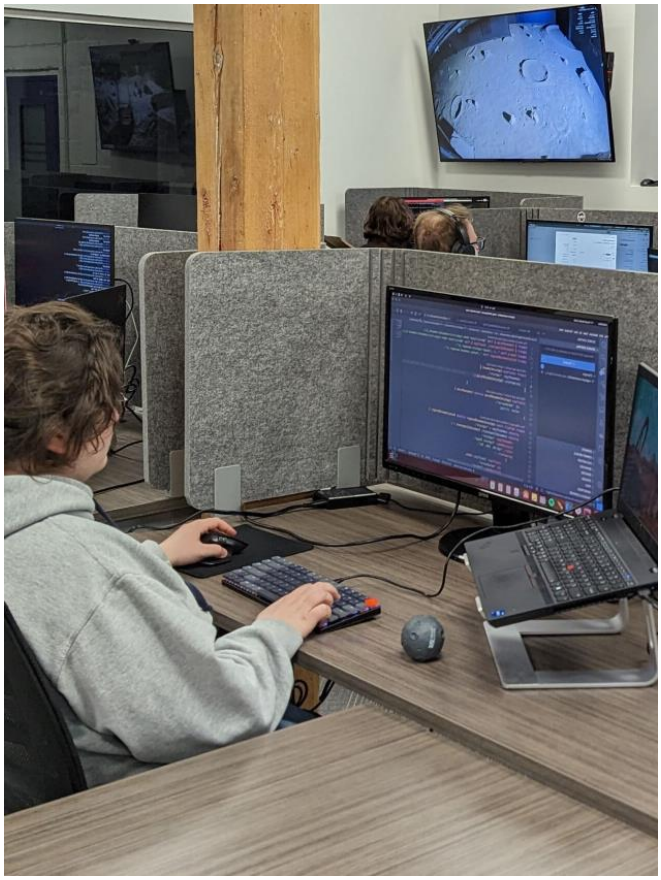
THE ROVER DRIVING ACADEMY

Teachers Guide

The Rover Driving Academy Program provides students with ability to become part of a lunar research team, operating a remote rover to explore a simulated lunar landscape, investigate areas of interest and identify lunar features.

MISSION CONTROL™



ABOUT THE PROGRAM

The Rover Driving Academy Program is a captivating educational program specifically designed for students in grades 6-9. It offers an in-depth exploration of lunar science and space missions, covering a variety of exciting topics such as lunar geology, crater formation, lunar phases, tidal locking, space travel, lunar landings, and rover operations. The program consists of multiple lessons, each with a distinct theme, allowing students to gain a comprehensive understanding of these subjects. The highlight of the Rover Driving Academy is the opportunity for students to actively participate in a learning experience where they become part of a team that operates a real lunar rover in a simulated lunar environment.

DRIVING LESSON PREPARATION

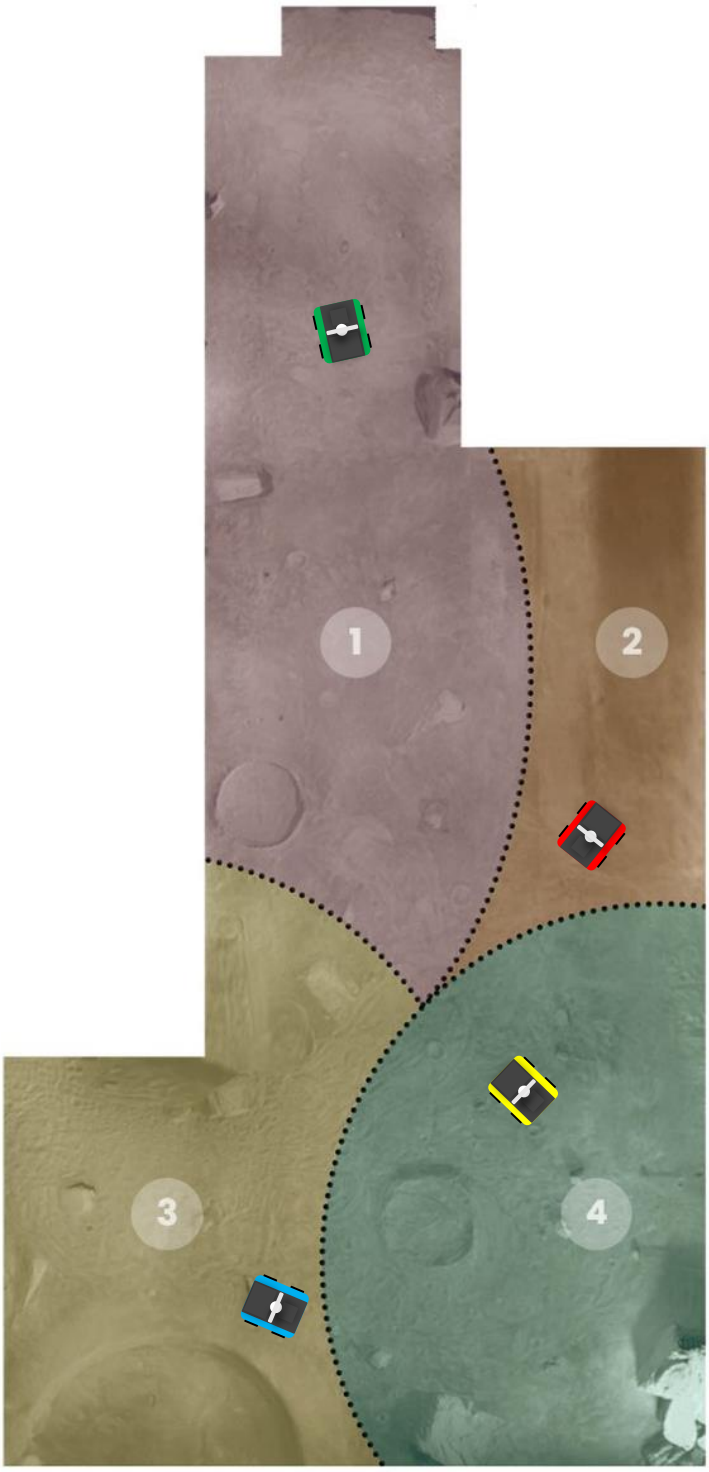
This part of the Rover Driving Academy Program is a thrilling adventure that's a bit like solving a lunar puzzle. Your students will drive a remotely operable lunar rover across a simulated lunar landscape, encountering lunar elements and identifying them using spectral data. It's an exploration, a challenge, and an opportunity for scientific discovery all rolled into one.

