“My School is an Island”

By 2017 Katharine Lady Berkeley’s School A Team:

Ellis, Geoffrey, Jake, Luke and Oscar
Acknowledgements

First and foremost, we would very much like to thank Sebastien B for showing us particular techniques which gave us the means to go about creating our model, as well as producing the stunning artist’s interpretation of the school design.

We are also inclined to thank Mr. & Mrs. H for allowing us to use their garage, workspaces, tools and eat everything in their house.

Penultimately, we are grateful to our teacher for arranging this opportunity to experience advanced engineering, and supporting us during afterschool sessions.

Finally, we would like to thank our mentor, Ms Powell, for all her dedicated support and advice, alongside assisting us in settling decisions and offering options and indicating issues we hadn’t spotted. Also, we would like to thank her for showing us around her workplace.

Drawn and Painted by Sebastien B
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PART 1

Introduction

About us
Team Introduction

Ellis is the overall team leader; however, we make most our decisions through voting, but Ellis also made sure we were all towing our part of the line and assisted us in most topics.

Geoffrey is head of construction and editing, we built the model in his garage and he made sure that everything went to plan with the construction of our model.

Jake is in charge of organisation; making sure that everyone attends meetings and gets stuff done in time. He also made and designed all our spreadsheets which allowed us to get everything done by the deadlines.

Luke is the financial director; he keeps totals of how much the school would cost to build in real life.

Oscar is in charge of design and energy; as his dad is a professional artist he was able to get us many realistic drawings of our school.

Our team is supported by Ms Powell, our mentor who works at ARC Energy Resources.

Our teacher also gave us lots of support.
Ms Powell, our mentor works for a company called ARC Energy Resources. ARC Energy Resources specialises in corrosion resistant weld overlay cladding and specialist fabrications. This basically is special types of metal that do not corrode easily over long periods of time. As the company name suggests, these materials are made into pipes to go under the sea which transport oil and gas from rigs at sea back to the mainland. They also produce special materials that can be used in nuclear power stations.

On Thursday the 27th of April, we visited Ms Powell at ARC Energy Resources to have a better understanding of what it is like to be an engineer. We spent the entire afternoon at Arc Energy Resources.

Other companies give ARC Energy Resources the pieces of metal that they wish to reinforce. Then it is Ms Powell’s job to produce the designs and details for the welder who will add the special welding to the products.

Ms Powell showed us around the factories where they weld. As they use actual welding arcs which produce bright lights, we weren’t allowed to watch anybody welding. However, Ms Powell took us into one of the welding chambers which wasn’t being used at the time. She showed us how the complicated welding machine worked and also a special machine which checks the quality of the welding.
Why We Chose This Project

We chose the project ‘My school is an island’ as a group decision out of the three projects provided to us for many reasons.

The first reason is that we thought that this will be the project that will be the most real and we can relate it to everyday situations. For example, bills for the school can relate to bills for houses and it can teach us about how we plan our finances for when we are older. We thought it would be fun to find out in real life how it is to run a school and we would be placed in a real-life work situation, especially if we are considering education as a career.

Another reason for choosing this project among others is that we thought that this project would bring up a lot of problems and puzzles that we would have to overcome together. As we all like problem solving we thought it would be fun to discover how these problems we faced are solved. School is quite personal to all of us and we are all related to it as we all go to school. This ensures that we will enjoy it much more.

We knew that if we were building a school on an island we could place it nearly anywhere on a map with little boundaries for our imaginations.

Finally, we are starting from scratch and we could imagine almost any design for a school and develop it. We also have multiple choices for each problem we face.

Overall, we thought it was a good idea to choose this project because it is fun to be placed in a real life situation, we have a budget to follow and we have free choice.
Our School

We created a questionnaire all about our school and we gave it to reception to be filled out by the reception staff and the site team. We were also able to find out lots of other information from the website. Here are our results:

- Students: 1502
- Staff members: 204
- School ground area: 11000m²
- Classrooms: 80

Bills...

- Gas per year: £26000
- Food supplies per year: £120000
- Funded through: Education support grant, national funding formula.

Food Information...

- Two companies deliver twice a week.
- Delivered four times each week.
- Incidentals get delivered fortnightly.
- All food gets delivered by truck.
Transport Information:

- 500 students walk,
- 700 catch a bus,
- 200 get a lift,
- None cycle,
- 100 drive.

