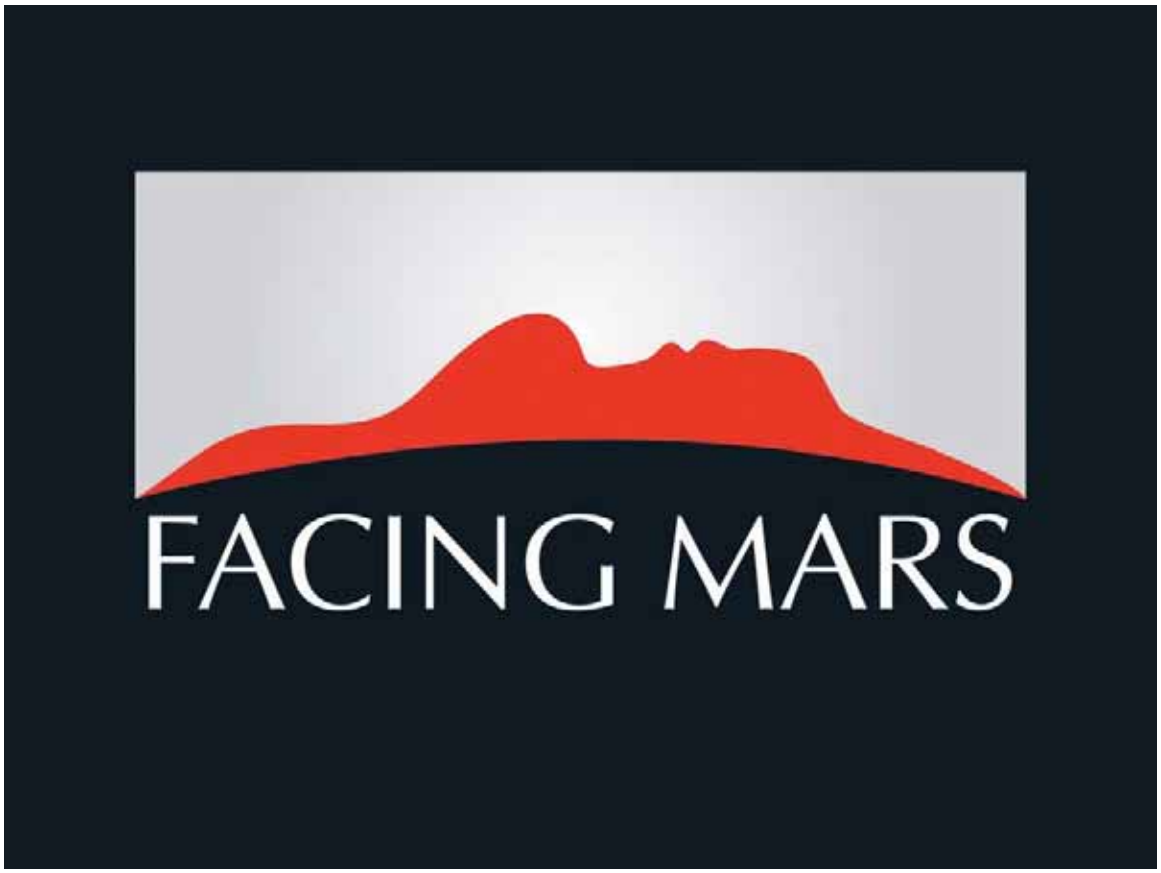

FACING MARS

LETTER TO TEACHERS: FACING MARS EDUCATION GUIDE

Are you and your students ready for the risks and rewards involved in *Facing Mars*?

This Education Guide is intended to accompany *Facing Mars*, an interactive, hands-on exhibition about the physical, psychological, technological and ethical questions involved in preparing for a voyage to the Red Planet.

In this exhibition, you will make discoveries and decisions that may influence your thoughts and opinions on a journey to Mars.

How would you cope with a dust storm on Mars? What would you do to keep your solar arrays free from dust for maximum power? Blast off into space! Design and launch your own rocket and test your ideas on what is necessary for a successful liftoff! Examine a Martian meteorite and find out what clues and questions this interstellar traveler provides. Can astronauts deal with the confinement and boredom of a three year journey to Mars? Would they risk their lives for a chance to explore space? Should humans even be going into space? Would you go?

This guide contains the following:

- Inquiry sheets for specific exhibits containing questions and answers, links to suggested activities, interesting facts relating to Mars and space travel.
- Grade specific curriculum connections to the National Science Education Standards and Pan Canadian Curriculum for *Facing Mars* experiences.
- A list of the exhibits with a brief overview for each experience

When you visit Facing Mars:

- Share expectations for the visit with students and chaperones.
- Try some pre and post activities before and after your visit.
- Use suggestions in this guide for more ideas.
- Divide your class into small groups to work together in the exhibition.

This Education Guide is a companion resource to the exhibition. The suggested questions and activities are designed to be flexible. Feel free to adapt them to suit the needs of your students. Change and modify questions and activities when appropriate for your class.

Facing Mars is produced and presented by the Ontario Science Centre

FACING MARS ONTARIO SCIENCE CENTRE

THEMES OF THE FACING MARS EXHIBITION

Are Humans Ready?

Would you leave behind your family, friends, and familiar surroundings to risk your life on a three-year, round-trip voyage to Mars? In *Facing Mars*, you have the chance to answer this question twice: as you enter the exhibition and again as you exit. While exploring each of the thirty, thought-provoking exhibits, take opportunity to reflect on your initial answer and some of the ethical questions about human exploration of Mars.

Should we even go to Mars? Are we ready as a species – will it be a global affair, a corporate venture or an expression of nationalism? Will humans go to Mars for scientific or financial gain? You can actively explore some of the thornier questions about life – and death – in space.

Surviving in Space

Space is not a friendly environment for human beings. Find out how microgravity weakens your bones and muscles, and even challenges your heart – and experiment with techniques that could counter these effects. See first-hand how being in space would affect your face – and feel first-hand what effect space might have on your head and stomach.

