Highlands Outpost

Highlands

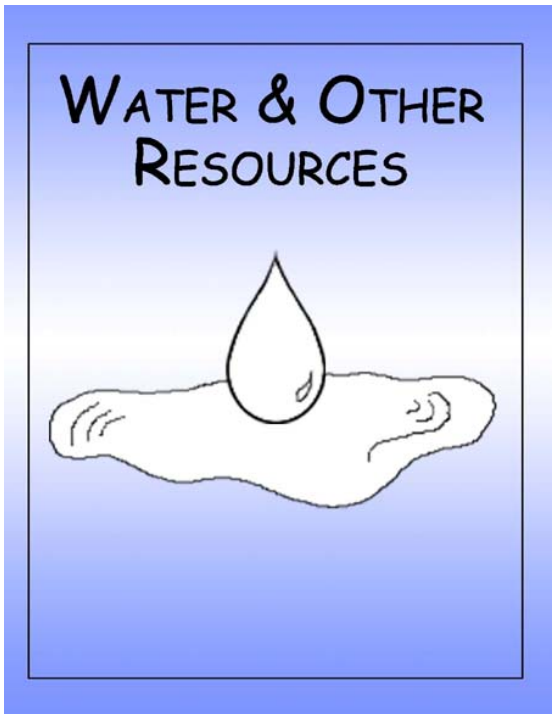
Water and Other Resources

This location is not sheltered from the Sun's heat. It gets too hot for water-ice to exist here.

The rocks have lots of titanium and aluminum that can be mined as building materials for a lunar outpost.

The loose lunar regolith – lunar soil – is very thick here. Regolith could be used to make "lunar bricks" for building and to cover an outpost to protect it from radiation.

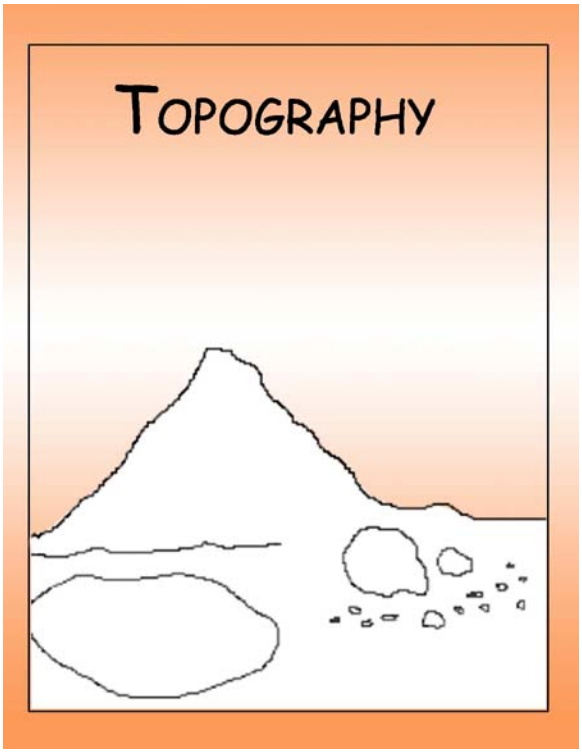
This site gets lots of sunlight and solar energy could be captured and stored for power.



Highlands

Topography

Much of the region is covered by highlands rocks that have been broken into big, angular rocks. Impacts have strewn rock and regolith – lunar soil – across the surface. There probably are some safe landing sites, but much more will need to be known to select one.



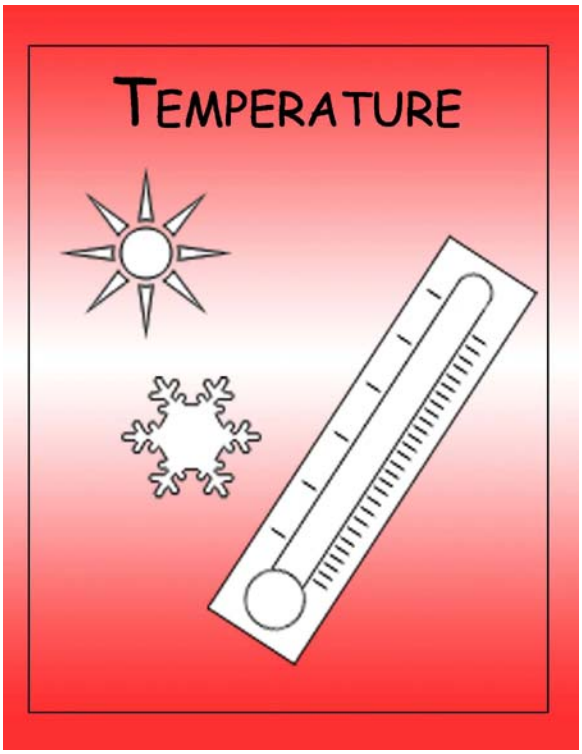
LRO's LROC instrument will provide pictures that can help engineers select specific landing sites and LOLA will provide information about the topography.

Highlands

Temperature

Temperatures range from very hot (253 F / 123 C) to very cold (-243 F / 153 C) with the two-week lunar day and two-week lunar night.

These are the same temperature extremes experienced by the Apollo astronauts. The protection of a space suit or a lunar outpost will be needed to work here for long periods of time.



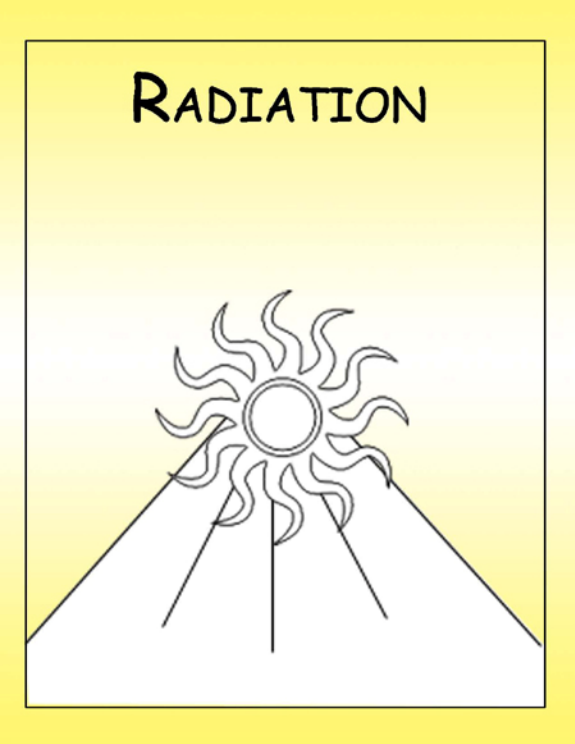
LRO's Diviner instrument will provide more information about the temperature ranges at this site.

