

UBC Mars Colony - 2019

Project Airlock Challenge



Phase 1 Event Summary

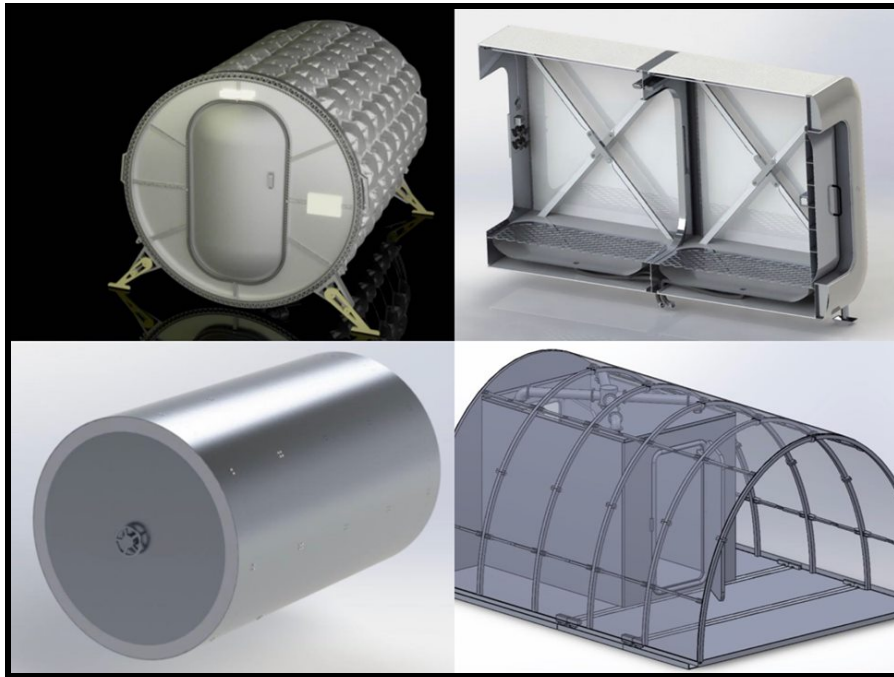
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The Outcome



Overall summary of the event:

The competition formally began Saturday, May 18th. The event kicked off with a welcoming speech given by the founder and former captain of UBC Mars Colony: Kyle Marquis. This was followed by an introduction of the judging panel, where each judge introduced themselves to the teams and the public.

The first presentation was given by the University of Toronto, succeeded by Memorial University. After a lunch intermission, Q&A session was held on the discussion of the exploration of the Moon, Mars, and beyond, and next was a presentation on different propulsion types with a focus on liquid engines given by UBC Rocket. The first day finished off with mentoring high school students competing in the ISSDC.

