

accelerate journal

Truro & Penwith College • Volume 1 • Issue 1 • 2025



PRECISION PARACHUTES & PERSEVERANCE

UKROC 2025
Cornwall's Future Engineers

IRIS & EPQS
Where curiosity becomes
discovery

ASTROPI
Coding in Orbit



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**ACCELERATE
PROGRAMME**

**TRURO & PENWITH
COLLEGE**
LOOK FURTHER • REACH FURTHER • GO FURTHER



Foreword

Each year, the Accelerate Programme brings together some of the most curious, determined, and imaginative young people in Cornwall. Together they build rockets, launch satellites, code experiments bound for orbit, and carry out research that pushes far beyond the classroom.

What unites them isn't competition; it's curiosity - the drive to ask what if? and how can we make this better? Those questions are the foundation of every breakthrough, every late-night problem solved, and every new idea tested in our labs and workshops.

As you explore this first issue of the Accelerate Journal, I invite you to look not just at the results of our students' work, but at the process - the collaboration, resilience, and creativity that made each project possible.

Cornwall is fast becoming a hub for technology and innovation, from Spaceport Cornwall and the National Drone Hub to a growing network of engineers, data scientists, and researchers. Our students are already part of that future, helping to shape it through their ideas and experiments.

The stories in these pages represent what happens when opportunity meets curiosity - and what's possible when young people are given the tools, trust, and freedom to explore.

— Alex Wyld
Accelerate Programme Coordinator
Truro & Penwith College

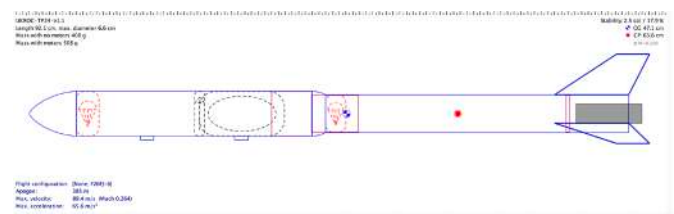
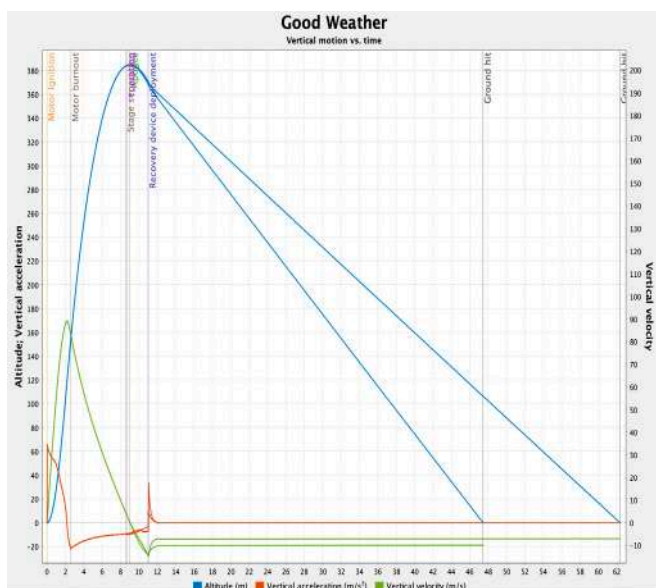
PROJECT: UKROC 2025

Reaching New Heights: Cornwall's Future Engineers

First-year Accelerate students took part in the UK Youth Rocketry Challenge, designing, building, and launching two-stage rockets capable of carrying two raw eggs to 790 ft (241 m) and returning them safely within 41–44 seconds. Competing against regional teams, they secured third place in the South West event - five successful launches and eight of ten eggs intact. The project combined aerodynamic modelling, 3D printing, and textile engineering to bring classroom physics to life.



The 2025 Accelerate UKROC team: Seth, Jack, Tom, Lucas & Kaden

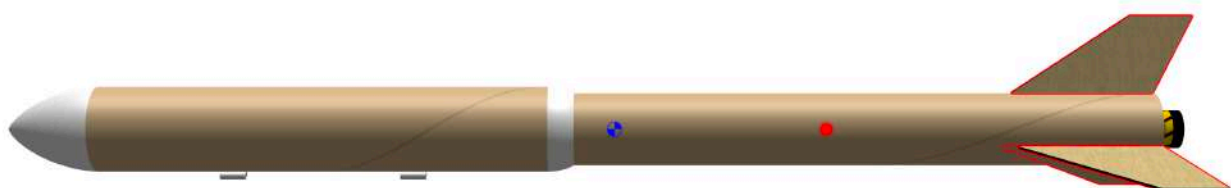


Method & Design

Using OpenRocket software, students modelled their two-stage designs to optimise thrust, drag and stability. 3D-printed nose cones and stage couplers, fibreglass-reinforced plywood fins, and dual-diameter cardboard fuselages provided a lightweight but robust structure. The custom parachutes - sewn from Heathcoat Fabrics material used in NASA's Mars 2020 mission - added a genuine industry link.

UKROC-TP24-v1.1
Length 92.1 cm, max. diameter 6.6 cm
Mass with no motors 408 g
Mass with motors 508 g

Stability: 2.5 cal / 17.9 %
CG: 47.1 cm
CP: 63.6 cm
at M=0.300



Flight configuration: [None; F26J-6]
Apogee: 385 m
Max. velocity: 89.4 m/s (Mach 0.264)
Max. acceleration: 65.6 m/s²

Results & Impact

Five successful flights, eight unbroken eggs, and a third-place finish. Students analysed discrepancies between simulated and actual altitudes to refine future designs. Skills developed included CAD, data analysis, project management and team leadership.