Highlands

Radiation

Damaging radiation from the Sun will be a problem, especially for astronauts working outside for long periods of time.

An outpost will needed to provide protective cover.



LRO's CRaTER instrument will provide more information about lunar radiation at this site.

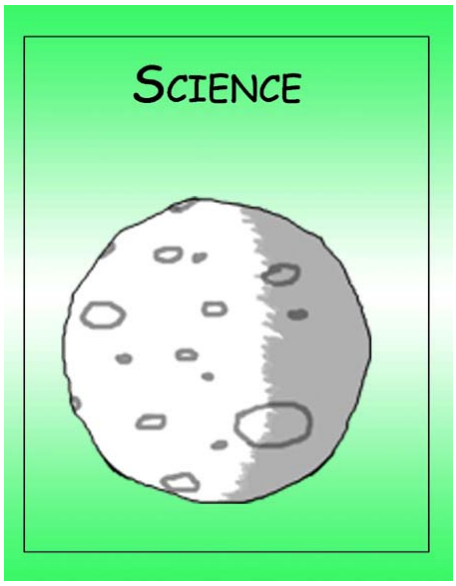
Highlands

Science

Scientists will be able to learn much about the old, cratered, light lunar highlands (terrae) at this site – which means they will learn much about the early history of the Moon's formation and its magma ocean.

There are craters of different sizes that happened at different times in the Moon's history. Scientists can investigate how asteroid impacts change the surface of a planet, and how impacts may have changed through time.

Some of these impacts may have created deep basins, and caused material from below the Moon's outer surface to be exposed, allowing scientists to "see inside the Moon."

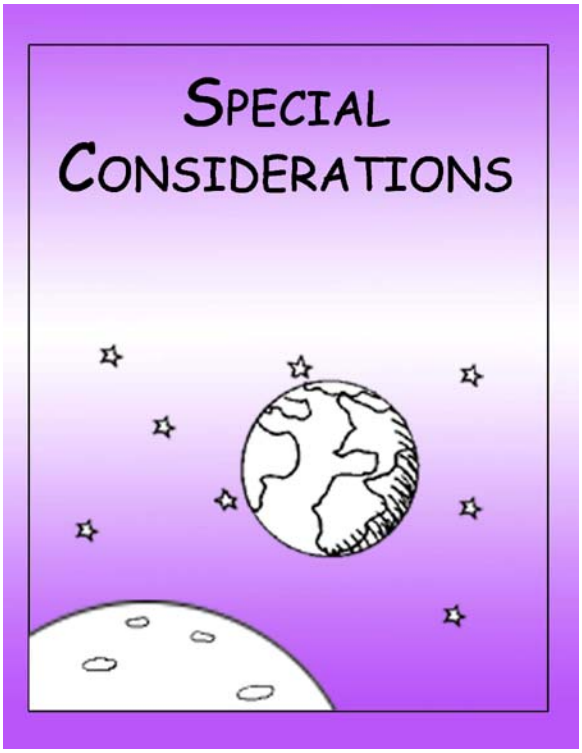


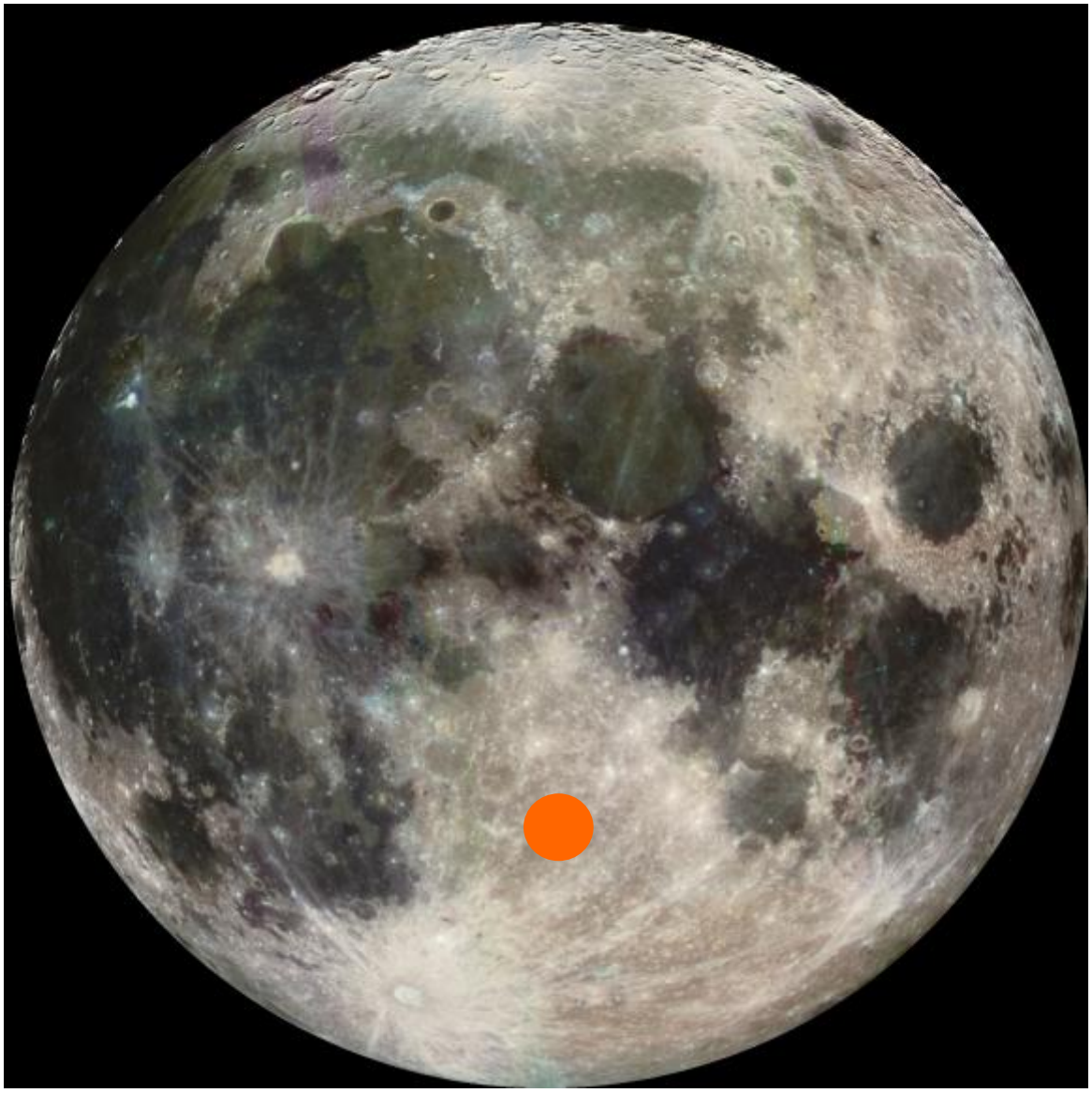
Highlands

Special Considerations

Earth will be in constant view from this site; this means that communications between Earth and a lunar habitat will be easy.

