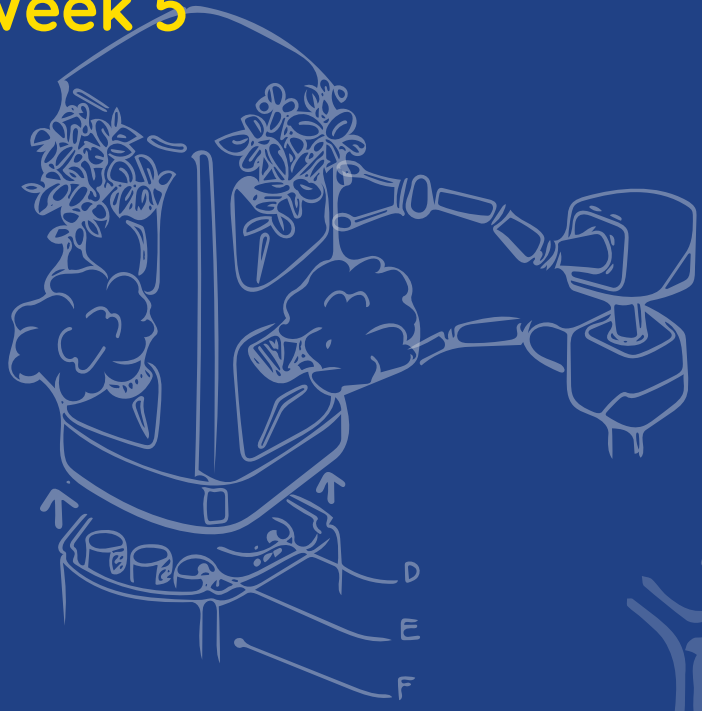
Name:

ENGINEERING DESIGN FOLIO

The Australian Virtual Astronaut Challenge

Week 5



SISP
STEM Industry School Partnerships

Splat 3D®
Think. Draw. Design.

v 1

Prototype

Testing your Solution

Testing can be undertaken throughout the progression of a project, although it is most commonly undertaken concurrently with the **Prototype** phase.

Testing, using the iSTEM process involves:

1. using the prototype to see if it actually works or performs to the specifications set at the beginning
2. generating user feedback as related to the prototypes you have developed, as well as gaining a deeper understanding of your users

When undertaken correctly, testing can often feed into most phases of the iSTEM process:

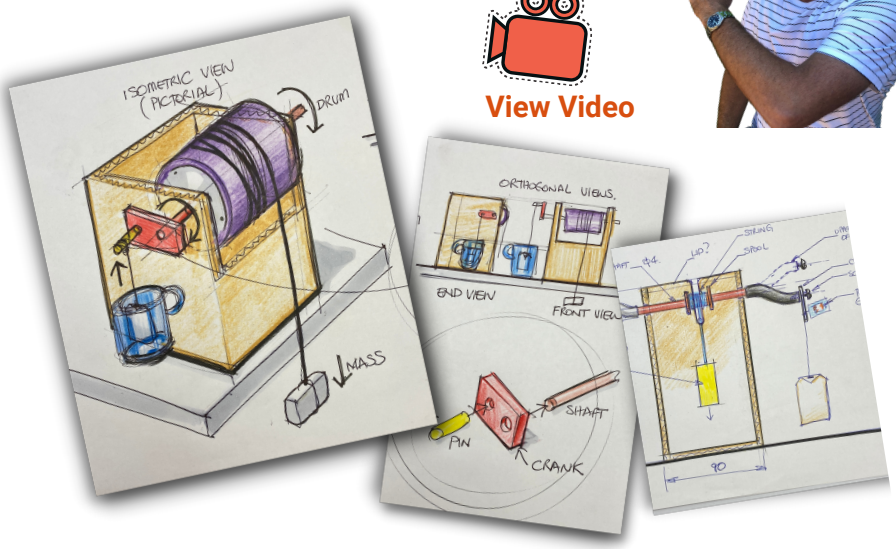
- it allows you to **Empathise** and gain a better understanding of your users
- it may lead to insights that change the way you **Define** your problem
- it may generate new ideas in the **Brainstorming** phase and finally
- it might lead to an **Iteration** of your Prototype

Activity: In week 3 you were asked to list some of the criteria for success of your project. Relist them below as they will become the criteria you will use to test and evaluate your project.

