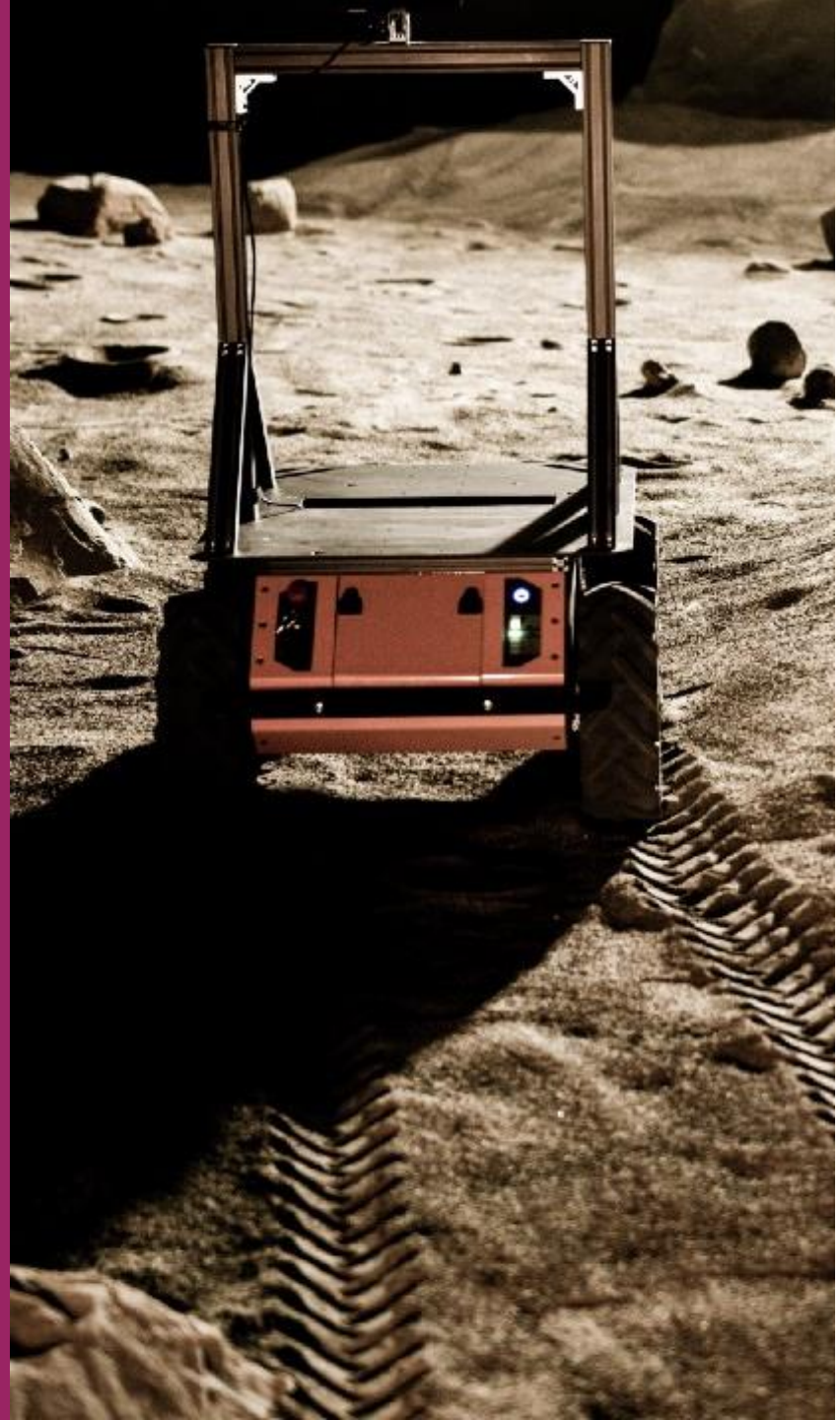
THE ROVER DRIVING ACADEMY

MISSION CONTROL™



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The Rover Driving Academy

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

THE LUNAR RESEARCH TEAM

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ROVER DRIVER

This is a real rover you're driving! Work with your team to drive your rover to the four lunar regions so the Rover Scientist can do their job. And work with Rover Safety to avoid the hazards! Remember that sending commands to the moon can take 1-2 seconds to cover the 384 400 km distance. Laggy controls is the cost of driving a vehicle so far away!

PTZ OPERATOR

Operates the Pan Tilt Zoom (PTZ) camera, to figure out where you are, and find all the lunar features. You also steer the science instrument, so work with the Rover Scientist to analyze the things you find. You can click on features in the image to fine-tune your aim. Zoom in to get the best images for your scientist!

ROVER SCIENTIST

Analyzes rocks, minerals, and geological formations, contributing to a better understanding of the Moon's history. Work with the PTZ operator to analyze the samples you find, and when you get your results, use the science sheet to match the minerals and rocks to the spectrums. Will you be able to find all the minerals and rocks?

ROVER NAVIGATOR

Work with the driver and PTZ operator to figure out where you are, and where you need to go to visit all four of the different lunar regions. The map holds important clues to help you find the minerals, rocks and achieve all the objectives.

ROVER SAFETY

Your display has the tools to find the hazards, and help the driver avoid them. Use the different views to help plot a course that keeps you out of trouble! Can you work with your driver to safely descend into the volcanic region?

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A LONG WAYS AWAY

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". This is the reality of driving real robots so far away, and it's one of the reasons that engineers and scientists work as hard as they can to make rovers smart enough to make their own decisions without waiting to hear from their human operators!