The Southern and Northern skies can be observed with telescopes.





Highlands Outpost

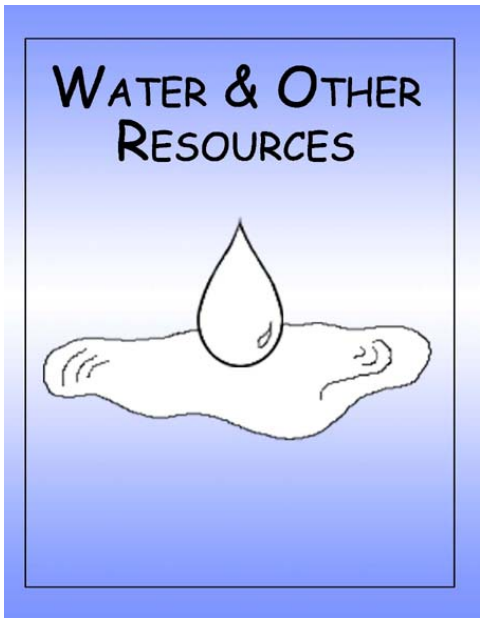
South Pole Crater Outpost

South Pole Crater

Water and Other Resources

Permanently Shadowed Regions (PSR's) at this site stay cold *all the time*.

Comets may have delivered water ice to the Moon! This ice could be used for water and the hydrogen and oxygen it contains can be used for fuel.



Rocks here may have high amounts of aluminum, iron, and titanium - elements that can be mined and used for building an outpost.

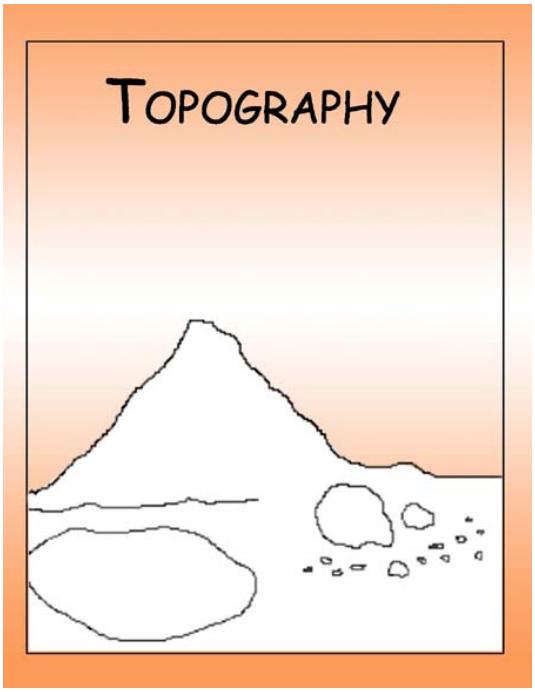
LRO's LAMP instrument will use ultraviolet light from "star-shine" to "see" into the PSRs. LAMP and LEND will provide information about whether or not ice is here.

South Pole Crater

Topography

The South Pole site occupies a crater that is a little over 100 km wide.

The topography is *very rugged* and flat areas are rare; landing at this site and getting around will be challenging and more details are needed.



While this site is in the dark, LRO's LOLA and LAMP will still be able to provide much more information about the shape of the surface and the features. LOLA will collect a topographic information using lasers. LAMP will collect "star-shine" that is reflected off the lunar surfaces to provide a detailed look at the features.

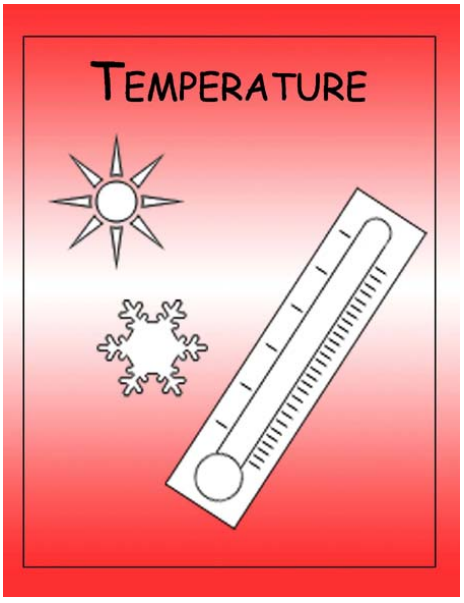
South Pole Crater

Temperature

Temperatures in the dark regions can be more than 380 degrees below zero all the time.

Because this site is a deep crater, there are Permanently Shadowed Regions (PSRs) that do not get heated by the Sun - the temperatures stay cold all the time!

How to warm it up? At the Moon's north and south poles there is constant daylight (though the Sun stays low on the horizon); solar panels can be placed on the high areas around the crater to provide power for heat, light, and other operations.

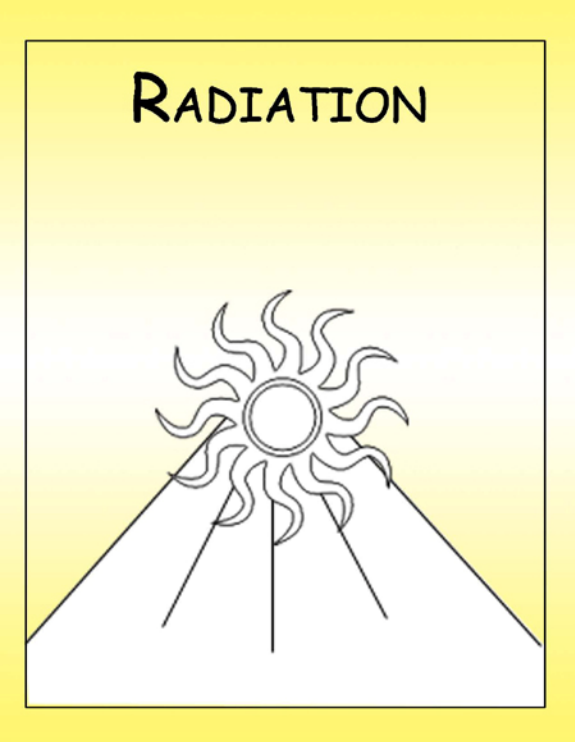


LRO's Diviner instrument will help provide more exact information about the temperature ranges.

