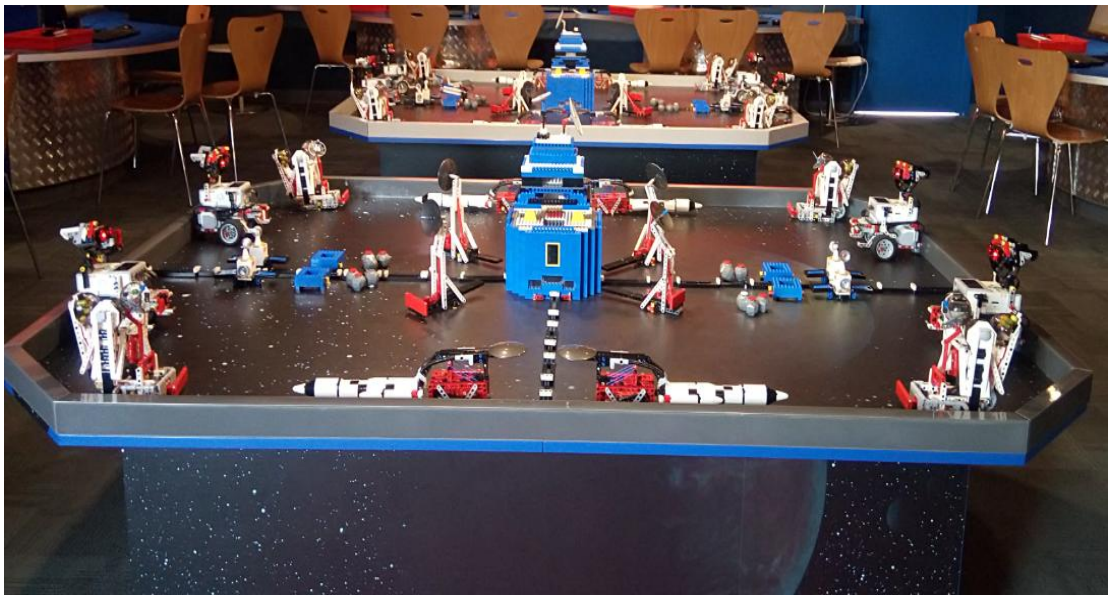
Cosmobot

A LEGOLAND® Malaysia
Educational Resource Guide



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Welcome to LEGOLAND Malaysia!

Education Programs: Cosmobot was developed by the LEGOLAND Education Department. For information on LEGOLAND Education programs, visit www.LEGOLAND.my/education

Directions: LEGOLAND® Malaysia is located in Nusajaya, Johor. The Park is just 18 minutes from Singapore via Tuas Second Link. From Tuas Second Link, proceed until you see the Nusajaya EXIT 312, within a few minutes you will see LEGOLAND® Malaysia Signage.

Just **30 minutes** from Johor Bahru, CIQ Johor and Singapore, LEGOLAND® Malaysia is accessible via Coastal Highway. From Danga Bay, proceed until you see the Nusajaya. LEGOLAND® Malaysia signage will be seen before reaching Kota Iskandar.

Located 30 minutes from North-South Highway and Senai Airport. Take Tuas/Nusajaya/Pontian/Tanjung Pelapas EXIT 253; proceed all the way to Nusajaya EXIT 312. LEGOLAND® Malaysia signage will lead you to the destination.

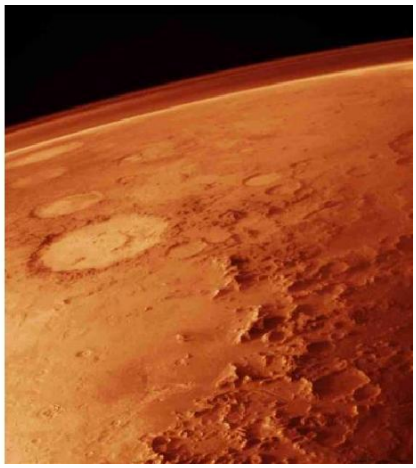
Safety: LEGOLAND Parks are built to the highest standards of quality and safety. Height restrictions apply on selected attractions throughout the park.

Hands on Activity:
Cosmobot program is a hands-on activity located at MINDSTORMS® in LEGO TECHNIC® area of the Park. The program is available on a first-come, first-served basis for park guests. Self-guided programs are not guaranteed these activities. School groups must call in advance to reserve a class. This class is subject to availability. Please call reservations at +607-597 8888 for more information.

Background Information

Learn about the planet Mars!

Mars is the fourth planet from the Sun and the second smallest planet in the Solar System, after Mercury. **Named** after the Roman god of war, it is often described as the "Red Planet" because the iron oxide prevalent on its surface gives it a reddish appearance. Mars is a terrestrial planet with a thin atmosphere, having surface features reminiscent both of the impact craters of the Moon and the volcanoes, valleys, deserts, and polar ice caps of Earth. The rotational period and seasonal cycles of Mars are likewise similar to those of Earth, as is the tilt that produces the seasons. Mars is the site of Olympus Mons, the second highest known mountain within the Solar System (the tallest on a planet), and of Valles Marineris, one of the largest canyons. The smooth Borealis basin in the northern hemisphere covers 40% of the planet and may be a giant impact feature. Mars has two moons, Phobos and Deimos, which are small and irregularly shaped. These may be captured asteroids, similar to 5261 Eureka, a Martian trojan asteroid.



Until the first successful Mars flyby in 1965 by *Mariner 4*, many speculated about the presence of liquid water on the planet's surface. This was based on observed periodic variations in light and dark patches, particularly in the polar latitudes, which appeared to be seas and continents; long, dark striations were interpreted by some as irrigation channels for liquid water. These straight line features were later explained as optical illusions, though geological evidence gathered by unmanned missions suggests that Mars once had large-scale water coverage on its surface at some earlier stage of its life. In 2005, radar data revealed the presence of large quantities of water ice at the poles and at mid-latitudes. The Mars rover *Spirit* sampled chemical compounds containing water molecules in March 2007. The *Phoenix* lander directly sampled water ice in shallow Martian soil on July 31, 2008.

Mars is host to five functioning spacecraft: three in orbit – the *Mars Odyssey*, *Mars Express*, and *Mars Reconnaissance Orbiter* – and two on the surface – Mars Exploration Rover *Opportunity* and the Mars Science Laboratory *Curiosity*. Defunct spacecraft on the surface include MER-A *Spirit* and several other inert landers and rovers such as the *Phoenix* lander, which completed its mission in 2008. Observations by the *Mars Reconnaissance Orbiter* have revealed possible flowing water during the warmest months on Mars. In 2013, NASA's Curiosity rover discovered that Mars' soil contains between 1.5% and 3% water by mass (about two pints of water per cubic foot or 33 liters per cubic meter, albeit attached to other compounds and thus not freely accessible).

Mars can easily be seen from Earth with the naked eye, as can its reddish coloring. Its apparent magnitude reaches −3.0, which is surpassed only by Jupiter, HYPERLINK "http://en.wikipedia.org/wiki/Venus" Venus, the Moon, and the Sun. Optical ground-based telescopes are typically limited to resolving features about 300 km (186 miles) across when Earth and Mars are closest because of Earth's atmosphere.

Before and After the Visit: Research and Action!

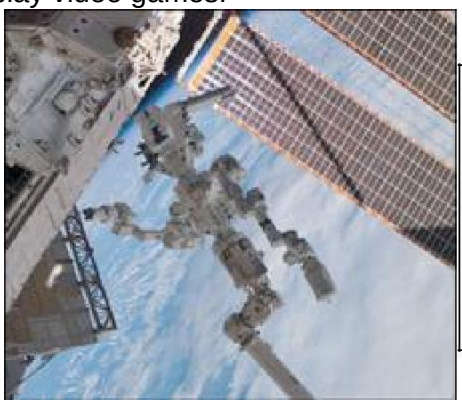
Astronauts use Robotics in Space

How Does NASA Use Robots?

NASA uses robots in many different ways. Robotic arms on spacecraft can move large objects in space. Robotic spacecraft can visit other worlds. Robotic airplanes can fly without a pilot aboard. NASA is studying new types of robots. These will work with people and help them.

What Are Robotic Arms?

NASA uses robotic arms to move large objects in space. The "Canadarm" robotic arm is on the space shuttle. The International Space Station has the larger Canadarm2. The space shuttle uses its arm for many jobs. The Canadarm can release or recover satellites. Astronauts have used it to grab the Hubble Space Telescope. This let them fix the Hubble. The shuttle and space station arms work together to help build the station. The robotic arms have added new parts to the space station. The arms also can move astronauts around on spacewalks. The space station's arm can move to different parts of the station. It moves along the outside of the station like an inchworm, attached at one end at a time. It has a robotic "hand" named Dextre that can do smaller jobs. An astronaut or someone in Mission Control must control these robotic arms. The astronaut uses controllers like joysticks used to play video games.



On the left: a robotic arm attached to the International Space Station.

On the right: Spirit is one of a group of robots that have explored Mars from the surface or from orbit

How Do Robots Explore Other Worlds?

Robots help explore space. Spacecraft that explore other worlds, like the moon or Mars, are robots. These include orbiters, landers and rovers on other planets. The Mars rovers Spirit and Opportunity are robots. Other robotic spacecraft fly by or orbit other worlds. These robots study planets from space. The Cassini spacecraft is this type of robot. Cassini studies Saturn and its moons and rings. The Voyager and Pioneer spacecraft are now traveling beyond our solar system. They are also robots. People use computers to send messages to the spacecraft. The robots have antennas that pick up the message commands. Then the robot does what the person has told it to do.

How can Robots help Astronauts?

NASA is developing new robots to help people in space. One of these ideas is called Robonaut. Robonaut looks like the upper body of a person. It has a chest, head and arms. Robonaut could work outside a spacecraft. It could do work like an astronaut on a spacewalk. With wheels or another way of moving, Robonaut could work on another world. Robonaut could help astronauts on the moon or Mars.

NASA is studying other ideas for robots. A small robotic arm could be used inside the station. A robot like that might help in an emergency. If an astronaut were seriously hurt, a doctor on Earth could use the arm to perform surgery. This technology could help on Earth, as well. Doctors could help people in faraway places where there are no doctors.

Robots also can be used as scouts to check out new areas to be explored. Scout robots can take photographs and measure the terrain. This helps scientists and engineers make better plans for exploring. Scout robots can be used to look for dangers and to find the best places to walk, drive or stop. This helps astronauts work more safely and quickly. Having humans and robots work together makes it easier to study other worlds.

Discovery Worksheet

Ride the Dragon, then solve the challenges faced when engineers animated the robotic models. Hint: Think about programming robots with sensors, motors, and timers.

Challenge #1: The coaster will pass through the castle at random times. How will the castle models come alive just as a coaster approaches?

Challenge #2: Motor 1 moves the dragon's body up, Motor 2 moves the head up, and Motor 3 opens the jaws. With only three motors, how do we cause these movements: body down, head down and jaws closed?

Challenge #3: The dragon's eyes light up and we hear him roar! How do we get him to stop this outburst without having to turn the switch off after each ride?

Teacher Notes: 1. A light sensor crosses the track. When the coaster breaks the beam, a signal is sent to the dragon's motors to start. 2. Each motor is programmed to operate first in forward, then in reverse. 3. The light and sound are originally triggered by another light sensor crossing the track. The light and sound are on a timer, programmed for a certain number of second.

Hands-On Activity

Cosmobot at LEGOLAND® Malaysia Resort

Go on a mission with LEGO® MINDSTORMS™ EV3 Cosmobots. Complete a set of missions on the planet Mars like activating communication stations, collecting rock samples, launching a satellite into low Earth orbit and launching a space rocket to send the first crew to explore and study the planet Mars!

Cosmobot introduces the group to the tasks that they need to complete through hands-on programming. Students work in pairs with a robot, attachments, and computer loaded with Cosmobot's EV3 software.

