# SDG 9 Future of Space

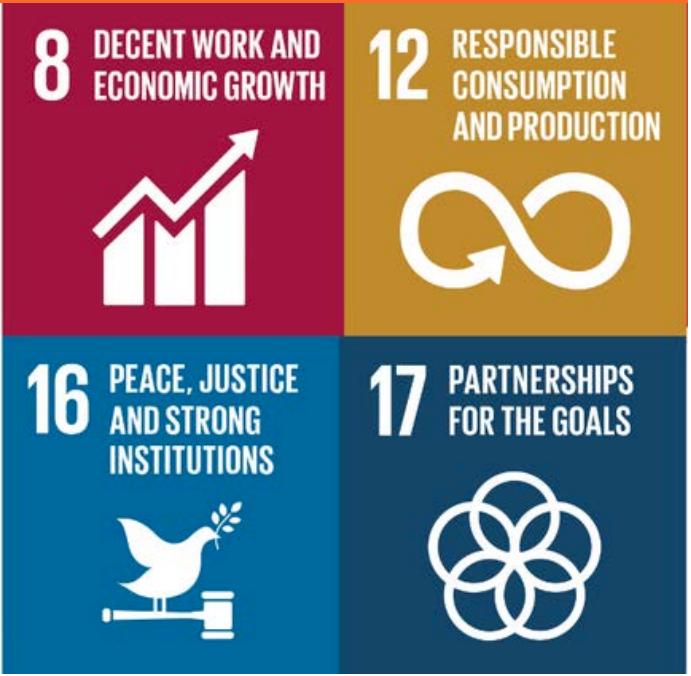
# Micro Module 7: Problem to Pitch - Space Design

## MM7: Problem to Pitch - Space Design

## Phase 3: Implementation

## Lesson 4 Design Thinking Stage 3 Ideate

## Subject Areas: Art and Design, CPSE, Climate Action and Sustainable Development, Engineering, Technology, SPHE




### Lesson Title and Summary: Design Thinking Stage 3 Ideate

In this lesson, learners will develop an understanding of the process of generating ideas building their skills in creative problem-solving. The lesson will guide learners through the ideation process, focusing on solving real-world problems in the emerging space industry.

Lerners will identify obstacles they encounter in the emerging space industry and brainstorm innovative ways to solve them, preparing them to develop solutions for real-world space concerns and emerging problems.

### Vocabulary: Agility, Creativity, Disruptive Innovation, Enterprise, Problem Finding and Solving

### In this lesson, the learner will:

- become comfortable with exploring experimental approaches
- develop skills around idea generation
- accommodate variables and limits into design processes
- learn to transfer and apply skills
- develop an understanding of problems and concerns within the emerging space industry

### Materials:

- Worksheet: Ideate Rapid Remix
- Worksheet: Remix SWOT
- Worksheet: Step Into The Problem
- Worksheet: Empathy Map
- Teacher's Guide: Ideate for Space Technology
- Internet access
- Paper, Pens, Pencils

# MM7: Problem to Pitch - Space Design
# L4: Design Thinking Stage 3 Ideate

## Activity Instructions

**Activity 1 Remixing ideas – Rapid Response (30 mins)**

1. Explain the activity has been designed to practice the 'ideation' concept and begin to understand how to develop creative problem-solving skills.
2. Watch the Video: Design Thinking Ideate [4:03 mins] and then organise students into groups of 4
3. Working in groups, each person in the group fills in a row on Worksheet: Ideate Remix 1
   - Space Technology item: e.g. oxygen filtration systems, spacecraft diagnostic tools, space habitat insulation.
   - What they like about it: e.g., design, the functionality, reliability, or technology innovation
   - Obstacles: challenges with the technology in a space environment (e.g., weight limitations, difficulty in repair, energy inefficiency, or resource waste)
   - How they would change it: Encourage them to creatively solve the problem e.g. using AI for predictive maintenance, creating modular systems for easier repairs, or using sustainable materials to reduce waste. This can be funny, imaginative, or practical.