Your class preparation is crucial. It's an incredible opportunity, but it also comes with significant challenges. Your students will need to know the equipment inside and out, understand their mission, and work seamlessly with each other.

So, as you go through the following lesson plan, remember that every piece of knowledge and skill your students gain will contribute to the success of their lunar exploration mission. This is your chance for your students to become lunar explorers, and together, we'll make it an unforgettable experience. Let's get started on this lunar adventure!

THE MOON YARD

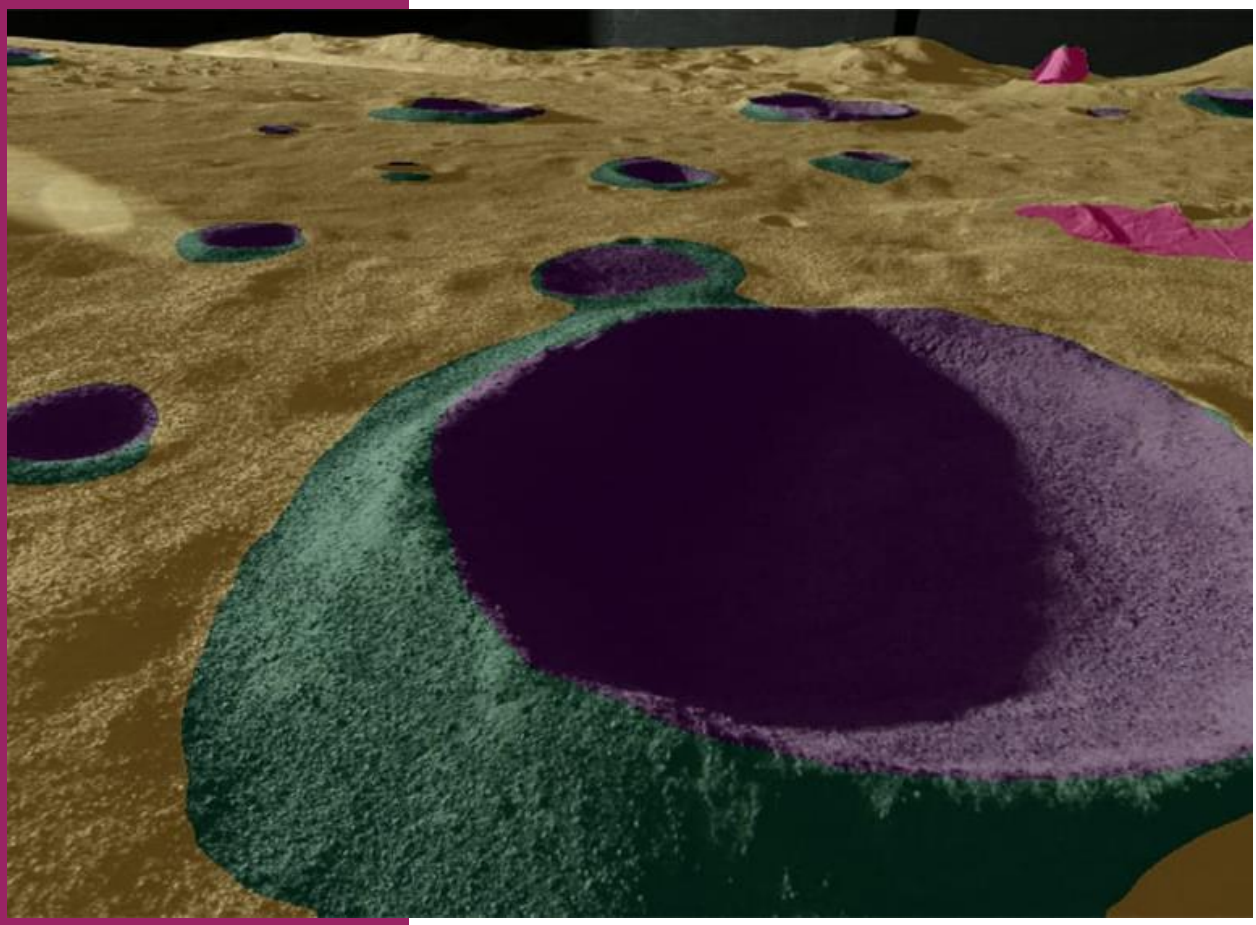
This is the Moon Yard Map which each teams Rover Navigator has access to via their UI. The Moon Yard is divided into 4 zones, each containing unique lunar features. Working in teams of 5 (*Rover Driver, PTZ Operator, Rover Scientist, Rover Navigator, and Rover Safety*) students will control 1 of 4 rovers and explore various lunar landscape on the Moon Yard and uncover lunar features using special spectral data.