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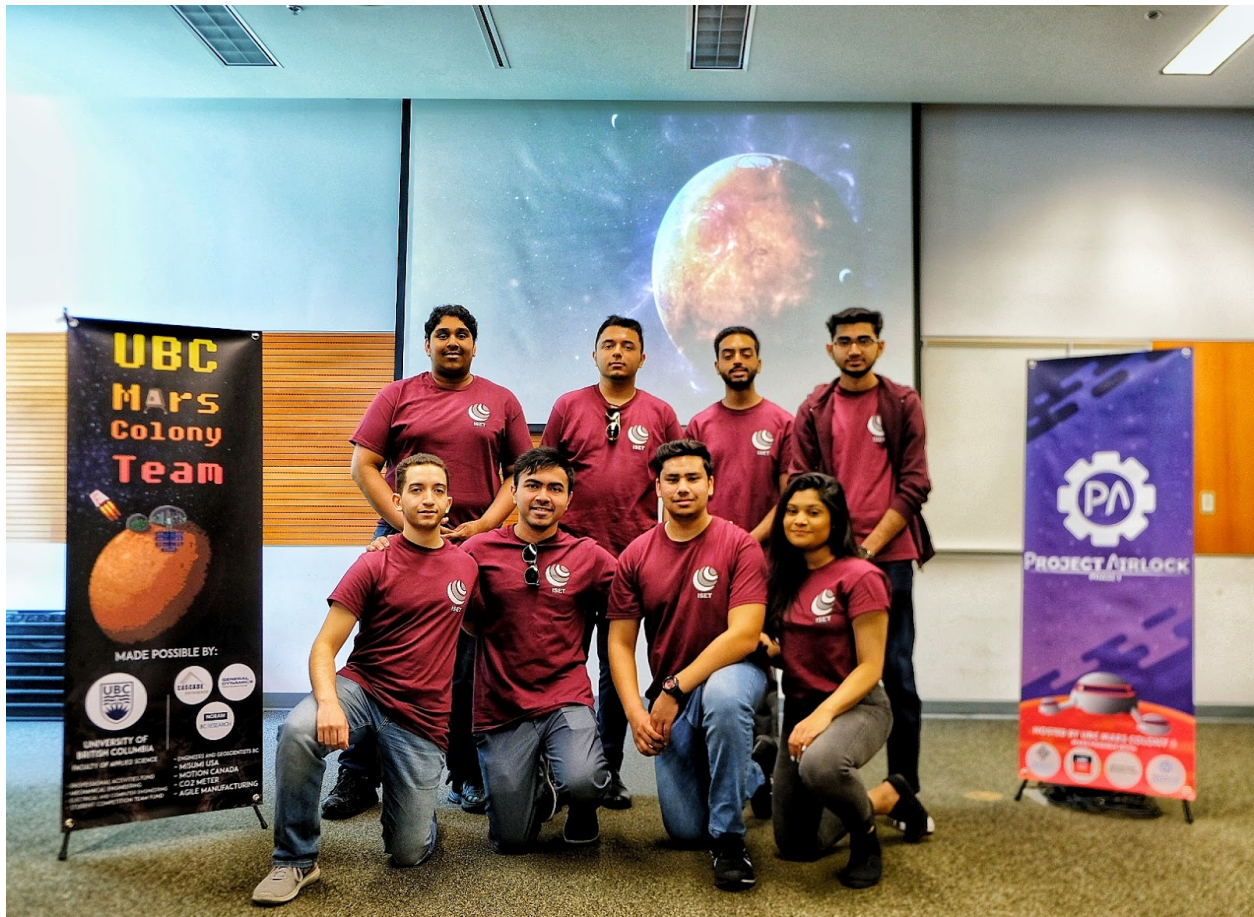
The second day started off with the last two competing teams, this started with the University of Waterloo with the University of Regina finishing off the presentations. This was followed by a presentation given by UBC Orbit about interplanetary communication. After a lunch intermission, UBC Mars Colony gave a presentation of the airlock, which was then followed by “Politics on Mars: Create and Debate”. Later in the evening, teams were invited downtown to Steamworks to network with industry professionals.

The final day began with a questioning period where judges were allowed to ask any remaining questions about the universities' designs. Judges were then given time to discuss among themselves and make a final decision. This was followed by the closing ceremonies where the final awards were announced.



Competing Teams

University of Toronto (Interplanetary Space Exploration Team)



The University of Waterloo (Watlock)



Memorial University of Newfoundland



University of Regina



The Judges

Greg Bellamy



Greg Bellamy, a Professional Engineer (P.Eng.) in several North American jurisdictions, is NORAM Engineering and Constructors Ltd.'s Chief Mechanical Engineer. Greg has previously held both mechanical and project engineering roles on many domestic and international projects.

He has 30 years of experience in the process industries ranging from executing international, world scale, green field projects

to developing new process technology. His experience covers many process industries including chemical, refining, fertilizer, and pulp & paper. His knowledge areas include piping, pressure vessels, hydraulics, heat transfer, process heat integration, and plant layout.

Greg is a proponent for the multi-disciplinary design of process equipment using a materials centric approach. In many high performance systems material properties determine the limits of application. Consideration of the mechanical, corrosion, thermal, and manufacturing properties of materials at the conceptual stage typically leads to an optimum outcome.

Lawrence Reeves



Lawrence Reeves has worked in the Canadian space industry for over 20 years, currently with his own company, Geocentrix Technologies, Ltd., and previously with UrtheCast and MDA. He has worked on a variety of missions, conducting orbit selection and analysis, power & propulsion budgets, coverage and data throughput analyses, spacecraft operations software, and launch contract management.

