

VULCAN XH558 Education Programme

in partnership with WORK-WISE INSPIRING SKILLS AND EMPLOYABILITY

he Avro Vulcan, with its

impressive technical innovations, helped place Britain at the forefront of aircraft design over seventy years ago. We are now using the spirit of this innovative thinking to help young people think about and explore some of the current and future questions in aviation, aerospace, and more broadly around future technologies and sustainability, learning the lessons from the past and using these to inspire the future. In early 1997, Dr Robert Pleming began to explore the feasibility of returning Vulcan XH558 to flight. It was to be the most complex return to flight project ever attempted – returning an ex-military, heavy, powerful and complex aircraft to flight, under civilian ownership. Even in those early years of the Vulcan to the Sky project, Robert was keen that the aircraft be an inspiration to young people to find a future career in Science, Technology, Engineering or Manufacturing (STEM).



Speaking before the aircraft took its first flight after restoration in 2007, Robert said:

"The Vulcan is an awesome sight – once seen, never forgotten. One of our main objectives is to take the aircraft to a new generation of the young who have never seen the aircraft fly before. We're a big part of the efforts to stimulate the young into thinking about design and engineering as a career.

This project is absolutely original, unique! What we're doing here has never been done anywhere in the world. Such a great example of British engineering. It's also incredibly visible and I hope it will motivate young people.

The Vulcan is one of the best British designs of all times. Our aim of flying the aircraft is to inspire the young with the best of British engineering."

While Vulcan XH558 does not fly anymore, she still has an important role to play in inspiring the next generation of designers and engineers.

By involving children from a young age, we hope to broaden their experiences and open up the world of engineering, design and creative problem-solving to give them the skills required for the world of work.

Working with our Education Partners **The Work-wise Foundation**, the Vulcan to The Sky Trust has embarked on an ambitious new journey to bring to life Dr Robert Pleming's vision of the legacy of Vulcan XH558 to inspire future generations.

XH558

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In this document, we will showcase some of the education engagement activity and impact to date, and share our aims and ambitions for our education programmes to take off and reach greater heights.

INSPIRING SKILLS AND EMPLOYABILITY

The Work-wise Foundation is an employer-led charity focusing on Science, Technology, Engineering and Manufacturing. We support the development of young people so they have the knowledge, skills, aptitude and opportunities for employment.

The Work-wise Foundation helps the private sector take the lead in preparing young people for employment and rewarding careers. We do this by establishing links, developing programmes on training and practical guidance, and connecting employers with their future employees. The Department for Education, in their new careers programme 2023, has recognised that it is important to encourage primary school children to think about future jobs early, whilst nurturing aspirations and challenging stereotypes. Evidence shows that children start to form ideas about their future as they start primary school.

By linking lessons and experiences in an age-appropriate way to different careers, training and skills, we will bring learning alive and start to inspire pupils and ignite a spark in their imagination about all the different opportunities open to them. This will broaden their horizons while providing chances to unlock talent, think about skills, engage with employers and discover different career prospects.

Through the Vulcan Education programme, we are providing such opportunities and here are just two examples:

"When I grow up I am going to be an engineer...keep your eyes on the television, you will hear about me there!" Flying Futures participant

"The best thing we have had in school" Teacher on Flying Futures

"At Macauley, we strive to give children experiences that they will remember forever. This truly was one of those days! An incredible machine and an even better experience for the children. Thank you." Mr Herrick – Head of Academy

DR PLEMING'S DELTA WINGS CHALLENGE: PRIMARY SCHOOLS

Year 5 children from the Delta Academy Primary Schools experienced a fun hands-on launch day where they learnt about the history and theory of flight and the story of the Vulcan. During the day of fun, the children designed their very own school airport, and even got the chance to build and fly a plane!

The children were set the challenge back in school to design and build their own mini Vulcans from sustainable materials, which were then presented to a panel of judges at a celebration day. The squadron of Vulcans was then displayed at the Get up to Speed with STEM 2023 showcase event, attended by over 5,000 visitors.