KEY DETAILS

- 30x20m testbed at Mission Controls HQ in Ottawa, Canada
- Geologically relevant features and reconfigurable landscapes: volcanic, polar, highlands, mare
- Lunar lighting conditions: Equatorial to polar
- Walls/ceiling painted matte black

MISSION CONTROL™



LUNAR LANDSCAPE DISCOVERY

Grade: 6-9
Time: 1 hour
Presentation: 20 mins
Drive Time: 40 mins

In this activity, students take on the roles of a lunar research and exploration team as they drive a remotely operable rover across a simulated lunar landscape. They'll have the exciting challenge of investigating areas of interest on a Moon Yard that contain numerous lunar features and identifying them based on provided spectral data.

Learning Outcomes

Scientific Exploration: Students will actively engage in the process of scientific exploration by operating a lunar rover, capturing images, and analyzing spectral data. They will gain hands-on experience in conducting experiments and making observations.

Problem-Solving Skills: As students search for and identify lunar elements based on spectral data, they will develop problem-solving skills. They will need to interpret data, make informed decisions, and collaborate effectively within their rover teams.

Teamwork and Collaboration: Students will work collaboratively in teams, assuming different roles (Rover Driver, Pan Tilt Zoom Specialist, Rover Scientist, Mapping Navigator, Rover Safety Guardian, and Communications Specialist). They will learn the importance of clear communication and coordination to achieve common goals.

Application of Scientific Knowledge: By identifying lunar elements using spectral data, students will apply their scientific knowledge and critical thinking skills. They will connect theoretical concepts about lunar composition to real-world exploration scenarios, deepening their understanding of lunar science.

THE PRE-DRIVING PRESENTATION

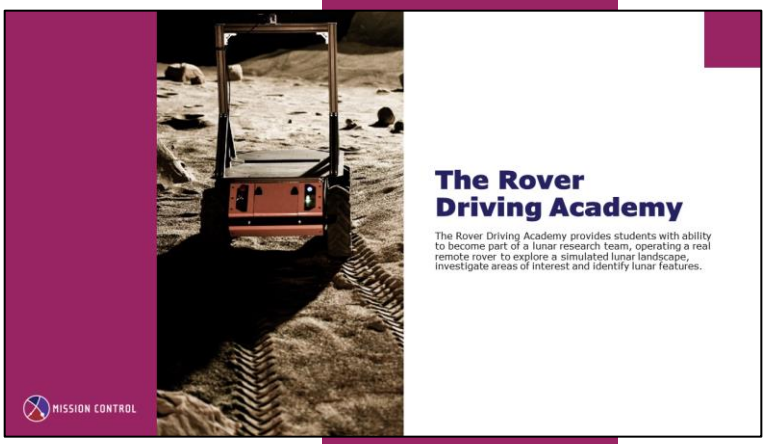
The teacher's guide includes a comprehensive walkthrough of the slide deck, providing additional content to enhance the teacher's understanding and prepare them for the class. The guide systematically covers each slide, offering detailed information, context, and insights to empower the teacher with comprehensive knowledge. This prepares you to effectively guide the students through the rover driving experience, ensuring a well-informed and engaging learning environment.

WELCOME

Throughout this experience, you'll recognize the importance of effective teamwork and communication in the success of your lunar exploration mission. You'll understand how each role fits into the bigger picture.

THE ACADEMY

The Rover Driving Academy is an adventure filled with exploration, problem-solving, and scientific discovery. To make the most of it, you need to be prepared. You'll be driving a remotely operable rover across a simulated lunar landscape, encountering various lunar elements, and identifying them based on spectral data. It's like solving a lunar puzzle, and each one of you is a vital piece of that puzzle.



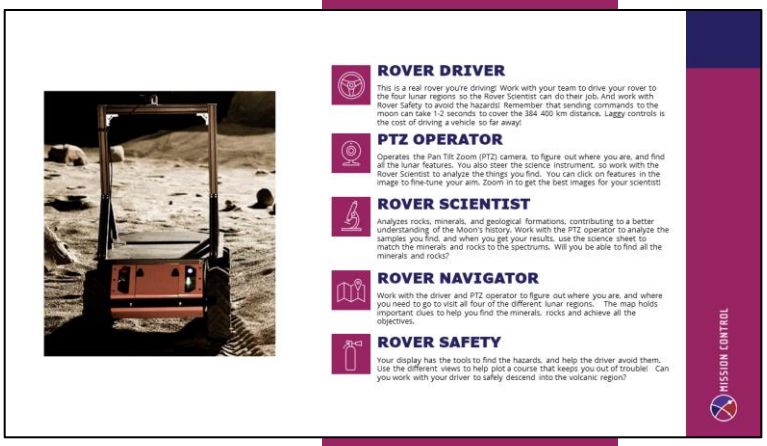
THE TEAM

Teamwork and collaboration are the cornerstones of lunar exploration. We rely on each other's expertise, communicate effectively, and work together to overcome challenges and achieve our lunar mission objectives. Together, we're a powerful lunar team ready to embark on this thrilling adventure.

THE ROLES

Role Familiarization. In this section you will explain the different roles within a lunar rover team: Rover Driver, PTZ Operator, Rover Scientist, Rover Navigator, and Rover Safety. For each role provide a brief description of the responsibilities and tasks associated with each role.

Facilitate a discussion about the importance of teamwork and collaboration in lunar exploration.



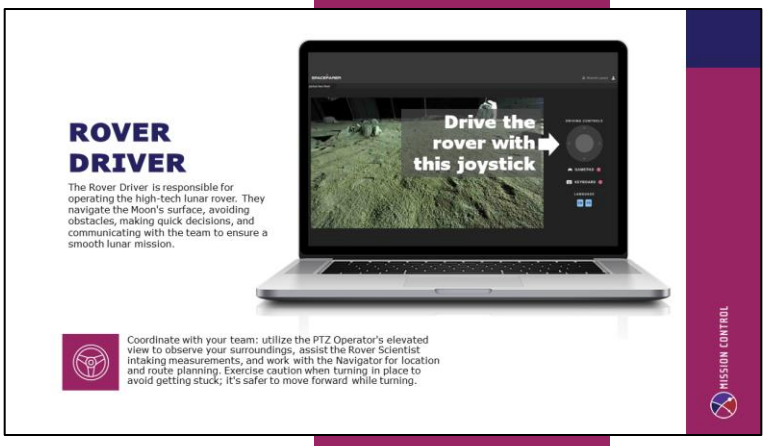
THE DELAY

Ensure you discuss the fact that there is a slight delay in the controls of these rovers. The Moon is 384,400km away from earth, which means it takes 1.25 seconds for a signal to travel from Earth to the Moon (and vice versa) at the speed of light. This can make driving the rover and controlling the PTZ feel "laggy".

ROVER DRIVER

Click and drag the circle in the middle of the joystick towards the direction you want to go. The camera on the rover lets you see what's ahead and a bit downward, helping you avoid obstacles.

The rover turns in a unique way. When you push the joystick left, the right wheels move forward while the left wheels move backward, turning the rover left. Pushing the joystick right makes the rover turn right.

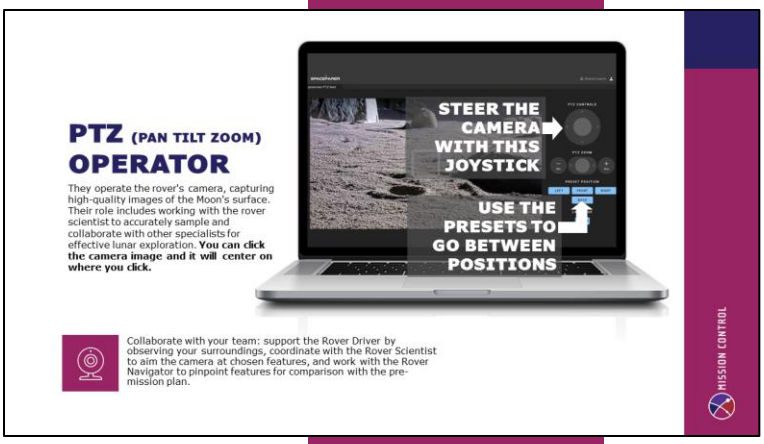


PTZ OPERATOR

Pan Tilt Zoom (PTZ) is a special camera moving horizontally (pan), vertically (tilt), and changing image size (zoom). It helps scientists study the Moon, capturing different views, exploring areas, and looking closely at cool features. It's like a camera that moves to take Moon pics from various angles and distances.

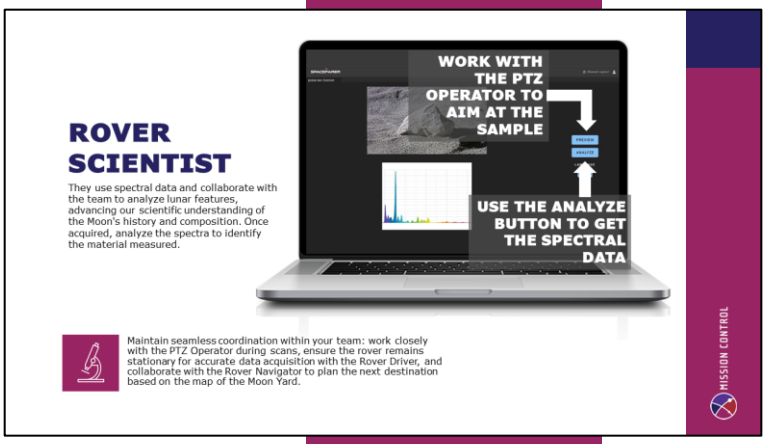
Learn adjusting pan (left-right), tilt (up-down), and zoom. The blue buttons quickly move you to their descriptions.

For fine tuning the aim, students can click the image to center the camera where they click



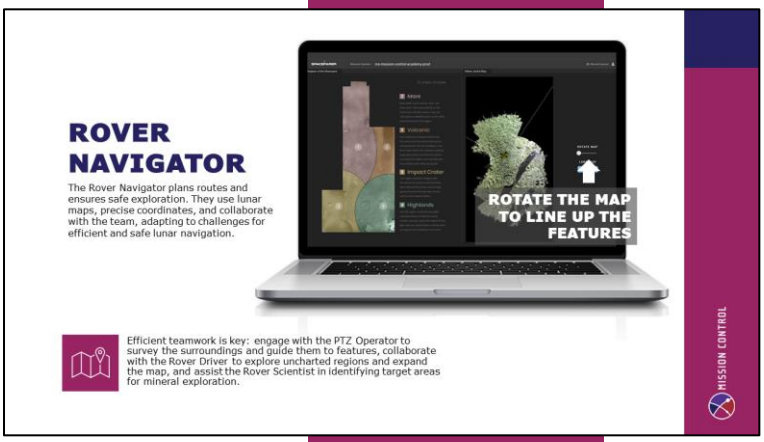
THE SCIENTIST

The Rover Scientist gathers spectral data gathered from the rover's spectrometer to analyze the rocks and minerals you will encounter. A spectrometer is with the PTZ camera, so what it is pointing at you can measure. ***You must be closer than 3 m range to get a reliable measurement!*** It takes time (up to 1 minute) for a measurement to be acquired. From the resultant spectra, you must then determine what kind of material you have just measured.



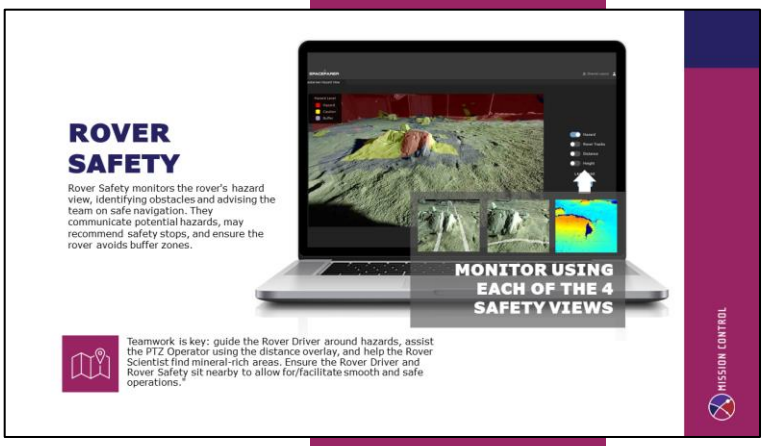
ROVER NAVIGATOR

The Rover Navigators primary responsibility is to plan our route on the moon's surface, making sure we explore different areas and, most importantly, ensuring we never get lost in the vastness of space. The rover builds a map as it drives. The farther you drive, the bigger the map! Your map shows the regions you're exploring and the features present.



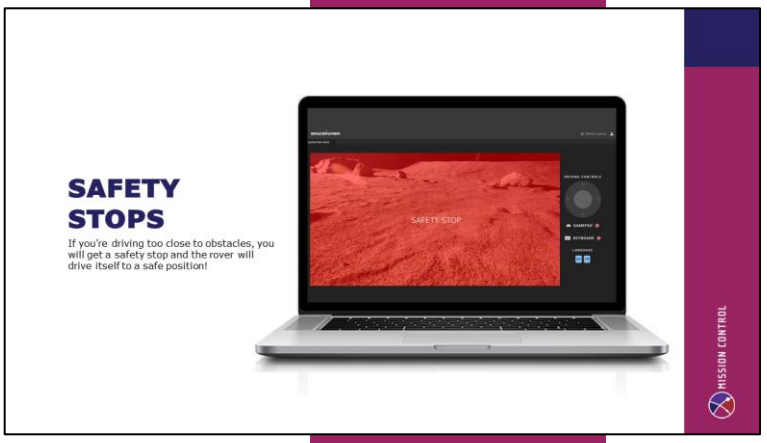
ROVER SAFETY

Rover Safety's main responsibility is to monitor the rover's hazard view. This view provides real-time data about the lunar surface and helps us identify potential obstacles or hazards. Use the overlays that help you evaluate the terrain. Hazard overlay shows red (hazard) yellow (probable hazard) and blue (buffer area around hazards) to stay safe.



SAFETY STOPS

If you're driving too close to obstacles, you will get a safety stop and the rover will drive itself to a safe position!



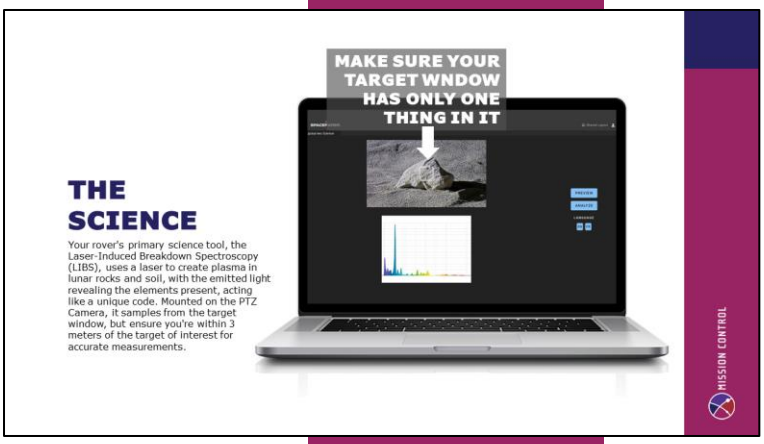
THE FEATURES

Now that we've explored the crucial roles within our lunar rover team and the importance of teamwork, let's delve into the fascinating world of lunar elements. These are the building blocks of our lunar landscape and identifying them is a crucial part of our mission.

THE SCIENCE

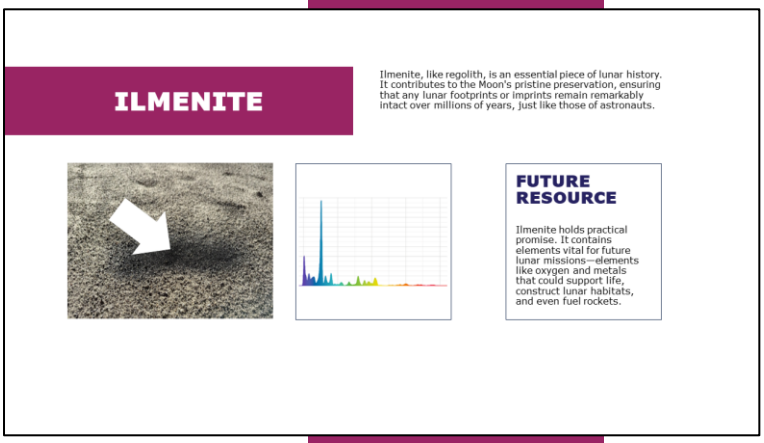
The main science instrument on your rover is called a Laser-Induced Breakdown Spectrometer, or LIBS for short. It works by shooting a laser at the rocks and soil, creating a tiny, hot plasma that gives off light. This light is then carefully examined to figure out which elements are in the rock or soil. Each element has its unique light pattern, almost like a secret code, helping scientists discover what the moon is made of.

Your LIBS is attached to the Pan Tilt Zoom Camera and samples whatever is in the target window. You need to be 3m or closer to your sample location or you won't get a proper measurement.



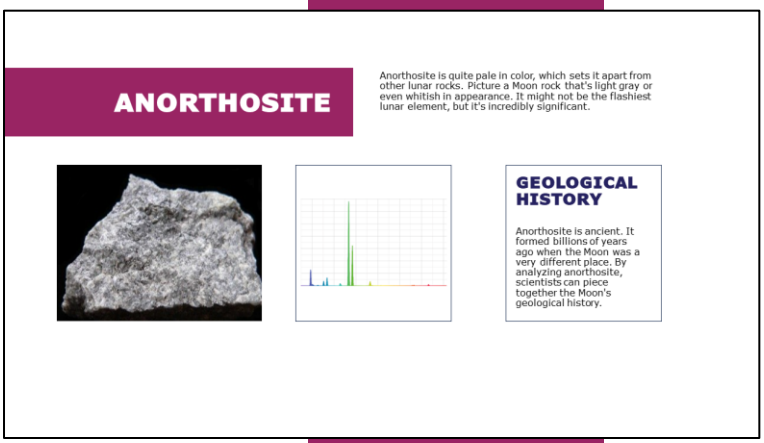
ILMENITE

As you prepare for your Lunar Landscape Discovery mission, keep an eye out for ilmenite. It may not dazzle like lunar rocks, but it's a vital element in decoding the Moon's secrets and shaping our lunar aspirations.



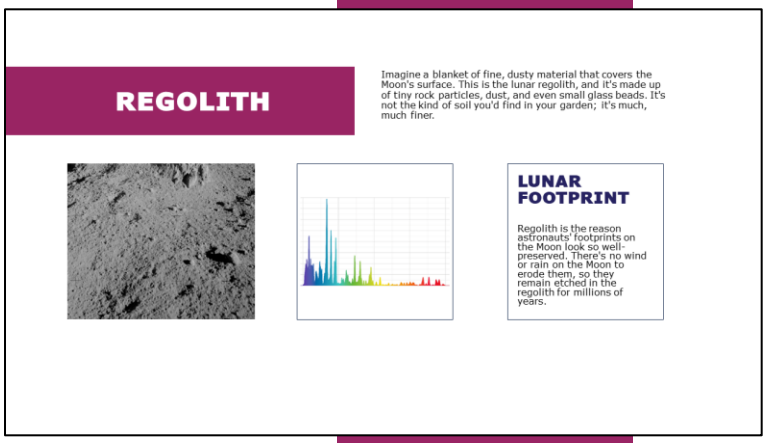
ANORTHOSITE

Anorthosite is like the Moon's bedrock. Just as bedrock forms the foundation of Earth's crust, anorthosite makes up a substantial part of the Moon's crust. It's one of the primary building blocks of the lunar surface.



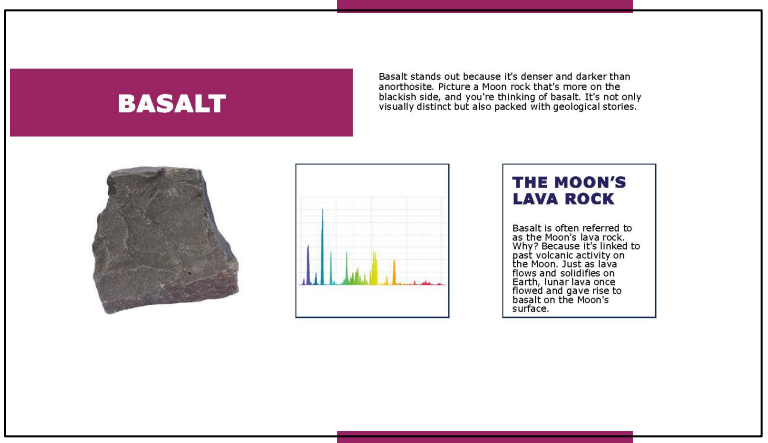
REGOLITH

Imagine a blanket of fine, dusty material that covers the Moon's surface. This is the regolith, and it's made up of tiny rock particles, dust, and even small glass beads. It's not the kind of soil you'd find in your garden; it's much, much finer.



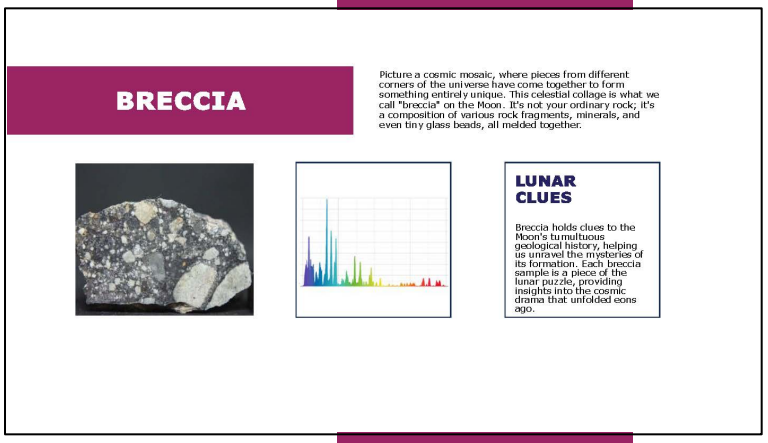
BASALT

Basalt stands out because it's denser and darker than anorthosite. Picture a Moon rock that's more on the blackish side, and you're thinking of basalt. It's not only visually distinct but also packed with geological stories.



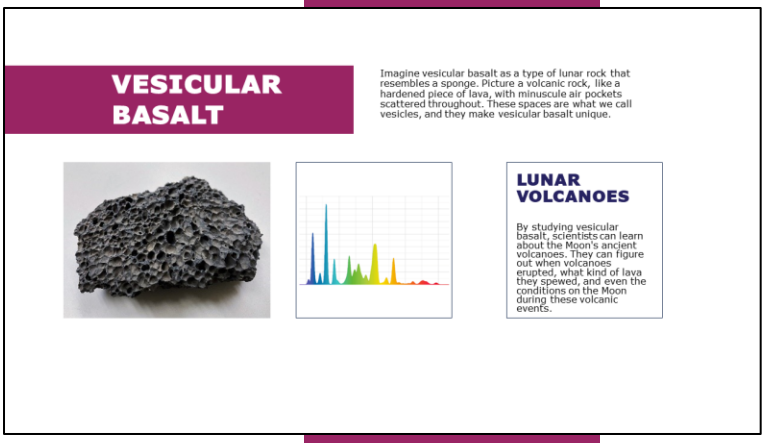
BRECCIA

Picture a cosmic mosaic, where pieces from different corners of the universe have come together to form something entirely unique. This celestial collage is what we call breccia on the Moon. It's not your ordinary rock; it's a composition of various rock fragments, minerals, and even tiny glass beads, all melded together.



VESICULAR BASALT

Vesicular basalt forms from molten rock, or lava, that erupted on the Moon's surface long ago. When this lava erupted, it was scorching hot and full of dissolved gasses. As the lava flowed across the lunar landscape, it started to cool down. When the lava cooled rapidly, those dissolved gasses couldn't escape in time. They got trapped, forming those tiny bubbles within the rock.



WATER

The Moon has water, although not in the form of flowing rivers like on Earth. Instead, it exists as ice, and it's often tucked away in the Moon's permanently shadowed craters.

THE MOON YARD

The Moon Yard in Ottawa is the simulated lunar landscape where the students will engage with the rovers in their exploration experience. The yard is divided into four zones, each containing various lunar features for investigation.

THE ZONES

By driving the rover, capturing high-quality images, analyzing rocks and minerals, mapping the terrain, and ensuring safety, students gain practical insights into the challenges and tasks involved in lunar exploration. The Moon Yard provides a dynamic environment for teamwork, problem-solving, and scientific discovery, enhancing students' understanding of space exploration concepts.

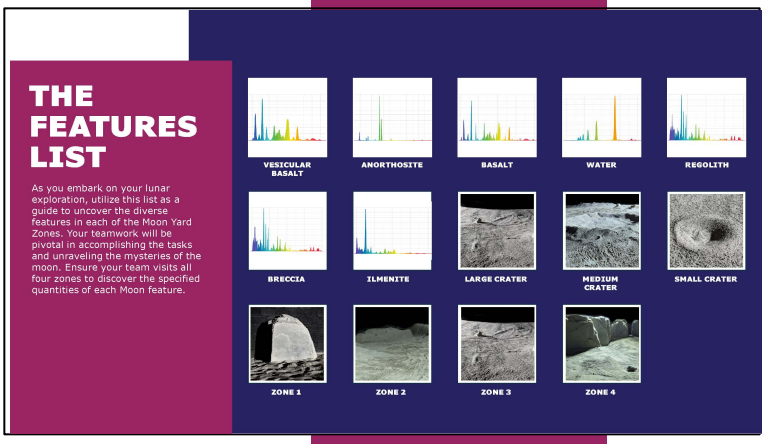
THE FEATUES LIST

We will introduce you to the all the lunar features you'll encounter during your exploration.

THE LIST

As you embark on your lunar exploration, utilize this list as a guide to uncover the diverse features in each of the Moon Yard Zones. Your teamwork will be pivotal in accomplishing the tasks and unraveling the mysteries of the moon. Ensure your team visits all four zones to discover the specified quantities of each moon feature. Mark the below each time you find a feature.

Leave this slide on screen as a reference for your students



LET’S DRIVE

Invite students to ask any questions or seek clarification on roles, elements, or rover controls.

Head to the laptops and login.

TROUBLESHOOTING

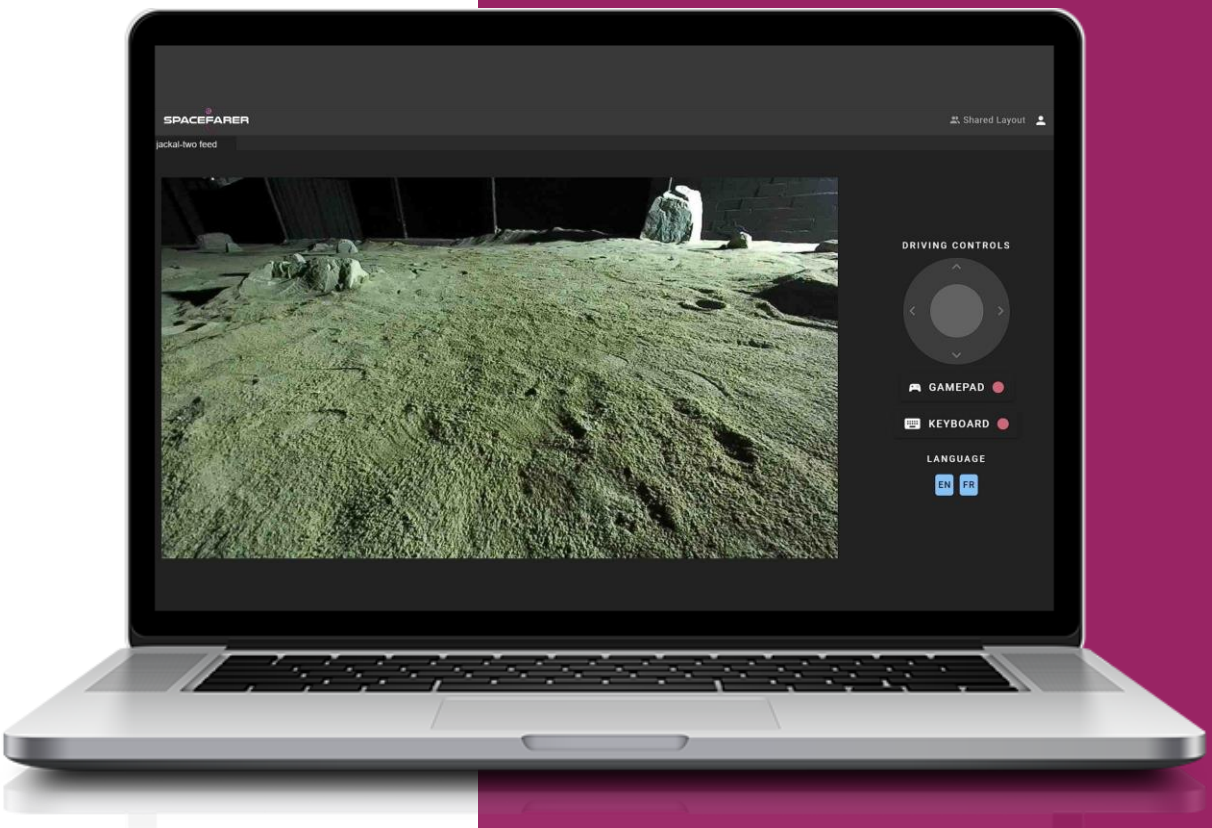
If students have logged into the wrong role and need to try again, make sure they use the log-out feature in the upper right corner before clicking on a link to try again.

It is frequently missed that, on the PTZ operator view, students can click on the image itself as well as use the joystick to move the camera. Clicking on the image can be a much more accurate way to center the camera on minerals or features.

Breccia and Regolith both have the same spectrum because regolith is made up of broken-down breccia. Think of how sand and sandstone are both made of the same materials. If the Brecia/regolith spectrum pops up, the students can decide which is which based on whether they scanned the sandy regolith, or they scanned a rock.

Students are often reluctant to descend into the volcanic region, but that's where they will find vesicular basalt. They are encouraged to find a safe route down to complete their checklist.

Students sometimes have difficulty understanding how to find water in craters. The water found on the moon can only exist in permanent shadows. Anywhere the sun touches the surface causes the water to evaporate. So to find water, the students must scan the shadows within the craters, not just the craters themselves.



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