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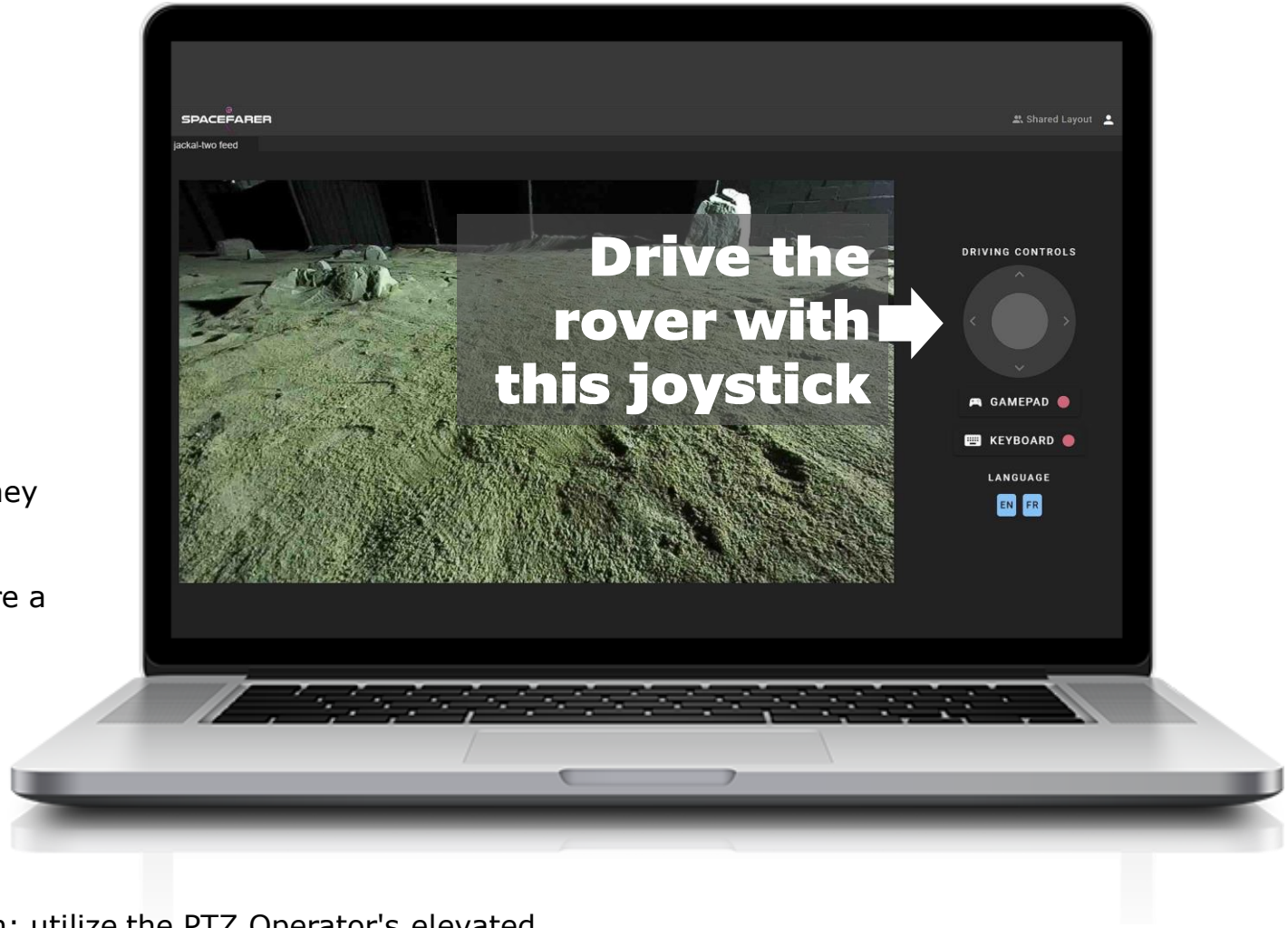
ROVER DRIVER

The Rover Driver is responsible for operating the high-tech lunar rover. They navigate the Moon's surface, avoiding obstacles, making quick decisions, and communicating with the team to ensure a smooth lunar mission.



Coordinate with your team: utilize the PTZ Operator's elevated view to observe your surroundings, assist the Rover Scientist in taking measurements, and work with the Navigator for location and route planning. Exercise caution when turning in place to avoid getting stuck; it's safer to move forward while turning.

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PTZ (PAN TILT ZOOM) OPERATOR

They operate the rover's camera, capturing high-quality images of the Moon's surface. Their role includes working with the rover scientist to accurately sample and collaborate with other specialists for effective lunar exploration. **You can click the camera image and it will center on where you click.**

Collaborate with your team: support the Rover Driver by observing your surroundings, coordinate with the Rover Scientist to aim the camera at chosen features, and work with the Rover Navigator to pinpoint features for comparison with the pre-mission plan.