South Pole Crater

Radiation

Because possible bases at this South Pole site are in Permanently Shadowed Regions (PSR), damaging radiation from the Sun will be low.



LRO's CRaTER will provide more precise measurements of lunar radiation.

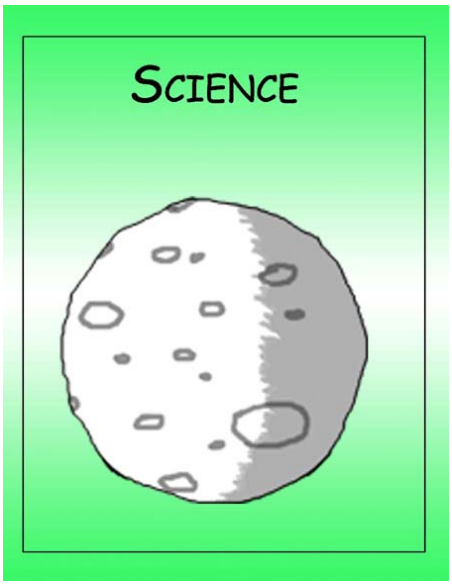
South Pole Crater

Science

This site has some cool geology. Because it is a crater, scientists will be able to study how craters form, different features of craters, and how impacts from asteroids and comets create lunar soil.

The crater sits in the lunar highlands – some of the oldest lunar rocks that formed when the Moon was covered by a deep magma ocean 4 ½ billion years ago. Scientists will be able to understand how the Moon has changed through time.

The South Pole is not such a hot site for astronomy; only the southern sky will be visible and the crater walls will restrict the view.

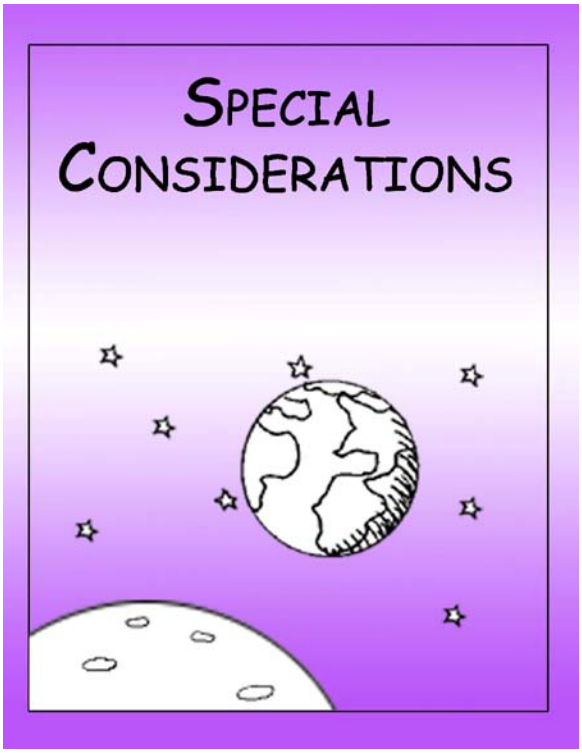


South Pole Crater

Special Considerations

While solar power is possible, from solar panels placed on the crater edges, LRO's LAMP technology may also be used to lighten things up! Imagine street lamps powered by distant star shine!

Earth will be in constant view from this site; this means that communications between Earth and this lunar outpost will be easy.



South Pole Crater Outpost

Aristarchus

Aristarchus

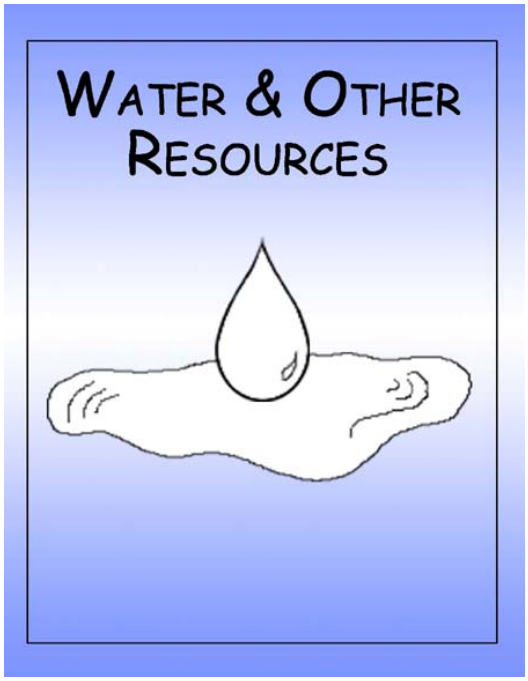
Water and Other Resources

Unfortunately, this site is not sheltered from the Sun's heat and there are no water-ice resources.

Titanium and iron are present in the rocks and could be mined to be used for building lunar outposts.

Loose lunar regolith – lunar soil - could be used to make "lunar bricks" for building and to cover a lunar habitat to protect it from radiation.

This site gets lots of sunlight and solar energy could be captured and used for power.

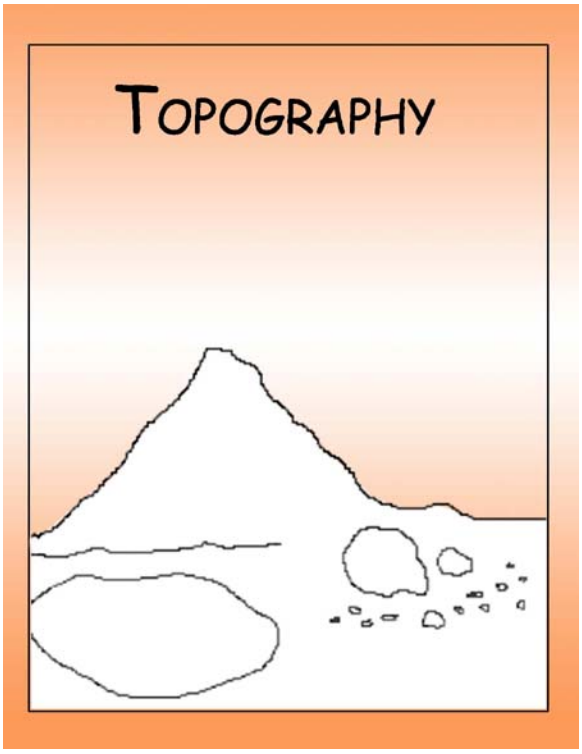


Aristarchus

Topography

The area around Aristarchus is rugged, but has large flat areas that could be used for landing.

