Xylem Global Student Innovation Challenge

WATER

impacts our lives every day, from meeting our personal needs to influencing the global economy and the well being of our planet. Factors like climate change, pollution and aging infrastructure threaten global water supplies and water security.

Xylem is a leading water technology company committed to "solving water“ by creating innovative and smart technology solutions to meet the world's water, wastewater and energy needs.

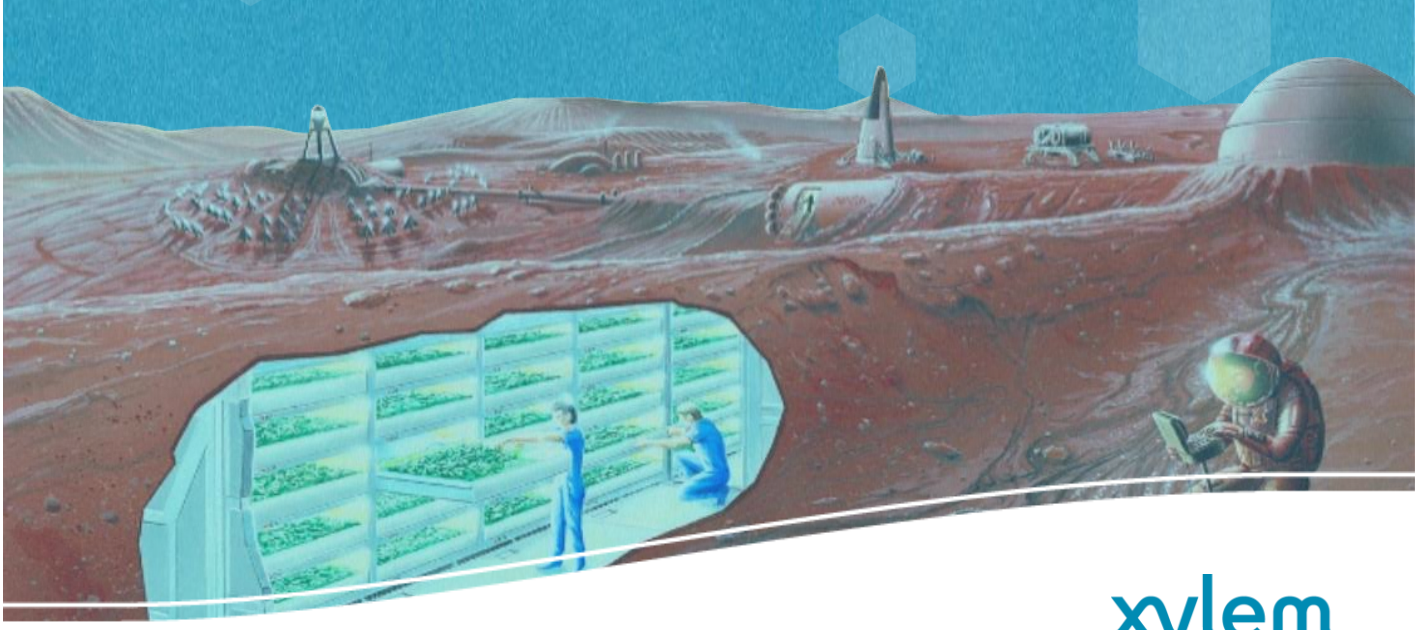
What if you lived on Mars?

PROBLEM STATEMENT

The world held its breath on February 18, 2021 as the Perseverance rover made its risky landing in Jezero Crater. It is believed that four billion years ago[1], water existed somewhere within this wide expanse of dust and rocks.

The ability to harness water on Mars is critical to the tantalizing possibility of human exploration. On the other side of the planet from Jezero Crater lies Mars' Arcadia Planitia plain. Here, scientists have evidence that water exists just below the surface as ice. Imagine that a series of unmanned missions have set up a base camp within Arcadia Planitia. You are part of an initial exploration team of 5 people who arrive to further investigate the area, and to develop an infrastructure plan to support a growing population.