Waste and rubbish Information:

- Rubbish is put into separate bins at the school.
- General waste is collected often – this includes food waste.
- Dry recycling is collected often – this includes paper, cardboard, plastic and tins.
- Hazardous waste is collected by a specialist contractor.

Medical Precautions:

- Parents notify the school,
- All teachers know first aid and know student’s medical conditions,
- Several fully trained first aiders in school,
- Canteen staff is aware of medical conditions as well.
Part 2

Problems we Faced

AND HOW WE SOLVED THEM!
School Design

Our secondary school “KLBS” is based upon our current school in relation to the size, number of pupils and facilities. We have chosen a unique design which makes use of the natural resources in the area.

Firstly, our school is designed under a hill which has many benefits including the fact that it will keep in heat in winter and keep the building cool in summer due to the thick turf ‘walls’. We have designed two sports pitches in the centre of the school as that is convenient and makes use of the islands shape. The sports pitches will obviously be rectangular but a circular shape allows us to have lots of viewing area around the edge. We chose to put the sports pitches in the middle of the school so that they are a little bit sheltered from powerful winds. All the same, our school is equipped for all types of extreme weather such as storms, heat waves and snow. We have made use of the lovely grass area covering the building as it can be used as an area for children to play.

Many people have asked us “will there be enough natural light?” and the answer is yes! Due to there being an opening in the centre of the school surrounded by glass lots of natural light floods the inside classrooms of the building. We also have lots of window in the hillside around the edge of the school. If you have seen our artist’s interpretation of the school you will see that at the entrance there is another giant glass façade that lets light flood in, and don’t forget that we will also have artificial lighting all around the school.
Our school is equipped with the same facilities as our current school but we have decided to make use of the waves and sea to promote water-sports at our school such as sailing, surfing, sea kayaking, and power boating. Our school also has around 80 classrooms, enough for all the 1500 (approximately) students. The classrooms will be quite standard, much like our classrooms. From our model and our artist’s interpretation, you can see the helipad on the side of the island. This is important if students need to quickly be transported to hospital.
Transport

One of the first dilemmas we faced when creating our island was transport, as we had to decide on the most cost-effective, efficient and reliable mode of transport. In the end, we narrowed it down to the options of bridge and ship. We decided against ship as the Lagoon Venicia was too shallow to allow this, with an average depth of 5m (and max depth of 20m, meaning there must be lots of reasonably shallow areas or some very shallow areas). However, we were also considering the fact that bridges had extremely high maintenance costs and initial building finance requirements as well as the fact that many citizens would complain (it wouldn’t be very aesthetically pleasing), and on top of this, both modes would have to be delayed or stopped on stormy days.

Nonetheless we managed to find a suitable option, thanks to the suggestion of a mentor who had completed the challenge in past years, which was the hovercraft. Although incredibly expensive, it would be able to convey all the students in just a few trips, as well as supplies and vehicles. It would take only an astonishing 56 seconds to cross the bay, and with disembarking time and other factors it would still only require around 11 minutes to go back and forth across the bay. This allows efficient transportation, so even if one is late little valuable lesson time is evaded.

All the same, there was a hill we still couldn’t climb – storms. Unless we were to invest in a form of “Heavy-Duty” hovercraft, storms would leave the craft stranded and without help. We couldn’t afford this, and therefore we came to the conclusion that the school would have to be closed on stormy days, as we couldn’t find an adequate solution. Although this may cause a reasonably minor lack of schoolwork, it also has another advantage – if the lagoon freezes
over, the hovercraft will still be able to transport and will even manage higher speeds as it is on an even more flat surface.

Another benefit is that it is only required to have a boat driving license, meaning that if it is necessary to use lifeboats or other marine craft for the benefit of the school it would already be covered by the driver, if we employed them as a full-time staff member.

Therefore, overall we decided our best option was to go for the hovercraft, as the benefits heavily outweighed the negatives and we thought it was the most suitable mode of transport over the distance that we needed to cover to transfer students and staff to the island school.
Energy

We chose solar power as our primary source of energy because of key factors including: location, reliability, efficiency and noise. We figured solar power would be the best resource as our school is in the Adriatic sea- a very sunny and warm area- so we could use this to our advantage and therefore we’d be much more efficient, as if we were somewhere with little amounts of sun it wouldn't make sense to use solar panels. Another factor affecting our decision was the noise, some wind turbines can produce over 100db so even though wind power is very productive it creates too much noise, which would distract children from work and potentially causing safety hazards to do with the large turbine blades, depending on the positioning of the turbines.

