Voyage to Mars Teacher Manual

Dear Educator,

Thank you for booking a Voyage to Mars, Challenger Space Mission at the Ontario Science Centre. You and your students are in for an exciting educational experience. If you have already flown a Challenger mission, you know the far-reaching value of this cross-curricular program.

The challenger experience consists of three components: pre-mission classroom preparation, the simulated space mission in the Challenger Learning Centre and post-mission reflection activities. In order to help you prepare for your upcoming mission, we strongly encourage you to attend a **FREE** Challenger Space Mission Orientation session held at the Ontario Science Centre (see Pre-Mission Preparation for details). If you are unable to attend the orientation, the following additional materials are included in this training package:

- **Lesson Plans**: A number of space-related in-class activities for student preparation.
- **Job Application Form:** Students briefly assess their best skills and apply for their desired team position.
- **Crew Manifest and Team Descriptions:** A class list for organizing students into teams. A description of each team and the strengths and learning styles suitable to performing each job accompanies the manifest to aid in placing students.
- **Exhibit Exploration Student Worksheet**: The Exhibit Exploration worksheets guide students on a journey through the Space Hall**,** located on Level 4.

The better prepared your students are, the more they will get out of the mission. As such, we recommend completing as many of the pre-mission activities as possible. After the mission, we encourage your students to use the excitement garnered from the experience to prepare reflection essays and hold a mini 'press-conference'.

Have fun preparing for your mission!

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WELCOME

In the Challenger Learning Centre (CLC) simulator your students role-play as futuristic astronauts aboard a spacecraft, and controllers at a base on Mars. The mission transforms your students into scientists, engineers, pilots, researchers, doctors and journalists as they work together to solve problems, make decisions and share in the thrill of human space exploration.

	
Mars Control ("brains") The Mars Control teams record and analyse data, and conduct research. They manage space flight operations and track the progress of the spacecraft crew.	**Mars Transport Vehicle ("hands")** The spacecraft is a science laboratory, where teams perform hands-on experiments to collect data, and relay that data to the Mars Control teams.

The mission will challenge your students to apply STEM skills, while using 21st Century skills such as critical thinking, teamwork, problem solving and communication. The following link provides further information on the facility, its history and our program: https://www.ontariosciencecentre.ca/School/Challenger-Learning-Centre/

PRE-MISSION PREPARATION

Free

TEACHER TRAINING WORKSHOP

We strongly encourage you to register and attend a **FREE** workshop held in the CLC at the Ontario Science Centre (OSC). The workshop will help familiarize you with the program and our simulator. You will fly a mini-mission, receive a training package and additional resources and have a chance to ask any questions you may have. **Workshops are held on Saturday mornings.** ***As an incentive, free entrance to the OSC is also extended to your family members*.** Below are links to the dates and times for this school year's Teacher Training Workshops:
https://www.ontariosciencecentre.ca/School/Programs/#gr4-8-16
https://www.ontariosciencecentre.ca/School/Programs/#gr9-12-10

CURRICULUM CONNECTIONS

https://www.ontariosciencecentre.ca/school/curriculum/junior/#p92
https://www.ontariosciencecentre.ca/school/curriculum/senior/#p98

IN-CLASS PREPARATION

In-class preparation prior to your mission is your responsibility. A few hours of classroom work are necessary to give students the appropriate background knowledge and attitudes essential for a successful mission. The more prepared your students are, the more they will extract from their mission. Pre-flight activities also serve to generate excitement in your students about their upcoming mission.

Materials in the teacher training package will help guide your in-class preparation by outlining mission events, suggesting classroom activities designed to reinforce the necessary skills and suggesting topics for further discussion and exploration. Among these materials you will find a **Team Description,** which describes each position, and a **Crew Manifest*** form**,** used for assigning your students to team roles. It is mandatory to fill out the **Crew Manifest**** *prior* to the day of your mission. We encourage you to allow your students to participate in this process by having them "apply" for team positions by completing the **Job Application Form**. Subsequently**,** these application forms can help you assign students to teams that best match their abilities and their expressed interests.