More mapping is needed to select the exact sites for landing and building.



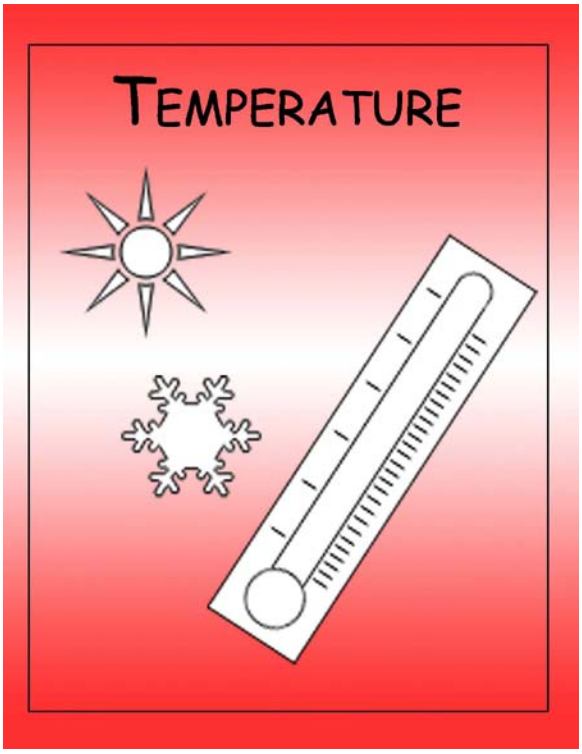
LRO's LROC will provide photographs that will help to select landing sites and LOLA will provide information about the topography.

Aristarchus

Temperature

Temperatures range from very hot (253 F / 123 C) to very cold (-243 F / 153 C) with the lunar day and night.

These are the same temperature extremes experienced by the Apollo astronauts. The protection of a space suit or an outpost will be needed to work here for a long period of time.



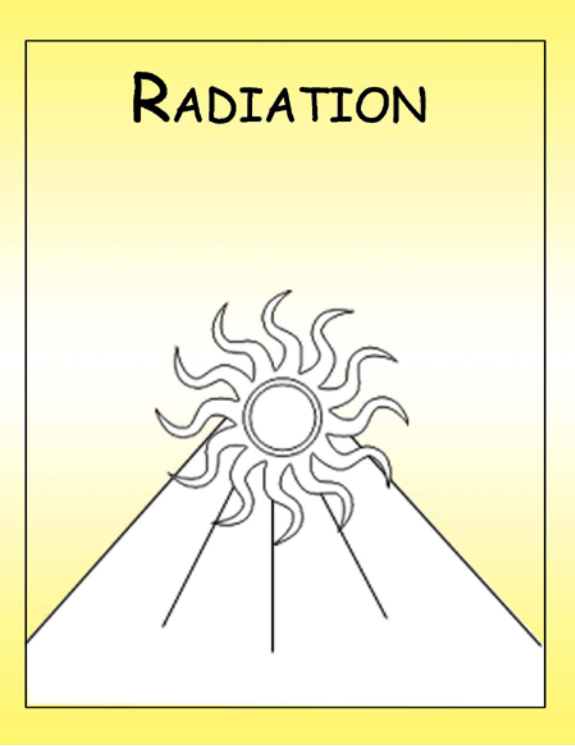
LRO's Diviner instrument will help provide more exact information about the temperature ranges.

Aristarchus

Radiation

Damaging radiation from the Sun will be a problem, especially for astronauts working outside for long periods of time.

An outpost will provide protection. Another solution is to create lunar habitats in the many natural lava tubes that exist at the site.



LRO's CRaTER instrument will provide measurements of lunar radiation.

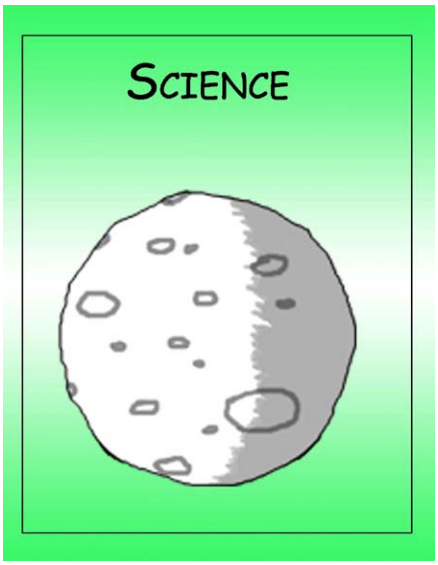
Aristarchus

Science

This is a very exciting location as both of the main types of lunar terrain are within reach: the old, cratered, light lunar highlands (terrae), and the younger, dark volcanic basalt lunar lowlands (maria).

There are several non-active volcanic features in the region, including ancient explosive volcanoes, lava flows, and lava tubes, as well as impact craters.

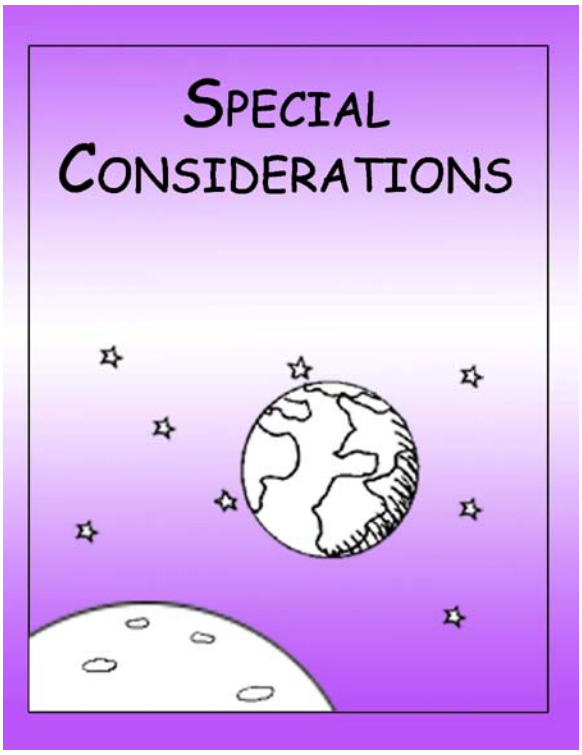
Scientists can study how the Moon's ancient crust formed, how large asteroid impacts created big basins on the Moon, and the volcanic activity that later filled the basins. They can compare volcanoes on the Moon with those on Earth and build a picture of the history of the Moon.