Your challenge is to make life sustainable on Mars for 100 scientists, engineers and designers that will be arriving in the years to come. Create a water budget to determine how, where and when to allocate water resources throughout the self-sustaining community.



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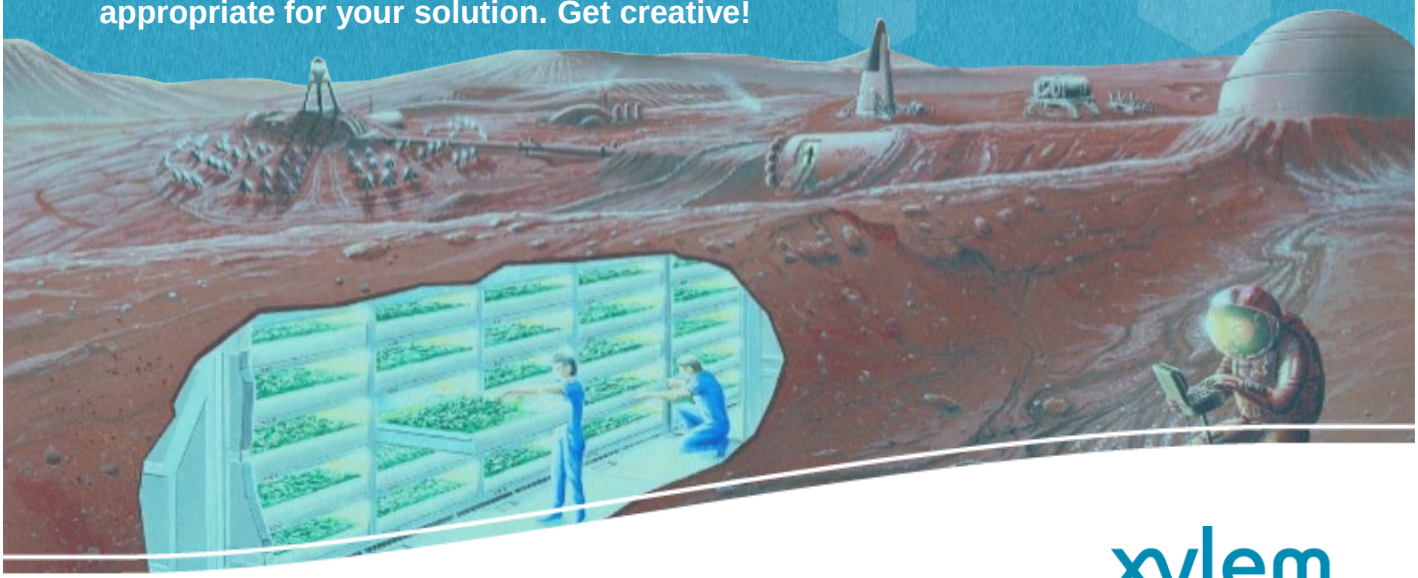
PAIN POINTS AND OPPORTUNITY AREAS

Develop a water budget for the community. Address at least one of the following questions in depth:

- **How much water is needed to support the community of 100 people? Consider how people will eat, drink, maintain hygiene, and even product oxygen and fuel. What infrastructure needs to be established to make this possible?**
- **The technology to extract and treat water from the soil has been proven, but needs to be scaled up to support an entire community. How do you securely transport the water from the source to your base?**
- **Part of the community's mission is to carry out expeditions in a 200 kilometer diameter exploration zone, centered at your base. What water will be needed on these expeditions, and where will it come from?**
- **How much reserve of water should you have at any given time, anticipating potential emergencies or disruptions to the water supply? Where will this backup water come from?**
- **How should habitats be planned to incorporate water into the living space?**

Your plans may be presented in the form of schematics, storyboards, drawings, models, technical specification documents, or any other form that is appropriate for your solution. Get creative!

