight. From aircraft braking to engine thermal management solutions, sensors, avionics, monitoring systems, seals, advanced composites, fire protection and detection, safety harnesses and ice protection.

We want to be sure you the best opportunities, our small intake of 15 graduates per year allows us to provide personal career support aligned to your background, aspirations and where you'll make the most impact.

You will be assigned two mentors; one business mentor who will be a senior leader and one professional development mentor, to support you in achieving chartership in your chosen field. You will also have direct access to the executive committee from day one.

From the start of your career, you will be expected to make a real difference, working on live projects with real experts, making a direct impact on the business, inspiring ideas and solutions. You will be part of a global graduate community, sharing best practice and building new social networks that will support you throughout your career.

You will have the opportunity to complete one or more of your job rotations overseas, so be prepared to travel and meet new friends.

We are looking for people like you

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SATCOM
Radome

Braking Systems
Brake Control Systems
Tyre Pressure Monitoring
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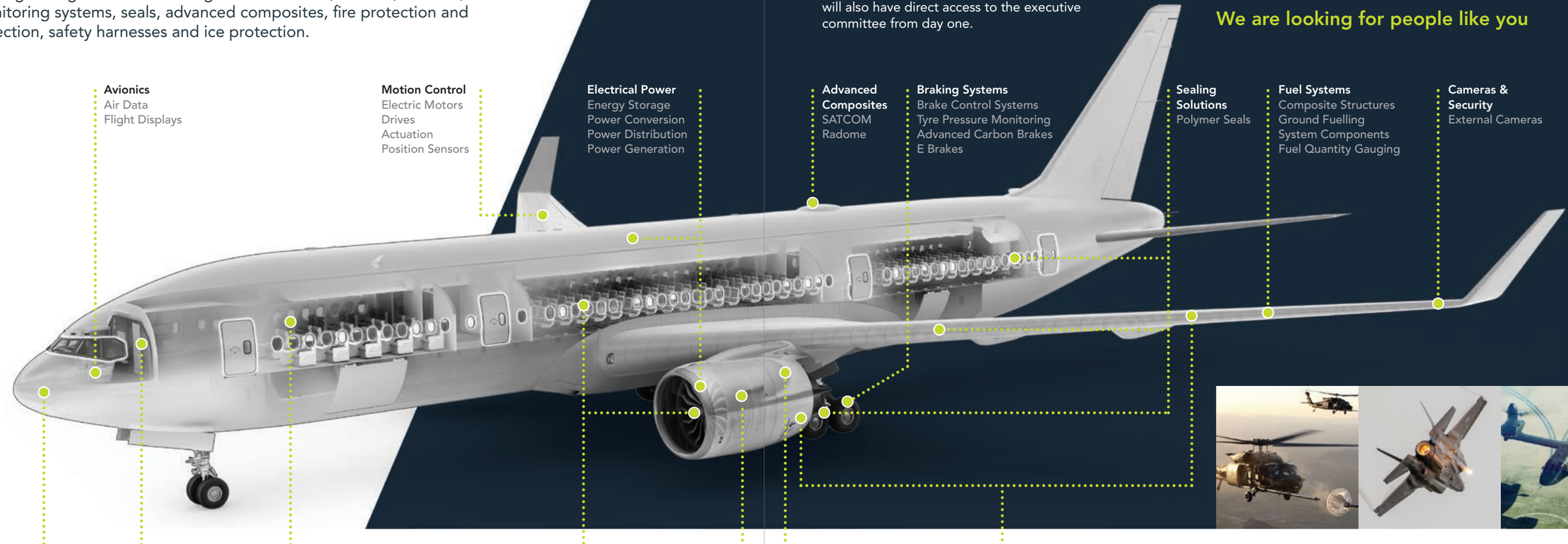
Fuel Systems
Composite Structures
Ground Fuelling
System Components
Fuel Quantity Gauging

Cameras & Security
External Cameras



Advanced Composites
Radome

Cameras & Security
Cockpit Door
Security System

Safety Systems
Special
Restraints

Fire Protection & Controls
Bleed Air Leak Detection
Cables & Clamps
Electronic Control Units
Fire & Overheat Detectors
Fire Suppression
Smoke Detection

Condition Monitoring
Engine Health
Monitoring Units

Sensors
Accelerometers
Fluid
Pressure
Speed
Temperature
Vibration

Engine Systems
Engine Controls
Ducting
Valves

Thermal management
Fans & Pumps
Heat Exchangers

Advanced Composites
Engine Composites
Ice Protection
Complex Secondary Composites

We are not just aviation specialists; our pioneering printed circuit heat exchangers and innovative monitoring and control systems help supply energy to millions and millions of people around the world. Specialists in advanced materials and thermal management, our life-saving solutions allow global defence teams to perform humanitarian and search and rescue activities, securing the safety of civilians and crews on just about every continent.

In fact, every day we enable the extraordinary to fly, to power, to live.