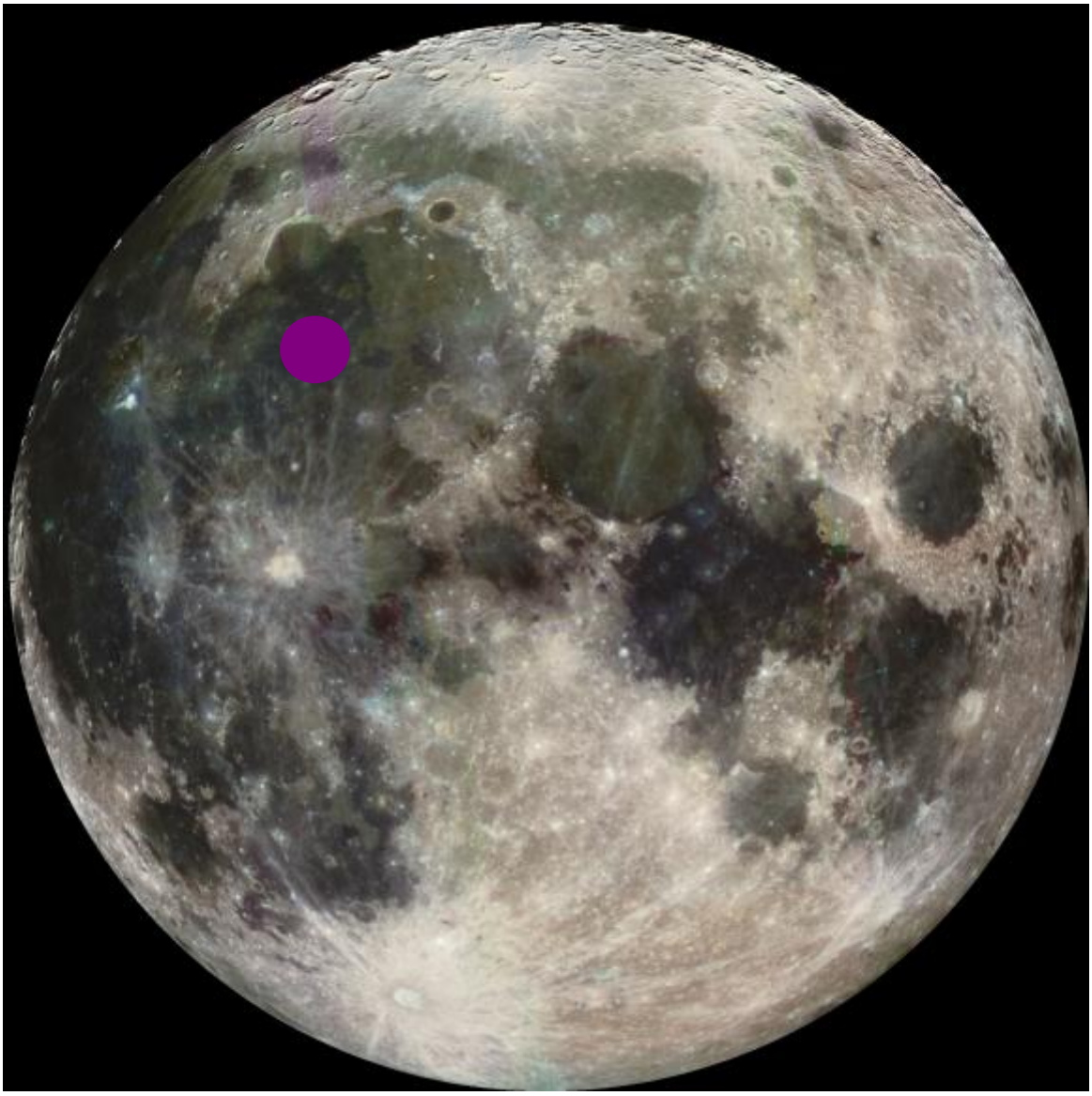


Aristarchus

Special Considerations

Earth will be in constant view from this site; this means that communications between Earth and this lunar habitat will be easy.





Aristarchus Outpost

Tranquility Outpost

Tranquility

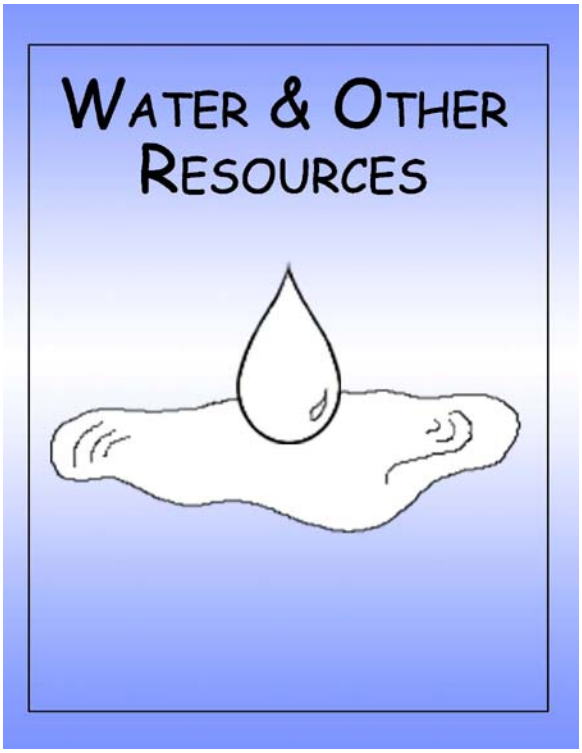
Water and Other Resources

Because of its location, Tranquility is not sheltered from the Sun's heat there are no water-ice resources.

The rocks contain lots of titanium and iron. These elements can be mined and used to build lunar outposts.

Loose lunar regolith – lunar soil - could be used to make "lunar bricks" for building and to cover the outpost to protect it from radiation.

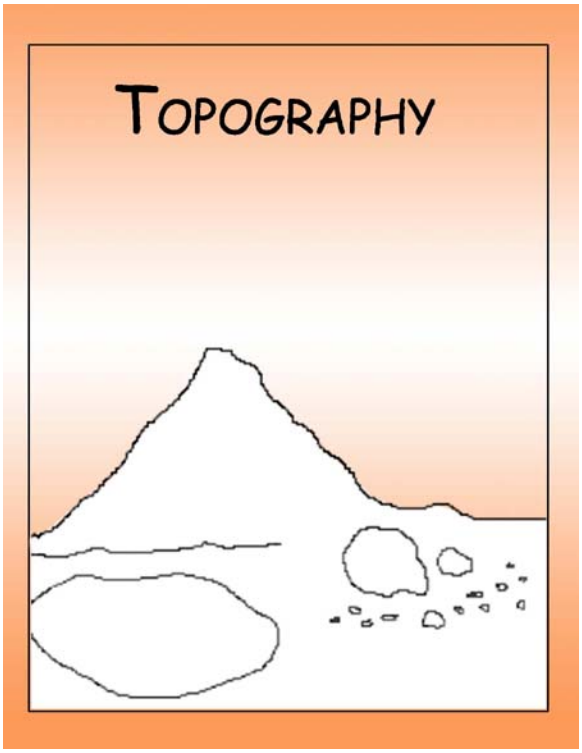
Tranquility gets lots of sunlight and solar energy could be captured and stored for power.