IMPACT:



STAFF

"Today I learned about the different parts of the Vulcan plane. I enjoyed entering the parts of the plane and learning about them as we went along." Leah

"We are very proud of the children and how they have conducted themselves, not only on Wednesday but throughout this whole project. It has been lovely to see them be so involved and dedicated to the process and their interest at how things work at the sessions." Kirsty Hall, Year 6 Teacher

"Today I learnt that it takes so much wiring and tanks to power the Vulcan, which is amazing!" _{Yusuf}

"It was amazing and the cockpit was super cool!" ^{Evie}

"I really enjoyed when we asked them questions and we learned new things." Amaara





FLYING FUTURES ROADSHOW

Partnering with Maker{Futures} from the University of Sheffield and funded by The Royal Academy of Engineering Ingenious Award, we brought together local individuals from industry and academia to work with primary schools to strengthen perceptions of engineering as an attractive, valuable and accessible future career option.

The Flying Futures Roadshow visited fifteen local primary schools and three public engagement events, giving children a taste of Aerospace Engineering. Young people aged 7-11 took part in activities which challenged their problem solving, creativity and collaboration skills to address some of the big questions facing the aviation industry.

Y5 STUDFNTS

Each activity, developed by engineers, required pupils to use the 'Maker{Cycle}': a process where children look for problems, think how they can make improvements, make a model and test their ideas.





t is widely accepted across education, business and government that young people's employability skills are as important as academic attainment for work readiness, entrepreneurship and career progression. The Careers and Enterprise Company's (CEC) 'Closing the Gap' report highlights that employer involvement with schools and colleges is critical to the delivery of world-class careers education.

In recent years, and through the implementation of the Gatsby Benchmarks, the number of employer encounters and workplace experiences that young people receive has increased significantly, but there is much more still to be done so that all children can be inspired by and better prepared for the world of work.

Our focus is to provide enrichment opportunities to learn about industry, and past, present and future technologies, by providing them with practical, hands-on learning and project management opportunities.

The following sections provide some examples of our work and impact to date:

OPERATION VULCAN

IMPACT:

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SCHOOLS Participatfi

Secondary schools were invited to design an interactive exhibition stand to display one of the bomb bay fuel tanks from Vulcan XH558. Schools attended open days at engineering company CBE+ and South Yorkshire Aircraft Museum, where a detailed project brief was delivered by our team of experts, plus a tour and hands-on flight-related engineering activities.

Over a 3 month period, 'Ask the Experts' sessions with engineers and Vulcan to the Sky Trust volunteers were held to allow students to ask questions and get feedback on their ideas, whilst working on their designs. A judging day was held at CBE+ where teams presented their designs to a team of industry judges. The winning students from Newfield School then worked with the CBE+ team and engineering consultants to create a working scale model of their design, learning about the whole process of taking a project from concept to reality. The final scale model was then showcased by the students at Magna Science Adventure Centre at Get up to Speed with STEM in 2022 alongside other school entries. Here students talked to visitors and VIPs about their project.



DR PLEMING'S DELTA WINGS CHALLENGE: SECONDARY SCHOOLS

Building on the success of Operation Vulcan, Delta Academy Secondary Schools were provided with the opportunity to enter this challenge. At a launch event, they learnt about the theory of flight, the history and heritage of the Vulcan and got hands-on, building their own models. Following the launch, the schools were challenged to design a sculpture which incorporated the Vulcan XH558 wing tips, to be displayed alongside Vulcan XH558.

These designs were then judged by an expert panel, with the team from Vale Academy impressing our experts the most with their design. The students subsequently worked with The Work-wise Foundation, Vulcan to the Sky Trust and CBE+ to turn their design into reality, supported by Chartered Engineer Steve Wainwright CEng FIMechE from DN4 Innovation Management Ltd. A 1:10th scale model was built and displayed again at Get up to Speed with STEM in 2023 along with other entries and the actual Vulcan wing tips. "The students have all really enjoyed the experience and gained an invaluable insight into a real engineering company. They were absolutely buzzing and haven't stopped talking about it. It is evident they have all grown as individuals, too". Ben Savage, Teacher Vale Academy

"It was a great experience and all students at Eckington School enjoyed participating." Chris Henzell, Teacher, Eckington School

"It was an absolute pleasure to be one of the judges for Operation Vulcan. It was clear that every single student had worked really hard on their designs and had received great support in the process."