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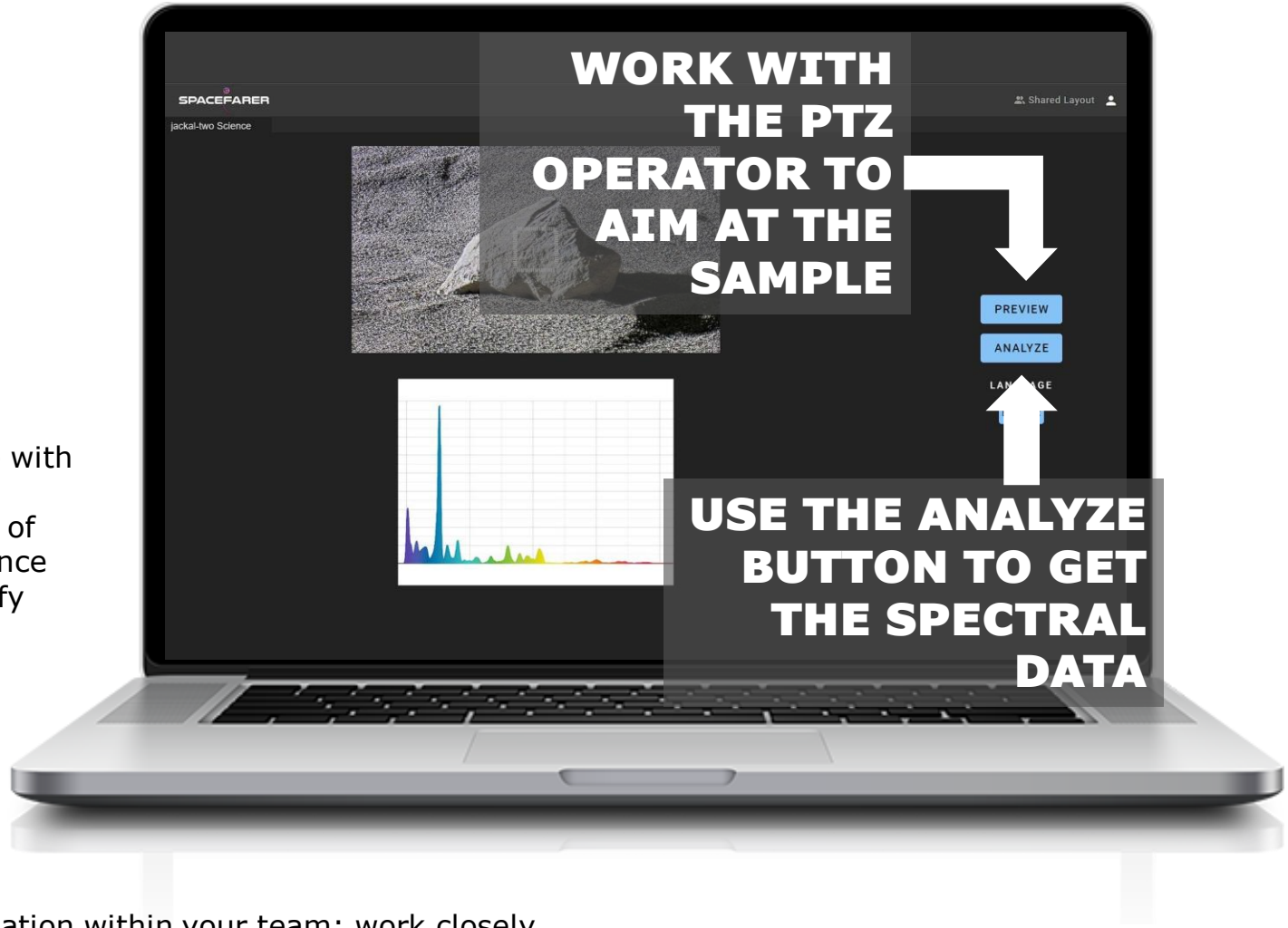
ROVER SCIENTIST

They use spectral data and collaborate with the team to analyze lunar features, advancing our scientific understanding of the Moon's history and composition. Once acquired, analyze the spectra to identify the material measured.



Maintain seamless coordination within your team: work closely with the PTZ Operator during scans, ensure the rover remains stationary for accurate data acquisition with the Rover Driver, and collaborate with the Rover Navigator to plan the next destination based on the map of the Moon Yard.

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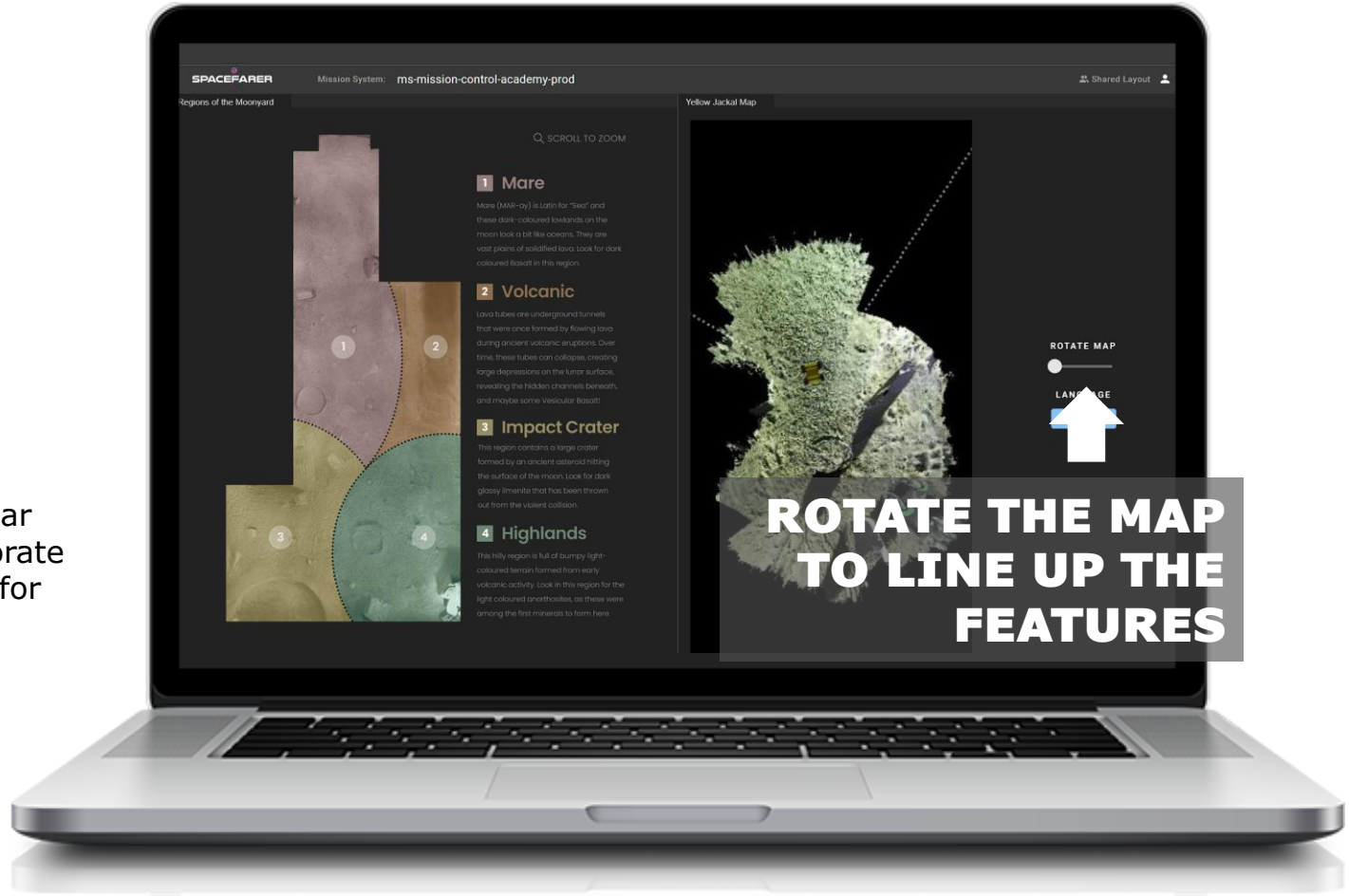
ROVER NAVIGATOR

The Rover Navigator plans routes and ensures safe exploration. They use lunar maps, precise coordinates, and collaborate with the team, adapting to challenges for efficient and safe lunar navigation.