Dealing with the dangers of intense space radiation and how to engineer adequate spacecraft shields are major challenges in venturing outside of Earth's protective atmosphere. Experiment with shield materials and check current conditions on the Sun. Discover too the daily dietary challenges of a three-year mission to Mars.

Getting Emotional

Perhaps some of the biggest questions and challenges of journeying to Mars are the emotional and psychological ones – we do not know how isolated and cramped quarters will affect a crew once Earth is just another speck in space.

Explore your own sense of personal space, gauge your tolerance for boredom and lack of stimulation, and even find out if you're emotionally infectious. How well would you cope with a crew of other high-achieving astronauts under stressful conditions?

Looking for Life

Are we alone? Could Mars harbour alien life? How would we recognize Martian life if it vastly differed from ours? Explore some of the reasons why some scientists think that Mars may have once sheltered life, how we might look for it – and how we can attempt to understand the Martian environment by studying extreme life forms here on Earth. You can even get close to a real Martian – a meteorite that was likely blasted off the surface of Mars many millennia ago.

Going to Mars – and Getting Back

Spending months in a confined space is not an ideal road trip – especially in microgravity. Efficient and innovative rocket and spacecraft design is critical for a mission – the better and more fuel-efficient the design, the more cargo the craft can carry.

Experiment with simple rocket designs, test and launch them to see how they perform. Space is a hazardous environment – and problems are certain to develop, requiring a crew with a range of skills and abilities who can improvise solutions. Try selecting a crew yourself and see if you can get the mix right. See how resourceful you are in a crisis situation.

Living on Mars

To survive on Mars, astronauts will be challenged in ways we can only begin to imagine. In such a cold and hostile environment, astronauts would have to depend on autonomous robots and gliders to go where human explorers cannot. Wielding tools while encased in a spacesuit is difficult – but working while surrounded by static-charged dust really intensifies the challenges.

Astronauts living on Mars would have to make use of local resources, such as mining ice as a source of water, air and fuel for the return trip. Explore some of these harsh challenges of life on Mars – as well as the more mundane, such as: what to eat and what to do with waste?

LIST OF ALL THE EXHIBITS IN THE FACING MARS EXHIBITION

What does space do to your face?
Explore some of the visible effects of microgravity on the human body – first-hand!

Can you give birth in space?
Hear answers to some of the more awkward questions about life in space and on Mars – and submit your own questions.

Spacecraft to Mission Control: do you copy?
Explore the some of the real challenges of long-distance communication – and how stressful that may be. Learn why no one might hear you scream in space.

Do you have the sense and sensibility for space travel?
See how emotionally contagious you are – do you easily catch emotions from others, do you infect others with yours, or are you immune to other people's feelings?

How close is too close?
Where do you draw the line between personal space and 'in your face'? Experiment with getting up close and personal - then imagine how you'd deal with three years of it!

Are we there yet?
Isolation – monotony – boredom. How will it feel to be away for months and years from all you have ever known? Enter the confinement chamber and begin to find out.

Choose a Mars crew with the right stuff
Who should go to Mars? What combination of skills, gender and ages should make up the crew? Test your matchmaking skills to come up with the best team to head for Mars.

Gimme shelter
Space is a harsh environment – explore the dangers of space radiation and how engineers propose to shield astronauts from hazardous weather conditions as they hurtle through space.

Blast off!
Design, test and launch your own rocket. Find out what makes for a stable flight, and what happens when your rocket is out of balance.

Can you cope in a crisis?
Can you repair the broken solar panel so it can harness as much power as possible from the 'Sun'? Are you able to improvise to survive?

Life on Mars?
Explore the possibility of life on Mars – how scientists are looking for it, and what extreme life on Earth can tell us about seeking life Mars.

Windows to Mars
Understanding Mars begins here on Earth – visit analogue sites where scientists conduct experiments, practise techniques and develop technologies for Mars.

Earth or Mars?
Can you spot the differences between the third and fourth planets from the Sun?

Would you go?
Tell the world if you would take the journey to Mars – and after seeing the exhibition, tell the world again. Did you change your mind?

A devil of a dust storm
Mars is a global desert of dust and rocks, including massive, whirling dust devils. This simulated dust devil gives you a glimpse of what astronauts may have to weather on Mars.

Rock of ages
Martians have been landing on Earth for years – Martian meteorites. Get a close-up view of a meteorite that was blasted off the surface of Mars millennia ago.

A bird's-eye view of Mars
Explore Mars by air as you soar over terrain captured and modelled by orbiting satellites. See how the Martian land lies through some of the highest resolution images available.

Can you do the Marswalk?
What might it be like to walk and move under Martian gravity? Using a harness and counterweight system, you can walk like an astronaut on the Red Planet. Discover how it feels to drop 62 percent of your weight in 30 seconds!

Fan a Martian dust storm
Sticky, staticky dust coats everything on Mars. Explore how big a challenge these tiny particles pose by stirring up and stepping inside your own mini dust storm.

First, do no harm
How do you cope with a medical emergency 50 million kilometres from home? Practice! See if you have the space surgery skills for Mars.

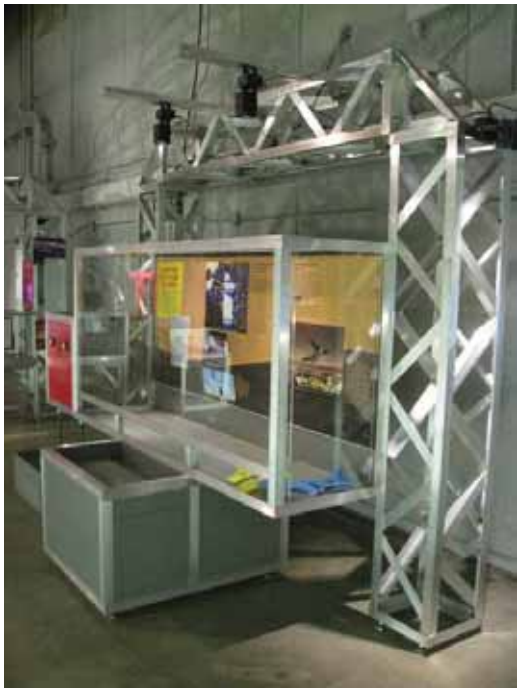
How hungry are you to go to Mars?
Explore what astronauts will eat, what they might grow and how they will cope as they journey far beyond the delivery zone for takeout pizza.

