TO THE MOON AND BEYOND

NEXT STOP: THE MOON!

To create a sustainable lunar outpost, people living and working on the Moon will learn to live off the land, using local resources in place of materials from Earth . . .

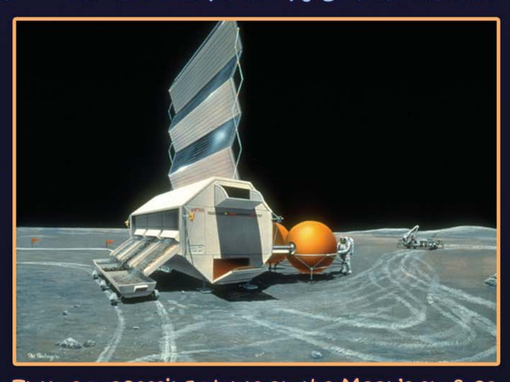
This image of the farside of the Moon was made from data collected by a laser altimeter, an instrument that measures the height or elevation of the landscape, onboard the Clementine spacecraft. White, red, and yellow areas are high, while blue and purple areas are low. The big, deep basin near the Moon's south pole is the South Pole Aitken Basin. Scientists and engineers are interested in placing a lunar outpost near the south pole because of the resources that may be found there.

Figuring Out What's Where

Spectrometers onboard spacecraft provide data about the materials on the Moon's surface. This information helps us better understand the process of how the Moon formed and has changed and where different rocks and minerals and other resources occur. Using this knowledge, scientists and engineers can plan future missions and select sites for outposts. What resources does the Moon offer and how will we use them?

"Soil" Solutions

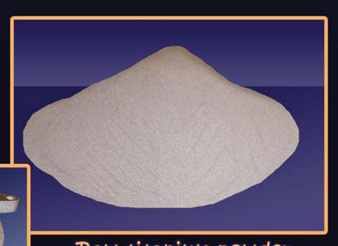
Countless impactors have pulverized the Moon's rock and created a layer of lunar "soil" — regolith — on the surface. Regolith can be a useful resource! Astronauts may extract oxygen from regolith to make breathable air. They may cover lunar habitats in regolith to protect themselves from dangerous solar and space radiation. Heating regolith fuses its particles; future outposts may have roads and building bricks made of fused regolith.



Future processing plants on the Moon's surface will extract oxygen from the lunar regolith.

Metals from the Moon

Iron and titanium harvested from basalts of the maria, and aluminum from lunar highland rocks, can be manufactured into materials for buildings, rovers, and solar panels.

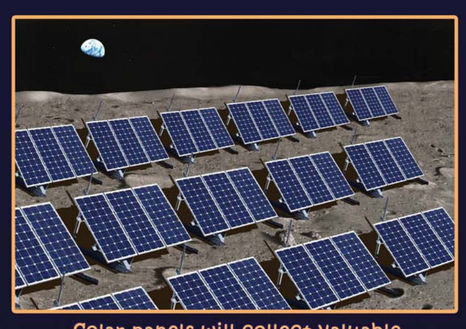


Raw titanium powder.

Titanium can be used to make lightweight yet very strong mechanical parts like this spacecraft component.

Solar Energy — A Renewable Resource

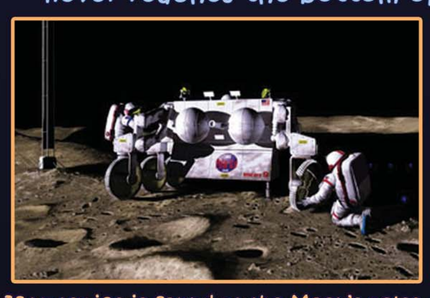
With daylight lasting 14 Earth days, sunlight can be collected, stored, and used to power the outpost, providing energy for lighting, instruments, and life support. Crater rims at the Moon's polar regions receive sunlight for even longer periods.



Solar panels will collect valuable energy for future outposts.

Water at the Poles?