Efficient teamwork is key: engage with the PTZ Operator to survey the surroundings and guide them to features, collaborate with the Rover Driver to explore uncharted regions and expand the map, and assist the Rover Scientist in identifying target areas for mineral exploration.

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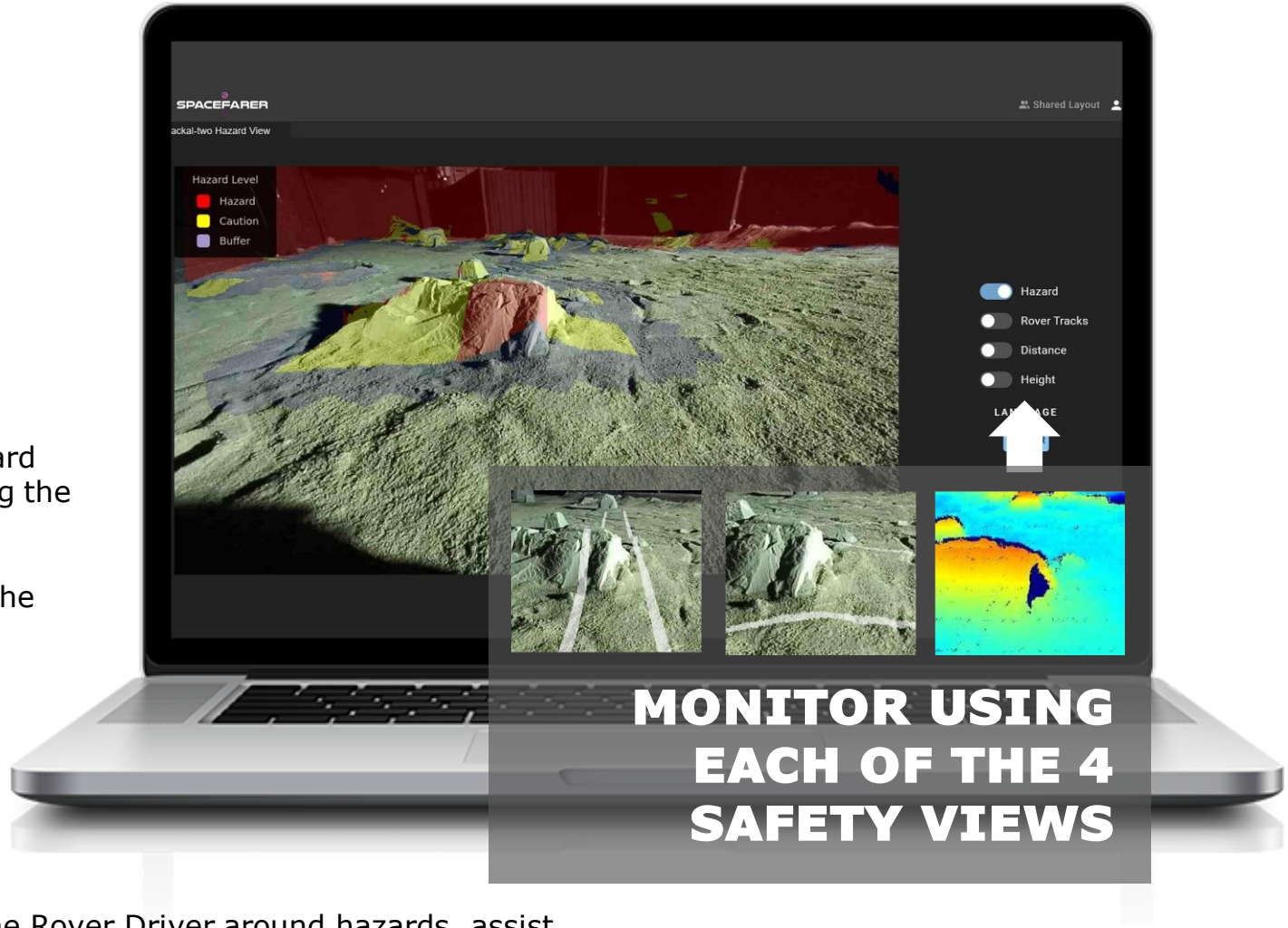
ROVER SAFETY

Rover Safety monitors the rover's hazard view, identifying obstacles and advising the team on safe navigation. They communicate potential hazards, may recommend safety stops, and ensure the rover avoids buffer zones.



Teamwork is key: guide the Rover Driver around hazards, assist the PTZ Operator using the distance overlay, and help the Rover Scientist find mineral-rich areas. Ensure the Rover Driver and Rover Safety sit nearby to allow for a smooth and safe operation.