Whirl 'til you hurl?
Most astronauts experience space sickness in microgravity – how does being dizzy affect you? Can you still solve simple puzzles after 30 seconds in the spinning chair?

Good vibes
Experience one of the ideas that scientists think may help counter bone density loss. Bone and muscle deterioration is perhaps the biggest obstacle to long-duration space flights.

Mars 101
Visit our resource stations for answers to some frequently-asked questions and other riveting facts about exploring the Red Planet. Find out everything you were afraid to ask about waste in space.

Can you handle the pressure?
How well can you work when there is little air? Experiment with simple tasks under low air pressure and find out why a good glove design is hard to grasp.



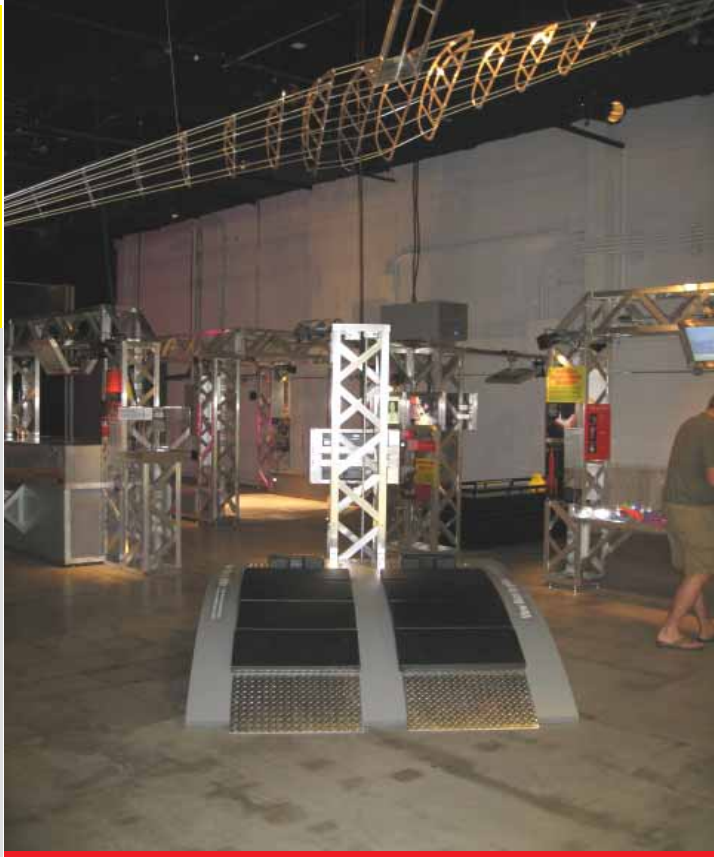
Winging it on Mars
Experiment with how well gliders might fly on Mars – and see if soaring over the Red Planet is as easy as it looks in the movies.

Baffle the bot
Create a challenging Martian maze. Can the robotic rover navigate its way home?

Bring Mars to life
Imagine it. Stage it. Shoot it. Create a stop-motion animation of pioneer life in a Martian colony.

Should we go?
Explore some of the ethical questions and issues around a venture to Mars. Where do you stand?

BIRD'S-EYE VIEW OF MARS



What it's about:

Landing an enormous spacecraft is no easy feat, but astronauts will have more than the mechanics to consider; they will also have to choose a landing site that meets multiple criteria. The atmosphere is thin, yet turbulence and high winds can make landings complicated. By reviewing images and videos from previous rovers and satellites, astronauts can get information about subsurface ice, craters, and landslide sensitive areas. They can rely on technology for some of the information, but human expertise is also critical. This experience allows visitors to flyover the surface of Mars to get up close and personal with some of the features of the red planet. We are "go" for landing!

What to say and do:

- **Where would you like to land? What will be some of your considerations when choosing a landing site** (flat surface, near potential water source, shelter from dust storms, etc.)
- **Can you spot some areas that you would avoid? Why?** (e.g. away from edge of crater or extinct volcano; ideally a smooth, flat surface that is near interesting features)
- **What are some resources on Mars that astronauts could use to their advantage?** (subsurface ice could be melted for human to drink, oxygen to breathe, combined with carbon dioxide and hydrogen to make rocket fuel)
- **Is there anything else that you could use to your advantage on Mars?**

Roger, Tranquility. We copy you on the ground. You've got a bunch of guys about to turn blue. We're breathing again. Thanks a lot.

Charlie Duke, CapCom, Mission Control (anxiously awaiting word from the astronauts of the first moon landing).

Pre or Post Activities

- **Grades 4-8**
  NASA Destination Mars Activity Packet (Lesson 3 and 4)
  http://is.gd/pq9

- **Grades 9-12**
  NASA: Is there Water on Mars
  http://is.gd/pqa

Cool Fact!

Olympus Mons, the tallest planetary feature in our solar system is about 27km tall , three times taller than Mt. Everest! Definitely a feature to steer clear of when trying to land on Mars!

BLAST OFF!

What it's about:

Rockets used during the Moon missions separated in stages, so as fuel was used up, the empty stages would fall away, leaving a smaller, more maneuverable spacecraft.

Rockets used for the Space Shuttle don't need as much fuel and power because they do not go as far into space. Rockets need a lot of power to get them off the ground; the bigger and heavier the rocket, the greater the force that is needed to lift them. The rocket shape and design, the materials, and the fuel all contribute to the success of a rocket. What kind of rocket will we need to go to Mars?