Another factor we considered was the eco-friendliness of the source. This immediately ruled out the possibility using nuclear or fossil fuels as they would create a polluted environment around our school and they would give off harmful CO$_2$ emissions, potentially damage the health of students attending our school.

We also thought that tidal or wave power would be ideal sources as we would be making good use of our surroundings. They are both reliable and efficient though the cost and size of a wave or tidal power generator is extraordinarily high.

As a source of gas for the science department and the kitchens we thought of importing gas containers though we would generate a very small amount on the island by compressing compost, giving off methane (CH4).
Overall solar panels provide us with the most efficient, reliable and economical source of energy benefitting the environment and surroundings. Solar panels don’t take up much space and would also be easily accessible, so we could fit them anywhere, unlike colossal wind turbines they take up much less space and produce all our necessary energy needed to power our school on an average. Like everything there are also some disadvantages, such as if we experience very little sunlight we won't produce enough energy to power our school, therefore we have decided to (within our school) incorporate a battery storing spare energy produced by the panels, so if we experience a very sunny week our battery will store all this energy and distribute it so we always have enough, including in particularly "sunless" weeks.
Natural Resources

Water

Obviously, water is used a huge amount in the modern world, and our school is no exception. But we want to use a pioneering technique that scientists have only recently come up with to desalinate saltwater. It uses a material only recently discovered called graphene. Graphene is essentially a virtually 2D slice of carbon, only one atom thick, which is arranged in a hexagonal lattice, making it extremely strong. These holes are just big enough for water molecules to fit through, but larger salt crystals cannot, along with all other bacteria and dirt. This means that it is ideal for a desalination plant. Instead of having to distil and condense the water, all is needed is a pipe with graphene membranes fitted on the inside of it to seamlessly convert dirty saltwater to clean drinking water.

Food

On our school grounds, we will have an array of vegetable patches for growing all sorts of food. Not only will this provide for the school canteen, but it could also be a useful learning tool, for biology or possibly geography, to show how certain species grow, or their anatomy. Also, it produces fresh produce, meaning that the canteens school meals can be of a much higher quality than many other schools, adding to our school’s higher reputation.
Methane

Methane is used in different places around our school, for example in the Bunsen burners in the science department, and also it can be used in ovens in the school canteen. Despite its importance in our school, and the fact that we could easily have it imported from elsewhere, we feel that it would be better to use what we have around us and produce our methane. We would do this by taking advantage of the partly marshy conditions in the shallow waters around our island, section off part of it to use as a sort of compost bin. We would place all of our food waste in it, and paired with the bacteria in the water already, the organic matter would break down, and bacteria would release large amounts of methane gas. As this is a natural process, there would be no excess unwanted gas, and the waste left over could be used as compost. Please note that this area of water will be sealed completely so that no rotten material could leak out into the surroundings.
**Waste Products**

**Waste**

We could have a large set of bins placed around the school, some for general waste, some for recycling and some for food waste. Chewing gum will not be a problem as we will have a clear ban. When the bins are full, a large hovercraft will travel to our island and collect the waste that will be loaded on by means of truck.

We could have a recycling plant nearby and the recyclable waste could be sent there to be recycled, but the general waste will still be sent to an incinerator. This will benefit us as we will cut down on costs and also know that we have recycled. This will also teach and encourage the students to recycle their waste. Food waste could be used for compost for crops and some will be sent to the mainland to be dealt with.

Some recyclable waste could be re-used to help the students with their learning by teaching them how to recycle and by doing projects with the recyclable waste instead of wasting it.

**Sewage**

Instead of having large pipes that go under the sea, as these could be expensive and hard to build, we will have a small tanker that can go on the hovercraft and it can then take the sewage to the nearest sewage plant.
The Location of Our School

We spent a lot of time researching this aspect of our school because we know how important it is to get it just right, to make sure that our school is as flexible and beneficial as a school on an island can get, and to choose a location where all the benefits of being on an island are kept, and the disadvantages minimised as much as possible. In the end, we chose our island to be in the Venetian Lagoon, at longitude and latitude 45.2595193, 12.2605454. To achieve this conclusion, we looked at a number of factors.

Weather

Weather is by far one of the major variables that affects how suitable a location is for having a school situated on it. The weather in the Venetian Lagoon is almost ideal, with summer temperatures being high, but not unbearable, at between 16 and 25 degrees Celsius, not dissimilar to Great Britain. Spring and autumn also have desired conditions, with average temperatures being roughly 15 degrees Celsius.
**Accessibility**

The location we chose is roughly 1.7km from land, however as it is in a lagoon, it is pretty much surrounded by land. This makes its location ideal because people from lots of different places can come to this school on a short trip by hovercraft, as well as supplies such as food and essential school items like pens and pencils.