Criteria

Design with Glenny D:
The best conditions for testing a new design is under real conditions, watch Glenny D, our resident designer, as he tests and Iterates his Jiggler machine.

View Video



Evaluate

Test and evaluate prototypes against the set constraints and criteria

Activity: Devise an appropriate test for your plant growth experiment, device or environment. In this test make sure that you can assess the **criteria for success** that you set earlier.

PMI is a quick method for evaluating ideas. Write down all the positive points of your design, then all the negative. Note anything interesting, e.g. questions that need to be answered to move forward.

Test results: Does your growth experiment, device or environment meet your criteria for success?

Plus Write down all the good points of your design e.g. 'aesthetics'

Minus Consider where your design did not perform as well as expected.

Interesting Observations that are neither plus or minus, although worth noting.

Evaluate and Iterate

An iteration is the next or improved version of a design

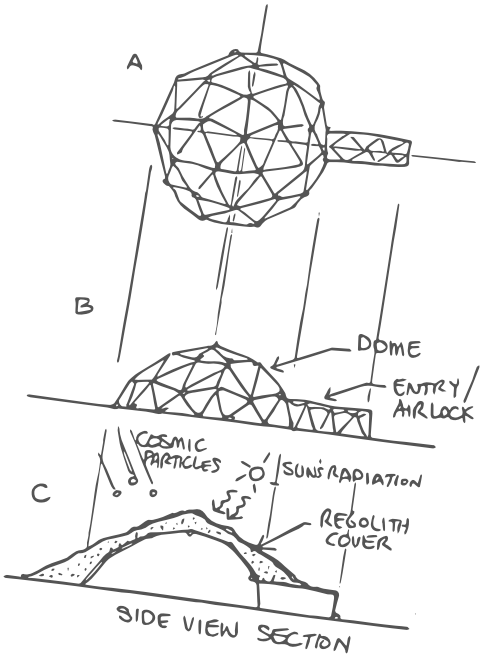
Often with projects, we don't get time to make an improved version/iteration. You may have more time if you are making your design at home. Let's at least consider a second iteration.

Activity: In the boxes below, sketch and explain four possible improvements to your design. Apply what you learnt from testing & evaluating.

1	2
3	4

Iterate

Activity: Evaluate the design improvements for your experiment, device or environment from the previous page. In the space below produce a second iteration design drawing or blueprint. These drawings will also be included in the final stage, **Communicate**, *where you get to share/explain/present your final design.*



Prototype

Build a Cardboard Geodesic Dome

Step 1: Choose Dome Size
There are two main decisions you need to make about your dome:
(1) What 'level' of dome complexity and (2) how big you want it.

(1) The idea behind a geodesic dome is to take a perfect (half) sphere and tessellate, or give 3at faces to it. The more faces, the more it smooth it is like the sphere. There are many levels of tessellation, but for the sake of my sanity, I chose "2V" (as defined by Desert Domes website), which has 40 faces. If you want to choose higher levels, be my guest, you can see the details in link.

(2) Now, you need to decide how big you want your dome to be. This will be entirely up to you, based on the amount of cardboard you have and what you intend to use your dome for. Here are some handy dome dimension calculators for a "2V" dome, which has 10 AAA triangles and 30 ABB triangles:

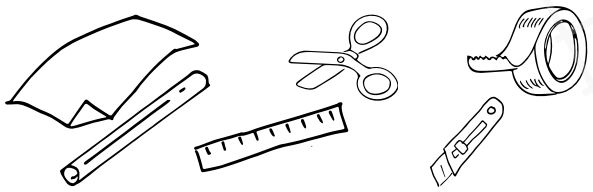
Calculate dimensions based on dome radius

Calculate dimensions based on strut/triangle

It is recommend that you use the radius method to get a rough triangle size, then use the triangle size calculator if you want to use rounder numbers.