For more information, visit our website now or use the QR code to view our on-line prospectus.

You have the potential to be a future leader of our organisation, focused on building engaged and empowered teams and capable of maintaining our reputation for delivering innovative, customer focused technologies worldwide.

To help you achieve this, we offer extensive training and give you the opportunity to experience a variety of operations, engineering and logistics roles. You will learn through doing and be expected to deliver working commercial programmes in real time from day 1 of enrolment. Working with our teams of experts you will explore all aspects of the business and learn about our full life cycle solutions, from product design to manufacture, supply, aftermarket and distribution solutions.

A CAREER IN THE RAF
ENGINEER OFFICERS

ROYAL AIR FORCE Engineering

The Royal Air Force uses state-of-the-art radar, aircraft and satellites to gather minute-to-minute information on airspace activity in and around the UK, providing vital early warning of potential threats such as unauthorised aircraft or missiles. We defend UK airspace through reconnaissance, intelligence gathering and surveillance, which enables our rapid response. As well as defending UK airspace, the RAF is there to give help when people need it most: supporting peace-keeping initiatives, providing humanitarian aid to victims of war and natural disasters, delivering life-saving shelters and food supplies, and so much more.

The Engineer Branch plays a central role in managing the design, maintenance and operation of technology to enable the RAF and wider Defence to deliver its outputs. As an Engineer Officer, you will be a leader as well as a technical decision maker, required to balance resources and risk by exercising professional engineering judgement in direct support of military operations. You will be given world class training, equipping you with the skills to lead and manage large teams of highly skilled technical personnel from the outset; accountable for your team's technical output, you will also be responsible for the management of their welfare and efficiency. You could work in either our Aerosystems (AS) or Communications-Electronics (CE) specialization. AS officers are responsible for our aircraft and weapons, including avionics and propulsion systems, airborne communications and ground support equipment, ensuring they are available at all times, combined closely with assuring their airworthiness and integrity. The role of CE officers is equally diverse, with responsibility for global communications and information systems, as well as cyber security, aircraft mission planning & support systems, information assurance and ground-based radar.

Once accepted into the RAF, you will start your career with Initial Officer Training at RAF College Cranwell in Lincolnshire. This is a specially designed course to help you develop your leadership and management skills that you will require to become an RAF Officer.

Following on you will embark on a further course at RAF Cosford, which is designed to prepare yourself further as a leader, technical manager and a professional engineer. Here you will begin to learn about engineering for military technology. Most people in the RAF work normal hours, with weekends and holidays free to spend how they choose – but there are other opportunities at your fingertips. We organise expeditions and adventures at home and around the world in over 100 activities. These could see you scuba diving in the Red Sea, climbing in the Himalayas and kayaking the rivers of Canada, all while getting paid for it.

Its graduates receive a salary of over £30,000+ after initial officer training and enjoy a range of unique benefits, such as subsidised accommodation, worldwide travel and free access to state-of-the-art sports facilities. Join the RAF and you will be stretched every day and receive the very best training to take on any challenge.

"IT'S GRADUATES RECEIVE A SALARY OF OVER £30,000+"

Regional & City Airports

INNOVATION IN MOTION

Celebrating RCA and Cranfield's strategic partnership to promote the development, testing and deployment of innovation in aviation - with a key focus on the future technologies and skills required to deliver both a progressive passenger experience and a sustainable future for the industry.

Regional & City Airports is a leading regional airport operator, connecting British communities through five airports and supporting a nationwide workforce of more than 7,000 people.

Dedicated to leading the charge towards net zero aviation and a sustainable future for the communities we serve, our partnership with Cranfield's National Flying Laboratory Centre is a reflection of our shared commitment to aviation's future.

Our vision - built on long term sustainability - is to help smaller regional airports prosper, enabling them to benefit from the economies of scale and cutting-edge best practice traditionally only enjoyed by larger hub airports.

Whether supporting offshore industries at Norwich, importing 2.5m items of NHS Covid PPE through Bournemouth, or hosting President Joe Biden's air fleet during the G7 summit at Exeter, RCA works with the world's best.

Working Towards Net Zero

RCA is proud to be a partner in the 2Zero project, which saw Exeter Airport host England's first successful trial of a hybrid electric aircraft on a commercial route last year.

Only the first step on a long journey, the event underlined how regional airports' technical backbone, skills and real estate can help achieve the ambitious but vital target of achieving Net Zero by 2050.

Building Better Futures

Regional airports are a critical part of the UK's infrastructure, and RCA is actively campaigning for four key steps to maximise their potential.