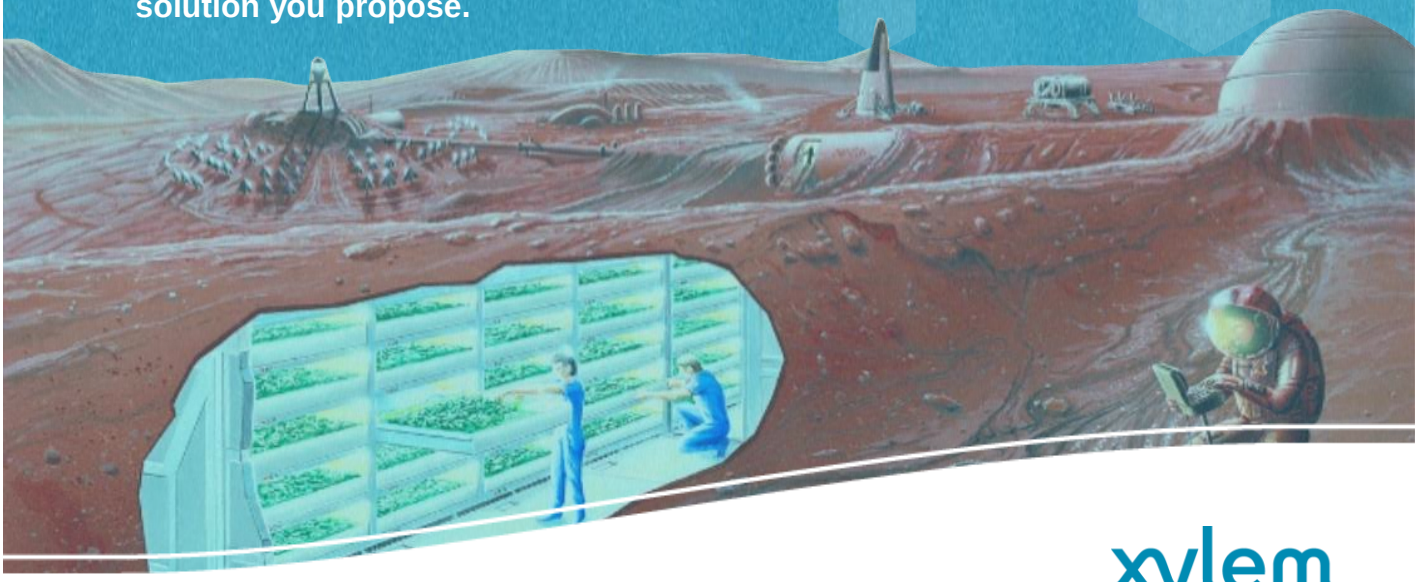


What if you lived on Mars?

PAIN POINTS AND OPPORTUNITY AREAS (Cont'd)

While developing your project, you may want to keep these broader questions in mind:

- **Mars has a very low atmospheric pressure, meaning that, unlike on Earth, water cannot exist in the open. Even frozen water on the surface can quickly become a gas if it isn't kept cold enough.**
- **An Environmental Control and Life Support System (ECLSS) is used in the International Space Station (ISS). The systems have water recycling technologies, with a recovery efficiency of 93.5%[2]. We can learn from these existing systems, but they will need to manage more uses of water and achieve higher efficiency on Mars.**
- **Water scarcity is also a major challenge on Earth. Water shortages are expected to affect over half of the Earth's population by 2050. What can our lessons about Mars teach us about Earth, or vice versa?**
- **This is a rare opportunity to establish a water system from scratch on another planet. On Earth, we often value water in economic terms and give it a "price". How do we define, or redefine, what the "value" of water and its uses are on Mars? Who is entitled to use it, and for what?**
- **Making water systems work on Mars is complicated and expensive. Consider the cost, timeline and feasibility for implementing whatever solution you propose.**