Materials & Equipment

- Cardboard
- A few sheets of paper
- Stanley knife or box cutter Pencil
- Fine-tip ball-point pen
- Rule
- Stapler/staples or brads

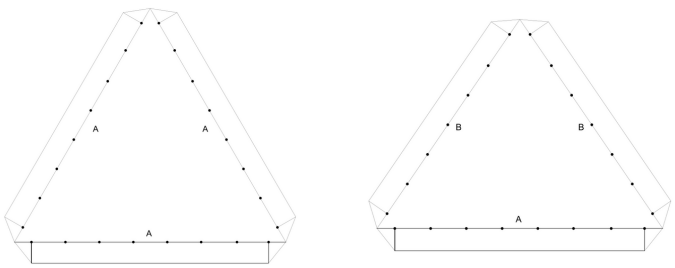


Step 2: Create Triangle Templates
A "2V" dome has two types of triangles: AAA and ABB, where A and B represent different lengths. To cut these out of cardboard, you will need to create templates out of paper.

If you want to make your own templates, find the details at https://www.instructables.com/Cardboard-Geodesic-Dome/

If you want to make templates the same size as in the picture above, use the PDF files below for the AAA and ABB triangles. When you print them, be sure your printer options are set to "Actual Size" and not "Scale to Fit Page".

AAA triangle Template ABB triangle Template



Prototype

Build a Cardboard Geodesic Dome

Step 3: Trace the Triangles
Use your templates to trace the necessary triangles onto your cardboard. Some things to note:

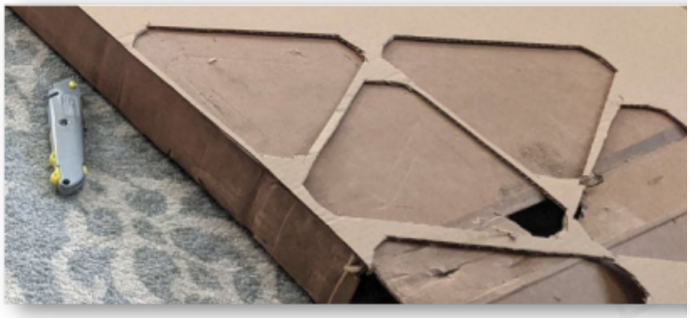
- Put the glossy side of the cardboard down, trace on the dull side.
- Alternate your triangles up/down to save space

The best way to trace the triangles was to:
1. Firmly hold the paper down the whole time to avoid slipping
2. Draw a dot at each corner (helps to realign triangle if it slips)
3. Manually trace the angled corner sections with pencil
4. Use the ruler to help trace the long edges (dull pencil helps)
5. Use the ball-point pen or other sharp object to poke holes into the cardboard (through the dots in the template) along the fold edge

Step 4: Cut Out the Triangles
This is the most effective way to cut out the triangles:

- Don't use scissors, it will bend the cardboard too much.
- Use a Stanley knife or box cutter to score/cut the top layer of cardboard Lift the cardboard up and push the knife all the way through to cut the other layer(s)

Safety First:
Get a parent or teacher to assist in this step



STEP 5: Fold the Flaps
Use e a hard rule to fold each 3ap up along the perforated line.

www.instructables.com

Prototype

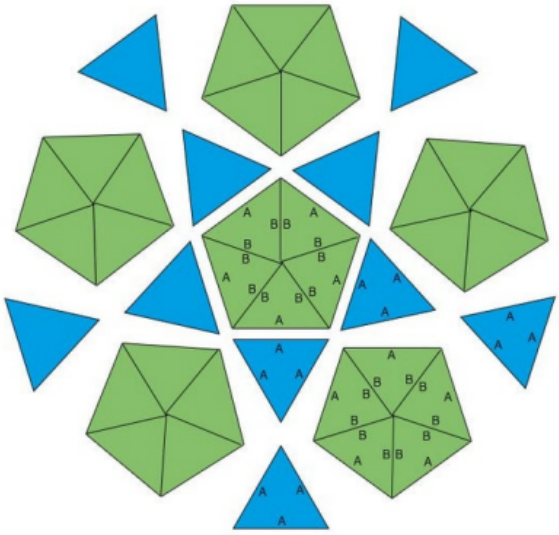
Build a Cardboard Geodesic Dome

Step 6: Assemble the Dome

Assemble the dome according the diagram, keeping the seams on the inside.

Use staples, 3 in each edge, but it is difficult to get the staples through. You may need to use a larger stapler for some edges

You could use brads to similar effect, or come up with your own solution. If you want to leave a door, leave of one of the lower AAA triangles.