1. Support regional connectivity to deliver growth and prosperity across the UK

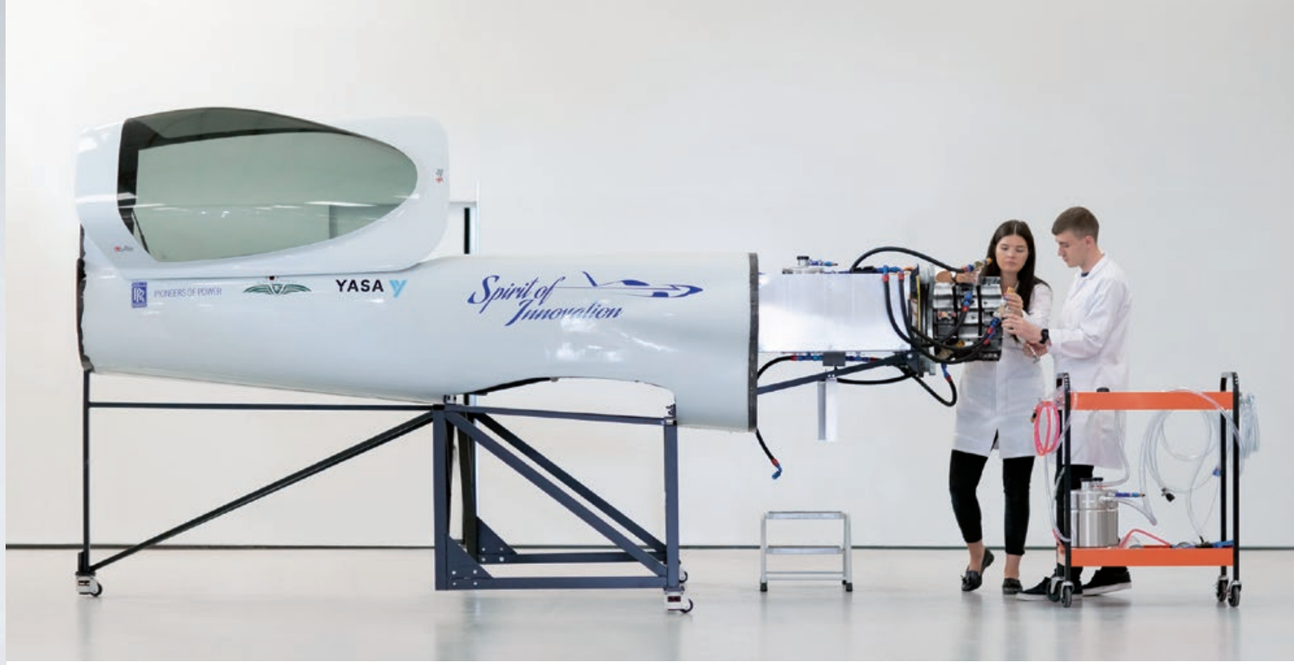
2. Promote specialist skills and training to foster homegrown potential

3. Utilise the regional aviation sector's capabilities to build a net zero future by 2050

4. Designate regional airports as Freeports and Enterprise Zones to enable frictionless trade with the UK

To find out more about RCA and the opportunities available visit rca.aero

WWW.RCA.AERO



BUILDING THE WORLD'S FASTEST ALL-ELECTRIC AIRCRAFT

Our ambitions to build the world's fastest all-electric aircraft have taken an important step forward with the completion of the testing of the ground-breaking technology that will power the world's fastest all-electric plane.

All the technology has been tested on a full-scale replica of the plane's core, called an 'ionBird'[1], including a 500hp electric powertrain powerful enough to set world speed records and a battery with enough energy to supply 250 homes.

The plane is part of our initiative called ACCEL, short for 'Accelerating the Electrification of Flight' which was launched at Farnborough Air Show in 2018. Our ACCEL project team includes key partners YASA, the electric motor and controller manufacturer, and aviation start-up Electroflight. The team has been developing the technology at Gloucestershire Airport while adhering to the UK Government's social distancing and other health guidelines and the systems will soon be integrated into our 'Spirit of Innovation' plane.

Image: ACCEL electrical battery

Supporting our net zero carbon ambitions
"Rolls-Royce is committed to playing a leading role in reaching net zero carbon by 2050. The completion of ground-testing for the ACCEL project is a great achievement for the team and is another important step towards a world record attempt. This project is also helping to develop Rolls-Royce's capabilities and ensure that we remain a leader in delivering the electrification of flight, an important part of our sustainability strategy." Dr. Rob Watson. Director of Electrical, Rolls-Royce.

The propeller is driven by three high power density axial electric motors and compared to a conventional plane, the propeller blades spin at a far lower RPM to deliver a more stable and far quieter ride. Combined they'll continuously deliver more than 500 horsepower for the record run. Even during the record run the all-electric powertrain delivers power with 90% energy efficiency and of course zero emissions. (In comparison, a Formula 1 race car tops out at close to 50% energy efficiency).

The world-record run
The first flight is planned for later this year and we are aiming to beat the current all-electric flight world record. Half of the project's funding is provided by the Aerospace Technology Institute (ATI), in partnership with the Department for Business, Energy & Industrial Strategy and Innovate UK.