Lawrence is the manager of the Canadian Satellite Design Challenge, a Canada-wide cubesat design competition, and was previously a Director of the Artificial Reef Society of B.C., a group which has sunk eight ships and a Boeing 737 in the coastal waters of B.C. to create marine life habitats. He is an avid golfer, cyclist, and skier.

Sheng-Hui Wang



Dr. Sheng-Hui Wang has 10 years of experience in aerospace and manufacturing for the Canadian government and his speciality is in corrosion and materials engineering. Sheng-Hui is a senior researcher at Canada's National Research Council (NRC), currently leading weld cladding and surfacing R&D for mining wear and corrosion reduction, and involved in materials evaluation and technical consulting services relevant to oil sands/hard rock mining and mineral processing industries.

Sheng-Hui has broad experience in overlay welding, laser cladding, additive manufacturing, welding metallurgy, physical metallurgy, electrochemical corrosion, mechanical behavior of metals, wear of materials, fatigue and fracture, environmentally-assisted cracking. He is a Professional Engineer (P.Eng.), a certified Project Management Professional (PMP), and an Adjunct Professor at the University of Calgary.

Kyle Marquis



Kyle Marquis is the founder and former captain of UBC Mars Colony, one of the institution's undergraduate student design teams. From an idea, all the way to creation, he forged this team from the ground up with the goal to develop the technology to enable people to survive on Mars and other planets. Sourcing funding and bringing over eventually 50 students to the team, Kyle was successful in creating a team necessary to design and build their first project: an expandable airlock for a Martian settlement.

In October 2018, Kyle and his team presented their work to the International Astronautical Congress in Bremen, Germany. That year, the team was able to draw interest in a competition and pursued it until it became the Project Airlock Challenge we have today. Now, the team is set to finish their airlock by May 2019 as Kyle moves on to a Masters in Aerospace Engineering after graduating from the University of British Columbia's Mechanical Engineering Department.

Garnet Butcher (Representing UBC Mars Colony)



Garnet Butcher is a fourth year Integrated Engineering Student at the University of British Columbia. He is the current Captain of UBC Mars Colony, and was seated at the judges table as a representative for the team as a whole. Garnet joined the team back in 2016 during the initial founding of Mars Colony. He has seen and been involved in the airlock project from the beginning, and has primarily worked in his role as Mechanical Team Lead.

The UBC Mars Colony team members who are in attendance will be completing rubrics for each team and then consolidating them to provide an overall score to add to the final judgment. We are very excited to act as a host for this competition, and know firsthand that the design and construction of a martian airlock is no easy feat.



Technical Safety BC

Janina Mihailescu (May 18th)



Janina Mihailescu, Engineering Information Lead at Technical Safety BC, is the recognized authority of engineering documentation and quality control of regulated engineering designs submitted to British Columbia from across the world, with a background of component engineering design and ISO quality control from Europe and Canada

Eric Lalli (May 19th)



Eric Lalli, P.Eng, Leader of Incident Investigations, 30 years of experience as a Professional Engineer in multiple industries including aerospace, vehicle production and failure analysis.

Tom Ng (May 20th)