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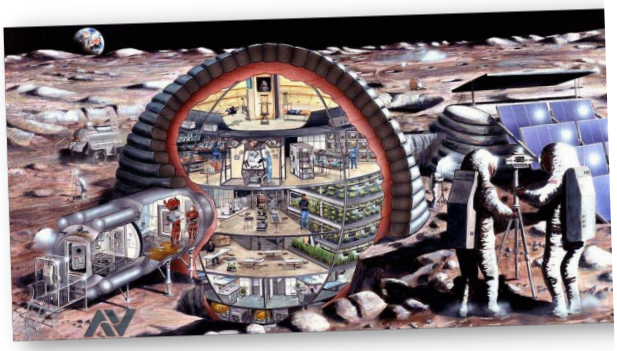
Activity:
Try building different size domes and connecting them together to make your very own home on the moon.



Train Like an Astronaut

Let's get active!

Your Mission: Agility Astro-Course
You will complete an agility course as quickly and as accurately as possible to improve agility, coordination and speed. Agility requires quickness, strength, and good balance and coordination. Walking up and down stairs, hiking outdoors and playing tag are some daily activities that require agility.

MISSION QUESTION: How can you perform a physical activity that will improve your agility, coordination, and speed?

Mission Assignment: Agility Training

Follow the directions listed below to complete the Agility Astro-Course. A warm-up/stretching and cool-down period is always recommended.

- Lie face-down on the ground at the starting point.
- When time starts, jump to your feet and run the course to the finish following these criteria.

1. Complete the course as quickly as possible.
2. Do not touch or knock over any cones.
3. Touching or knocking over a cone is a 2 second penalty added to your completed time for each cone infraction.

- Rest at least one minute. Return to the line, repeat the Astro-Course at least three times, following the same directions as the first time. Continue to practice improving your movements, accuracy and time.

Follow these instructions to train like an astronaut

Improving agility makes it easier for you to move around objects quickly and safely. By improving your movements and time on the Agility Astro-Course, you may find it is easier to change directions while moving or running and keep your balance instead of falling over or bumping into other people or objects.

https://trainlikeanastronaut.org/

Train Like an Astronaut

Let's get active!

It's a Space fact:
Astronauts practice strength and agility through training exercises designed by NASA Astronaut Strength, Conditioning & Rehabilitation Specialists (ASCR). These fitness specialists conduct an annual fitness test, design individual exercise programs, and provide one-on-one pre-flight and post-flight conditioning activities for the astronauts. The agility we use every day on Earth is different from the agility used in space. Being in space over a period of time can affect astronaut's agility. This is observed once the astronauts return to Earth. Due to the astronauts living in microgravity environment and not using their muscles as they do on Earth, their muscles weaken. After they return from a long duration mission, astronauts work with ASCRs to restore and maintain agility as before their spaceflight mission.

Agility: The ability to quickly and easily move your body.

Coordination: Using your muscles together to move your body.

Fitness Accelerations:

- Using the same set up as the Agility Astro-Course, move the cones to make the agility course larger. One may also add more cones to increase the agility factor. One may also reduce the area of the Agility Astro-Course by using less cones. Is this course more difficult to complete?
- Immediately before engaging in the Agility Astro-Course, do jumping jacks for 30 seconds. Compare this time to the times for the first three trials. Did your time increase or decrease? Explain.
- Change the environment in which the Agility Astro-Course is performed (i.e. inside to outside).
- Decrease the rest time between trials.

Think Safety:
Researchers and ASCRs working with the astronauts must make sure they have a safe environment in which to practice so the astronauts are not injured.

- A warm-up and cool-down period is always recommended.
- Avoid obstacles, hazards, and uneven surfaces.
- Wear appropriate clothes and shoes that allow you to move freely and comfortably.
- Drink plenty of water before, during, and after physical activities

Mission Assignment: Full Body Training

- Stand on one leg. Wave your arms and other leg about and still try to keep your balance.
- Participate in a field sport such as soccer or a racket sport such as tennis.
- Take part in a relay race with other pairs of students.

1. Stand beside your partner.
2. Using a scarf or bandana, tie you and your partner's legs that are nearest to each other together at the ankle.
3. Race a measured distant to the finish line.

https://trainlikeanastronaut.org/