Judge & Business Development Director at Advanced Electric Machines

"I really enjoyed working as part of a team and hearing the positive comments from the judges. My biggest challenge was to be creative."

VALCAN TO THE BY TRUST COC+

"What an excellent experience today has been! On behalf of Rossington All Saints Academy, we would like to thank you all for organising. In my opinion

Saints Academy, we would like to thank you all for organising. In my opinion, every team was a winner today just by taking part and showcasing all their hard work."

K Noble, Teacher, Rossington All Saints Academy

IMPACT: **11** 8 SCHOOLS

"I really enjoyed working as part of a team and developing technical skills. My biggest challenge was having the courage to present to different judges." Student

DONCASTER UTC YEAR 10 PROJECTS

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Students from Doncaster UTC (University Technical College) worked alongside Vulcan to the Sky Trust on re-designing the wing from the Vulcan. Students used research, textbooks and blueprints of the Vulcan to redesign the wings to be more cost-effective, and to include new smart materials.

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The project began with a presentation from the Vulcan to the Sky Trust team, outlining the impressive history and heritage that surrounds the aircraft. Students researched, sketched, designed and modelled their wing design, outlining how they would change the shape, design and function. Regular contact visits were undertaken by the Vulcan team during the project to test out ideas and options. Finally, all Year 10 students were given the opportunity to visit and see XH558 up close. The latest project with Doncaster UTC involves the Vulcan's ejector seats. Students are cosmetically refurbishing a Vulcan ejector seat, whilst a second seat is providing hands-on learning opportunities including scanning, 3D printing, CAD design, prototyping, additive manufacturing and reverse engineering.

This is all being mapped to, and enhancing curriculum delivery. In a truly collaborative approach, this project is also being supported by Doncaster-based engineering company Agemaspark and their Managing Director, Paul Stockhill.



"Vulcan to the Sky Trust was so impressed with our students' dedication to their employer project, that they personally invited them to view the Vulcan aircraft in all its splendour.

Students had the opportunity to interact with volunteers, some of whom had flown, worked on, navigated, or served on the original Vulcan crew. The volunteers' enthusiasm and commitment were contagious. The next generation of engineers has been inspired by hearing their remarkable stories and learning all the information about them."



Miss Nortrop, Teacher of Engineering, Doncaster UTC



"I want to do this so I can add this to my CV. When I look back, I can remember the amazing opportunity I had to work with Vulcan." _{Student}

"I really enjoyed the Vulcan talk it was really interesting." _{Student} Seventy years ago, Britain led the world in aircraft design, and it was then that the famous Avro Vulcan was born. It still remains one of the best examples of aerospace innovation and engineering, combining the requirements of a bomber with the performance and agility of a jet fighter. This is its story...

History

Following the end of the Second World War in 1945, tensions started to grow between two sides: the USA and Western Europe on one side, and Russia and Eastern Europe on the other.

Both sides were also starting to develop nuclear weapons to defend themselves against attack by the other side, and this

> gave rise to what became known as the Cold War – something that lasted for another 45 years.

The British Government was developing its own nuclear bombs, and soon realised these bombs needed new, bigger, faster aircraft to carry them. In 1947, the Government issued the specification for a new bomber to UK aviation companies, inviting them to submit design

tenders. It was decided to order three of the designs; the Valiant; the Victor; and a design from a company called Avro. This was like nothing that had been seen in the skies before. It had huge delta-shaped wings and Avro called this new aircraft... the Vulcan! The three aircraft were collectively known as the V-Force and delivered Britain's strategic nuclear deterrent during the 1950s and 60s.

To investigate the practically unknown characteristics of the delta design, it was decided that a series of one-third scale research aircraft would be built, the first flying in 1949. These experimental aircraft led to the first full size Vulcan taking to the skies for the first time in 1952. Over a period of 32 years, a total of 134 Vulcans were made, and towards the end of the Cold War, many aircraft were converted from bombers to reconnaissance aircraft and fuel-carrying tankers. This required some modifications, one of which was to allow the Vulcan to be fitted with up to three additional cylindrical fuel tanks in its bomb bay.

The Vulcan played a famous part in the battle for the Falkland Islands between Britain and Argentina in 1982 - in fact, this was the only time the aircraft saw active service within a war. They served the RAF up until 1984, when they were finally grounded, with the exception of one...