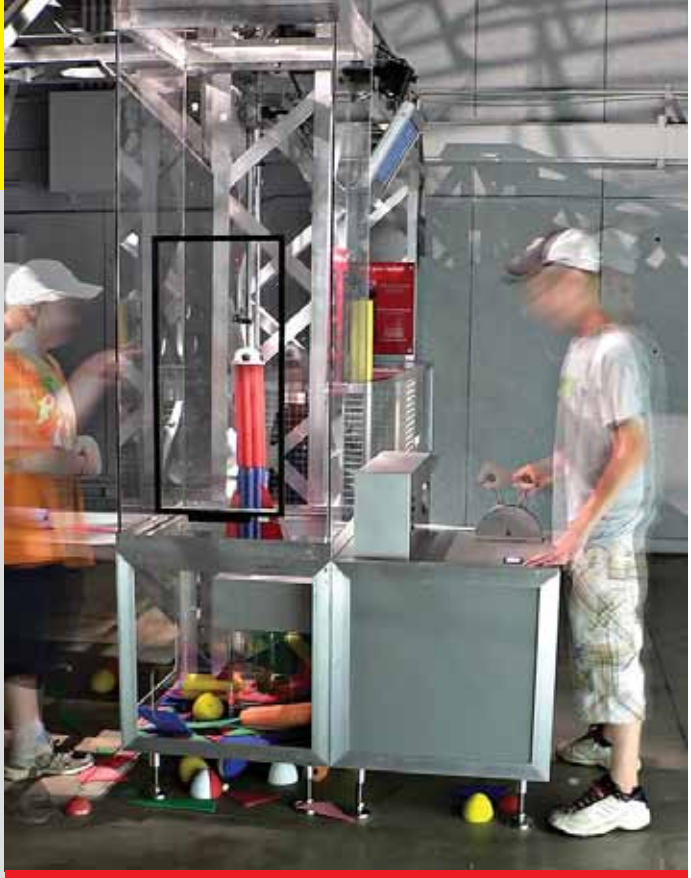
The visitor will have the opportunity to design and test their own rocket using the materials provided....3, 2, 1, Liftoff!!

What to say and do:

- **What qualities do you want in a rocket design?** (e.g. stable, strong, reusable pieces) What materials/shapes should you pick that would provide those chosen qualities?
- **What happened when you tested your rocket?** What worked well? What do you need to improve? What could you try differently next time? (if the rocket design is not successful, students can pick one thing to change for their next attempt)
- **Can your rocket withstand strong winds at liftoff?** (test with Wind Tunnel)

"One test result is worth one thousand expert opinions."

Wernher von Braun



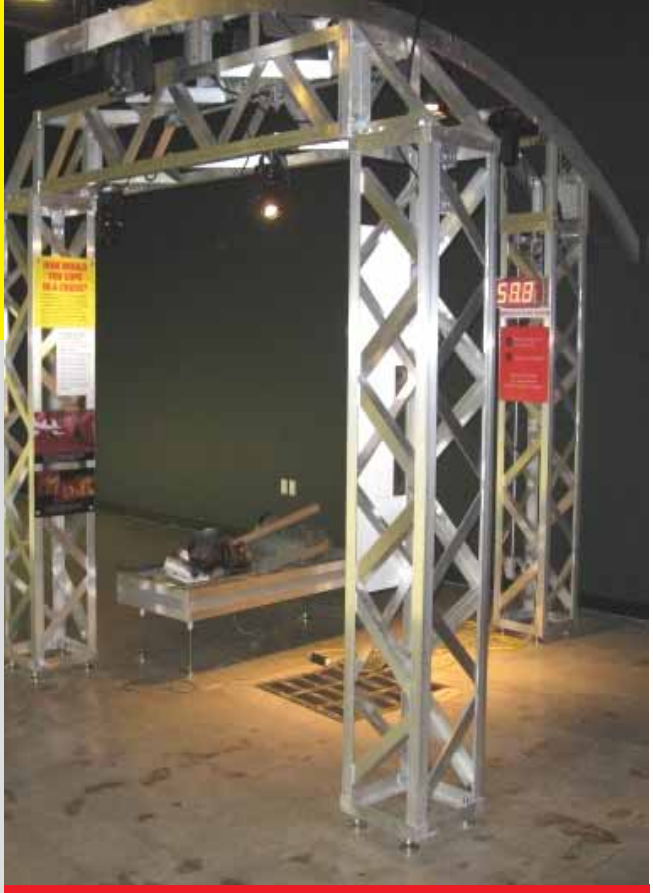
Pre or Post Activities

- Grades 4-8 Make your Own Rocket! http://is.gd/pqC
- Grades 9-12 Build and Launch a Rocket http://is.gd/pqF

Cool Fact!

Did you know that when the space shuttle lifts off, the dangerous combination of hydrogen and oxygen rocket fuel combine to make....water!

CAN YOU COPE IN A CRISIS?



What it's about:

Solar panels are important in space travel because they can replace batteries and chemical fuel in certain situations. Bringing fuel is incredibly expensive, heavy, and takes up space. If power generated from solar panels allows for less fuel needed, the spacecraft will be lighter or other materials can be brought in its place. The more light and sun these panels receive, the more energy they can convert to power other pieces of equipment. The power meter will display a percentage: the more light converted, the higher the percentage shown.

The Challenge:

The solar panels in this experience need a framework that can support and angle them for the greatest sun exposure. Using the random pieces of materials in the experience allows for innovation and creativity ... critical skills needed in space missions when things don't go according to plan!

What to say and do:

- Which materials are sturdy enough to support these panels? Which materials will not work? Why?
- Which forms provide the most stable support for the solar array? (cylinders, A-frames, spheres, etc.). Test out the ideas early on; it's important to make mistakes! What makes something stable?
- As the position of the sunlight changes, what modifications do you need to make to your design? Are there certain light positions that are not as desirable as others?
- Can you use ideas from previous designs to inspire new versions?

"I don't know what you could say about a day in which you have seen four beautiful sunsets.
John Glenn

Pre or Post Activities

- Grades 4-8 Measuring Solar Electricity
  http://is.gd/w1O
- Grades 9-12 Solar Activities
  http://is.gd/w1R

Cool Fact!