Teacher Prompt - Ask for input from the grid randomly e.g. "Group one tell me what's written in the second column, row 2, write their answer on the board. Repeat three more times until you have something on the board from each of the columns e.g. group 4 tell me what's written in the column 3, row 1, group 2 tell me what's in column 4, row 2, group 3 tell me what's in the column 2 row 3 – see example

| Space Tech | What they like about the Space Tech Item | Annoyances / Issues | What change would remove this problem |
|---|---|---|---|
| Habitat insulation | provides reliable internet for astronauts | uses too much water which is scarce in space | create a robotic arm to work outside |

Ask the groups to start coming up with possibilities for a business, activity or service that include the 4 variables above, the more random the variables the better to push their creativity.

**Activity 2 Remixing ideas Rapid Response 2 (20 mins)**

1. Repeat the activity replacing the variables lesson 4 outcomes, current product, service or activity, the problem and the change required.

## REFLECTIVE EXERCISE: 3-2-1

- Three things they feel they have learnt from the tasks
- Two things they found most interesting and would like to explore more
- One – their opinion they have about the tasks

Use Post-its or a mentimeter survey - www.mentimeter.com - to gather reflections

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## EXTENSION / REDUCTION ACTIVITIES

Reduction: For a shorter class undertake activity 1 only and use activity 2 in a follow-up class, asking learners to generate 3 business, enterprise, product or service ideas from the variables created in the class.

Extension: For a longer class, use the work in activity 2 with the Remix SWOT worksheet. Ask the class to undertake the same process for the Idea Remix using one of the businesses, services or activity 1 ideas that has come out of the first part of the lesson. Learners can follow up by developing an empathy map for a user of the ideas, products or service that have come out of activity 1

Learners can also integrate learning from DT 1 Empathy and use the worksheet: 'Step into the Problem' to work through the ideas generated

## MEDIA BOX: (materials, online video links, extra resources, case studies etc)

Design Thinking Ideate [4:03 mins] https://www.youtube.com/watch?v=zbLxs6te5to

15 Space Tech Companies That Are Making Great Strides
https://www.spacecapital.com/publications/15-space-tech-companies-making-great-strides
gad_source=5&gclid=EAIaIQobChMIg5aLzuudiQMVPZFQBh3PiyxaEAAYASAAEgJAHvD_BwE

Expleo 'Expleo signs European Space Agency's Zero Debris Charter'
https://expleo.com/global/en/insights/news/european-space-agency-zero-debris-charter/

Space for the sustainable development goals [17:08 mins] https://www.youtube.com/watch?v=VHxNfP6EufA

## Local Trip / Expertise / Additional Work and Assessments

Learners can begin to research Irish Space stakeholders connected to the problem they identified. These stakeholders might include engineers, universities, suppliers, influencers, and even regulatory bodies. Learners can undertake a stakeholder mapping to visually represent the influence and interest of each group in relation to their selected space problem and a corresponding Space for Sustainable Development Goals.

For example, in a problem like space debris, stakeholders may include:

- Governments (influence over space waste management)
- Engineers (interest in sustainable space innovation)
- Suppliers (influence over product sourcing)

# MM7 L4TG: IDEATE FOR SPACE TECHNOLOGY


**Teacher Support:**
You don't need deep knowledge of space technology. By focusing on the Design Thinking process and encouraging learners to imagine solutions to space challenges, this lesson offers an engaging way for students to interact with the emerging space industry, whether or not you have expertise in the field.

The goal is to build creative problem-solving skills and an understanding of real-world technology issues, all within the exciting context of space exploration. Focus on guiding learners through the design thinking process. Here are some helpful things you can do:

- Guide creativity: Encourage learners to think outside the box. Remind them there are no bad ideas in brainstorming.
- Connect to real-world issues: Point out that space exploration isn't just about astronauts or physics and engineering, it's about solving problems like sustainability, resource management, and technology innovation.
- Fun facts: Keep things light by sharing fun facts or trivia about space (e.g., astronauts have to exercise 2 hours a day to avoid muscle loss in zero gravity!).