"One of the main ambitions of Dr Robert Pleming and his team in restoring Vulcan XH558 to flight was for her to be a catalyst to inspire young people into careers in engineering and other STEM-related roles.

I'm proud to be delivering this legacy and to further advance the development of the Vulcan to the Sky Trust into even more of an education focused charity, a charity that will continue to showcase Vulcan XH558, sparking aspirations in young people in the roles available after taking STEM subjects."

Marc Walters – CEO, Vulcan to the Sky Trust

"As a Trustee, I am delighted to see that Dr Robert Pleming's and the Trust's vision is being actively delivered to inspire <u>careers within the STEM sector.</u>

It is very inspiring to see so many young people benefitting from the educational partnership between Vulcan to the Sky Trust and The Work-wise Foundation."

> Dr Steve Liddle CEng FRAeS Trustee Vulcan to the Sky Trust



WORK-WISE

"It is an honour and privilege for The Work-wise Foundation to contribute to the Vulcan XH558's story. This next chapter is the most important as we educate and inspire future generations, helping them learn from the past to help shape a better future.

Over the past few years we have seen young people be amazed, inspired and encouraged to consider and pursue careers in science, technology, engineering and maths."

VULCAN XH558

Vulcan XH558 was built in 1960 and chosen by the RAF in 1984 to remain in operation as a display aircraft. Over the years XH558 performed at air displays in front of millions of people until the Ministry of Defence discontinued the Vulcan Display Flight. In 1993, XH558 - the last Vulcan in RAF service - landed for what many believed was the final time.

However, one person was not going to let the Vulcan disappear from our history. In 1997, Dr Robert Pleming began the journey to restore XH558 and put her back into the skies. When the Vulcan was bought from the MOD, the purchase included an almost complete library of original documentation and design data, and several hundred tons of spare parts which were invaluable to the project. After many years of modifications and repairs, Vulcan XH558 finally returned to the skies in 2007, and thrilled spectators at air displays all over the world until 28 October 2015, when it was grounded for the final time.

Vulcan XH558 has now started the next chapter in its story, helping young people think about and explore some of the current and future questions in aviation, aerospace, and more broadly around future technologies and sustainability, learning the lessons from the past and using these to inspire the future. Whilst Vulcan XH558 can no longer take to the skies, this hasn't stopped us ensuring as many young people and educators as possible get to experience and learn about the aircraft, and the technology and engineering associated with it.

We regularly attend careers fairs and STEM-related events to engage and inspire the next generation, bringing along volunteers, engineers and as much Vulcan equipment as space will allow, from flight simulators to engines, fuel tanks, wing tips, schematic drawings to ejector seats! These events allow visitors to have a hands-on experience of the history of the Vulcan; this, sat alongside modern technologies from other exhibitors, showcases innovation within the sector whilst honouring the past of British engineering. Here are just a few examples:

WORK-WISE

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Get up to Speed with STEM

Get up to Speed with STEM is a live, annual, one-day showcase event at Magna Science Adventure Centre, which aims to introduce, inform and inspire students, parents and teachers about the world of work in the Science, Technology, Engineering and Manufacturing (STEM). Now attracting over 5,000 young people each year, we have been a regular at this Showcase event for the past 10 years.

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YOUNG PEOPLE

Scan code to watch a short video of the 2023 live event:

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REACHING OVER

589 Parents/carers/educators

WORK-WISE

A SCIENCE SUMMER SCHOOL EVENT

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SCHOOLS

ele 30

SCHOOLS

IMPACT: 🌓 588

STUDENTS

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300

STUDENTS

ENGAGED WITH

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North Star Science School

Headlined by Professor Brian Cox CBE, this interactive day of speakers and workshops aims to showcase Britain as the best place in the world to do science and engineering.

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Vulcan to the Sky Trust, working closely with The Work-wise Foundation, are co-creating a workshop with Doncaster UTC to deliver at the 2023 event. This will be co-designed and presented by UTC students to an audience of 480 younger students, giving them a exciting, practical hands-on experience relating to technology used on the Vulcan and other applications.