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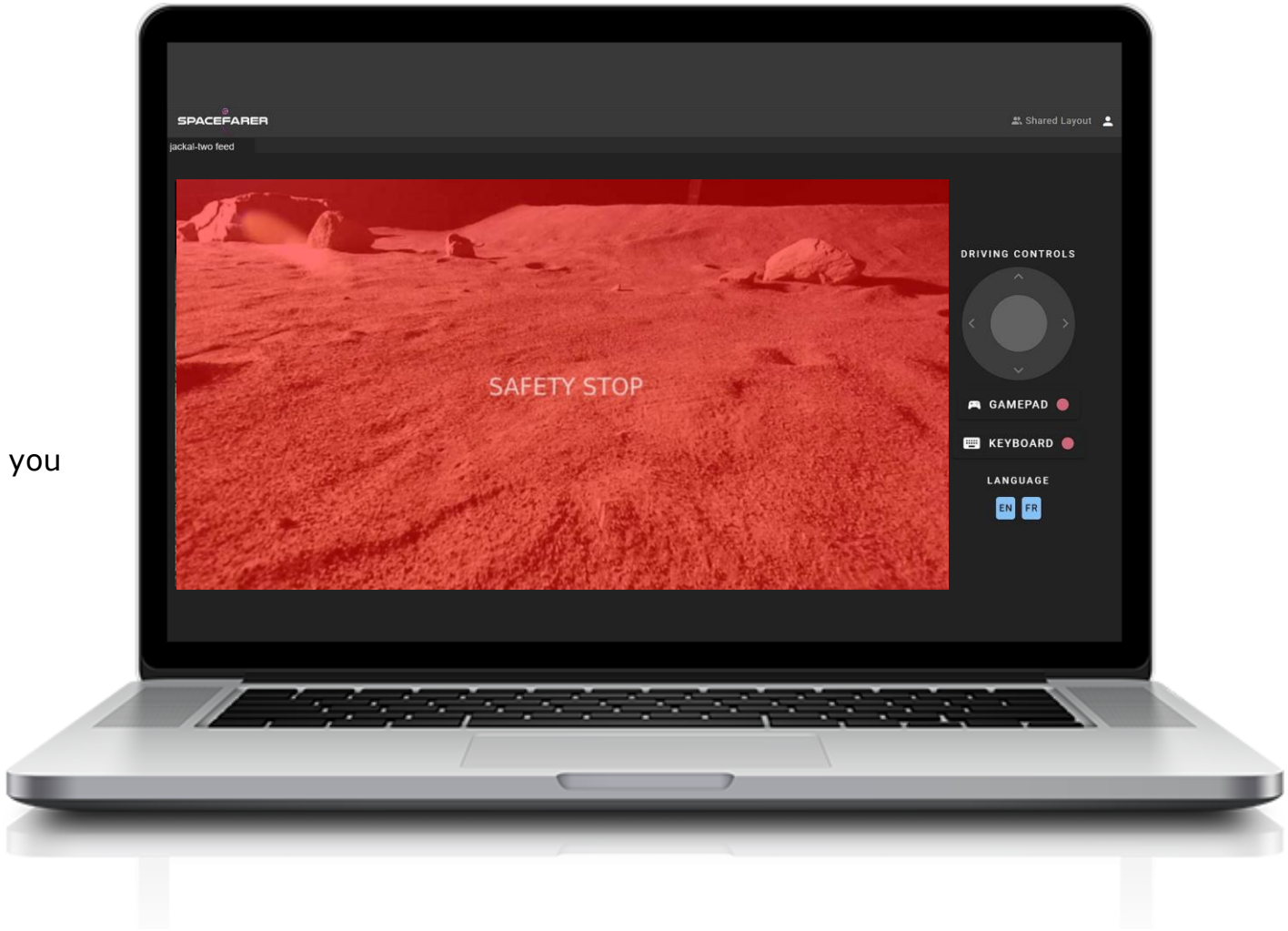
SAFETY STOPS

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



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THE MOON YARD FEATURES

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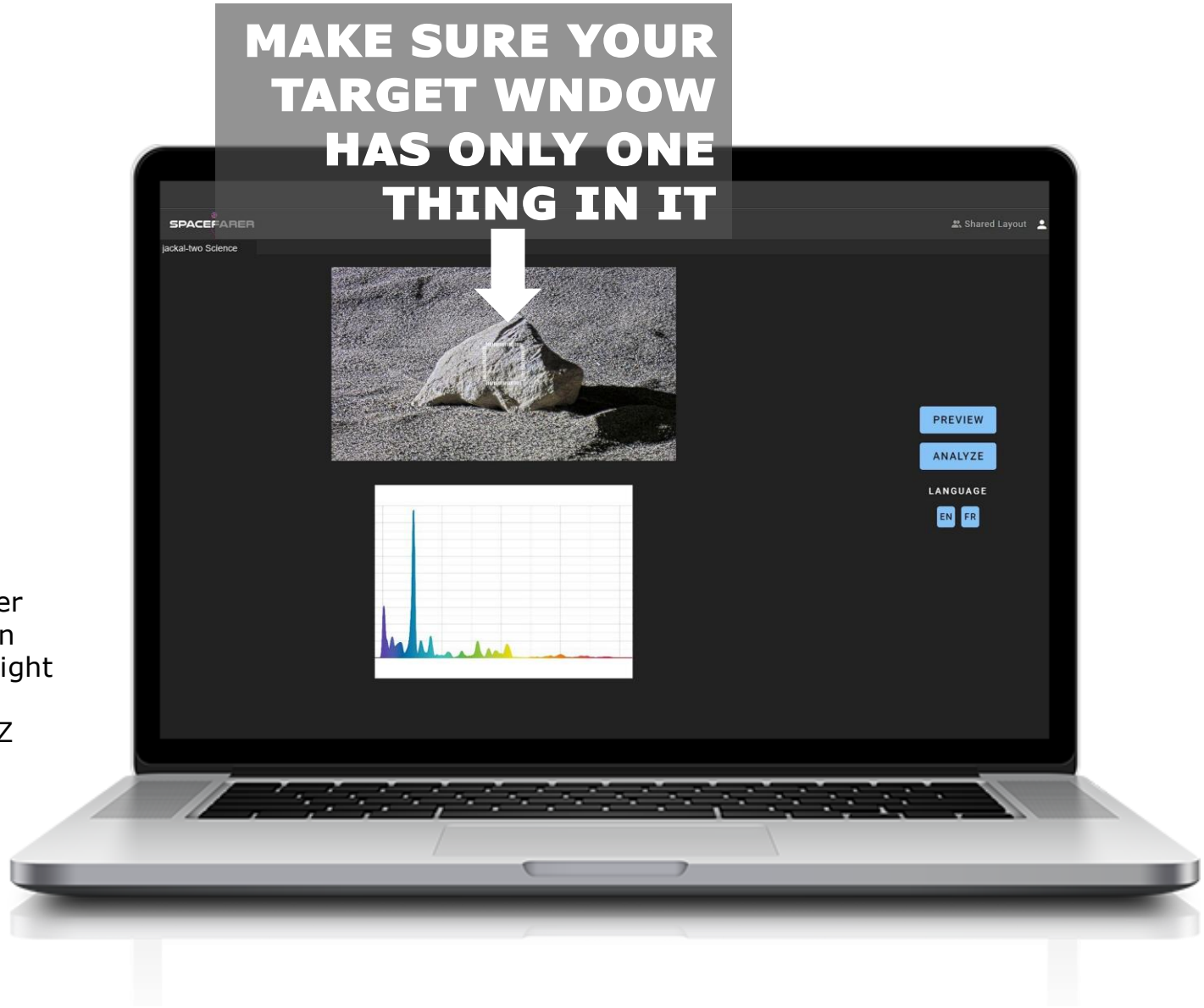
THE SCIENCE