“My favourite part was working in a team and developing my communication skills.”
— Tom, Student Engineer

“This project teaches real engineering and problem-solving skills that help you stand out for university applications.”
— Seth, Team Leader

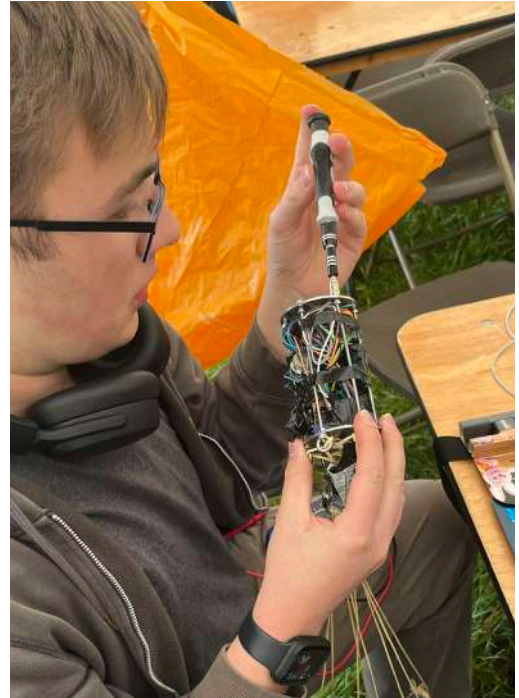


PROJECT: CANSAT 2025

Miniature Satellites, Big Data

Accelerate students took part in the 2025 UK CanSat competition - a challenge to design, build, and launch a satellite the size of a drinks can. Their mission: to collect live atmospheric data during descent and transmit it to a ground station for analysis. The team's CanSat not only recorded temperature, pressure, and altitude, but also carried out a secondary environmental study, measuring methane and carbon monoxide concentrations to investigate local air quality.

The CanSat's circuit was designed by the students, choosing each component on their suitability for the mission. The parachute - made from ripstop nylon - was optimised for a steady descent rate of around 6–7 m/s. A dedicated ground station captured live telemetry throughout the flight, allowing students to compare the data with their predicted models once recovered.



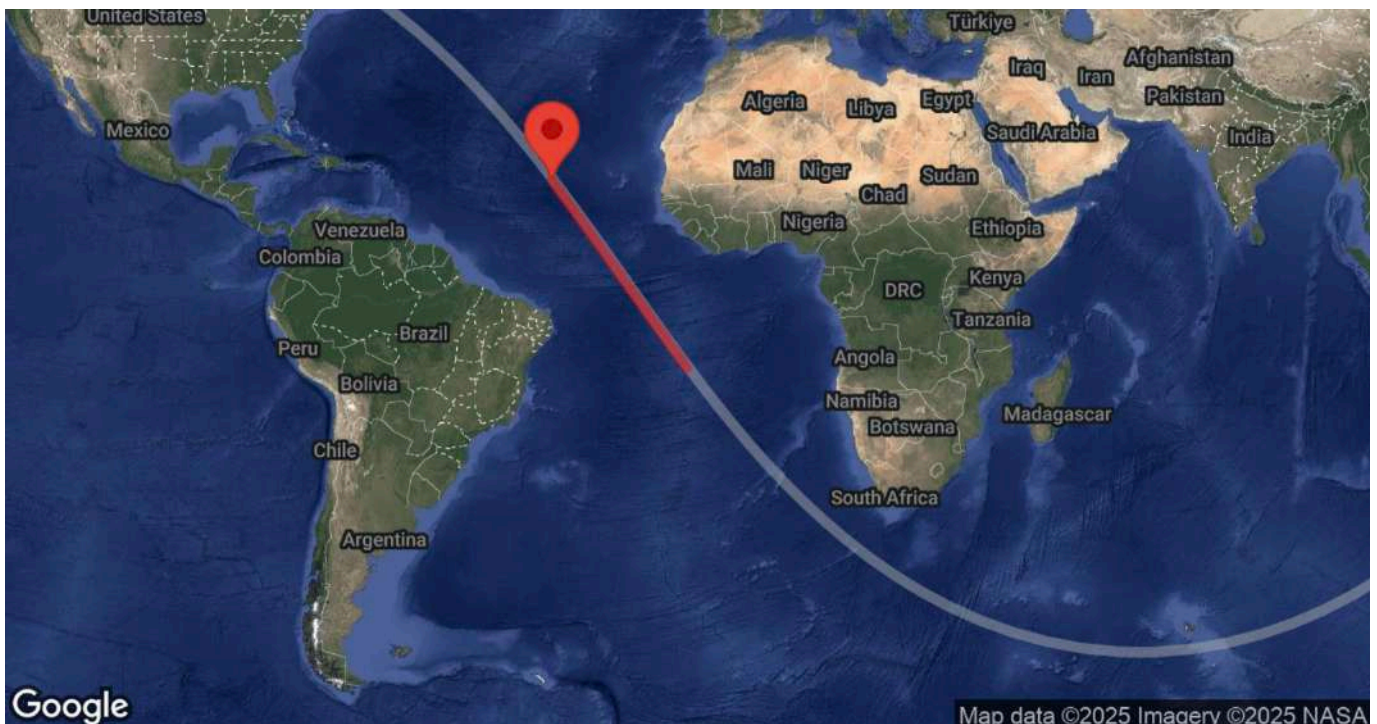
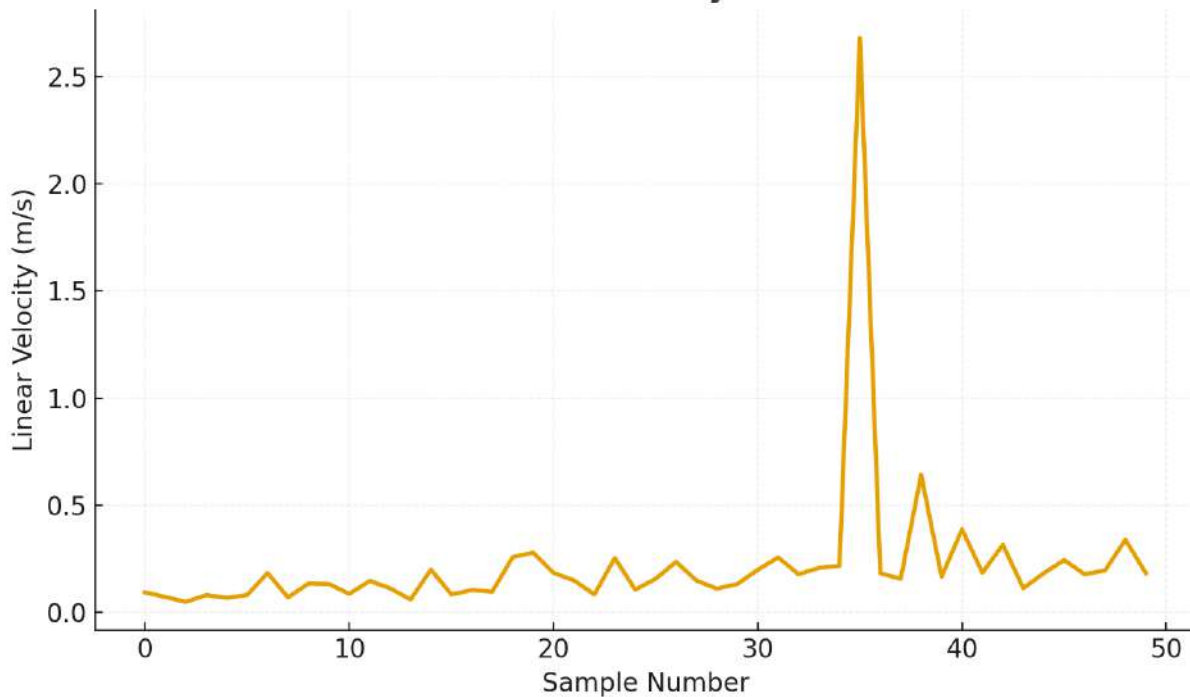
PROJECT: ASTROPI 2025