**Sea Conditions**

Because of the fact that it is in a lagoon, the sea conditions around our island will be pretty calm. This means that our school will be able to be open for the maximum amount of days per year. It also means that even in a storm, it is possible that our school will still be open. In addition, the average depth of the lagoon is only 5 metres meaning that it is safer than most islands, even if the worst happens.

**Language**

Another reason we chose the location that we did was to avoid a large language barrier. A lot of the time, when there is an island, its far enough away from land to be between two countries, and this poses the dilemma of language. It is hard to teach on two different languages, so we chose to put our island close to land to resolve this issue, as well as making it easier to import and export materials.
Part 3
Conclusion
**Finances**

The school has a lot of glass in it so this will be a major cost when building the school. As we chose to cover the school in soil it will mean that less money needs to be spent on insulation.

**Energy**

As we have chosen the solar energy source, we would need to buy expensive solar cells, which cost about £5,000 pounds per 3 kWh and 21 sq. m. as it is not a reliable source of energy, we will use a battery to store the excess energy on a sunny day.

**Transport**

We have decided to use a hovercraft to get to school as although not cheap, it’s efficient. It will cost roughly £26,000,000 to build. We have also decided to have a back-up helicopter which will cost around $250,000 to build. We have decided to get a van to transport goods around the island. This will cost around £10,000 to build. The landing pad cost will be around £15,000.

PE: We have decided to get a 3G pitch for multi-sports PE. This will cost around £30,000. The basketball hoops will cost around £1,000.

Sewage: To get rid of sewage by using a treatment plant, it will cost around £300,000.

Desalination plant will cost £50,000

Our gas bill per year will be £37,500

Water sports: Water sports facilities will cost around £11,000

Rough total: £26,714,500 to build (Staff wages will also cost a lot of money.)
Model Making

The making of our model was an exceedingly fun project. Over the holidays we put over 50 man-hours of work into creating and building our model. With the help of Sebastien B, we learnt a few techniques that empowered us to be able to construct the model.

Planning

Before we began construction, we drew out the exact positioning of the segments and areas to ensure that everything would be assembled in the correct position. This then left us with minimal chances of accidental misplacement.

Construction

To begin, we began forming the dome-shape skeleton of the school, using the method we had discussed over the past weeks. This included cutting a supportive curved piece of corrugated brown cardboard followed by thin white cardboard, a total of 64 pieces, split equally between the two types. 7 of each were also half-size, so that the entrance car-park and helicopter pad had enough space. The white card was glued on top of the brown card, which was in turn glued onto the base, eventually leaving us with a fairly even dome that would be the main focus of the model.

After, we paper-mached it as this would smoothen out the model and strengthen it, which we hair-dried to save time. In the centre of the dome we glued remaining pieces of cardboard to the edges so as to
hide the brown corrugated cardboard. The model was now spray-painted a dark green, to hide any underlying colours that may spoil later work.

The road was then drawn and painted around the base of the dome, the sea was also painted using a special technique to avoid brush-stroke obviousness, followed by covering the dome in a flock adhesive which would allow the covering of flock (leaving depositions of small fibre particles in a definite area – in this case a grass-like texture) to stick well to the dome. We also drew out and flocked a separate piece of card for the pitch. This took longer than 8 hours to dry.

Next we re-painted some areas and placed natural objects, such as bushes, rocks and sand. This would give the impression of realism. The helipad was drawn using a white-chalk pen, which was also utilized to draw the outlines on the sports pitch. The windows were glued on, as well as the pitch and the natural objects.

Penultimately, we shook off excess material that hadn’t been glued on by the PVA or adhesive, leaving us with a more lifelike model and finally we applied the mini “solar panels” using a hot-glue gun, after drawing out their positions around the perimeter of the open centre area.
Conclusion

We have spent a lot of time designing our school on an island, and possibly even more time writing about it. We have tried our best to make it as concise, clear but detailed as possible, however this section is to clarify things just that little bit more.

The choices we have made are as follows: The location of our island in the Venetian Lagoon, because of the calm, warm weather and easy accessibility, we chose to use hovercrafts as transport because of their flexibility, solar panels for energy because of their convenience and low maintenance costs, and chose to build our school partially underground to save energy and space.