***** The numbers in the Crew Manifest refer to the recommended order in which you assign team roles. Thus, if you have 24 students attending, you would only fill in positions 1–24.
****Please bring three copies of your completed manifest with you on the day of your mission**.**

In addition to completing the Crew Manifest, please ensure your students know the following upon their arrival to the CLC:

1. The name of the team to which they have been assigned.
2. Their role in the mission and the tasks they will perform.
3. The overall *Voyage to Mars* storyline.
4. e they will start the mission: either in the Spacecraft or Mars Control. *

*Halfway through the mission, students will switch places, so everyone will have an opportunity to experience both Mars Control and the Mars Transport Vehicle spacecraft.

Students must also:

- Have sufficient reading skills so they can understand and pronounce the specialized vocabulary used in this mission.
- Be ready to listen attentively when required.
- Understand that all teams are equally important to the success of the mission.
- Know that Spacecraft teams are conducting experiments while Mars Control teams are analyzing data and conducting research.
- Understand they are in charge of the mission, and are expected to work both independently and as a team.

TIPS FOR PLACING YOUR STUDENTS

- Pair slower readers with strong readers and ESL learners with stronger students.
- Probe, Isolation, and Remote suit hands-on learners.
- Communication suits students who are proficient readers, calm, organized, and work well under pressure.
- Data should be able to read and type well.
- Identified students (ADHD, Autism, Associated Behaviour, Associated Learning Problems, etc.) may prefer Remote, Medical or Life Support.

Skills Developed	Limitations, Barriers and Risks
• Performing tasks • Recording, analyzing and interpreting data • Active listening • Effective communication and teamwork • Problem solving and critical thinking • Decision making • Risk-taking • Dealing with constraints • Letting go of the fear of failure and/or making errors	• Reading level • Content understanding • Content communication • Lack of engagement • Fear of taking risks • Unable to cope with uncertainty • Stress-level

PROBLEM-SOLVING STRATEGIES

Problem solving and critical thinking skills are core components of every mission. Therefore, it is helpful if students are aware of some learning strategies that enhance problem-solving skills.

The acronym **IDEAL** represents the five steps usually contained in many solution strategies:

1. **I**dentify the problem.
2. **D**efine and represent the problem.
3. **E**xplore possible solution strategies.
4. **A**ct on the strategies.
5. **L**ook back and evaluate.

Using an array of pedagogical and methodological strategies, teachers can promote reflection on the problem-solving process. Students are able to solve more complex problems with greater independence, providing they have the tools.

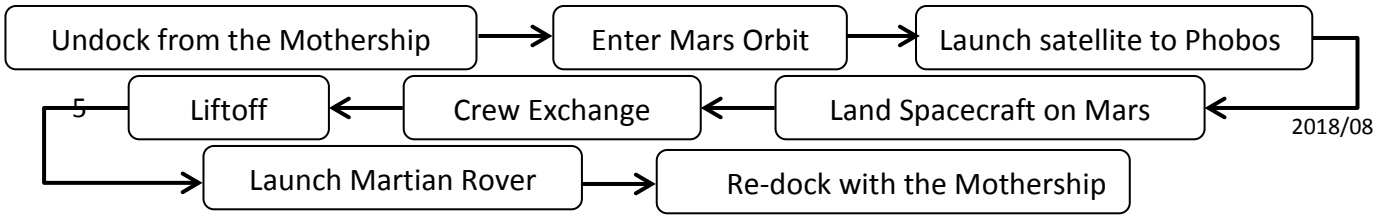
VOYAGE TO MARS STORYLINE

Since the dawn of civilization, humans have been driven to explore. A century after the first image was taken from the Martian surface; humans are now exploring the Red Planet in person. But is it worth the journey? While going to Mars offers untold scientific discoveries, such a mission comes with many risks, such as health problems, radiation exposure, living in confined spaces and meeting the basic human requirements for survival.

Your mission begins in the year 2076. Humans established a permanent base on Mars several decades ago, and scheduled crew changes are necessary. A crew of astronauts has been living on Mars at this base for the past two years, and they are anxiously awaiting the arrival of a spacecraft bringing a fresh team of astronauts, so that they can return home to Earth. The new crew of astronauts is excited about their imminent arrival at Mars Base, where they will begin a two year stay on Mars, conducting research and fulfilling their dreams of living on the Red Planet. The Mars Base team must safely guide the Spacecraft through several manoeuvres before landing.

Your teams will explore the challenges of working in space and the perils of living on another planet. Together, teams will learn the value of collaboration and effective communication as they perform experiments, analyze data and solve problems. Your teams will be under tight deadlines to complete these tasks while gaining an appreciation for the "luxuries" of planet Earth.