Sunbeam me up!
The astronauts living and working on board the International Space Station use power converted from over 30 000 solar cells on their Solar Array Wing!

FACING MARS

ONTARIO SCIENCE CENTRE

CAN YOU DO THE MARSWALK?

What it's about:

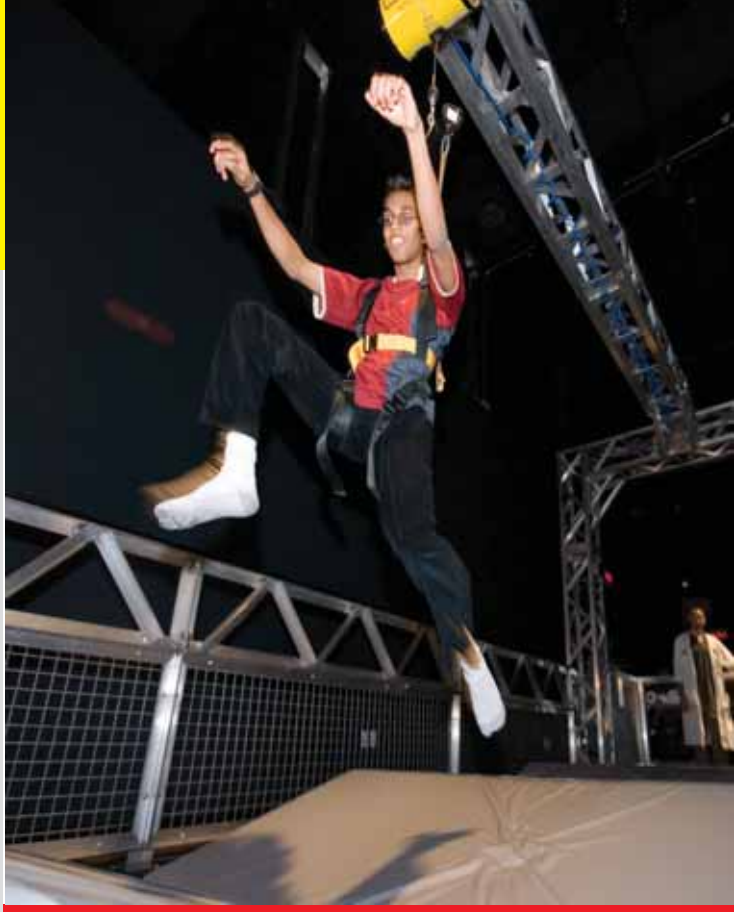
Anything that has a mass has gravity, and the larger the mass, the larger the gravitational force (or pull). Mars has a smaller mass than Earth, so it also has less gravity; the gravity on Mars is about 40% of that on Earth. There is not as much force pulling us down on Mars as there would be on our home planet. Our weight (the gravitational force) would change, but our mass (e.g. 70 kg) would stay the same; translation: we'd feel lighter! That sounds like a great perk when exploring Mars, but there are some serious considerations. This change in force requires adjustments to things we'd take for granted here on Earth. Combine this with bulky space suits, and simple things like running become awkward. Astronauts on the moon reported that they couldn't run, so instead they had to skip along!

In this experience, participants are attached to a winch to feel what it would be like to take a stroll on the red planet. Get moving!

What to say and do:

- **What does it feel like? Do you feel lighter or heavier?** (lighter)
- **If you were working or living on Mars, what activities would be easier for you to do with this type of gravity?** (e.g. jumping to reach for things; most activities would be easier as gravity would not be weighing you down as much)
- **What adjustments would you need to make if you lived on Mars** (e.g. Mars Rovers going over bumps would throw people out of their seats!)
- **How would this gravity make it easier for rockets to launch from Mars?** (less gravity on Mars means less force and fuel needed to liftoff)

"Apollo proved that humans were not forever a prisoner of Earth's gravity. We could leave our planet and go to other celestial destinations."
Neil Armstrong



Pre or Post Activities

- Grades 4-8: Different Gravity http://is.gd/pAN
- Grades 9-12: Different Gravity http://is.gd/pAN

Cool Fact!

Think about this:
People have not walked on the moon since 1972, but the moon could be a great dress rehearsal for astronauts as they prepare for Mars.

CAN YOU HANDLE THE PRESSURE?

What it's about:

Gloves and spacesuits need to protect astronauts from the extreme heat, cold and pressure of space. The gloves need to allow astronauts to complete experiments that require lots of fancy finger work! These jobs are made more difficult and dangerous due to the low air pressure in space and on Mars. The lower pressure outside the glove causes the air inside the glove to expand as it tries to equalize. This effect can make the gloves puffy, awkward and uncomfortable.

What to say and do:

- **How easy do you find the tasks once the gloves have been put on?**
- **How does that change once you extract some air, and the pressure is lower?** (the tasks should be more difficult, and the gloves may feel bulkier; fine motor skills decline)
- **How would you improve the space gloves?** (different materials, place seams in different places, have different layers of gloves)
- **Which glove properties need improvement?** (comfort, temperature, etc.)
- **The winner of the NASA space glove design challenge used his knowledge as a sail maker to help with his design of seams. What knowledge or experience could you use?** (properties of hockey gloves, winter gloves, golf gloves, etc.)

"Unfortunately the suit is so stiff, I can't do that with two hands, but I'm going to try a little sand trap shot here."