We think that these combinations go together very well, and overall would produce a self-sustaining, thriving school.
Personal Experiences

Over the period of time that I have done this project, I have learnt a lot, not only things to do with engineering, but also useful lessons for life, like how to work efficiently as a team, and prioritising my work to get things done when they are needed, on time and at the best possible quality.

On the engineering side of things, I have learned equally as much, invaluable things like how to successfully recreate what we had thought of in our minds, putting it into a model. Also, I have learned to make compromises when things don’t go exactly to plan, which happened during the making of the model. Of course, I have learned more trivial things, such as the things we learnt during research, for example I have learnt so much more about my real school, as well as high tech aspects of our fictional school like the graphene filter and the hovercrafts.

Finally, I also learned a huge amount from our trip to ARC Energy Resources, like what it takes to be an engineer, and I also I learnt an awful lot from seeing engineering in action, and also meeting the engineers themselves, seeing what their opinion of engineering is. Not to mention having our mentor explain about her job and what she does. I’d like to take this opportunity to personally thank the organiser of the Go4Set competition for giving me this extraordinary experience.

--Ellis
Over the Go4Set period, I feel I have been empowered to experience a bit more of the true nature of advanced engineering. I have been inspired by the underlying necessities of engineering, such as in-depth analysis, research and planning that show the true requirements, rather than simply the building aspect. Overall I believe that Go4Set has offered a unique opportunity to experience and explore the underside of construction at a young age, permitting a captivating option that I hope will continue to inspire generations to come to confer with the fascinating world of manufacture and engineering.

--Geoffrey

I feel privileged to have taken part in Go4Set. It has taught me many skills which definitely will help me in the future and will also help me with my school work. Go4Set has taught me to be more organised and has taught me different ways to share out tasks and communicate information within a team. As Go4Set is a team project, I have found better ways to make sure everyone does a fair share and that people don’t feel left out.

I have learnt more about being an engineer from working with our mentor Ms Powell and seeing around her workplace. I have learnt lots from my peers about how they work and I have learnt from them other skills, for example model building and problem solving skills. I would like to thank everyone who made Go4Set possible for us and gave us this amazing experience.

--Jake
I have thoroughly enjoyed working on the Go4set project and I am pleased to have been a part of it. I especially enjoyed planning the island and working out the best solutions to many problems that we have faced I have learned many things along the way.

One of the things that I have learned is that teamwork and cooperation has helped get us through, with all of us contributing and even without one of us we would have completely different results. The next thing I have learned along the way is that a Gantt chart can help a lot with planning out what work to do and when and I can now use it at times in the future. The final major thing that I have learned is that I need to spread my work out across the weeks.

The major thing that I can take with me from this experience is having built the model I have learned how to produce a neat, aesthetically pleasing piece of work with the right materials.

If I did this project again, to improve my work and contribution I would try to be more organised with my work.

--Luke

This year I have participated in the Go4Set challenge, I have found it a great way to experience engineering at a young age. I have really enjoyed the model making aspect of the project as I found that that was when our ideas really came to life. I found the hardest part was thinking up of all the problems associated with building a school on an island, this needed a lot of thought on what the problems were and how we could solve them. I have also enjoyed being part of a really hard working team and in my opinion we have done really well in all the aspects of the project.

--Oscar
Appendices

These are some of the notes we took over the Go4Set period (going back in time)

To do by next week- 3rd May:
Oscar- School design, Personal Experience
Luke- Finance, why we chose this project, personal experience
Jake- Compile content, personal experience
Ellis- Conclusion, personal experience
Geoffrey- Summary of model making, Appendicies, personal experience

To do by end of Easter holiday:
Everyone- Finish Model

To do by next week- 11th April:
Luke- Finallise report on energy (!!!)
Jake- Team introduction
Oscar- Design classrooms
Together- Stats and figures of our school
Ellis- Summary on Water filtration

To do by next week- 4th April:
Jake- Decide school name
Jake- Allocate team roles (summary)
Luke- Finalise report on sewage and waste
Oscar- Finalise report on energy

To do by next week- 15th March
Jake- Design HD gantt chart
Everyone- Report on transport
Think about floods and other possible weather related problems

To be done by next week-Wed 8th
Jake and Luke- fact file on our school
Ellis and Oscar- Decide specific location and explain all reasons behind it.
Geoffrey- finalise transport
Jake- Produce a professional front cover if report
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- Completed
- Work on it