**Prompt Questions**

- What systems help astronauts maintain the space habitat (e.g., air, water, or food systems)?
- What tools do astronauts need to fix things in space?
- What challenges might arise if something breaks down in space, and how can we solve them?

**Space Technology for Discussion:**

- Oxygen Filtration Systems: Systems that keep the air breathable in space habitats.
- Water Recycling Systems: Technologies that recycle and purify water, since fresh water is limited in space.
- Repair Drones/Robotics: Robots or drones that can help with spacecraft maintenance, especially in dangerous situations.
- Waste Recycling Systems: Systems that recycle waste materials into usable resources, reducing the need for new supplies from Earth.
- Solar-Powered Systems: Energy-efficient systems powered by the sun, critical for energy generation in space.

**Examples for activity 1 to encourage learners if they are stuck**

**1. Space Technology: Waste Recycling System**

- What They Like: Converts waste into usable resources, reducing the need for resupply from Earth.
- Obstacles/Issues: The system is slow and requires manual sorting of waste materials, making it inefficient.


- How They Would Change It: Create an AI-powered sorting system that automatically categorises and processes waste faster and more efficiently.

**2. Space Technology: Astronaut Exercise Equipment**

- What They Like: Keeps astronauts healthy by preventing muscle loss in zero gravity.
- Obstacles/Issues: The equipment is bulky and takes up a lot of space, which is limited in a spacecraft.
- How They Would Change It: Develop a foldable, compact exercise machine that can be easily stored when not in use and offers the same benefits.

**3. Space Technology: Space Suit Cooling System**

- What They Like: Regulates astronaut body temperature during spacewalks, preventing overheating.
- Obstacles/Issues: The cooling system drains the suit's battery quickly, limiting the duration of spacewalks.
- How They Would Change It: Use thermoelectric cooling technology powered by body heat to reduce battery consumption and extend spacewalk times.

**4. Space Technology: Space Habitat Lighting System**

- What They Like: Mimics natural Earth sunlight to regulate astronauts' sleep cycles and improve mental health.
- Obstacles/Issues: The lights are too bright for some crew members, leading to eye strain and discomfort.
- How They Would Change It: Introduce smart, adaptive lighting that adjusts brightness based on personal preferences and circadian rhythms.

**Random and intentionally mismatched  examples**

These intentionally mismatched examples break the logical flow between the technology, what they like, the obstacle, and the proposed change. This creates a fun and random thought exercise that offers an experimental approach to ideation.

**1. Space Technology: Water Purification System**

- What They Like: It can be operated remotely from Earth.
- Obstacles/Issues: The system is too loud, causing sleep disruptions for astronauts.
- How They Would Change It: Introduce a more durable, long-lasting battery system to reduce maintenance needs.

**2. Space Technology: Solar Panels**

- What They Like: It’s lightweight and easy to install.
- Obstacles/Issues: The system uses too much water, which is a limited resource in space.
- How They Would Change It: Create a robotic arm to handle maintenance tasks outside the spacecraft.

# MM7 L4TG: IDEATE FOR SPACE TECHNOLOGY


**3. Space Technology: Air Pressure Control System**

- What They Like: It provides fast and reliable internet for astronauts.
- Obstacles/Issues: The system is hard to clean and frequently malfunctions.
- How They Would Change It: Use holographic interfaces to allow astronauts to monitor air pressure from anywhere inside the habitat.

**4. Space Technology: Space Habitat Insulation**

- What They Like: It keeps food fresh for longer periods of time.
- Obstacles/Issues: The insulation is prone to overheating during spacewalks.
- How They Would Change It: Design it to be self-repairing using nanotechnology.