Coding In Orbit

As part of the European Space Agency's Astro Pi Mission Space Lab, Accelerate students coded an experiment that ran aboard the International Space Station.

Using the Raspberry Pi computers installed on the ISS, the team developed a program to calculate the speed of the space station using the onboard sensor suite of the ISS. Their code impressed the judges and their program was chosen to run on the spacestation on the 21st April 2025.

Measured Linear Velocity Aboard the ISS



Is there naturally occurring hydrogen gas in Cornwall?

Truro College

Erin Bryant, Miles Townsend, Aziz Uslu, Stepper Bloomfield, Maisie Tutt, Henry Cooper, Dellen Oakley, Eva Blackford, Lucy Watson, Caisie Mullen, Freya Smith, Megan Hindson and Tom Jago.

Summary

In our ongoing research we aim to find if there is naturally occurring hydrogen being produced in the granite and serpentine in Cornwall through the processes of radiolysis and serpentinisation respectively. So far, we have collected 10 gas samples at sites of interest around Cornwall, we have had them analysed at the Royal Holloway University of London's (RHUL) climate science laboratory. From our data we have evidence that the St Austell granite could be a promising site for the production of natural hydrogen, and we are hoping to prove this by collecting and analysing more gas samples at this site as well as expanding our research area in the future.

Introduction

The need to go green to protect our environment is evident. Hydrogen gas will be part of the solution but producing it requires a huge amount of energy. It does occur naturally in rocks and if we can find it in large enough quantities, it could be part of the sustainable solution. Cornwall may be the answer as its granite and serpentine may be producing hydrogen. 80% of the world's natural hydrogen is produced by serpentinisation, and a lot of the rest by radiolysis in granite where water molecules are split during radioactive decay. In this study we aimed to identify whether naturally occurring hydrogen exists in Cornwall by collecting samples around the county and having them analysed at RHUL's climate science laboratory.

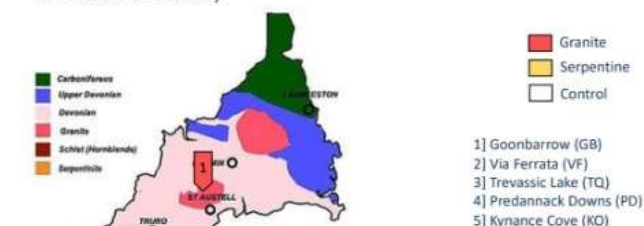
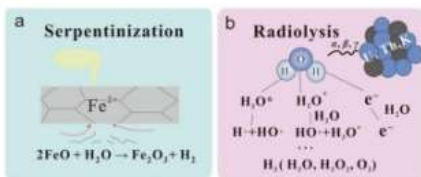


Figure 1: A geological map of Cornwall illustrating the locations of our chosen sampling sites and the target rocks.

Figure 2: a) Diagram to show how hydrogen is produced by serpentinisation. b) Diagram to show how hydrogen is produced by radiolysis.



Method

We chose four sites based on lithology (presence of granite and serpentine), and a lack of pollution sources (town/road proximity and wind direction). A fifth control site – a westerly-facing cliff with onshore, prevailing wind – was chosen to record background levels of hydrogen. We sampled each site and repeated the sampling on a second day. We collected an air sample at each site using a gas pump and canister, ensuring we were not sampling over soil. We used an environment meter to record air pressure, temperature, wind speed and direction, location coordinates, and any notable features. Samples were sent to RHUL for laboratory analysis, testing for H_2 , CO , CO_2 , and CH_4 .



Figure 3: The pump and gas canister used for taking samples.



Figure 4: Control sample at Kynance Cove.

Results

As shown in Figure 5, on day 1 we found high background concentrations of hydrogen at VF2 over the Cammenellis granite compared to our control, as well as high hydrogen at GB1 over the St Austell granite. Surprisingly, the hydrogen was low at PD4 and TQ3 which are both over the serpentine, where we expected to find the highest concentrations of hydrogen (given that 80% of the world's naturally occurring hydrogen comes from serpentinization). On day 2, GB1 and VF2 showed much lower hydrogen concentrations compared to day 1, and PD4 showed high hydrogen and carbon monoxide concentrations.

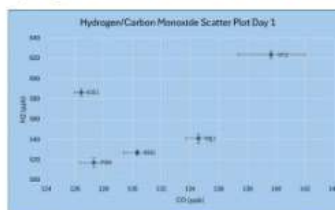


Figure 5: A scatter plot of hydrogen against carbon monoxide for day 1 of sampling (includes uncertainties in the data).

Sample ID	Date	Location	Latitude	Longitude	Altitude (m)	Pressure (hPa)	Temperature (°C)	Humidity (%)	Wind Speed (m/s)	Wind Direction	H ₂ (ppb)	CO (ppb)
GB1	13/10/25	Goonbarrow	50°22' N	10°45' W	9.3	1015.5	8.8	68.1	195	062.4		
VF2	13/10/25	Via Ferrata	50°20' N	10°45' W	9.5	1015.5	9.8	56.8	165	063.4		
TQ3	13/10/25	Trevassic Lake	50°20' N	10°45' W	7.8	1015.5	8.8	51.1	85	094.5		
PD4	13/10/25	Predannack Downs	50°17' N	10°45' W	12	1015.5	8.8	54.7	75	085.0		
KO5	13/10/25	Kynance Cove	50°12' N	10°45' W	115	1015.5	7.7	56.8	50	087.0		

Figure 6: Environment recordings day 1.

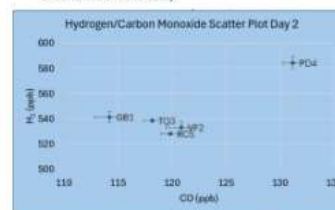


Figure 7: A scatter plot of hydrogen against carbon monoxide for day 2 of sampling (includes uncertainties in the data).

Sample ID	Date	Location	Latitude	Longitude	Altitude (m)	Pressure (hPa)	Temperature (°C)	Humidity (%)	Wind Speed (m/s)	Wind Direction	H ₂ (ppb)	CO (ppb)
GB1	26/10/25	Goonbarrow	50°22' N	10°45' W	9.3	1015.5	14.9	60.0	193	1803.0		
VF2	26/10/25	Via Ferrata	50°20' N	10°45' W	9.5	1015.5	14.5	65.8	85	1005.9		
TQ3	26/10/25	Trevassic Lake	50°20' N	10°45' W	7.8	1015.5	15.6	64.5	85	1016.8		
PD4	26/10/25	Predannack Downs	50°17' N	10°45' W	12	1015.5	13.8	67.2	75	1018.3		
KO5	26/10/25	Kynance Cove	50°12' N	10°45' W	115	1015.5	12.6	73.6	50	1001.1		

Figure 6: Environment recordings day 2.

Analysis and conclusions

The St Austell granite is the most promising site with elevated hydrogen and lower carbon monoxide on day 1. Low CO is important because it indicates that the hydrogen is not coming from a pollution source, (hydrogen is produced in combustion), and therefore the hydrogen is likely to be coming from the granite. This indicates that it would be worth continuing with this research and completing more samples to gain representative data. This shows that hydrogen is being produced by radiolysis in the granite, possibly at Goonbarrow, due to the elevated amount of radioactive material that has been discovered there in the past. Although the hydrogen levels were found to be low over the serpentine at TQ3 and PD4, this could indicate that the hydrogen being produced is trapped, which could indicate a very exciting development and is something we are going to pursue. The results from day 2 were very different from day 1, perhaps due to higher air pressure, preventing the gas migrating to the surface. Although PD4 had much higher concentrations of hydrogen on day 2, we believe that this was also due to a nearby combustion source because of the increased levels of carbon monoxide.

The future: we aim to take more samples at all sites, to expand our area to include more sites, and engage RHUL in a program of mobile air sampling. We hope that this will identify any trends in hydrogen levels and ultimately prove that Cornwall could be part of the natural hydrogen revolution.

Acknowledgments

We would like to thank the following for their help and support: The Royal Society, RHUL, Professor David Waltham, Dr Rebecca Fisher, Isaac Standen and Mandy Winstanley.

References
www.wikiwand.com/en/articles/Geology_of_Cornwall (Figure 1)
www.sciencedirect.com/science/article/pii/S1364032123007463
www.lyellcollection.org/doi/full/10.1144/geoenergy2024-002
www.mdpi.com/1996-1073/16/5/2400 (Figure 2)

Original Research

To what extent may humans be considered an endangered species

Truro College

Lucie Penrose

Summary (or abstract)

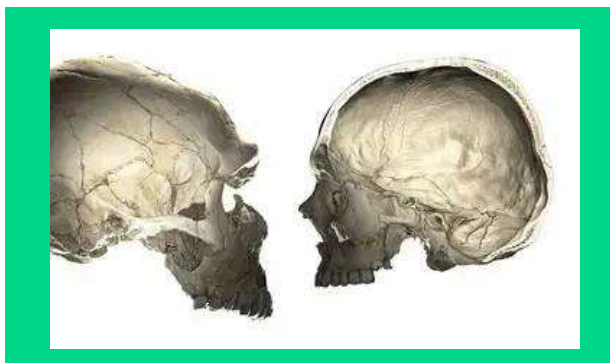
My aims and objectives:

- Explore the environmental stress created by humans
- Investigate changes in fertility and birthrates
- Consider how social factors are changing population
- Investigate similar species to humans and the trajectories they followed
- Consider how diseases have potential to put our population at risk.

Every day, the earth becomes hotter, and our planet becomes less hospitable for species to thrive. It is surely only inevitable that the human race will become extinct. To investigate factors of species endangerment factors that can be evaluated are increasing temperatures and extreme weather conditions or patterns, decreasing land availability either from land loss due to water levels rising or increasing population creating a land deficit, and increasing spreads of diseases.

Introduction

When investigating whether human could be classed as an endangered species I was surprised by the lack of research; scientists constantly investigate climate change, population growth and diseases however very few people had brought the subject to an idea of fatality. I was fascinated by my topic as with constant changes to our planet due to climate change so many species have become endangered or extinct and many humans appear to have a laissez fair attitude. I believe this is because it has not occurred to people that our species could be next. Constant conversation of the environment fail to stress that Earth will survive without humans, we will not survive without Earth. Due to what can only be described as pure arrogance, humans have begun to view themselves as indestructible and idea of extinction is far from people's minds. This really made me consider the longevity of the human species and led me to explore the trajectories of other similar species in order to evaluate the homo sapiens.



Neanderthal skulls and human skulls

Method

I undertook my project as my EPQ, I used secondary research reading a range of sources from historical and archaeological accounts to scientific papers and studies. I collected my data and compiled a 5000-word dissertation on my subject evaluating and interpreting whether or not humans may be classed as an endangered species. I used the google scholar search engine and college libraries to collate data and information. My research ranged in subject as parts of my subject become philosophical, archaeological and biological, with the greatest focus on biological.

Results

An endangered species is a species with a rapidly decreasing population or loss of habitat. Currently, the human population overall is not decreasing however there are some countries with decreasing birth rates such as South Korea and China. Whilst all countries don't reflect this decrease, internationally there is a growing increase in infertility with one in six couples in the UK being diagnosed with infertility.

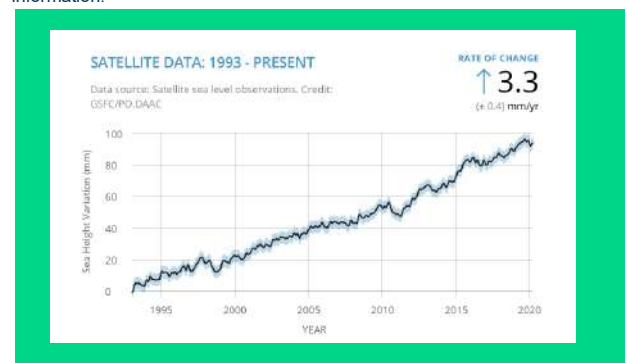
Arguably, there are two main causes for a loss of habitat: climate change and overpopulation. World Health Organisation data (2023) estimates 3.6 billion people live in areas susceptible to climate change, that's a potential 3.6 billion people displaced from their homes, countries, cultures and lives. That is almost half our current population. Many people aren't reacting to climate change as the issue is passed as irrelevant or ineffective to their lives. The reality is climate change is already having a colossal impact and is set to cause even further damage.

National geographic (2024) shares predictions of 95% of Tuvula's land will be below sea level by 2100. 12000 people will be displaced from their homes, their history and their heritage, their way of life isn't just endangered anymore it is dying before their eyes.

Active sustainability estimates that if global temperatures increase by 1.5 degrees Celsius then average of water levels will rise by 40cm moreover, an increase of 2 degrees Celsius will cause an average water level rise of 46cm. These levels may seem insignificant however it will increase coastal erosion, create more flood plains and force international migration of animals and humans a like. Consequently, more people will live in higher risk areas increasing risks of fatalities and climate refugees. This strains governments and builds a financial burden which ultimately can not be afforded.

Analysis and conclusions

At the present stage of population and habitat, I have concluded humans are not an endangered species as a whole however there are certainly specific countries and regions with high land loss and climate threats and rapidly decreasing birthrates and fertility rates that qualify as endangered. As a whole the human race is on the verge of becoming an endangered species and once the limit is pushed, chances of revival are limited. In my research, I found challenges in gaining access to papers and finding the key details I needed, often getting overwhelmed by large chunks of information.



NASA Graph showing rising waters due to climate change globally

Acknowledgments

Thank you to my lecturers Shannon Schofield and Euan Beatie for giving me guidance throughout my EPQ and IRIS Research.

References

- World Health Organisation (12th October 2023) Climate Change. Available at: [Climate change](#) (Accessed 24th February 2025)
- Stoloff, S, National Geographic (8th July 2024) This Pacific island country is disappearing. What happens next? Available at: [Tuvalu is slowly disappearing. What happens when its land is gone?](#) (Accessed 24th February 2025)
- NASA (1993-2020) [Rising Waters: How NASA is Monitoring Sea Level Rise - NASA Science](#)

Big Data: ATLAS

Identifying the presence of the Higgs boson through the $H \rightarrow WW$ decay channel

Truro College

Summary

This research project has attempted to gather sufficient evidence to confirm the existence of the Higgs boson utilising the data provided by CERN. As the Higgs boson has a lifespan of 10^{-23} seconds^[1], which is far too short to be detected in the LHC, we must instead prove its existence via its decay products; in this case by observing the two $W^\pm$ bosons produced in the $H \rightarrow WW$ decay path depicted below (Figure 1).

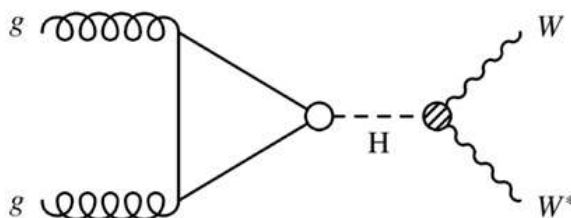


Figure 1: Feynman Diagram from CERN (2022), showing the decay of the Higgs boson into two W bosons.^[2]

Introduction

The Higgs boson was first theorised by Peter Higgs at the University of Edinburgh in the 1960s and only recently proven in 2012. Until its discovery, the Higgs boson was one of the only particles of the Standard Model of particle physics that had not been observed. The Standard Model is currently considered the closest thing to a "Grand Unified Theory" available to physicists, as it describes three of the four fundamental forces: the strong and weak nuclear forces, as well as the electromagnetic force. While the Standard Model is not able to adequately explain gravity, it was able to predict the existence of the Higgs field and its respective boson, the Higgs boson.