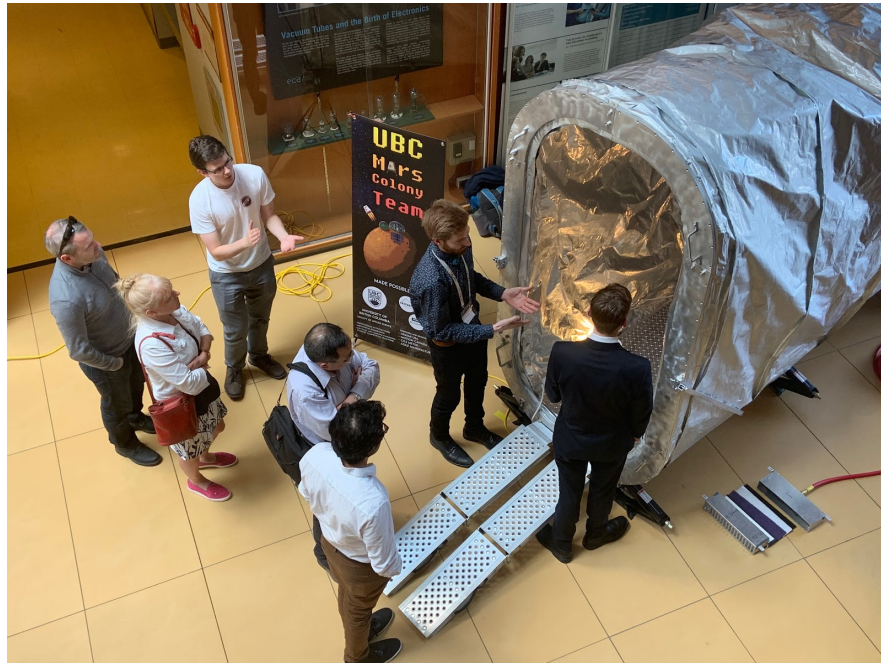


Tom Ng, P.Eng, Leader of Engineering at Technical Safety BC with 13 years professional engineering experience in static equipment design, diagnosis, and repair from the energy industry in Alberta and British Columbia.

Featured Design Team Presentations

UBC Mars Colony

The host team, UBC Mars Colony, had a short presentation on their own experience with airlock design and construction. This was a critical inside look to the challenges that teams will be faced with during Phase II, the prototyping phase.



UBC Rocket

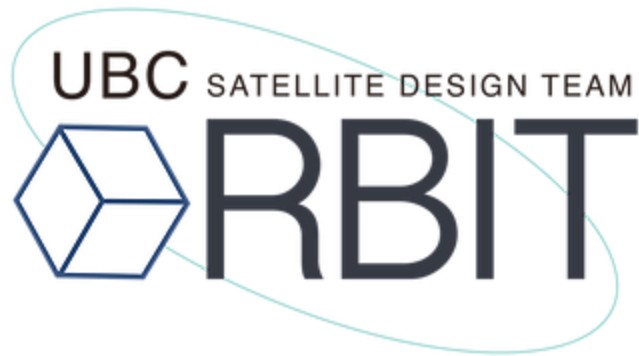


Another UBC engineering design team, UBC Rocket, took the time to teach the audience about the intricacies of solid versus liquid propulsion types. The team is dedicated to the design, manufacture and launch of suborbital rockets. They are currently working hard towards the \$1,000,000 Base 11 Space Challenge.



Fun fact, they share a team space with UBC Mars Colony!

UBC Orbit



UBC Orbit is an engineering design team dedicated to the innovation, design, and development of satellites. Their presentation consisted of the challenges and possibilities of interplanetary communications. UBC Orbit is currently involved in two country-wide efforts to improve Canada's contribution to the aerospace industry: Canadian CubeSat Project (CCP) and Canadian Satellite Design Challenge (CSDC).



Special Events

Space Exploration Q & A Panel



Space exploration panel (from left to right): Sabha El Shawa, Anita Gale, Lawrence Reeves, Kyle Marquis, Geoffrey Goldman, Yuze Zhang

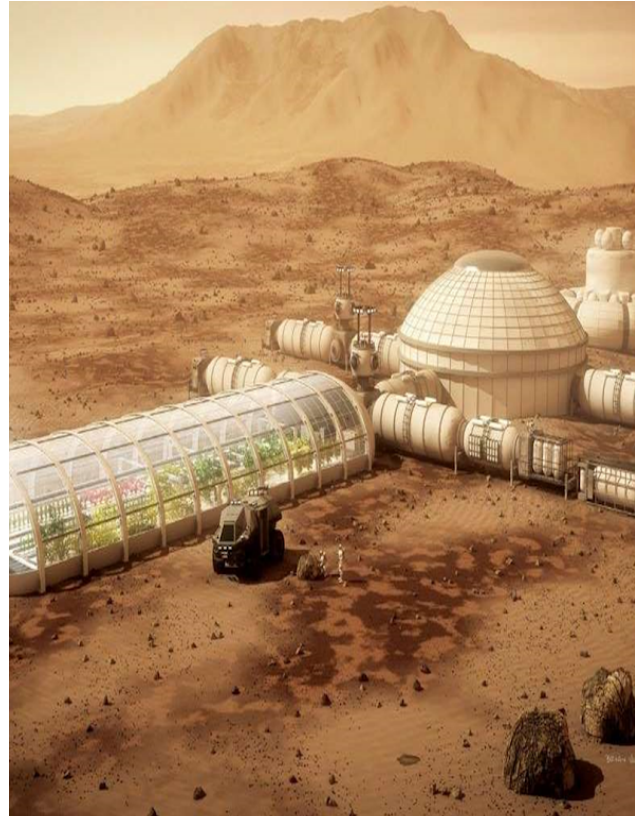


Create and Debate!