Inspiring the next generation
We are also looking to inspire young people, with the ACCEL project, to consider STEM careers (Science, Technology, Engineering and Maths). We have developed downloadable materials aimed at primary school children around the project. These are linked to the UK curriculum and everything can be downloaded from the Spirit of Innovation STEM section of our website.

[1] *There is a long history of iron-birds in aviation for testing propulsion systems ahead of flight, but in this case we have named the test airframe 'ionBird', after the zero-emission energy source propelling the aircraft.*

ROLLS ROYCE

HR Smith
Group of Companies

The HR Smith Group is a family owned independent engineering and manufacturing company, which has been serving the military and civil aircraft industries for over 50 years.

Now a well defined industry leader for airborne antennas and a range of life saving Search & Rescue products the company focusses on continuously developing and expanding its in-house capabilities to remain innovative.

The Group's longstanding apprenticeship scheme is the bedrock of the business with 85% of all apprentices securing careers within the company. Technical apprenticeships and careers include:

> **Mechanical Design Engineers**
> **Radio Frequency & Antenna Engineers**
> **Software & Digital Engineers**
> **PCB Design Engineers**
> **Environmental Test Engineers**

hr-smith.com/careers

SCITEK

The software that participants of the flying classroom interact with is the culmination of more than two years of engineering effort by SCITEK Consultants Ltd.

Bringing together the live readings from more than 70 sensors installed on the customised SAAB 340 which are digitised with military spec hardware. Where possible, existing aircraft sensors have been used, with data extracted from the aircraft's serial buses, although many additional sensors were required for non-standard measurements. Along with acquiring sensor readings, the software is also calculating a range of aircraft data in real time such as engine thrust, sideslip and the aircraft's current centre of gravity.

All of this data is processed by a central server running on a rugged laptop which then wirelessly streams it to 30 Microsoft Surface Pro tablets, providing participants with a high-resolution 12" touchscreen display from which they can interact with the data. The server is capable of recording all data at up to 100Hz as part of the flying classroom and, for more advanced research, up to 1024Hz.

The data is displayed on the touchscreen in gauges similar to those found in the SAAB's cockpit, and with an update rate of 100Hz, participants can see the data changing with minimal latency. This results in an experience akin to that of the pilot looking at the actual cockpit cluster. In addition to real time data, historic trends of particular data points are available along with up-to-date VFR maps showing the aircraft's current location, flight path, heading and live camera feeds from the cockpit.

SCITEK has used National Instruments LabVIEW to create all of the software components used in the flying classroom. LabVIEW's native support for a range of communication protocols and ability to rapidly create user interfaces for displaying data made it an ideal choice for the flying classroom. This has resulted in a robust system which can be easily scaled for future flying classroom experiments or adapted for more specific advanced research projects.

SCITEK is delighted to be able to contribute towards this platform which will greatly improve participants' inflight experience, enhance learning opportunities and ultimately extend the boundaries of Cranfield's aviation research.

Saab UK - proud to partner with Cranfield University

The Flying Classroom

The National Flying Laboratory Centre (NFLC), part of Cranfield University, has expanded its fleet with the transfer of ownership of the Saab 340B. Delivered to the University in mid-2021, the Saab 340B aircraft is a unique facility in the UK as it provides aerospace engineering students from over 20 Universities and Cranfield with invaluable flight test experience as a flying classroom.

Modifications to the aircraft support the next generation of aero-engineers. Being larger than Cranfield's previous aircraft, the Jetstream 31, the Saab 340B allows the NFLC to accommodate more students on each flight and create new research capabilities. The flying laboratory also undertakes research projects testing the development of aerospace technologies and flight operations.

The modifications to ensure the aircraft was upgraded from a standard commercial plane to a fully bespoke facility, with all the technical equipment necessary to ensure the testing of the boundaries of aviation, was completed by Saab in Linköping, Sweden.

Since the first flight of a Saab 340 in 1983, there have been 240 operational aircraft used by 34 different operators.

Digital Air Traffic Control Centre

In December 2018, Cranfield Airport became the first airport in the UK to have an operational digital air traffic control centre. Supplied by Saab UK, the innovative technology replicates what can be seen through the windows of a traditional air traffic control tower. It enables smarter approaches to air traffic control by digitising and integrating airport functions and improves a controller's situational awareness, enabling quick and informed decisions.

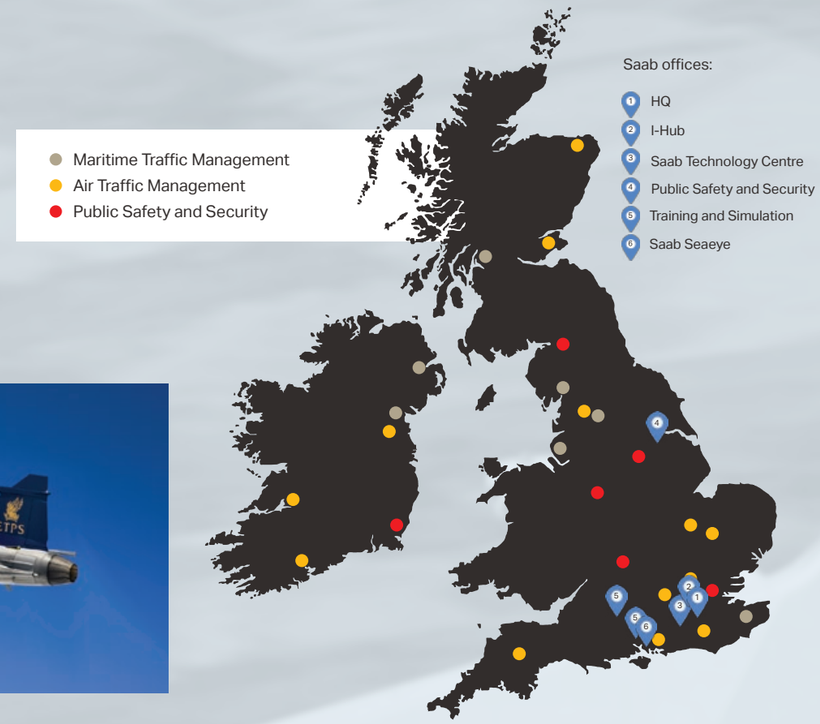
Following on from the success at Cranfield, in April 2021 London City Airport became the first major international airport to convert its traditional air traffic control tower to Saab's digital tower technology.

Digital Aviation Research and Technology Centre (DARTeC)

Saab is a consortium member of DARTeC and is investing in the centre by providing Saab products and PhD funding to support DARTeC's aim to address research challenges facing the aviation industry such as:

- the integration of drones into civilian airspace;
- increasing the efficiency of airports through technological advances;
- creating safe, secure shared airspace through secure data communication infrastructures; and
- increasing the reliability and availability of aircraft through self-sensing, self-aware technologies.

Saab's contribution to DARTeC aims to ensure that research in the digital aviation area is at the forefront and that Saab products are being developed to meet the challenges in future aviation.



Saab UK - a key strategic partner in the United Kingdom

For over 40 years Saab's UK operations have delivered advanced defence and security systems to the UK, working with our customers to meet the demanding challenges they face at home and abroad.

Saab's UK supply chain is made up of nearly 1,000 of the best companies in the industry, across the length and breadth of the country.

We reinvest 23% of annual revenue in R&D, collaborating with partners, including industry and academia, to ensure we anticipate our customers' future needs and remain globally competitive. As part of this we established our I-Hub research network with Imperial College London in 2019, and in 2020 we announced a £50m Technology Centre in Farnborough linked to FCAS.

Our ongoing alliance with British partners, sees Saab playing an important role in co-development and technology sharing, bringing together the best of Swedish and British innovation for the international market.

Learn more at saab.com/uk

SAAB TECHNOLOGIES

SAAB

DISCOVER OUR CAREER PATHWAYS...

Sustaining a high degree of technological excellence requires diverse talent and ever changing skills. Across the UK, Safran provides Work Experience, Apprenticeships, Industrial Internships and Graduate Programmes to cater for a wide variety of interests and career paths.

GRADUATE PROGRAMME
To develop high performance, safer and environmentally-friendly technology solutions, we are constantly on the lookout for the best talent. The Graduate Programme will give you the opportunity to contribute to the ongoing culture of innovation and enjoy a unique and fulfilling experience.

From day one, you'll be taken on a journey to help you discover where your expertise lies. You will get the chance to take on various placement opportunities and have your own training plan, coordinated by Safran University.

SEATS GB
PREMIUM MANUFACTURER OF FIRST AND BUSINESS CLASS SEATING SYSTEMS
We specialise in designing, producing, certifying, and assembling customisable, high added value aircraft seats for passengers. We currently have more than 1 million seats in service with over 100 airlines around the world.

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A GLOBAL LEADER IN AERONAUTICAL POWER AND ELECTRICAL SYSTEMS
We are an expert in the entire energy chain on board an aircraft. At the heart of the design and production of aeronautical electrical systems, our expertise include distribution, conversion, wiring, and load management.

NACELLES
ONE OF THE MAIN INTEGRATORS OF AIRCRAFT ENGINE NACELLE SYSTEMS IN THE WORLD
We are renowned for engineering and aerospace expertise, we propose a range of nacelle systems to suit each type of aircraft: regional jets, business jets, and commercial aircraft.

SAFRAN UK
SHARED SERVICE CENTRE FOR UK SITES
We support the Safran UK entities with a range of services including: transactional finance, HR (Graduate Programme and central HRIS Administrator), L&D coordination through Safran University, Indirect Purchasing, Tax and International Mobility

HELICOPTER ENGINES
EUROPEAN MAINTENANCE CENTRE HUB, SUPPORTING BOTH CIVIL AND MILITARY MARKETS
We perform level 1 to 3 maintenance and repairs on engines either on-site or at our customers' facilities. Our technical and support staff is also committed to delivering excellence in the manufacturing, maintenance, repair and overhaul of complex components such as air starters, air producers, auxiliary power units and oil pumps.