The Higgs field is a fundamental field, much like the electromagnetic and gravitational fields, that is said to be responsible for the mechanism that gives particles mass (aptly named the Higgs mechanism). Every field within the standard model has its own boson. Discovery of the Higgs boson proved the existence of the Higgs field, validating a key prediction of the Standard model.

Method

The Higgs boson can decay into two $W^\pm$ bosons as shown in (Figure 1). However, this decay channel is not the only source of $W^\pm$ bosons within the ATLAS detector.

Two quarks can scatter into a pair of $W^\pm$ bosons^[3] (Figure 2). Alongside this top quarks very frequently decay into $W^\pm$ bosons^[4] (Figure 3). We will have to eliminate these background sources to isolate the decay signal of the Higgs boson.

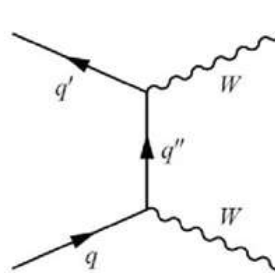


Figure 2: Feynman Diagram from CERN (2022) showing the scattering of two quarks into two $W^\pm$ bosons^[3]

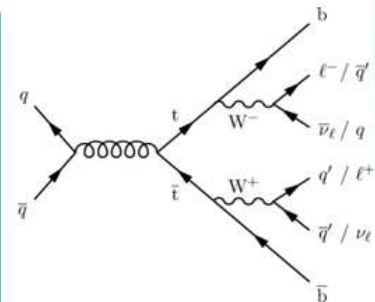


Figure 3: Feynman diagram from CERN (2024) showing the decay of a top quark into a $W^\pm$ boson and bottom quark^[5]

Method, continued

Because two $W^\pm$ bosons have a greater mass ($\sim 2 \times 80 \text{ GeV}$ ^[7]) than the Higgs boson ($\sim 125 \text{ GeV}$ ^[8]), a conventional resonant "bump-hunt" cannot be used to find the Higgs signal, like the original plot proving the existence of the Higgs (see Figure 6), as invariant mass is not conserved in this decay path. Instead, a non-resonant search must be employed where we compare some measured variable of the decay products (in this case transverse mass) to the expected results to the collected results to see the differences. In this case the $W^\pm$ bosons that are detected from the real data are compared to the expected background extracted from 'Monte-Carlo' simulated data.

The presence of pairs of $W^\pm$ bosons within the real data taken from the Atlas Open Data repository was searched for by searching for its decay products, as the $W^\pm$ boson also has far too short of a half-life to be detected on its own. To identify pairs of $W^\pm$ bosons we must search for two oppositely charged leptons with sufficient energy alongside enough missing energy from the non-interacting neutrinos that the decay also results in. Monte-Carlo simulations of particle physics without any interactions that produce the Higgs boson were checked for valid pairs of $W^\pm$ bosons as well. The Monte-Carlo simulated data was then reweighted to account for the greater amount of simulated data available comparative to the real data. After this, valid simulated events were subtracted from the real data, removing a large majority of the background sources of $W^\pm$ bosons.

References, continued

6. Falco Beirer, J. and Beirer, J. (n.d.). *International Workshop on Advanced Computing and Analysis Techniques in Physics Research Towards a simplified Motivation: Fast Simulation*. [online] Available at: <https://cds.cern.ch/record/2892452/files/ATL-SOFT-SLIDE-2024-040.pdf> [Accessed 13 May 2025].
7. Torrence, E., 2001. *W boson properties*. arXiv preprint hep-ex/0110003.
8. Chatrchyan, S., Khachatryan, V., Sirunyan, A.M., Tumasyan, A., Adam, W., Bergauer, T., Dragicevic, M., Erö, J., Fabjan, C., Friedl, M. and Fruehwirth, and properties in the WW decay channel with leptonic final states. *Journal of High Energy Physics*, 2014(1), pp.1-86.

Once the background has been subtracted, any remaining positive quantity of events can be said to have a high likelihood of being the result of the decay of a Higgs boson into two $W^\pm$ bosons.

Results

After analysing over 200,000 real events and 1,300,000 Monte-Carlo simulated background events and reweighting the backgrounds in relation to the real events, the following histogram was produced (Figure 4). Blue represents the measured $W^\pm$ boson pairs; orange represents the expected $W^\pm$ boson pairs background from the scattering of quarks and green represents the $W^\pm$ boson background from top quark decay.

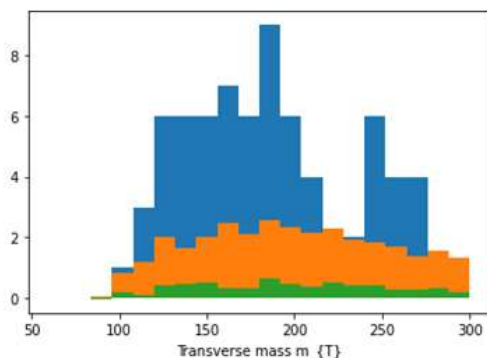


Figure 4: Plot showing the Monte Carlo simulated events on top of the signal extracted from the events analysed.

Subtracting the background gives us a clearer image of the additional events (Figure 5).

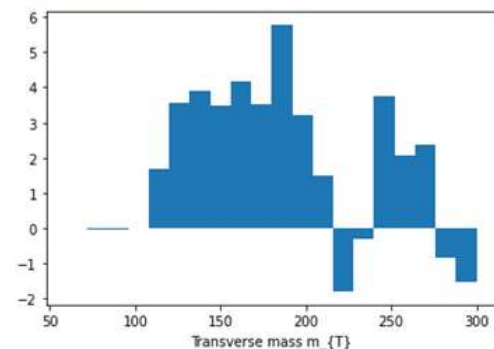


Figure 5: Result showing the subtracted histogram, the isolated Higgs signal

The resulting graph clearly shows a large number of events outside of the predicted background. It is highly likely that almost all of these events are the result of the decay of the Higgs boson.

Conclusion

While this is extremely strong evidence for the existence of the Higgs boson, the negative sections in the 210-230 and 280-300 regions show a disparity between the predicted and the actual results. This may suggest that there is some level of inaccuracy in our Monte-Carlo simulated data or not enough events were analysed to account for the "noise" in our data. Despite this possible inaccuracy, our surplus of events is so large that this graph is still sufficient evidence to strongly support the existence of the Higgs boson.

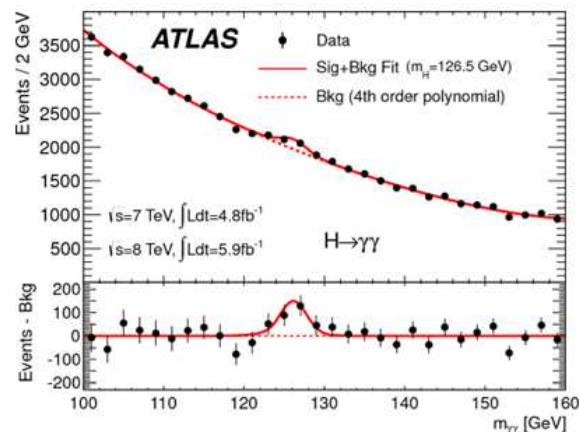


Figure 6 Plot from CERN (2012) showcasing a bump at 125 GeV (The previously theorised mass of the Higgs boson).

Acknowledgments

Thank you to my lecturers: Alexander Wyld, Alice Peretti and Lee Raby for their help with understanding statistical methods and underlying physics used to complete my research.

References

1. ATLAS. (2025). ATLAS chases long-lived particles with the Higgs boson. [online] Available at: <https://atlas.cern/Updates/Briefing/Higgs-LLP-Displaced-Vertices> [Accessed 13 May 2025]. Torrence, E., 2001. *W boson properties*. arXiv preprint hep-ex/0110003.
2. CERN.ch. (2018). Available at: https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HIGG-2016-07/fig_01a.png [Accessed 13 May 2025].
3. ATLAS. (2025). ATLAS probes the Higgs mechanism in the scattering of W boson. [online] Available at: <https://atlas.cern/Updates/Briefing/VBS-Polarisation> [Accessed 13 May 2025].
4. Lannon, K., Margaloi, F. & Neu, C. Measurements of the production, decay and properties of the top quark: a review. *Eur. Phys. J. C* 72, 2120 (2012). <https://doi.org/10.1140/epjc/s10052-012-2120-0>
5. CERN. (2022). [online] Available at: <https://cds.cern.ch/record/1484203/plots> [Accessed 13 May 2025].

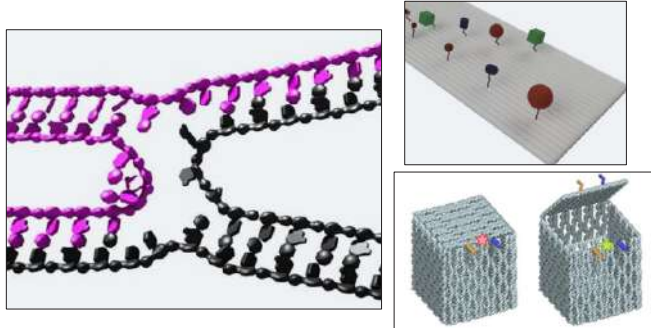
What is the optimal length of oligonucleotide strand for the stability of a DNA nanostructure?

Summary

The DNA strands in DNA nanostructures are held together by oligonucleotide staples between consecutive strands of DNA. The length and number of strands these staples cross can be changed and configured to be longer or shorter and cross more or less strands. The aim of the project is to find out what configuration of staple length gives the most stable structure, if these ideal strengths cause weakness in other areas, and also if varying the lengths of the edge staples on the same design has any effect.

Introduction

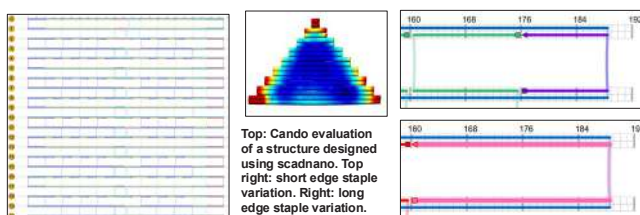
DNA origami is the creating of nanostructures using a long single strand of DNA, which is folded to form a 2d or 3d shape. This shape is held together by short complementary oligonucleotide strands called staples between different part of the scaffold. These bond to the single strand of DNA via complementary base pairing to create a double helix structure, staples can stretch over many strands of DNA and lock each helix to the next, preventing the movement of the helices and allowing the creation of nanostructures. These structures have many possible uses, such as to act as artificial breadboards that can attach to the cell membrane via cholesterol bound to staples¹ or to form drug boxes with chemical keys the only open the box when close to a affected cell. However, these shapes need to be held together by staples, and these staple connections need to be strong enough for the structures shape to be preserved at body temperature so the structures can function in the body. The project focuses on the ideal length of these staples to give maximum stability to the design.



Left: Junction between strands of DNA². Top Right: DNA origami breadboard with molecules attached². Bottom Right: DNA origami drug box with 'keys' that can open and close in the presence of a cell or molecule².