Tranquility

Topography

This site has wide smooth areas for landing sites and for future outposts.



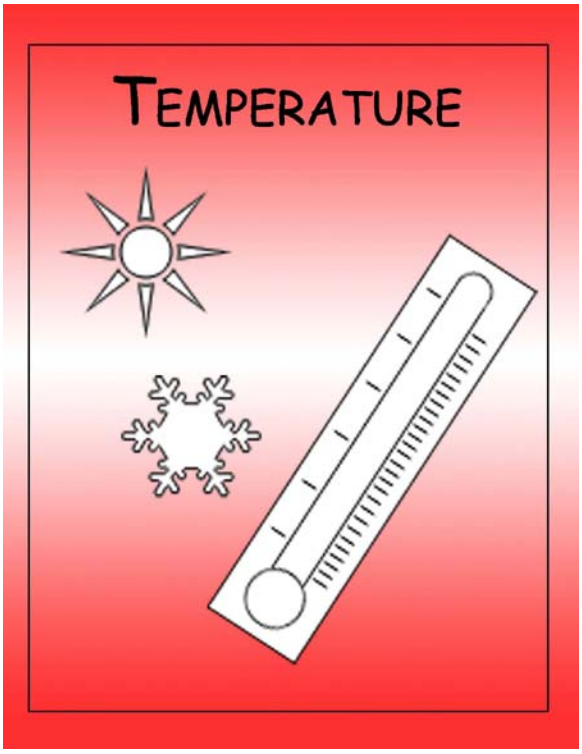
LRO's LROC will provide pictures that will help engineers select specific landing sites and LOLA will provide information about the topography.

Tranquility

Temperature

Temperatures range from very hot (253 F / 123 C) to very cold (-243 F / 153 C) with the lunar day and night.

These are the same temperature extremes experienced by the Apollo astronauts. The protection of a space suit or an outpost will be needed to work here for long periods of time.



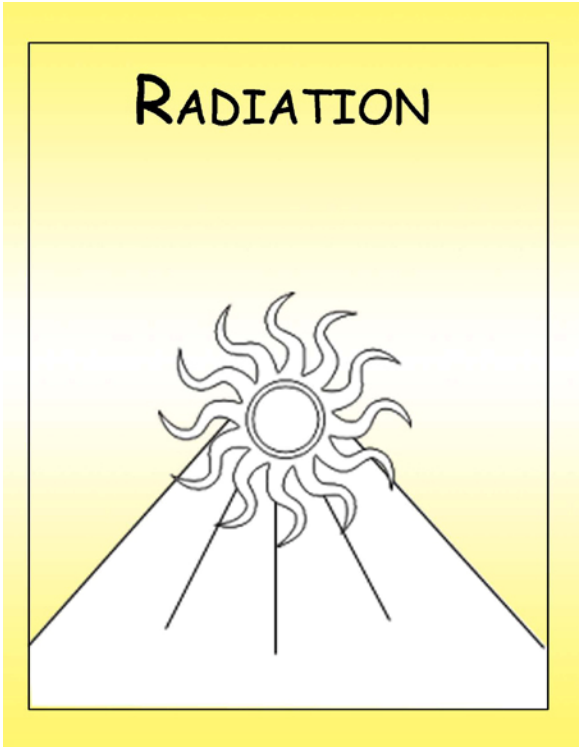
LRO's Diviner instrument will provide more information about the temperature ranges at Tranquility.

Tranquility

Radiation

Damaging radiation from the Sun will be a problem, especially for astronauts working outside for long periods of time.

Protection will be necessary. One solution may be to build a base. Another is to create outposts in the natural lava tubes that exist at the site.



LRO's CRaTER instrument will provide more information about lunar radiation at Tranquility.

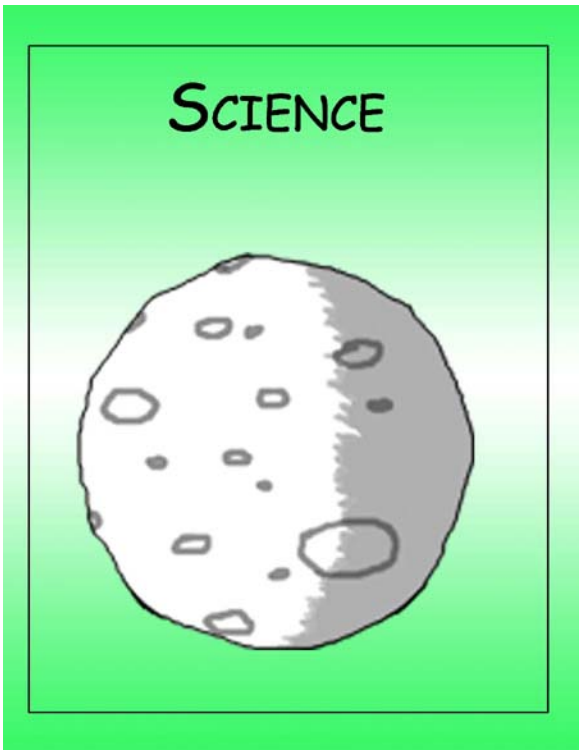
Tranquility

Science

A lunar outpost at Tranquility would sit in a major basin on the lunar surface.

There are several volcanic features in the region, including low shield volcanoes (like Hawaii!) and volcano chains and many different lava flows both old and young. Scientists could study craters and ancient lunar crust.

Scientists can study how large asteroid impacts created the big basins on the Moon. They can also learn about the different types of volcanic flows that later filled the basins. Scientists can build a picture of the history of the Moon.