Your rover's primary science tool, the Laser-Induced Breakdown Spectrometer (LIBS), uses a laser to create plasma in lunar rocks and soil, with the emitted light revealing the elements present, acting like a unique code. Mounted on the PTZ Camera, it samples from the target window, but ensure you're within 3 meters of the target of interest for accurate measurements.



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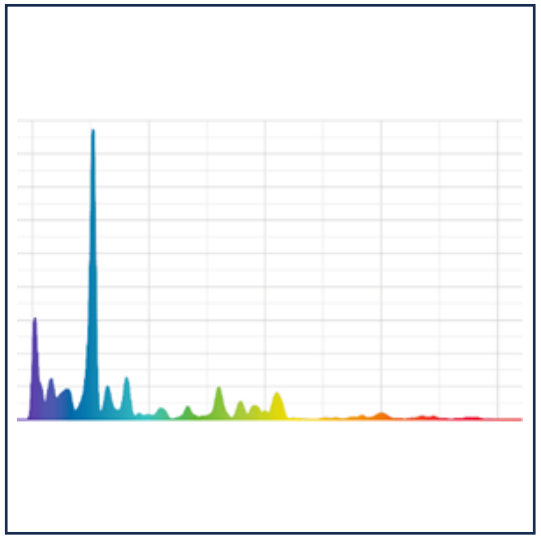
ILMENITE

A fascinating aspect of ilmenite is its presence not only on Earth but also on the moon and other celestial bodies. Its potential as a resource for future space exploration missions' sparks curiosity about its formation, distribution, and how it could be utilized to support human endeavors beyond our planet.

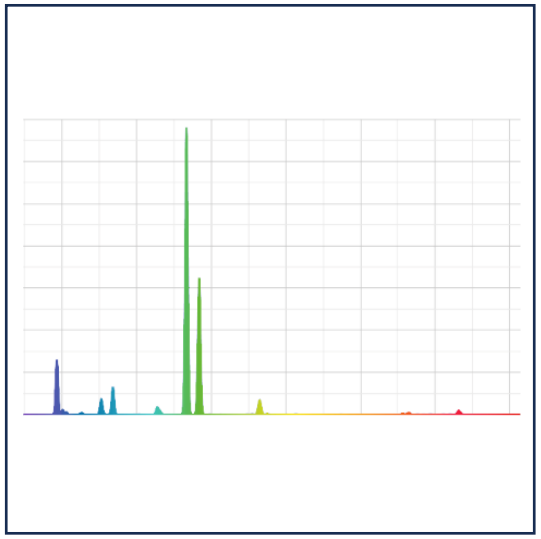


FUTURE RESOURCE

Ilmenite holds practical promise. It contains elements vital for future lunar missions—elements like oxygen and metals that could support life, construct lunar habitats, and even fuel rockets.

ANORTHOSITE

Anorthosite is quite pale in color, which sets it apart from other lunar rocks. Picture a Moon rock that's light gray or even whitish in appearance. It might not be the flashiest lunar element, but it's incredibly significant.

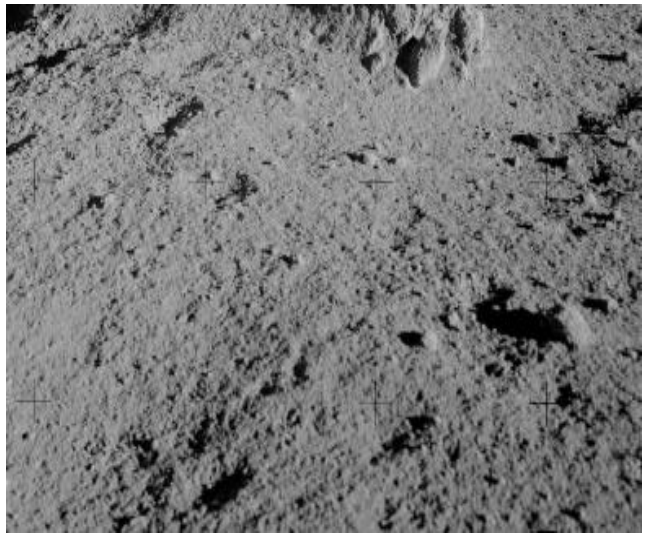


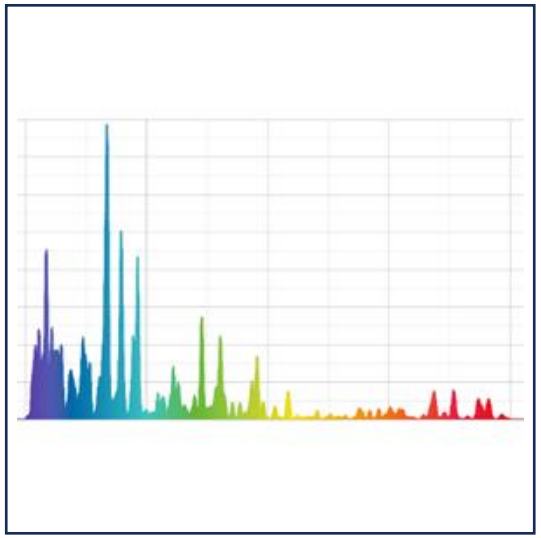
GEOLOGICAL HISTORY

Anorthosite is ancient. It formed billions of years ago when the Moon was a very different place. By analyzing anorthosite, scientists can piece together the Moon's geological history.