TEENTECH®

TO THE SKY

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TeenTech

A live event aimed at inspiring the innovators of the future, supporting teenagers in gaining skills, experiences and connections to guide them in future careers. We have previously run interactive workshop sessions at the TeenTech event. Reaching young people is key to our education programmes, and we aim to do this, not just through schools, but through community and family engagement activities, encouraging cross-generation family learning in a fun and interactive way. Here are a couple of examples:

KELHAM ISLAND INDUSTRIAL HERITAGE MUSEUM DROP-IN DAY

We ran a drop-in day for families during the holidays where children could come along to make, build and experiment with lots of aviation-related activities, from programming robots, building and adapting Vulcan aircraft to launching pets into flight!



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ATTENDEES

IMPACT: 1,800



We took a large vacant retail unit in the shopping centre, setting up a mini exhibiton with The Work-wise Foundation, to celebrate the Vulcan XH558.The exhibit was open every weekend for families to drop-in over a three month period. It gave visitors the opportunity to find out more about Vulcan, engineering companies and jobs in the region, and have a go at hands-on STEM activities. This included flight simulators, model making, creative building with K'nex, rocket and car building and launching, racetrack challenges, experiments with recycling, creative design and much more.



Scouts, Cubs and Beavers are regular visitors to XH558, and we continue to encourage youth groups to visit. They can explore this engineering icon and participate in a range of activities related to the principles of flight, as well as learning about the history and the engineering excellence of this iconic aircraft.

IMPACT: ()>500 scouts, cubs & beavers visited

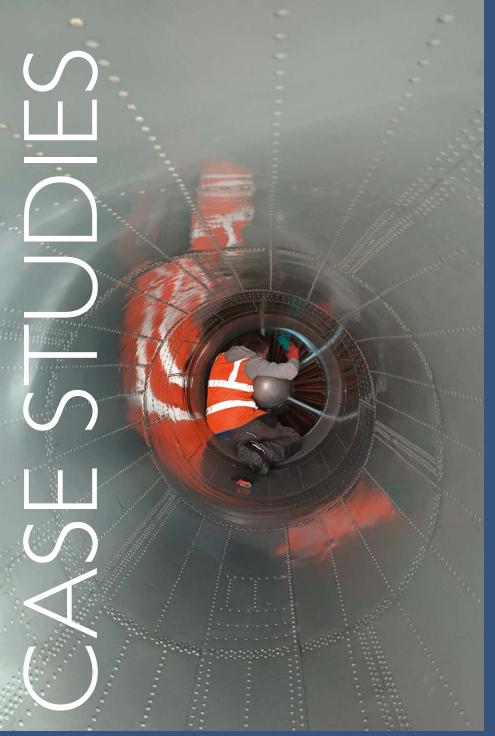
• We supported the 75th Anniversary of the **Air Cadets** baton relay from Lands End to John O'Groats, as well as holding numerous dining experiences for squadrons around the region, parade nights and passing out ceremonies. To commemorate this, a new squadron was commissioned in honour of XH558 known as the 558 Finningley Squadron ATC.

IMPACT: ()>1,000 AIR CADETS VISITED

For four years, the Air League of Monaco brought ten students over from Monaco to visit. They had the opportunity to work on the aircraft and visit other organsations in the region from the aerospace industry, including AMRC, Factory of the Future, Renault F1, Leeds University Aerospace Flight Simulators, and heritage sites including Bomber Command Memorial, RAF Scampton, South Yorkshire Air Museum and Kelham Island. This helped to spread the word about our engineering prowess and history.







Marcus (Age 13)

Marcus has volunteered with the Trust since starting secondary school. Here's what he has to say on the experience so far:

"I have really enjoyed going out to work with the Vulcan team as aircraft engineering and ground support, and this is what I'd like to do career-wise. I've followed the Vulcan all over since I was very young with my family – I used to sell gingerbread Vulcans with my sister to raise money to help to keep her flying. I'm really passionate about jets and running them. I find the academic work fine, but I love to be hands-on and to be working with the team who operate the aircraft.