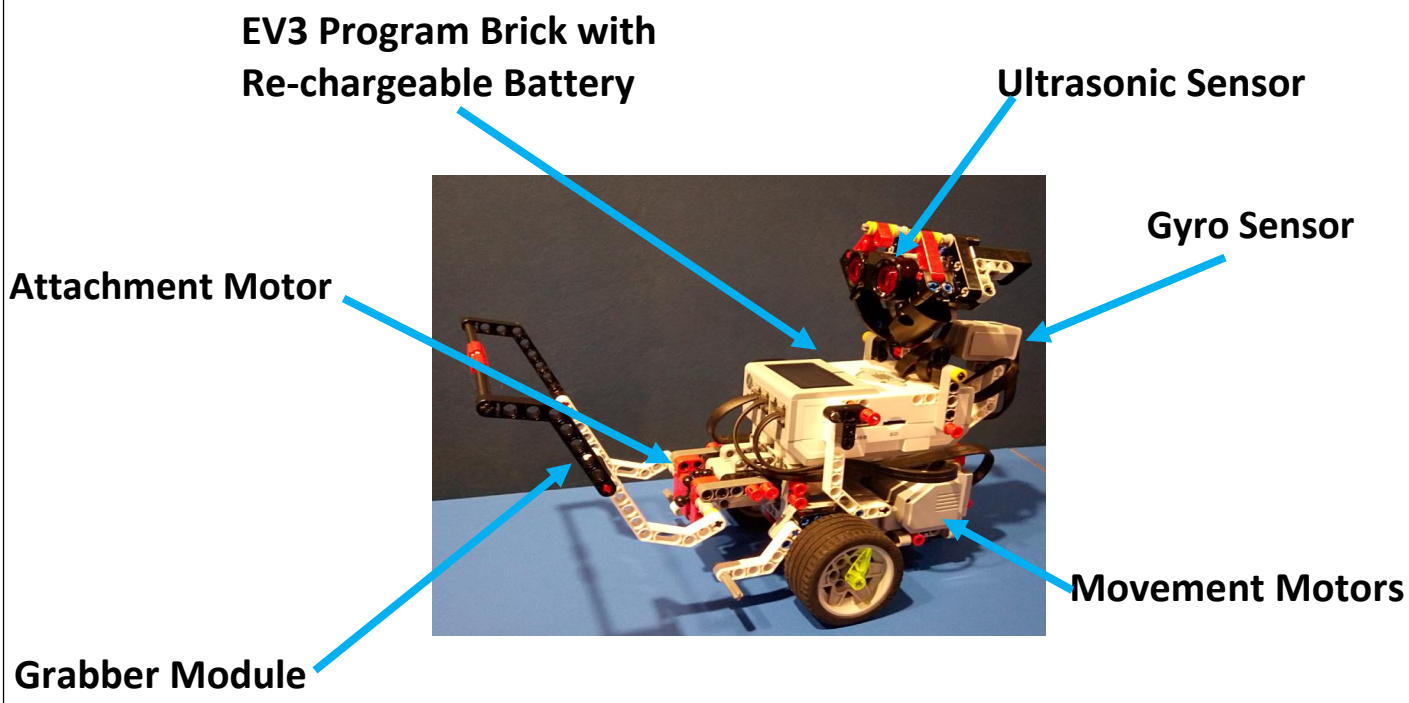
Each pair plans a strategy to complete the robotic tasks needed to program robots on the planet Mars!

Students use the icon-based program to set up their robot's actions, and then test it on the Mars "mining camp table".

Students modify their program based on the results, until they successfully complete one or more missions. They have a chance to demonstrate their strategy to the group.

Check out the robot's body:

- Find the EV3 program brick, a tiny microcomputer that acts like the robot's "brain."
- Find the Infrared window, which receives instructions for action.
- Find the Gyro sensor, programmed to conduct precise turning.
- Use your Grabber Module to help complete the challenges.



Create a program on the screen:

- Click and drag the commands to go forward, backward, left, and right then finish off with a victory dance!

**Gyro sensor programming is upon request during during school group booking. Not applicable on ad hoc basis.*

About Cosmobot

Educational Objectives

- Explore computer programming with motors and sensors to complete tasks with a robot.
- Predict and investigate how different strategies affect a robot's performance.
- Learn to use different types of motors with different attachments
- Relate the Hands-On investigations to the experience of LEGOLAND attractions.