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GENERAL NOTES

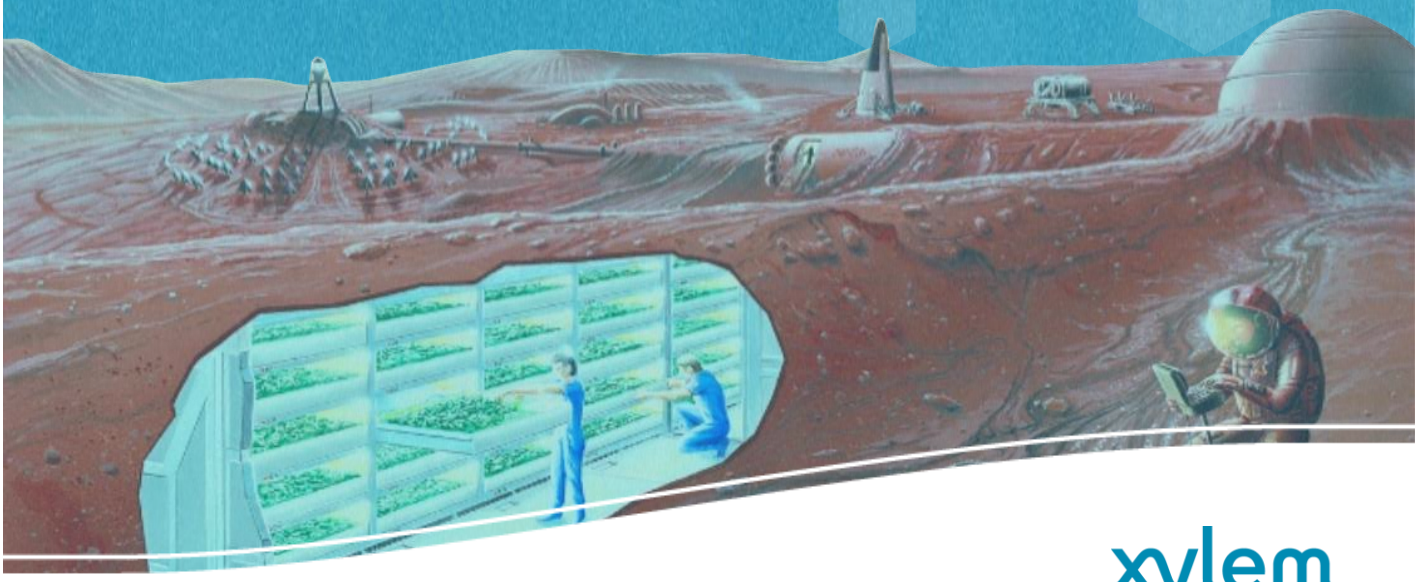
You may make the following assumptions in developing your project:

- **Your landing site is 39.8N, 220.6E[3] [4] on Mars' surface.**
- **When convoys of people arrive, the water supply and food carried in their manned spacecraft, as well as previous shipments with unmanned spacecraft, is enough to sustain them for 14 months after landing on Mars[5].**
- **There is a regular supply of critical equipment, habitats, and other tools sent from Earth.**
- **You may assume that the technology for water extraction and treatment is already proven. Similarly, the technology for growing and harvesting crops has been established. However, the methods need to be scaled as the community grows to 100 people.**

RESOURCES AND DATA

Design inspiration:

- **Mars City Design: Mars City concepts *(Link 1)***



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RESOURCES AND DATA (Cont'd)

- Robots 3D-Print a Mars Habitat: ideas for feasibility of systems on Mars *(Link 2)*
- Apollo 13 *(Link 3)* and The Martian films *(Link 4)*
- Forbes: Resource Utilization On Mars Could Be The Model Of Efficiency And Sustainability *(Link 5)*
- NASA: Benefits for Humanity: Water for the World *(Link 6)*

Technical resources:

- NASA: Human Exploration of Mars, Design Reference Architecture *(Link 7)*
- NASA: Environmental Control and Life Support Systems on the International Space Station *(Link 8)*
- NASA: Mars Trek. Use this map to explore the surface of Mars *(Link 9)*
- NASA: First Landing Site/Exploration Zone Workshop for Human Missions to the Surface of Mars (2015) *(Link 10)*
- NASA: Arcadia Planitia: Archeron Fossae and Erebus Montes Workshop *(Link 11)*