Method

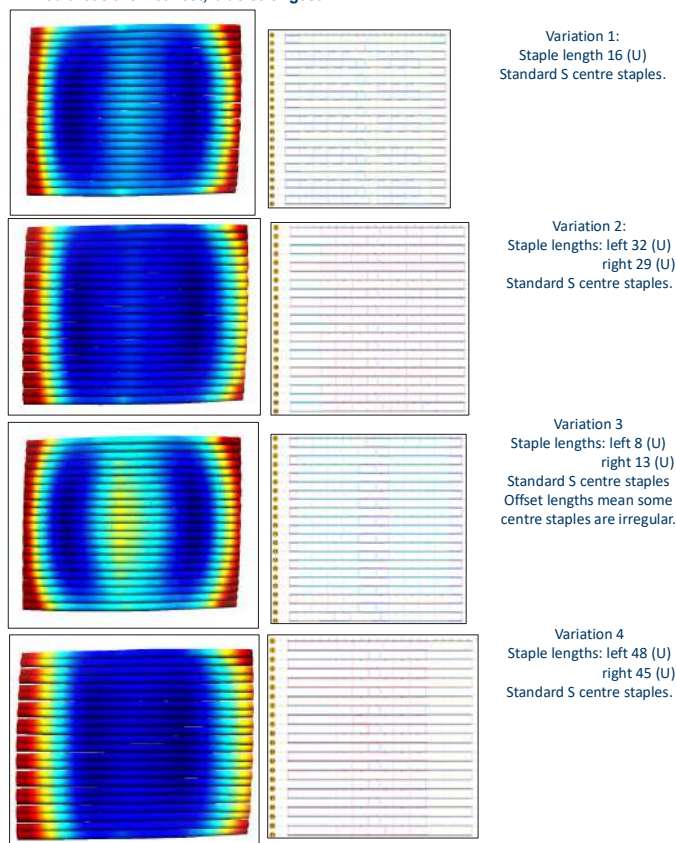
Using the CAD software Scadnano a simple rectangle 22 strands long by 181 offsets (bases) wide was created using the p7249 DNA sequence taken from a virus. In the central regions of the shape simple S shaped staples (8-16-8) were used as much as the shape would allow to try and keep the core stability of the structure constant. The ends of the scaffold are connected by C shaped staples that between each variation the length of which was changed from 8 up to 29 bases. These shapes were then analysed using Cando software which visualised the stability of the structure into regions of strength (blue) and areas of weakness (red).



Standard shape used to compare the effects of changing lengths of end staples.

Results

Here are the results of the 4 variations with 7 different edge staple lengths. Red areas are weakest, blue strongest.



Analysis and conclusions

The results found that the best staple length for overall uniform stability was the 16 offset staples found in Variation 1, these gave well balanced edge strength with good core stability as the symmetry of the design allowed uniform core staples with slight areas of weakness at the edges. The best if strength is desired only on one end, such as to attach other molecules, is to have the edge staples on the side strength is desired to be in the 29-45 offset range and the other side larger staples in the 32-48 offset range.

More accurate results could be obtained by experimenting with different shapes of staple and scaffold, and repeating variations 2 and 4 to completely rule out the chance of the core staples affecting the strength of the edge instead of the length of the edge staples themselves.

Acknowledgments

Many thanks to Neil Garrido for the computer analysis of my designs and helping me with the software, also to Shannon Schofield who reviewed my work and helped set up the project.

References

1. Mollica, M. Y. (2016). *DNA Origami Breadboard: A Platform for Cell Activation and Cell Membrane Functionalization* [Master's thesis, Ohio State University]. OhioLINK Electronic Theses and Dissertations Center. [WWW] http://rave.ohiolink.edu/etdc/view?acc_num=osu1461163132
2. IRIS. DNA Origami Introduction & project overview [WWW] https://resourcecentre.researchinschools.org/?projects=dna-origami&doing_wp_cron=1747232396.2685070037841796875000 (accessed 14/05/2025)

CERN TRIP 2025

In July 2025, Accelerate students travelled to Geneva, Switzerland, to visit CERN, the European Organisation for Nuclear Research — home to the world's largest and most complex scientific instruments. The trip offered a rare insight into the scale, collaboration, and ingenuity behind cutting-edge particle physics, bridging classroom theory with the frontiers of discovery.



Students were given an in-depth guided tour of the CERN site, including rare access to two of its most fascinating facilities. At the Antimatter Factory, they learned how researchers create and trap antiparticles for experiments exploring fundamental symmetries in nature. Seeing the delicate magnetic containment systems in action — designed to hold antiprotons that would otherwise annihilate on contact with matter - brought theoretical physics vividly to life.



The Future of Accelerate

Building on Momentum

As the Accelerate Programme grows, so too does its ambition.

The next chapter will see new projects, stronger collaborations, and an even greater focus on giving Cornish students access to meaningful STEM opportunities.

From rockets to research, satellites to sensors, Accelerate continues to show what young scientists can achieve when curiosity meets opportunity.

In 2025–26, Accelerate will establish a dedicated hub space on campus - a collaborative environment equipped with 3D printers, electronics benches, CAD workstations, and a lab-grade microscope.

This new space will allow students to design, test, and refine their ideas under one roof, supporting hands-on learning across maths, physics, engineering, computing, biology, chemistry and environmental science.

The programme will continue to broaden the range of national projects available, including:

- F1 in Schools – exploring aerodynamics, teamwork, and design innovation.
- Junior Water Prize – applying science to real-world sustainability challenges.

Each initiative builds on Accelerate’s founding principle: learning by doing - using real-world problems to develop both scientific understanding and confidence.

“Our goal is to make Cornwall known not just for its coastlines, but for its contribution to science and innovation,” says Alex Wyld, Programme Coordinator.

“Accelerate students already have the curiosity - we’re just giving them the space and support to grow.”