**Extension Ideas:**

- Learners can explore SWOT analysis for one of their proposed solutions, looking at strengths, weaknesses, opportunities, and threats of their idea within the space industry.
- Invite students to create visual prototypes of their technology solutions through drawings or simple models.

# MM7 L4 WS: Idea Remix 1

**Team Name**

**Date**

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

This worksheet will help you play with ideas using space technology items.

Fill in the boxes - to work will then work with the whole group to develop a number of possible ideas.

**Name a Space Technology**


**What do you like about this item**


**Are there any issues / annoyances**


**What would you change / fix the issue?**

| Name a Space Technology | Likes | Obstacles | Change |
|---|---|---|---|
| | | | |

| Name a Space Technology | Likes | Obstacles | Change |
|---|---|---|---|
| | | | |

# MM7 L2WSB SPACE TECHNOLOGY SOLUTION SWOT ANALYSIS

Name _____

Date _____

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Use this adapted SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis to consider each of your group's Space Technology ideas.

Take one idea from each of the group members and work together to complete the boxes for each Space Technology Solution



| SPACE TECH PURPOSE | STRENGTHS | WEAKNESSES | USERS / CLIENTS OPPS AND THREATS |
|---|---|---|---|
| | | | |

| SPACE TECH PURPOSE | STRENGTHS | WEAKNESSES | USERS / CLIENTS OPPS AND THREATS |
|---|---|---|---|
| | | | |

| SPACE TECH PURPOSE | STRENGTHS | WEAKNESSES | USERS / CLIENTS OPPS AND THREATS |
|---|---|---|---|
| | | | |

# MM7 4WSc: Step into the problem

This worksheet helps you think about your users and any issues they might have


- What's the Problem - A
- Empathy A, Step into the problem
- Possible ideas / Solutions:

- What's the Problem - B
- Empathy B, Step into the problem
- Possible ideas / Solutions:

- What's the Problem - C
- Empathy C, Step into the problem
- Possible ideas / Solutions:

Name: Assessment : Date:

# MM7 2WSB USER EMPATHY MAP - EMPATHY MAP

Walking in someone else's shoes

**What does your user think and feel?**

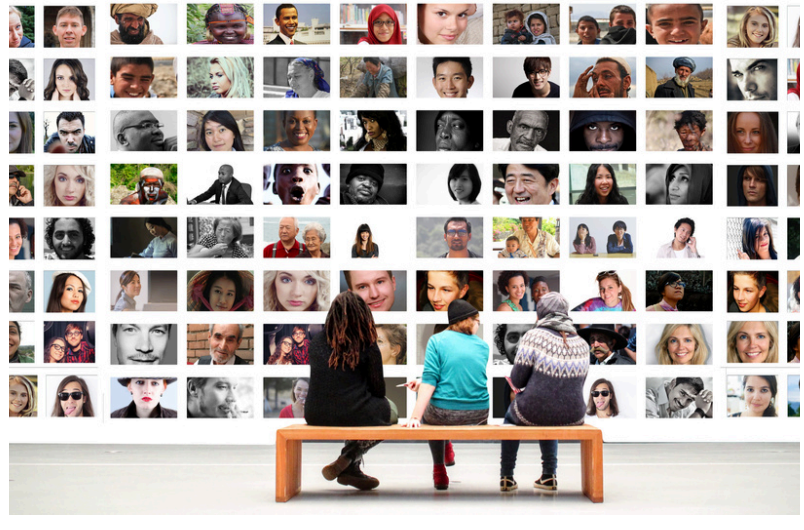
- What really matters to them?
- What do they think about?
- What are their worries, dreams or aspirations?

THINK AND FEEL

**What sort of things does your user hear / listen to?**

- Where does your user get their information?
- Who might your user listen to or be influenced by?

HEAR



SEE

**What does your user see?**

- What sort of views might your user see?
- Where might they shop for food / clothes?
- What might ideas or trends might they notice?

WHAT DO THEY SAY AND DO

- What other things might your user do?
- What other things are they interested in?

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE