OFF-EARTH HABITATS

MISSION PLAN

Australian Space Agency

Australian Space Discovery Centre

Mission Objective

Design and construct a diorama or 3D Model of a Lunar or Martian habitat that would solve one of the problems that makes it difficult to live in space.

The Big Question

What would it look like to live off-Earth?

Content

Images

***Above**: A base on Mars, Martian colony in desert.*

***Below**: Artist impression of Australia's vision for a lunar base.*

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Context

In December 2017, NASA announced the Artemis program: an extraordinary endeavour to put humans back on the Moon, and then further on to Mars.

In October 2020, the Australian Space Agency partnered with NASA in this program by signing the **Artemis Accords.** This is a group of common principles for cooperation between countries in space.

In the Apollo missions, humans stayed and lived on the Moon for only a few days. To make Artemis possible, we have to learn how humans can survive for much longer on another planet.

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Australia in Space

The cosmos has fascinated humans for millennia. First Nations Australians have been looking up into the sky for 60,000 years and making observations to inform their hunting, gathering, social and navigation practices.

Australia was very active in the early decades of the Space Age. We were one of the first countries to launch our own satellite. Today, Australia's involvement is growing again. We are contributing to part of the Artemis program.
As humanity plans to go to the Moon and then on to Mars, Australia has an important role to play.

Surviving Beyond Earth

Food, Air, Water and Shelter are the 4 basic needs humans need to survive.

On Earth, we have a perfect atmosphere that allows us to breathe. It is made of 78% nitrogen, 21% oxygen, 0.9% argon, and 0.1% of other gases.

Earth gives us some serious protections from things like harmful UV radiation coming from the sun. We also have the resources to build habitats to live in.

Australia is very used to surviving in climates with very little water. In Antarctica, we use melt lakes or systems like reverse osmosis. In the outback we use bore holes leading to underground lakes.

Australia has a large agriculture industry, and we have learned how to farm and grow foods in unfavourable conditions. This involves growing native species and working with native animals.

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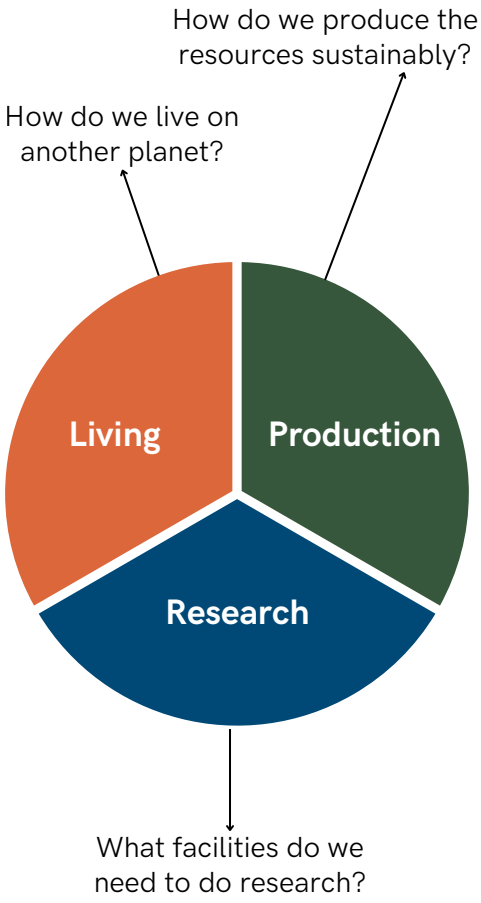
Consider....

Are these four things all we need to survive and thrive another planet?



Thriving Beyond Earth

Sleeping and Eating

There is less gravity on the Moon and Mars compared to Earth.
Eating on the ISS is significantly more challenging than on Earth: the lack of gravity makes the way we consume foods different.

Socialising and Recreation

Mental health matters in the high-stress environment of space. Humans need contact with family and friends, but delays on Mars could make that harder.
Astronauts will also need new ways to relax without usual activities like movies or sports.

Exercising

On the ISS astronauts must do 2 hours of exercise every day to retain their muscle mass. Even then when they come back to Earth, they must do rehabilitation to regain their original abilities under Earth's gravity.

Hygiene

Cleanliness is important if we want to stay healthy. The ISS has a filtration and cleaning system that keeps humans away from dangerous waste products.

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Things to consider...

How can we make sure humans get a good night's rest off Earth?

How might we eat on another planet?

Should we supplement with emotional companion robots?

What kinds of ways might you want to relax in space?

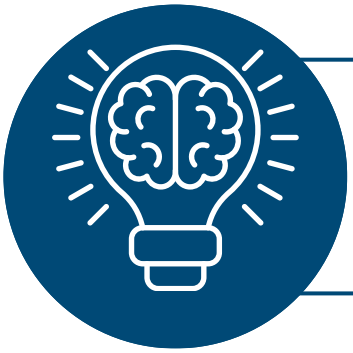
How will astronauts do rehabilitation on another planet?

How will they survive this period whilst they wait to be able to start constructing a settlement?

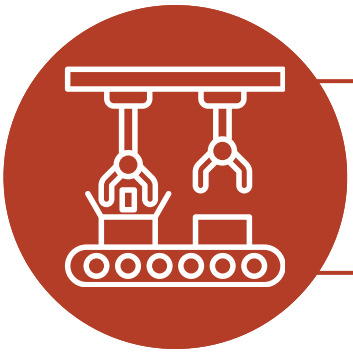
How would we dispose of our waste products on another planet?

How might we keep ourselves clean whilst also conserving precious water?

Design Principles



THINK
Select one challenge humans would face living on the Moon or Mars



MAKE
Make a model of your solution, be creative!

TEST
Does this solution work for everyone? Is anyone or anything missing?

IMPROVE
Change or add something to your solution so it helps everyone!

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Design Process

Use this structure to begin and continue your journey developing your space habitat

Phase 1: Think & Make

Write down the problems you are thinking of. What goes into them? How might you have a solution? Draw it!

After you have drawn your solution, construct a model of your Lunar or Martian habitat.

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Your Mission!

Design and construct a diorama or 3D Model of a Lunar or Martian habitat that would solve one of the problems that makes it difficult to live in space.

Things to consider...

Think of a problem facing life on another planet or in space.

Would breathing be the same as on Earth?

How about how we do exercise?

Would food grow differently?

Think of ways you will solve your problem.

Try to get ideas from things we do on Earth and things they do on the International Space Station.

Phase 2: Test & Improve

What can you do to fix your design or change it? Draw it!

Things to consider...

Think about how your diorama works, is anything missing?

What could you do to improve it?

After you have drawn your improvements, make the changes to your habitat model.

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Opportunities

School Students

- Mission: SPACE
- ROBOGALS Science Challenge
- ROBOCUP Junior Australia
- Junior Space Design Competition
- KIBO Robot Programming Challenge

University Students and Beyond

- Australian Rover Challenge
- NASA Space Apps Challenge
- ROBO Cup

Apply your skills!

You can use the skills you have learned today in the real world challenges and competitions. Here are some that you can get involved in!

Where might you go?

All the activities you have done today relate to different types of careers and areas of expertise.

If you would like to find out more, search https://www.space.gov.au/job-roles-and-career-pathways to look at specific careers in the space industry.

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