REGOLITH

Imagine a blanket of fine, dusty material that covers the Moon's surface. This is the lunar 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.



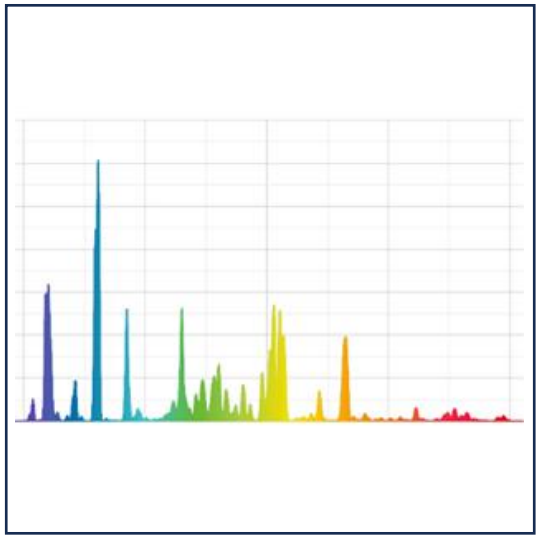


LUNAR FOOTPRINT

Regolith is the reason astronauts' footprints on the Moon look so well-preserved. There's no wind or rain on the Moon to erode them, so they remain etched in the regolith for millions of years.

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.

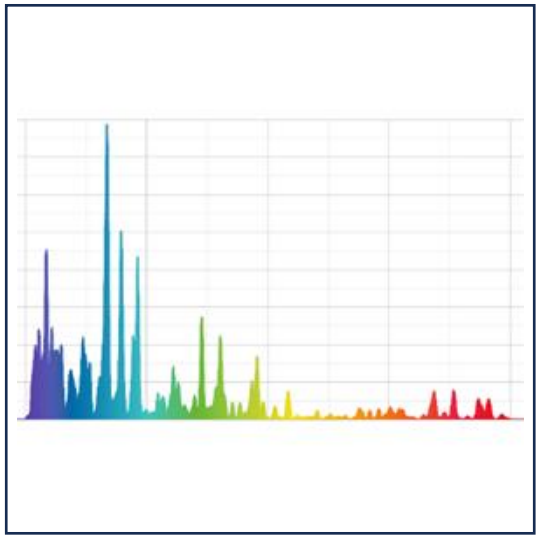


THE MOON'S LAVA ROCK

Basalt is often referred to as the Moon's lava rock. Why? Because it's linked to past volcanic activity on the Moon. Just as lava flows and solidifies on Earth, lunar lava once flowed and gave rise to basalt on the Moon's surface.

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.

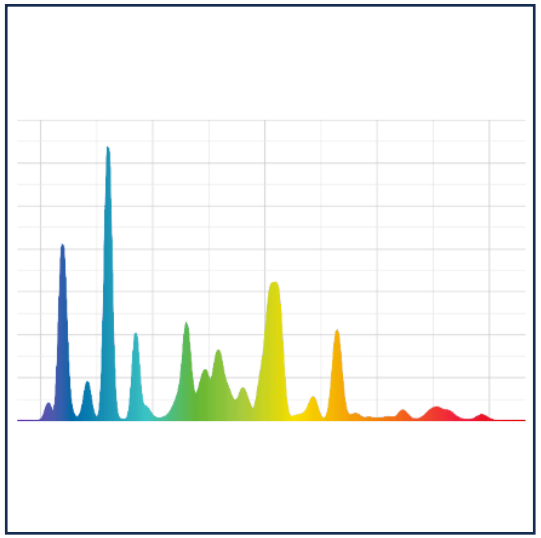


LUNAR CLUES

Breccia holds clues to the Moon's tumultuous geological history, helping us unravel the mysteries of its formation. Each breccia sample is a piece of the lunar puzzle, providing insights into the cosmic drama that unfolded eons ago.

VESICULAR BASALT

Imagine vesicular basalt as a type of lunar rock that resembles a sponge. Picture a volcanic rock, like a hardened piece of lava, with minuscule air pockets scattered throughout. These spaces are what we call vesicles, and they make vesicular basalt unique.

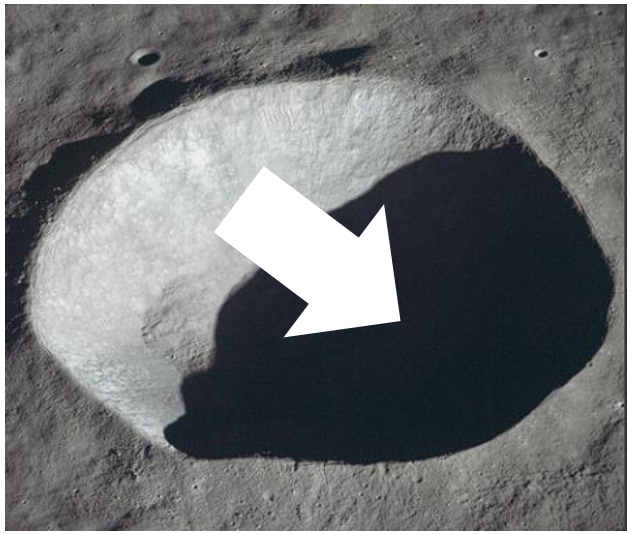


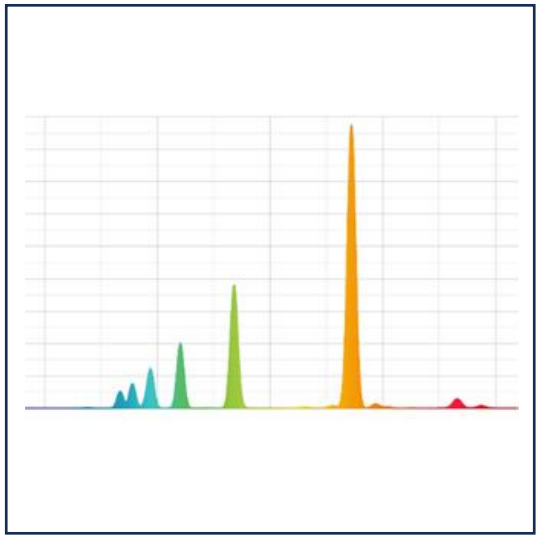
LUNAR VOLCANOES

By studying vesicular basalt, scientists can learn about the Moon's ancient volcanoes. They can figure out when volcanoes erupted, what kind of lava they spewed, and even the conditions on the Moon during these volcanic events.