Alan Shepard, Apollo 14, golfing on the Moon, 6 February 1971

Pre or Post Activities

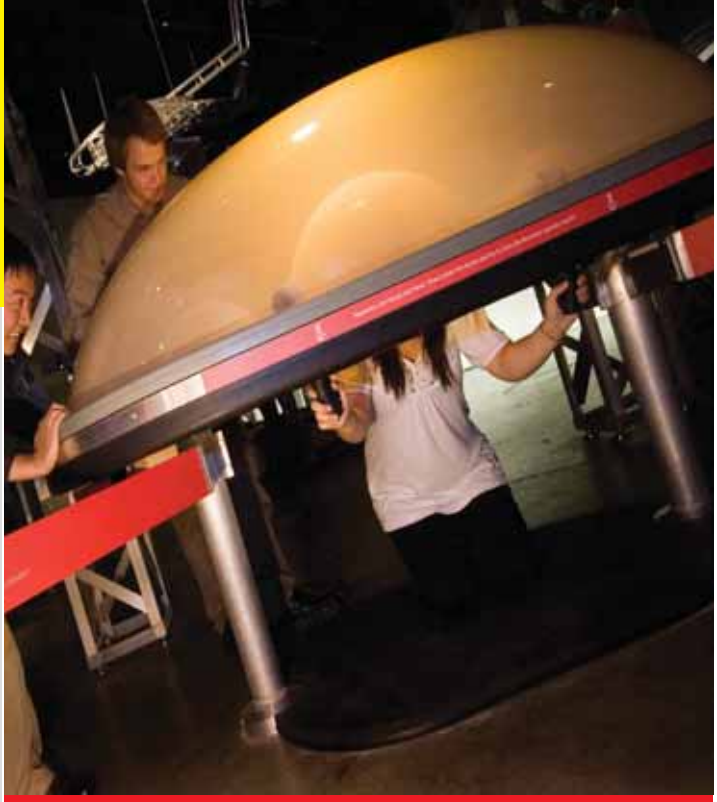
- Grades 4-8
  Staying cool in space: Glove design activity
  http://is.gd/ppz

- Grades 9-12
  Getting the Right Fit: Glove design activity
  http://is.gd/ppB

Cool Fact!

Glove and War?
A glove suited for the challenge of space needs to undergo a battery of tests. One test includes pumping the gloves full of water until they burst! All in the name of science!

FAN A MARTIAN DUST STORM



What it's about:

Martian dust can be dangerous just by being everywhere! There are concerns that the fine particles will affect equipment, spacesuits, and human health. This dust is more like flour than sand, and it can easily be inhaled, potentially causing respiratory damage and irritating skin and eyes.

This dust can also affect the planet's temperature. The dust absorbs light from the sun, causing less to be reflected, making the overall temperature slightly warmer. Have you ever shuffled your feet along the carpet, and then given yourself a shock when you touched something? Well, dust devils on Mars have the potential for a much more powerful discharge, which researchers fear could be harmful to people and equipment.

In this experience, participants can control the combination of wind and dust when working with solar powered machines, and discover some of the difficulties involved in exploring this dusty destination.

What to say and do:

- **What happens to the solar panels when they are covered in dust?** (they are not as efficient)
- **Can you find a way to use the fans that can clear the dust from the solar panels?**
- **How can dust affect us here on Earth? On Mars?** (can affect visibility, equipment function, solar power, human health)
- **Can you think of everyday examples with static electricity?** (brushing dry hair with comb, lightning, clothes from the dryer)
- **Describe the dust? How is this dust different from household dust?** (much finer, like flour)

"Electricity is really just organized lightning."
George Carlin

Pre or Post Activities

- **Grades 4-8**
  Store and Spark an Electric Charge
  http://is.gd/Qak

- **Grades 5-12**
  NASA Abrasion Tester Activity
  http://is.gd/oln

Cool Fact!

Feeling blue?
The sunset on Mars is usually blue because of the dust in the atmosphere!

GIMME SHELTER

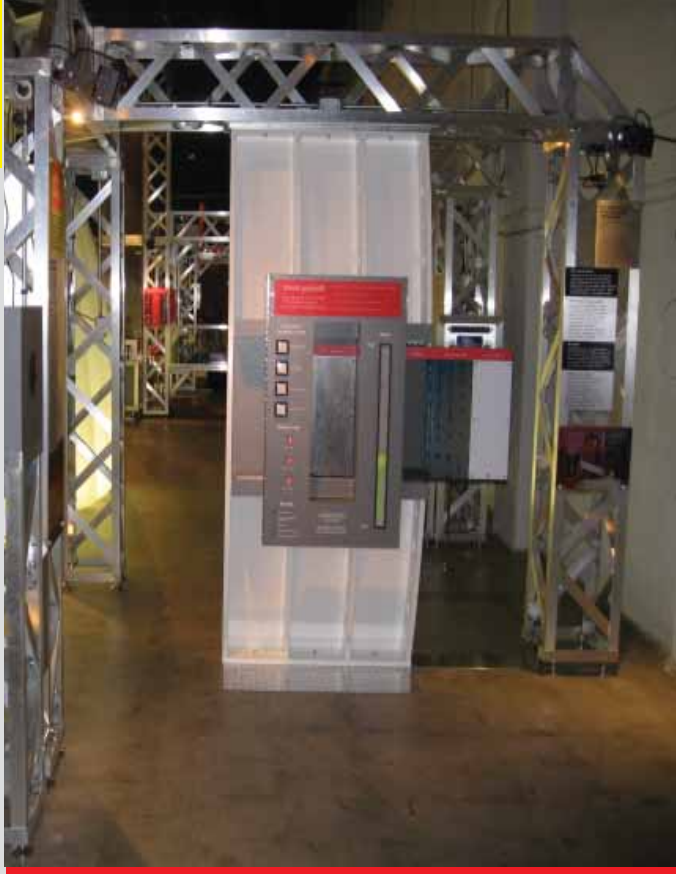
What it's about:

In this experience, participants can test how different materials would protect a spacecraft crew from the dangers of radiation. The simulated "Radiation detector" will indicate how effective the materials are at radiation protection.

Radiation can come from a variety of sources. On Earth, we are constantly exposed to radiation, but we try to limit unnecessary exposure during our everyday lives. Without Earth's atmosphere and magnetic field to protect astronauts from some types of radiation (galactic cosmic rays and solar wind), the crew only have their spacecraft and its contents to provide minimal safety. Another danger is secondary radiation: as the cosmic rays collide with atoms, there can be a domino effect as they bang into other atoms. Lighter atoms produce less secondary radiation. We also need to consider the practicality of the protection. If the shields are too heavy, will we need more fuel for the journey? Will we be able to launch a rocket that completely protects people? There can be serious health problems with the prolonged and increased radiation exposure that travelers to Mars would face: is it worth the risk? Would you go?