AEROSYSTEMS & SERVICES
KEY INTERNATIONAL PLAYER IN AERONAUTIC EQUIPMENT AND SYSTEMS FOR AIRCRAFT AND HELICOPTERS
We are closely involved everyday around the world working with our customers in operating and servicing our products. The services we offer include the supply of spare parts and repairs to components.

LANDING SYSTEMS & SERVICES
FOREFRONT OF LANDING GEAR TECHNOLOGY FOR OVER 85 YEARS
We have a full life-cycle capability from concept to in-service support. This includes research and development, engineering design, systems integration, test and production, maintenance, repair and overhaul.

SAFRAN IN THE UK

With a presence in the United Kingdom dating back 90 years, Safran is the partner of choice for customers in the aerospace and defense markets. Safran provides solutions for top-tier customers in the United Kingdom (UK) and worldwide, including government agencies and leading prime contractors.

90
OPERATING IN THE UNITED KINGDOM FOR
90 YEARS

10
LOCATIONS

3,000+
EMPLOYEES

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POWERED BY TRUST

*The 50/50 company between Safran Transmission Systems and Rolls-Royce

SO ARE YOU READY FOR THE JOURNEY?

Visit us at: **www.safran-group.com**
or contact us at: **safran_uk_hr.saf@safrangroup.co.uk**

SAFRAN

PASSPORT TO CHANGE

Supporting young people to aspire to the skies

Many young people around the world aspire to careers in aviation. The aviation industry provides a total of 87.7 million jobs worldwide[1] and contributes more than US$686bn[2] to the global economy every year. We all deserve the chance to turn our dreams into reality. But, sadly, some young people still face much greater barriers to realising their dreams than others.

At Virgin Atlantic, we aim to deliver a real difference, invest in the hearts and minds of young people, and use our business as a force for good by making careers in aviation and STEM (science, technology, engineering and maths) more accessible. To make a change for good, we must bridge the gender gap and the social mobility gap, offering opportunities to all.

That's why we're pioneering our Passport to Change programme. It's a first-of-a-kind global programme that will see more than 350 disadvantaged 12- to 15-year-olds enjoy 12,000 hours of dedicated learning time with our airline, and bring STEM engagement to young refugees.

We are proud that the young people participating represent the diversity of the communities that we serve. Over their year-long journey with us, our young people will gain first-hand insights into how airports work, meet experts from every department at Virgin Atlantic, and build their confidence and skills, working closely with our volunteer mentors.

During this unique learning experience, we aim to inspire all these young people to raise their aspirations to the skies.

Your donation to the Virgin Atlantic Foundation helps us deliver life-changing opportunities for young people and make their dreams come true. Thank you for your support.

Passport to Change | SPEAKERS for schools | smallpeice | UNHCR

"Passport to Change is opening up opportunities for me to fulfil my dream of becoming a pilot. I am excited for a future in taking everyone to the skies and connecting the world"

Ayanna, 13,
Luther J Price Middle School, Atlanta, Georgia

1. HTTPS://WWW.STATISTA.COM/TOPICS/1707/AIR-TRANSPORTATION/
2. HTTPS://WWW.STATISTA.COM/STATISTICS/1110342/MARKET-SIZE-AIRLINE-INDUSTRY-WORLDWIDE/

Global connected classroom: Inspiring the next generation

Do you remember who, or what, inspired you at school? Through the global connected classroom we aim to inspire young people about the possibilities of STEM and careers in engineering and aviation as well as attracting more young people into STEM disciplines.

Inspiring future generations to engage in STEM subjects is not only crucial for pupil's educational development, but to the future of the UK aerospace and aviation industry.

Our outreach activities start with school-aged pupils through our range of support activities, such as the Schools Aerospace Challenge and visits for local schools. School engagement is a core part of our strategy and very much at the heart of commitments we have made to our partners.

As well as inspiring those who can visit us at Cranfield, or visit the flying classroom at regional airports, the modifications that will be made to the Saab 340B over the next year will allow us to connect to classrooms around the world. Thanks to the ERA Foundation we are upgrading the aircraft's communications system, installing a new data router, developing software for the student interface and upgrading the mixing desk in the Cranfield online suite which will allow us to broadcast video, audio and flight data in high definition.

The global connected classroom connects to the aircraft's on-board system (funded by the Royal Commission for the Exhibition of 1851) and is supported by equipment donated by Inmarsat and Honeywell. Together, the two systems will allow us to teach in the air – to university students on-board the aircraft and to schools around the world.

It will be a genuinely 'global connected classroom' for STEM inspiration – unique in the world.

"Nothing ever becomes real till it is experienced."
John Keats

Thank you to our supporters

We are grateful for the incredible support of our donors. Thank you!

