Protect and Grow: Lunar Payload Lab

Part 1

Using our cut-out template, build the payload outer walls and a way to secure seeds and plants within it.

Part 2

Build a way to simply and reliably release water to the seeds and plants in your payload

This booklet will guide you through activities, allowing you to participate and share your ideas on this lunar mission!

These instructions are designed specifically for school-aged people; however, participation is welcomed from any age. Participants under 15 years old must have adult supervision for all activities. For any handling of sharp tools, hot materials, or potentially hazardous items, ensure an adult is present.

The ALEPH project is an Australian payload putting seeds and plants on the Moon.

Part 1

Background

Australian scientists and engineers are working on an exciting project called the Australian Lunar Experiment Promoting Horticulture (ALEPH), sending plants to the moon to see how they grow.

We've put together a cut-out template for you to build a version of our payload, which will be approximately the dimensions of one of the seed/plant containers.

But the trip to the moon is pretty bumpy – there's a lot of shaking on the rocket. Our scientists and engineers need to find a way to protect the seeds and plants so that they don't bounce around the container they're in.

To keep the plants and seeds safe on the journey, we need to find a good *growth medium.* This is the material that plants grow in, like soil or sand. We also need a way to keep the medium and plants in one place.

Your Objective: **To find and test different types of growth media and ways to secure it to keep the plants safe during the trip to the Moon.**

What you'll need:

- [x] This Instruction booklet (check!)
- [ ] Seeds (different varieties and sizes)
- [ ] Plants (like small grasses or herbs)
- [ ] Craft supplies* (scissors, tape, glue, mesh, tissue paper, etc.)
- [ ] Recycled items (plastic bottles, containers, cardboard, rags, etc.)
- [ ] A smartphone or camera to take pictures of growth
- [ ] A small torch or keychain light
- [ ] Different types of growth media (e.g., soil, mesh, peat moss, etc.)
- [ ] Gloves

Be Creative!

*Scissors and other sharp tools should be handled carefully. Ask an adult for help if needed. Always use glue in a well-ventilated area