WATER

Within the moon's cold and dark craters, there are hidden reservoirs of ice. These aren't like the ice you'd find in your freezer; it's more like ancient, frozen lunar treasure. These ice deposits have been collecting over billions of years, preserved in the extreme cold of the moon's shadowed regions.





FUEL AND LIFE SUPPORT

One of the most exciting aspects is that water can be converted into hydrogen and oxygen. These two elements are vital components of rocket fuel and can also provide life support for future lunar inhabitants.

THE MOON YARD

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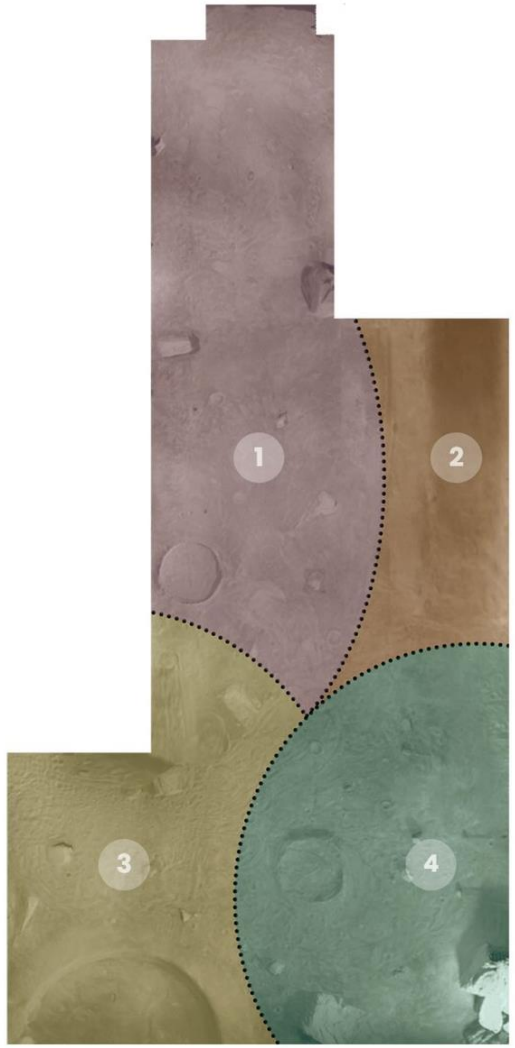


ZONE 1
MARE

Mare (MAR-ay) is Latin for “Sea” and these dark-coloured lowlands on the Moon look a bit like oceans. They are vast plains of solidified lava. Look for dark coloured basalt in the in this region.

ZONE 2
VOLCANIC

Lava tubes, formed by ancient volcanic activity, create underground tunnels on the Moon. Collapses over time expose hidden channels and potentially expose some vesicular basalt.

ZONE 3
IMPACT CRATER

This region contains a large crater formed by an ancient asteroid hitting the surface of the moon. Look for a dark shiny ilmenite that has been thrown out from the violent collision.

ZONE 4
HIGHLANDS

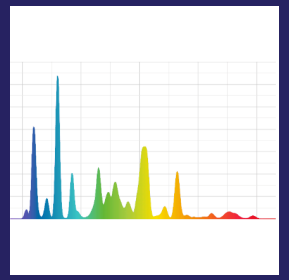
This hilly region is full of bumpy light-coloured terrain formed from early plutonic activity. Look in this region for the light coloured anorthosites, as these were the first among the minerals and rocks to form here.

THE FEATURES LIST

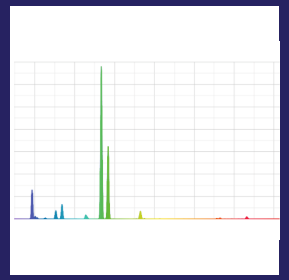
MISSION CONTROL™

THE FEATURES LIST

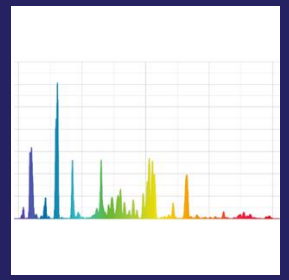
As you embark on your lunar exploration, utilize this list as a guide to uncover the diverse features in each of the Moon Yard Zones. Your teamwork will be pivotal in accomplishing the tasks and unraveling the mysteries of the moon. Ensure your team visits all four zones to discover the specified quantities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



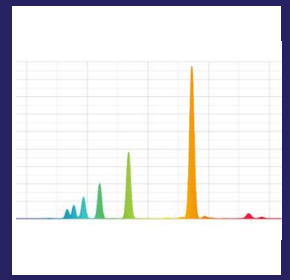
VESICULAR BASALT



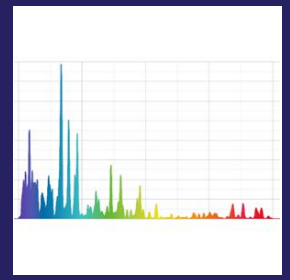
ANORTHOSITE



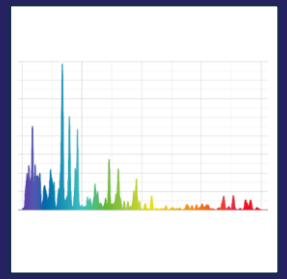
BASALT



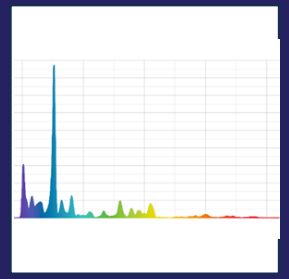
WATER



REGOLITH



BRECCIA



ILMENITE

LARGE CRATER

MEDIUM CRATER

SMALL CRATER

ZONE 1

ZONE 2

ZONE 3

ZONE 4

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