What to say and do:

- **Which materials offered the greatest protection and a lower Geiger counter reading?** (answers vary – for high energy galactic cosmic rays, combinations of engineered polyethylene and carbon nanotubes with embedded hydrogen fuel; for high energy solar radiation combinations of polyethylene and/or aluminum or carbon – but there is no absolute "right" answer)
- **Which materials offered increased radiation exposure?** (aluminum)
- **Should we only let certain people risk the radiation exposure on a voyage to Mars?** (e.g. only seniors, only males, only females who do not want children, etc)
- **Would you go to Mars knowing that it could permanently damage your health? Why or why not?** (answers may vary – people may risk health for exploration and discovery, or they may decide their health is more important than a space mission)



Pre or Post Activities

- Grades 4-8
  Radiation Activities with Teacher Information
  http://is.gd/w2q
- Grades 9-12
  Radiation Activities with Teacher Information
  http://is.gd/w2y

Cool Fact!

Seasons in the Sun!
The Earth's axis is tilted. and incoming solar radiation is not evenly distributed on the Earth's surface and seasonal changes occur.

"Mars is there, waiting to be reached."

Buzz Aldrin

LIFE ON MARS

What it's about:

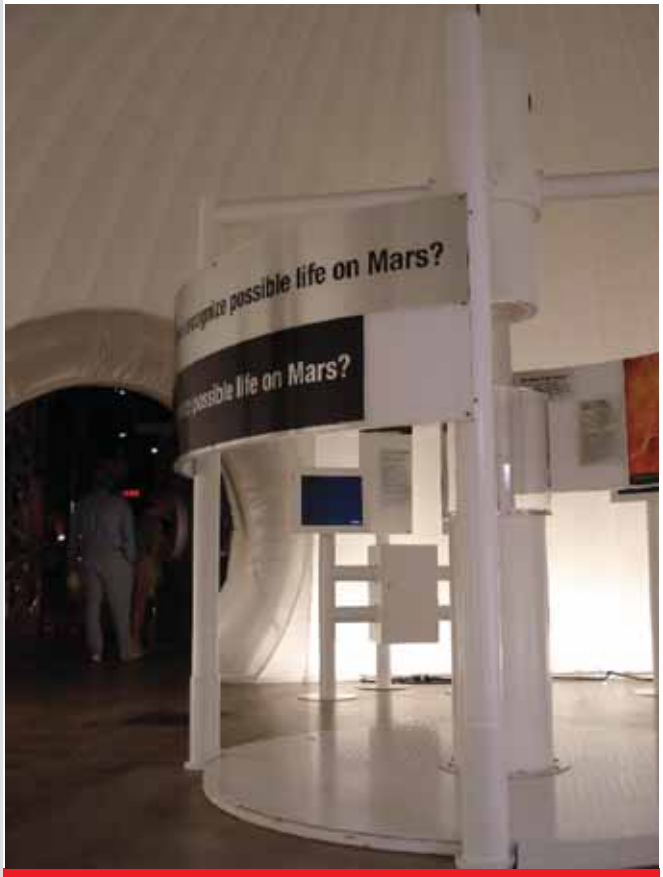
Extremophiles are microbes that live in conditions that would kill other creatures.
Imagine suffering from heat exhaustion at 4º C (39º F)! Some living things thrive on bitter cold, deep ocean depths, hot springs, or salt pools. What adaptations have allowed these organisms to survive in such unfriendly habitats? What does this mean for possible life on Mars? Cyanobacteria, like those shown in this experience, are a group of bacteria believed to be among the first to evolve on Earth. Scientists believe that early Earth and Mars shared many similarities; is it possible that there was, or is, life on Mars? If so, how could we study it while protecting it from exposure to Earth bacteria or other contaminants?

What to say and do:

- **What is our definition of an extreme life form? Is an extreme environment on Earth a normal environment on other planets?**
- **What are some of the extreme conditions that are found on Mars?** (radiation, extreme cold, dust storms, lack of accessible water, little atmosphere, no oxygen)
- **How do some living things survive in extreme habitats? (**e.g., some animals hibernate, some microbes can create food without photosynthesis, some equalize internal and external pressure at ocean depths.)
- **How could learning about extremophiles help humans survive on Mars?**(e.g. extremophiles that can survive in extreme cold could provide clues as to how humans can protect themselves, bacteria that can create food without sunlight can provide useful information in looking for life under the surface of Mars)

"For the first half of geological time, our ancestors were bacteria. Most creatures still are bacteria, and each one of our trillions of cells is a colony of bacteria."

Richard Dawkins



Pre or Post Activities

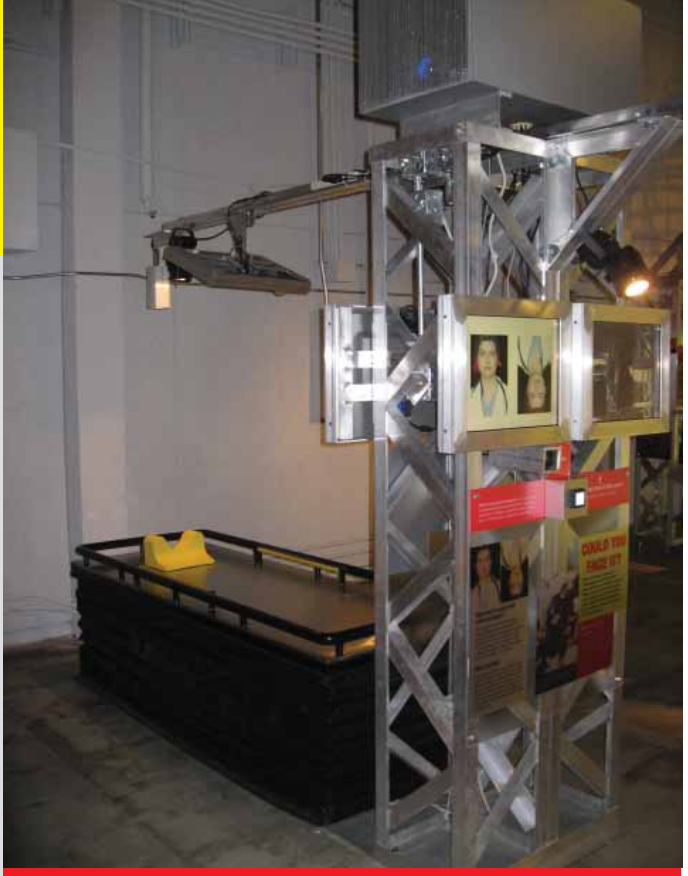
•Grades 4-8
Astrobiology in the Classroom
http://is.gd/w3E

