The Mars Society's "International Mission to Mars" High School Engineering Design Course & Competition

Overview of Program

In the summer of 2022, the Mars Society conducted a truly groundbreaking educational program for 40 high school students from around the world, modeled on the approach taken in engineering design courses at some of the best universities in the world.

With this six-week virtual program, the Mars Society made educational history by demonstrating the value of a new and much more creative way to teach science and engineering at the secondary school level than is currently being practiced.

Tuition fee for the course was a nominal $50, making it possible for students of all economic levels to participate. The first cohort represented a diverse and multicultural group of 40 high-school age students from around the world who were organized into five teams based on their time zones. Students hailed from the U.S., Canada, Germany, Poland, the United Arab Emirates, Peru, the Philippines, Singapore and India.

The participants were provided background lectures via Zoom video conferencing by some of the most prominent Mars experts in the world on a wide variety of topics, such as ASU professor and Mars rover camera expert Dr. Jim Bell, NASA Ames scientists Chris McKay and Carol Stoker, author Homer Hickam, noted biologist Dr. Steven Benner, and many more. These lectures included how to search for life on Mars, how to design spacesuits and other critical mission elements, and the science and technologies behind Mars exploration.

The participants then designed their own Mars surface mission, including its habitat, surface vehicles, scientific instruments, power system and other equipment and supplies, crew size and composition, mission location, scientific objectives, rations, duration, and exploration plan. They had 30 metric tons of useful payload that had already been delivered to the Martian surface, plus an ascent vehicle capable of returning up to six astronauts from Mars to Earth.

Each team wrote about their design in a report, with each team member responsible for authoring a section. During the program, the students were encouraged to communicate and collaborate using whatever tools and methods they were most comfortable with. In addition, eight coaches/mentors composed of science educators and Mars subject matter experts were also assisting and supporting the students with their design work and presentation preparation activities.

The final competition occurred in three rounds. During the first round, each team had 30 minutes to present their designs of a human Mars expedition to a panel of eminent judges. During the second round, each of the teams had 30 minutes to make criticisms of the other teams' designs. For the third round, the participating teams had 30 minutes to defend their design by rebutting the criticism advanced by the other teams, as well as to present a final "closing argument" on why their design was the best.

An expert panel of judges rated the participants' designs, presentations and rebuttals based on their technical and scientific merit and how they address the major factors of Science, Engineering, and Human Factors.

The program succeeded in teaching these high school students advanced concepts about science, engineering, technology and mission design. Some students remarked they were now more likely to pursue a STEM field of study in college, and that the experience had inspired them about the possibilities of working in a space-related career field.

Schedule

As we plan to expand this program, here are the updated schedule and rules for the course & competition.

Spring 2023 Cohort (at your location)	**Summer 2023 Cohort (online)**
Week of March 6 - Begin Lectures	Week of July 3 - Begin Lectures *(No activities planned for July 4th)*
Week of March 20 - Team formation & design discussions begin	Week of July 17 - Team formation & design discussions begin
Week of March 27 - Spring break - no scheduled activities	Week of July 31 - Final Reports due
Week of April 17 - Final Reports due	Week of August 7 - Presentations & Judging
Week of April 24 - Presentations & Judging	Week of August 14 - Announcement of winners; end of program
Week of May 1 - Announcement of winners; end of program	

Rules / Judging Criteria

There are three key elements of the scoring rubric: Science, Engineering, and Human Factors Challenges. Teams are organized to have individual students, or sub-teams, focused specifically on these areas, so that the proper discussion and tradeoffs could be made in their final designs. In addition to handling their own area as well as they can, the students work out the best possible compromises to produce the best overall result.

Each team's design is awarded up to 40 points for Engineering, 40 points for Science and 20 points for Human Factors. Each judge will award these points accordingly.

The team with the most overall points wins. To serve as a tiebreaker and as additional team designations, the number of "wins" in a specific category will also be considered. A win is defined as getting the largest number of points in one of the three areas across all judges.

Eg: In 2022, Team NEW ERA was the overall winner in total points and also won for Human Factors. Other teams, who placed lower overall, were top winners in Engineering and Science.

The winning team was invited to present at the International Mars Society Convention in October 2022.