- "I really enjoy preparing the jet, as you know you've done your job when they start her up running.
- "In 5 years' time I'll be doing my A Levels, or similar qualifications so that I can get a degree apprenticeship or go straight to university to do aerospace engineering. In 10 years' time, I hope that I'll be in a job, or finishing my degree apprenticeship. I'm already looking at what's out there, and planning. Hopefully I'll have my engineering licences by then. Thanks to XH558, I've been inspired to follow my dreams''.

Imogen

As one of our younger followers, Imogen has always had a love for Vulcan XH558. In primary school, she managed to persuade one of the engineers to let her sit on the steps of the Vulcan to enter a school reading competition for the most unusual place to read a book. She followed the jet during the final flying years, and living close to the airport, was able to watch the many take-offs and landings, as well as seeing Vulcan XH558 fly at airshows. She has appreciated the innovation and forward thinking behind the design and the creativity of the engineers that drove the design forward, modifying it to make it even more efficient. She is fascinated, too, by the fact that the designing was done by paper and pen, rather than by computer-aided design.

Just as in engineering creativity, innovation and forward thinking are all key attributes in games design and, sparked through her interest in Vulcan, Imogen is now heading off to study Games Computing at university.



"It has been an absolute pleasure to work in partnership with The Work-wise Foundation and Vulcan to the Sky Trust over the past year. Collectively, competitions have been created to engage, inspire and excite pupils whilst keeping the history of the Vulcan Bomber and the importance of creating future engineers at the forefront of extra-curricular and enrichment activities.

The time and dedication which goes into the planning and delivery of these competitions is limitless and pays tribute to the dedication of these companies whose main objective is to enrich the lives of children through an engineering platform. Delta Academies Trust are very fortunate to have the current competition delivered exclusively to both primary and secondary academies throughout the area and wholeheartedly welcome the opportunity.

Many thanks for all of your time and effort."

Kerry Noble Lead teacher of KS3 Engineering and Technology, Delta Academies Trust

"Working with The Work-wise Foundation, Vulcan to the Sky Trust and CBE+, our students have obtained work-related skills that we struggle to emulate in the classroom.

These are extremely relevant and important skills for life that every child needs to develop, use and recognise. The Operation Vulcan competition challenged our students' team to work together creatively, collaboratively and effectively to come up with their own design solution for a real-world design problem.

Whilst we talk of the real world in our lessons and the scope of work out there in it, it is only when our students see the reality of managing, time, funds, and resources that they truly gain the knowledge and the skills that will benefit them in their futures.

We welcome opportunities to work alongside experts in STEM fields to provide our learners with experiences they will never forget."

Donna Barker Subject Leader Technology, Newfield School



DELTA





We would like to thank our many supporters and volunteers whose help, encouragement and collaboration has been invaluable. With special thanks to:

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Maker {Futures}

Part of The University of Sheffield, Maker Futures help early years settings, schools, libraries, museums and community spaces develop their maker education provision. They offer continuing professional development resources, downloadable guides and the opportunity to book a visit from the mobile makerspace.

How you can get involved



"We hope that organisations and individuals will get behind the project and help us fulfil Dr Robert Pleming's ideas, engaging with young people across the region, and capturing the imaginations of tomorrow's engineers through the power and legacy of XH558."

John Sharman, Chairman of Vulcan to the Sky Trust

Businesses:

You can help through sharing your own and your company's knowledge, skills, expertise, resources and time, supporting existing programmes and investing in future initiatives. If you are able to help us, please get in touch.

lnvestors & Funders:

Vulcan XH558 has a tremendous legacy, but also an even more vital mission still to fulfil, helping future generations shape their own destiny and the world in which we live. This can only be achieved by securing her future and investing in the education programmes that will make this possible. If you feel you can help, please contact us.

Schools & Communities:

We are placing education, inspiration and community involvement at the heart of everything we do. If you are part of an educational establishment, community group or youth organisation and you think we can help you, please contact us.

🕈 Volunteers:

We welcome new volunteers of all ages and we particularly want to encourage young people to be inspired, get involved and learn a range of skills covering topics such as Avionics, Airframe and Propulsion.

To find out more and get involved:

Vulcan XH558: Marc Walters mwalters@vulcantothesky.org

Education Programme: John Barber john@work-wise.co.uk



VULCAN TO THE SKY TRUST

HONOURING THE PAST, INSPIRING THE FUTURE



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