A fun workshop where small groups were able to build their ideal martian societies.

Many aspects of this potential society were explored. Some very interesting discussions were sparked regarding the following:

- Education
- Religion
- Law and Order
- Politics
- Infrastructure
- And more



Awards

Five awards were available for claiming from the competitors:

Best Presentation

Best Report

Most Creative Solution

Second Place Overall

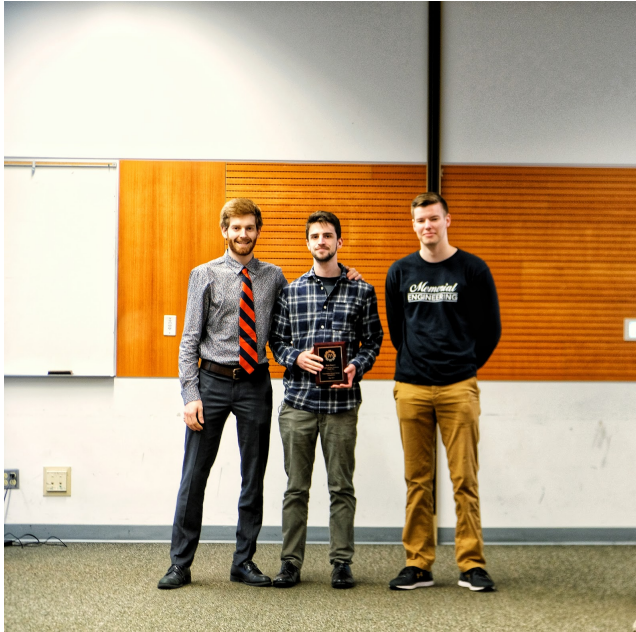
First Place Overall

The results are as follows:



Best Presentation
University of Waterloo





Best Report
Project Airlock Challenge
Phase One

Expandable Airlock Design
Competition

May 2019

Best Report
**Memorial University of
Newfoundland**

Second Place Overall

University of Toronto



First Place Overall

& Most Creative Solution
University of Regina



Phase II: The Prototype

Moving Forward from Here

With the great success of Phase 1 of Project Airlock, everyone is excited to move forward into Phase 2. It has been a clear goal from the conception of this competition to have participating teams create physical prototypes of their airlock designs. The purpose of this is to provide students with hands on experience in machining and fabrication.

The UBC Mars Colony team has learned an incredible amount from constructing their own design. Team members have been involved with advanced machining techniques such as milling and waterjet cutting. The team was faced with many challenges throughout the prototyping phase, some are outlined below:

1. **Funding:** the cost of “martian-grade” materials and components is very high, especially for student teams with access to limited funding.
2. **Workspace:** finding places to work and store a large project such as an airlock can be incredibly difficult on a university campus. This includes sourcing appropriate machining tools and capacity necessary for manufacturing.
3. **Timeline:** participating members are all students who likely have busy schedules (courses, co-op, part time jobs, etc.). Such a complex project requires strict deadlines and regular work sessions, which is not always possible to abide by due to the nature of the volunteer workforce.
4. **Transport:** Participating teams are from all across Canada, and are expected to transport the full-scale prototype airlock all the

During the Phase 1 competition weekend, the four participating teams were invited to an open discussion on the structure of Phase 2. Many concerns like the ones listed above were brought up, as well as many possible solutions.

To accommodate for these challenges, Phase II will have an altered timeline and scope. Discussions on the specifics are still underway. The planning committee is dedicated to providing a concrete timeline and scope for phase II as soon as possible. Stay tuned and expect some follow up in the upcoming weeks.

From all of us here at UBC Mars Colony:

THANK YOU!