Gifts over £5,000

Major gifts help students from over 20 universities, and Cranfield, achieve their full potential and contribute to our mission to be at the forefront of aviation and aerospace research and education.

Professor Dame Helen Atkinson DBE, FREng

Cranfield College of Aeronautics Alumni Association (CCAAA)

Professor Iain Gray CBE, FREng FRAeS

Professor Sir Peter Gregson FREng and Lady Gregson

Graham Howat (MSc Air Transport Engineering 1968)

Dwayne Lucas (MSc Aircraft Design 1980)

Antony Peaker (MSc Aerospace Dynamics 2005) in memory of Pamela Peaker M.A.

Stephen Read (MSc Air Transport Engineering 1974)

340 Club

The 340 Club recognises the support of alumni and friends who contribute at least £1,000. By supporting the NFLC in this way 340 Club donors are having a transformative effect on the aero-engineers and aviation leaders of the future.

David Brailsford (MSc Aerodynamics 1971)

Professor Graham Braithwaite FRAeS

Martin Brennan (MSc Human Factors & Safety Assessment in Aeronautics 2014)

Dr John Deane (MSc Aerodynamics 1976, PhD Aerodynamics 1979)

Professor John Fielding FRAeS (MSc Aircraft Design 1970, PhD Aircraft Design 1979)

Arif Ghouse (MSc Air Transport 1990**)**

Thomas Graham (MSc Aircraft Design 1974)

David Haward (MSc Air Transport Engineering 1970)

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Dougie Hunter (MSc Aerospace Vehicle Design 1986)

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The Royal Commission for the Exhibition of 1851

Virgin Atlantic Foundation

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All gifts – no matter how big or small – help us support thousands of students in realising their ambitions of becoming aerospace engineers and aviation leaders, as well as carrying out transformational research.

Marwan Al Shagra (MSc Aerospace Vehicle Design 2017)

Richard Allen (MSc Electronic System Design 1996)

Oscar Alvarez Robles (MSc Air Transport Management 2002)

Weng Ang (MSc Astronautics and Space Engineering 1994, EngD School of Engineering 1998)

Daniel Arcos (MSc Aerospace Vehicle Design 2013)

Friends and family in memory of Reginald Austin (Dip Aerodynamics 1953)

Nicolas Baro (MSc Aerospace Vehicle Design 2015)

Dr Caroline Barrass

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Mauricio Caceres Henao (MSc Aerodynamics 1993)

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Phillip Campbell (MSc Aircraft Design 1984)

Dr Stephen Carnduff (PhD School of Engineering 2008)

Duncan Casey

Judith Chivers (MSc by Research in Leadership and Management 2017)

David Civica (MSc in Aviation Safety Management, Risk and Regulation 2025)

David Clark

John Constable

Luis Contreras Blanco (MSc Autonomous Vehicle Dynamics and Control 2016)

Dr Michal Czapinski (MSc Computational and Software Techniques in Engineering 2009, PhD School of Engineering 2014)

Gary Dewar

Jason Digance (MSc Safety and Accident Investigation (Air Transport) 2010)

David Downie (MSc Air Transport Engineering 1984)

Louis Dresse (MSc Air Transport Engineering 1984)

Jude Echema (MSc Aerospace Vehicle Design 1995)

Hollie Edmans

Clive Ellam (MSc Aircraft Design 1955)

Dr Oluwatoyin Fatona (MSc Computer Integrated Manufacturing 1990)

Dr Dimitrios Fouflias (MSc Thermal Power 2003, PhD School of Engineering 2009)

Kassia Gardner (General Management Programme 2021)

Dr Jason Gauci (PhD School of Engineering 2009)

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Sylvain Gloux (MSc Air Transport Management 2010)

Dr Sergio Gomes (PhD College of Aeronautics 1990)

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Andrej Holúbek (MSc Computational Fluid Dynamics 2017)

Yu-Jou Huang (MSc Thermal Power 2017)

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Andy Johnson

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Kesavan Karunanethy

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Levent Mertsoy (MSc Aircraft Design 1980)

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Dr Michael Mifsud (MSc Aerospace Dynamics 2001, PhD School of Engineering 2008)

Benedicta Morrow (Exec MBA 2020)

John Mortimer (Dip Aircraft Propulsion 1958)

Aurelien Moureaux (MSc Aerospace Dynamics 2006)

Dr Randy Mumaw

Ian Munn (MSc Air Transport Management 2010)

Steven Murray (MSc Air Transport Management 1988)

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Dr Johnson Odukoya (PhD Environment and Agrifood 2015)

Graham Oliver

Gregory Olympios (MSc Air Transport Engineering 1984)

James Pagliaro

Symeon Pantelidis (MSc Aerospace Vehicle Design 2008)

Avni Patel (MSc Air Transport Management 2012)

Petros Perdikoulis (MSc Aerospace Vehicle Design 2020)

Dr Sharon Pickering (MSc Human Factors & Safety Assessment in Aeronautics 2001)

Dr Jegan Pushparajalingam (MSc Aerospace Dynamics 2007)

Nikolaos Rafailakis (MSc Computational Fluid Dynamics 2014)

Mahmood Razee (MSc Air Transport 1990)

Elizabeth Redfern (MSc Computer-Aided Design and Computer-Aided Manufacturing 1987)

Kevin Reeve

Tilemachos Alexandros Rodis

Gill Rodwell

Robert Ruckman (MSc Transport Studies 1975)

Arturs Saveljevs (Exec MSc Airport Planning and Management 2015)

Eric Sevor (MSc Safety and Accident Investigation (Air Transport) 2015)

Basanta Sharma (MSc Air Transport Management 2018)

Sarah-Ellen Shergold (MSc Aerospace Dynamics 2009)

Zoe Skreki (MSc Air Transport 1995)

Ronnie Smith (MSc Human Factors & Safety Assessment in Aeronautics 2007, Master of Defence Administration 2008)

Rafal Sojka (MSc Computational and Software Techniques in Engineering 2011)

Michael Spruce (MSc Computational Fluid Dynamics 1991)

Angela Styles

Dr Yicheng Sun (PhD Aerospace 2018)

Robin Thevathasan (MSc Aircraft Design 1978)

Vaughan Thomas (MSc Aerospace Vehicle Design 2015)

Emma Turner

Stephen Vella (MSc Air Transport Engineering 1976)

Anthony Venios (MSc Aerospace Dynamics 2000, Exec MBA 2009)

Pietrick Voyer (MSc Airport Planning and Management 2014)

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Simon Witts

David Woodley (MSc Propulsion 1964)

Dan Xu (MSc Aerospace Dynamics 2013)

Dr Daqing Yang (PhD School of Engineering 2010)

Geng Zhou (MSc Aerospace Vehicle Design 2017)

Anonymous (50)

Please note this list recognises all contributions to the campaign from 1 January 2019 until 16 June 2022

Supporting the nation's aero-engineering students

"A unique experience that thrills and gives a sound context for all the lectures and experiments." That's how Professor John Fielding, former student and now Emeritus Professor of Aircraft Design at Cranfield, describes the flying classroom.

"A "Dutch roll" and stalls must be experienced," Professor Fielding adds.

More than 1,200 aeronautical students from over 20 universities around the world experience a flight in our flying classroom each year as part of their degree course. This fully-instrumented aircraft supplies students with real-time data about a range of performance parameters, allowing them to become flight test engineers during their flight.

The Jetstreams holds fond memories for many of today's aviation leaders, and it served Cranfield well for over 15 years. However, as it was ageing, in 2019, we launched an ambitious fundraising campaign to replace the much-beloved aircraft with a Saab 340B.

Like previous flying classroom aircraft, the Saab 340B will cement your understanding, and put into context the academic elements and theory of your course – but with improved data screens you, and the students that follow you, will be able to interact with the screens and data. It's perhaps the closest you can get to a real-life flight test. This is great for your career as you'll be able to talk about your experience in interviews and apply your learning in future job roles.

It will also allow the National Flying Laboratory Centre (NFLC) to accommodate more students on each flight, and create new research capabilities and collaboration opportunities – so your flight could also be part of an industry research project!

About the NFLC campaign

Philanthropy has played a vital role in realising the ambition we set out to achieve in 2019 to buy the Saab 340B and modify it for its new role. It is thanks to the generous support from alumni, friends and partners that we've got the new flying classroom flying our first cohort of students, the first of many generations to follow in the flight paths of those before them.

Our work to support the next generation of aero-engineers and aviation leaders continues. Each gift, regardless of size, will help ensure we can continue flying the Saab 340B for decades and provide the unique flying classroom experience to future generations.

To find out more about the campaign visit our website:
www.cranfield.ac.uk/NFLCcampaign

"I wanted to give back to an institution and programme that had so much influence on my aerospace career. It was important to me to perpetuate the continued excellence exemplified by Cranfield."

Dwayne Lucas (MSc Aircraft Design 1980),
Vice President, Special Projects, Aerospace Industries Association of Canada

"I sponsored the door for the new flying classroom, the Saab 340B, to welcome all the future students to a Cranfield aircraft, to follow those who had entered the Ansons, Tiger Moths, Austers, Bulldogs, Doves, Jetstreams – but not the Paris, as we had to climb over the cockpit coaming!"

Professor John Fielding (MSc Aircraft Design 1970),
Emeritus Professor of Aircraft Design, Cranfield University

"There really are a lot of great causes out there that need financial support. To me the NFLC is such a rare and wonderful opportunity for inspiring students to experience first-hand both normal and unusual operating characteristics of aircraft in flight. I felt honoured to be part of this campaign to continue that legacy for future students."

Arif Ghouse (MSc Air Transport 1990),
Airport Director, Paine Field Airport, Washington USA

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