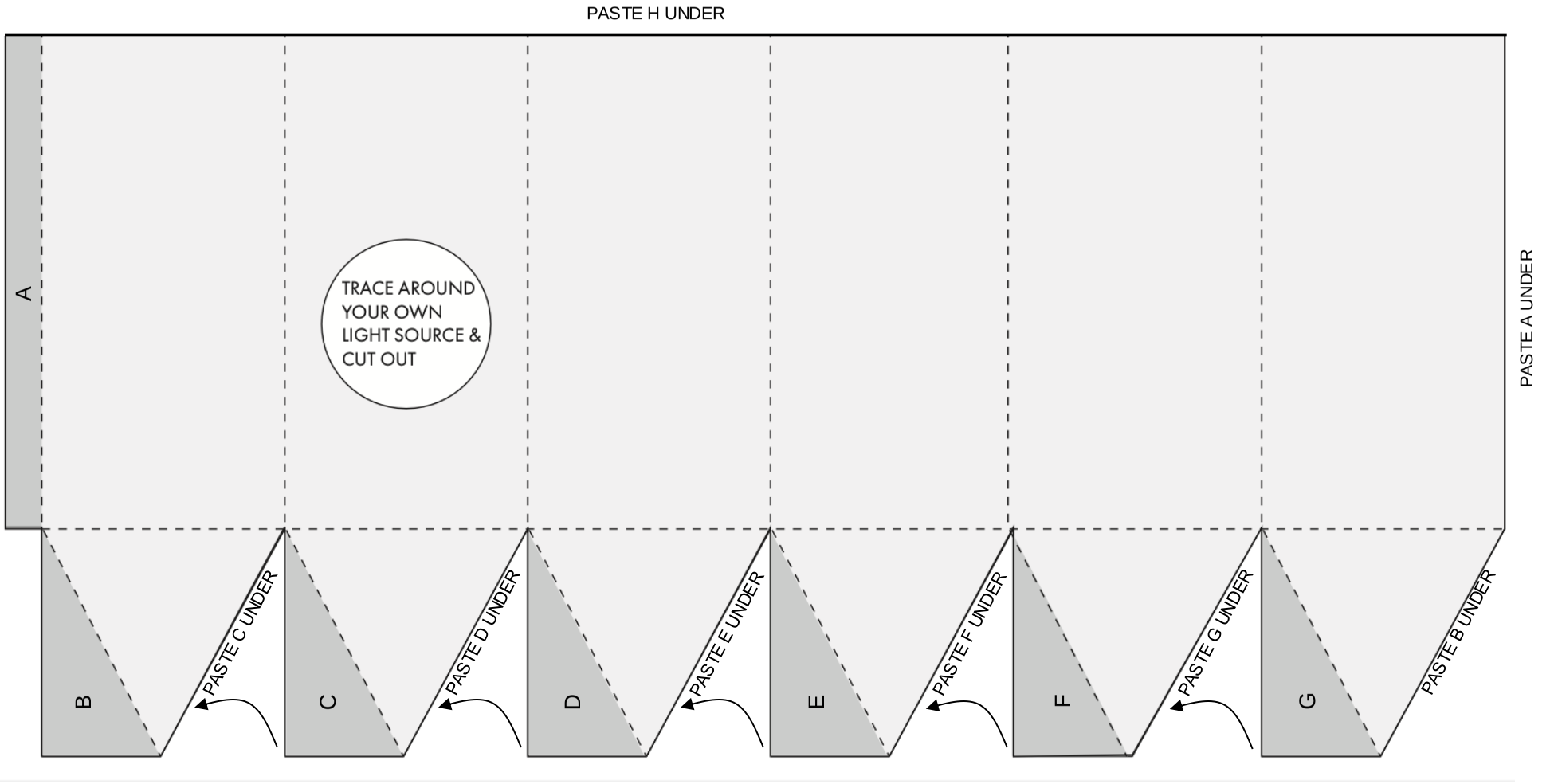
Steps

1. Print template (pages 5 & 6 - Payload Body and Payload Front) and glue it onto cardboard or recycled plastic.
2. Cut along the solid outer lines and fold along the dotted lines
3. Glue along the darker grey sections, and once folded together, press down to attach (alternatively, you can attach together first, then secure with tape instead of glue)
4. Use the Brainstorm page to brainstorm how to secure your seeds/plants inside your payload
5. Using the growth medium you have chosen and common household materials and/or recycled materials, design a way of keeping the seeds/plants in place
6. Shake the payload to simulate launch vibrations*
7. Check whether your seeds/plants and the growth media stayed in place after your shaking experiment, and mark your design against the criteria
8. Make any changes you need to improve the design

*Be careful when shaking the container to simulate launch vibrations. Ensure you are in an open area, away from people and fragile items, and that the container is sealed securely to prevent any spills.

CUT ALONG THE SOLID LINES, FOLD ALONG THE DOTTED LINES, ADD GLUE/TAPE TO THE DARK GREY SECTIONS AND ASSEMBLE TO CREATE A CYLINDER WITH A CLOSED END

Payload Body



Template design developed by RMIT Industrial Design Students Makushla Harper and Maximillian O'Brien.

Payload front

USE GLUE TO REPLACE WINDOW WITH CLEAR PLASTIC, AND ATTACH THIS FRONT COMPONENT TO THE OPEN END OF THE PAYLOAD BODY USING THE TOP FLAP

Brainstorming

In the columns below, try to come up with as many ideas as you can for different *growth media* (something to plant the seeds and plants in, e.g., soil) and ways of securing (holding in place) the seeds and plants in the growth medium.

Not all growth media need a way to secure plants/seeds. For example, seeds planted in a gel will generally stay in place, and gel just needs to set in a container (like jelly). Other things, like soil or sand on the other hand, need a way to keep it from flying around.

Growth Medium:

- _____
- _____
- _____
- _____
- _____
- _____
- _____

Way of Securing:

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

Criteria

Use these criteria to assess your design when you test it

Shoot Space

Ensure there is enough room for seeds to sprout shoots and for plant leaves to continue to grow. Plants/seeds should not be damaged.

Secure Seeds

Seeds and plants need to stay in place when you shake the payload. This tests if the design can hold them tight, just like in a rocket.

Visible Plants

Plants should be clearly visible at the end of the experiment. A good design helps you check on the plants easily.

Medium Stay-Put

Make sure the soil or growth medium doesn't move around. If it becomes loose during launch, this could disrupt the electronics and prevent mission success.

Mission Ready

The design should be lightweight and reliable, making it practical for space missions.

Test Results

In the table below, enter the results of the test of your design against the criteria:

Criteria	Score (1-10)	Feedback
Shoot Space		
Secure Seeds		
Visible Plants		
Medium Stay-put		
Mission Ready		

Notes

Use the below space to record additional notes and/or thoughts.

Part 2

Background

Once the seeds and plants are securely in place, the next challenge is ensuring they receive the right amount of water to start their growth. In space, we can't afford complex systems that might fail — simplicity and reliability are key. Your task is to design a water release system that is straightforward yet effective.

Think about using simple tricks to release water all at once. Maybe a small container that opens when something moves or changes shape with a simple trigger like light, electrical signal or heat. Get creative and see what you can come up with!

Your Objective: **Design a simple device that can release water to the plants automatically, using materials you can find around you.**

For designs involving sharp, hot, or electric components, always check with an adult before starting, and ensure that all experiments are conducted in a safe, controlled environment.

What you'll need:

- [x] This Instruction booklet (check!)
- [ ] Your payload from Part 1
- [ ] Craft supplies (wax, balloons, rubber bands, cotton strings, paper towel, etc.)
- [ ] Recycled items (plastic bottles, containers, straws, etc.)
- [ ] Water
- [ ] A smartphone or camera to take pictures of growth

Creativity is Innovation!

*Your safety is most important. If your design involves anything sharp, hot or electric (or otherwise dangerous) always check with a parent/guardian before starting.

Steps

1. Gather all the things you need to build your water release mechanism.
2. Experiment with different ways of releasing water. Ensure that you do this over a sink or container to avoid water spilling*.
3. Take notes and draw your design.
4. Assemble your “final prototype” and put it into your payload from part 1
5. Water the seeds/plants in your payload with your water release mechanism and monitor plant growth over a week.
6. Take images of the inside of your payload from the front window once per day to monitor growth. Try to make sure your camera/smartphone takes the image from the same angle each day.

*Remember to perform the water release experiment over a sink or container to prevent spills. Be mindful of your surroundings to avoid water contact with electrical devices.

Notes

Use the below space to record additional notes and/or thoughts.

My Design

Use the below space to draw your design

Thanks for getting involved!

If you would like to share your designs with the ALEPH team, you can use this form (QR code above): https://forms.gle/eqxVavMtPpDbyhH98

Overall, these activities aim to test different ways to grow plants on the Moon, including reliable watering systems, different types of growth media and ways to keep the plants safe during the trip to the Moon. It also encourages creative thinking and innovative design, considering constraints of space missions.

This is part of a larger educational program that will allow students to learn about the moon and its environment, to participate in a real-world scientific experiment, and to contribute to the global understanding of plant growth on the moon.

Brought to you by Lunaria One, QUT Queensland University of Technology, RMIT UNIVERSITY