•Grades 9-12
Astrobiology in the Classroom
http://is.gd/w3J

Cool Fact!

Hot Stuff!
A heat loving extremophile, Thermus aquaticus, is used in molecular biology to help multiply and analyze DNA!

WHAT DOES SPACE DO TO YOUR FACE?



What it's about:

In microgravity (en route to Mars), our blood doesn't circulate the same way as it does on Earth. Here on Earth, blood is prevented from pooling in our legs by a circulatory system that pushes it upwards, countering the effects of gravity. In the microgravity of space, the fluid isn't being pulled down with the same force, allowing a fluid shift to occur. The legs become smaller because the muscles of the legs force blood and other fluids toward the upper part of the body. As the fluid is redistributed in the chest and head, it can cause stuffy sinuses, headaches, and difficulty in tasting food! The loose flesh on our face rises, and the bags under our eyes look even puffier! As people are floating around in microgravity, there is no "right side up", and this may cause difficulties in reading facial cues that we take for granted here on Earth.

What to say and do:

- **What does it feel like?**
- **What other systems would be affected in microgravity?** (e.g. loss of bone mass and muscle because bodies are not working against the force of gravity, increased blood pressure)
- **How would microgravity (free fall) affect your daily life and routines?** (e.g. no chips because crumbs would float everywhere and get into equipment, no showers because loose water droplets could damage equipment and grow mold!)
- **For a Mars mission, people could be experiencing microgravity for years, what are some of the dangers that we need to be aware of before sending people into space for such a long period of time?** (increased blood pressure, loss of muscle, chronic headaches, weak bones, etc.)

"Discovery consists in seeing what everyone else has seen and thinking what no one else has thought."

Albert Szent-Gyorgyi

Pre or Post Activities

- Grades 4-8: Microgravity Science Activities
  http://is.gd/w2q
- Grades 9-12 Neurolab/Microgravity activity: Teacher Edition
  http://is.gd/w36
- Grades 9-12 Neurolab/Microgravity activity: Student Edition
  http://is.gd/w3b

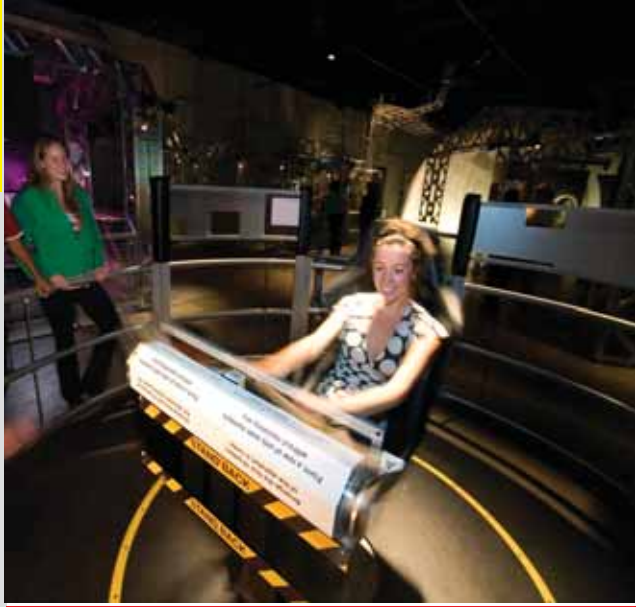
Cool Fact!

Think about this: Internal organs shift upwards in space, taking inches off of your waist! Alas, when astronauts return to earth, gravity and your waist go back to normal!

FACING MARS

ONTARIO SCIENCE CENTRE

WHIRL 'TIL YOU HURL



What it's about:

Feeling dizzy, disoriented, and nauseous? Welcome to space training! Some astronauts get motion sickness during launch, and this can last for a few days until they adjust to the weightlessness of space.

The neurovestibular system is a network of eyes, ears and brain that is hard at work to make sense of the microgravity and the random spins involved in space travel. When spinning, tiny hairs in the inner ear send messages to the brain to report the movement. The canals in your ear are positioned to detect different types of movement (pitch, roll, and yaw). These canals try to keep a person balanced and ready for anything...a difficult task when floating around in space!
Even when astronauts are feeling disoriented, they still may have to perform tasks that rely on their senses and their smarts. By testing out the following activity, you can find out if your body and brain are space worthy!

What to say and do:

- **Describe how you felt when you were spinning?** (if they feel uncomfortable, they can stop at any time)
- **Describe how you felt after you had stopped spinning and tried to complete the task?**
- **What are some real life experiences that might remind you of some of the physical symptoms associated with a space mission?** (riding roller coasters, spinning on playground equipment, watching movies on large screen, etc.)
- **What other occupations besides astronauts would need to be familiar with motion sickness?** (pilots, gymnasts, figure skaters, etc)

"You can't depend on your eyes when your imagination is out of focus."

Mark Twain

Pre or Post Activities

- Grades 4-8
  Astronauts' Balance Test (4th and 5th activity listed)
  http://is.gd/pAl

- Grades 9-12
  Creating Vestibular Illusions in the classroom
  http://is.gd/pAq

Cool Fact!

The longer astronauts stay in space, the longer they experience a dizzy feeling once back on Earth!