Data from spacecraft missions suggest that water ice may exist at the Moon's poles. Because the poles are not tilted toward the Sun, sunlight never reaches the bottom of deep craters. They are permanently dark and very, very cold. Water ice, perhaps delivered by comets, may be trapped in the craters. Water is an important resource for future outposts not only for drinking, but also because hydrogen and oxygen, the elements that make up water, can be separated and used to make spacecraft fuel. The oxygen can also be used to make breathable air.

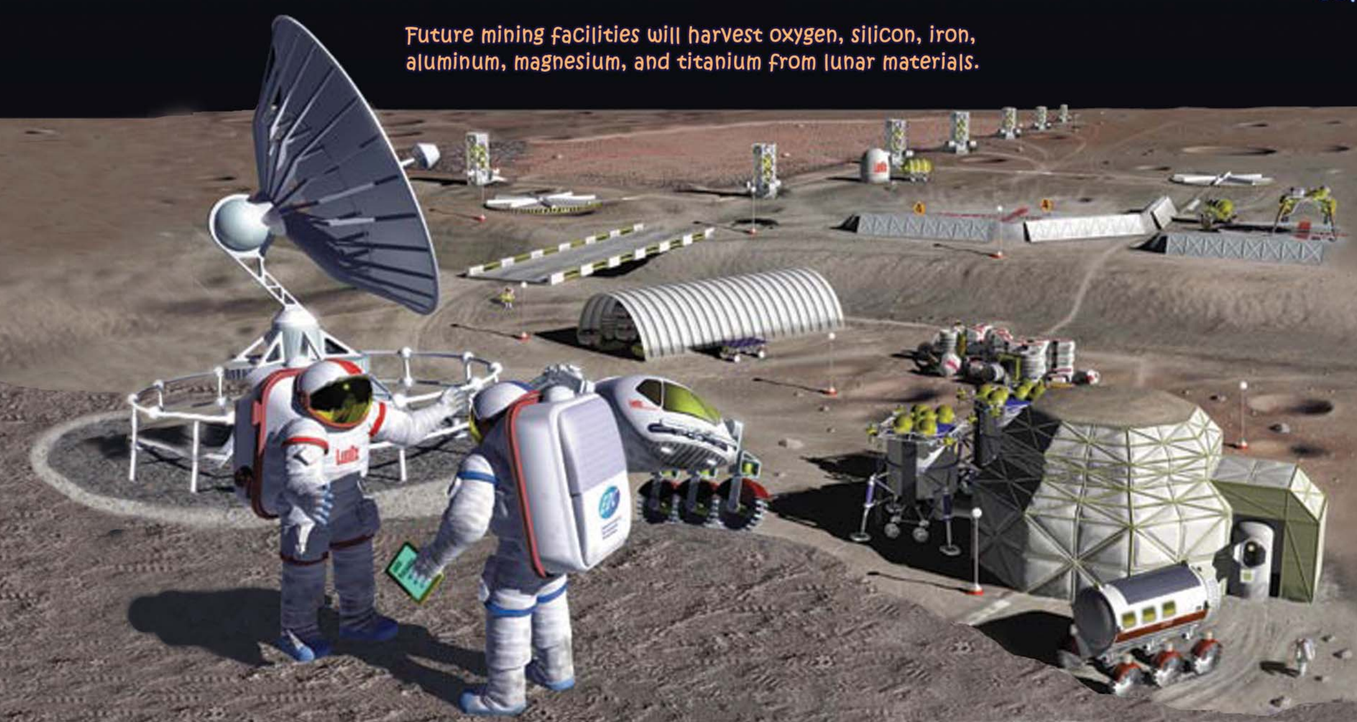


If water ice is found at the Moon's poles, astronauts may use robots to help mine it.

Reduce, Reuse, Recycle

Astronauts need to use their resources carefully. Shipping materials from the Earth to the Moon will be expensive, costing more than $10,000 per pound! Existing and new technologies such as water recycling, robotic activities, and the use of fuel cells to produce electricity will help conserve resources.

Future mining facilities will harvest oxygen, silicon, iron, aluminum, magnesium, and titanium from lunar materials.



By living and working on the Moon, we will develop the skills and technologies we need to explore our solar system.

NASA

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