MISSION STAGES



MISSION DAY LOGISTICS

ARRIVAL

Plan to arrive **40 minutes** before your mission start time, so please allow plenty of travel time for your trip to the Science Centre. It can take a while to check in, store belongings and distribute School Identification stickers. Please also inform your students of the following:

- Lockers for coats and other belongings are available at a charge of $1.
- There is no food, drink or gum allowed in the simulator (water is okay).

CHALLENGER STAFF

Our Challenger educators are known as **Commanders**. They will be wearing blue astronaut flight suits and will escort you and your students to the simulator for the mission.

MISSION TIMES & MEETING LOCATION

10 a.m. mission: Meet the Commanders at the School Reception Desk, located on **Level 2**.
12 and 2 p.m. missions: Meet the Commanders at the HOT ZONE, located on **Level 6.**

ORGANIZING YOUR GROUP

When students arrive at the bridge outside the simulator, you should assist the commanders in separating your students into the two main teams: Mars Control and Mars Transport Vehicle. Once the teams are sorted, the commanders will hold a short briefing to provide an overview of the mission and their assignments.

As a teacher, your role is **Flight Affairs Officer**. As such, it is your responsibility to have all of your students fully trained and ready to go to work as Mission Specialists. Please encourage parent volunteers to assist students with reading and interpreting information, yet allowing students to maintain their independence. This is necessary for students to feel some ownership and confidence in their individual roles and to enjoy the success that results from their effort.

POST-FLIGHT ACTIVITIES

The days following your mission are crucial to consolidating the skills learned from the mission experience. Students tend to leave the mission with a renewed spirit of camaraderie, boosted self-esteem and a desire to explore and learn. To extend the experience students can:

- Analyse and reflect on the experience during the mission.
- Hold a news conference using the data logs and the report from the media team.
- Discuss the experience so students are able to transfer what they have learned into the everyday world of their classroom and school.
- Hold a debate on the human colonization of Mars (page 31, Mars Activity Guide)

At the core of all learning is the way we process our experiences, especially our critical reflections on the experiences. Experiential learning engages students in critical thinking, problem solving and decision making in contexts that are personally relevant to them. An important component to experiential learning is the **reflection discussion** that occurs after the experience. Reflection provides a chance for students to examine and link their simulation experience to prior and subsequent learning. Reflection can take numerous forms and touch on a variety of issues. It furthers learning and inspires provocative thought and action.

Teachers are encouraged to help students explore, analyze and synthesize their actions, thoughts and emotional states. For example, students can think about what thought processes influenced them to act a certain way, to make a particular decision or to solve a problem. Perhaps those decisions were made under stress, with insufficient information and time constraints. If students felt either ashamed or embarrassed by their performance during a mission, a debriefing discussion will give students the opportunity to clarify and consolidate insights and to re-frame the actual outcome for a *desired* outcome.

EXPERIENTIAL LEARNING THEORY

Immersive simulations play a vital role in the success of real space missions. Prior to travelling into space, astronauts use simulations as a training tool for the complex tasks and experiments they will be performing, such as operating the Canada Arm or 'walking' in space. The CLC introduces students to the thrill of space flight by engaging students in distinctive, immersive, hands-on simulations.

Teams of students role-play as scientists, engineers, pilots, researchers, doctors and journalists. They work to solve real-life and space-life challenges. A simulation makes pretend situations available to the learner to practice and hone necessary skills, rather than having them jump

right into the real experience — where a “do-or-die” mentality can often make the individual nervous and unconfident. Simulations can compress time and remove extraneous details and therefore, are optimized for learning. Indeed, the true magnificence of a simulation is that it provides an immersive learning experience, where skills, process, and knowledge can all be practiced without real life consequences. The ability to explore, experiment, and repeatedly apply this knowledge to life’s situations is what makes simulations a versatile form of learning.

In a CLC simulation each team has an instruction manual that outlines the mission specific goals and guides students through hands-on activities. Each student is essential for the completion and success of the mission; only by coming together as a team and sharing information, can the mission succeed. The simulation mimics real life situations allowing students to practice a wide range of skills. It is also a safe place to take risks without failure, thus, learners are at ease to immerse themselves completely. Simulations encourage problem solving and with that the potential to transfer that new knowledge to the real world. This ‘consequence-free’, hypothetical context combined with role-playing, enables students to disengage from their perceived self, allowing them to see themselves with a different perspective.