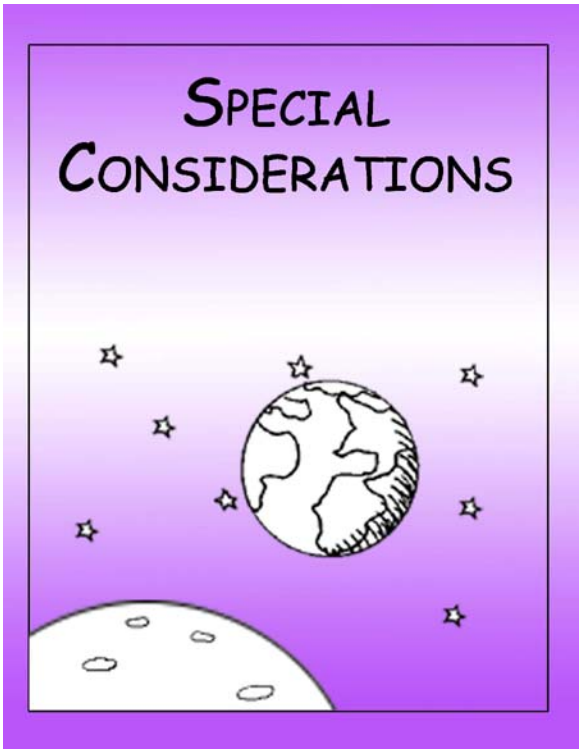
Tranquility

Special Consideration

This was an Apollo landing site; rocks from this site provide information about the resources.

Earth will be in constant view from this site; this means that communications between Earth and a lunar habitat will be easy.

Because Tranquility is close to the equator, the Southern and Northern skies can be observed with telescopes.



Tranquility Outpost

Far Eastern Outpost

Far Eastern

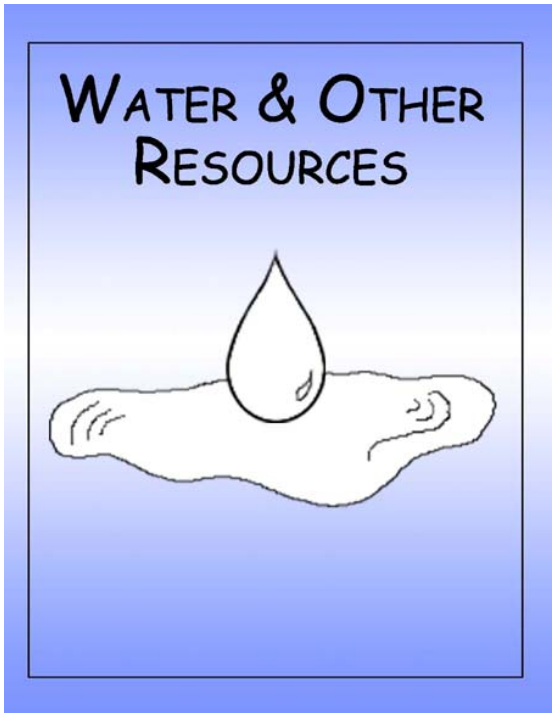
Water and Other Resources

This location is not sheltered from the Sun's heat. It gets too hot for water-ice to exist here.

The rocks have lots of titanium and aluminum that can be mined as building materials for a lunar outpost.

The loose lunar regolith – lunar soil – is very thick here. Regolith could be used to make "lunar bricks" for building and to cover an outpost to protect it from radiation.

This site gets lots of sunlight and solar energy could be captured and stored for power.



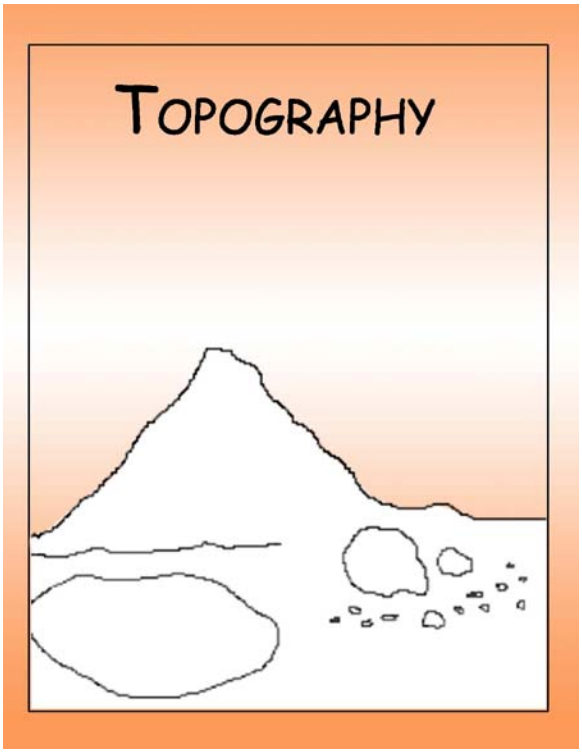
Far Eastern

Topography

Much of this region is covered by dark, volcanic basalt rocks that have been broken into big, angular rocks.

There also are large flat areas that could be used for landing and for building.

More detailed images are needed to select the best place for a base.



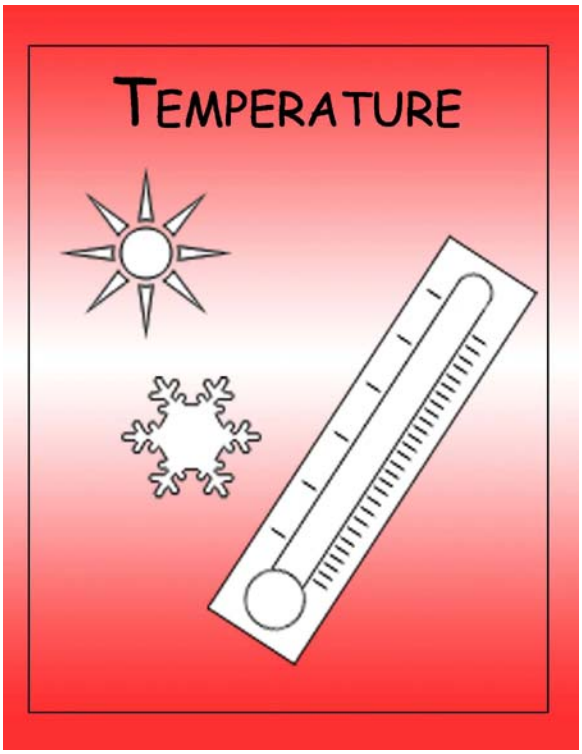
LRO's LROC instrument will provide pictures that can help engineers select specific landing sites and LOLA will provide information about the topography.

Far Eastern

Temperature

Temperatures range from very hot (253 F / 123 C) to very cold (-243 F / 153 C) with the two-week lunar day and two-week lunar night.

These are the same temperature extremes experienced by the Apollo astronauts. The protection of a space suit or a lunar outpost will be needed to work here for long periods of time.



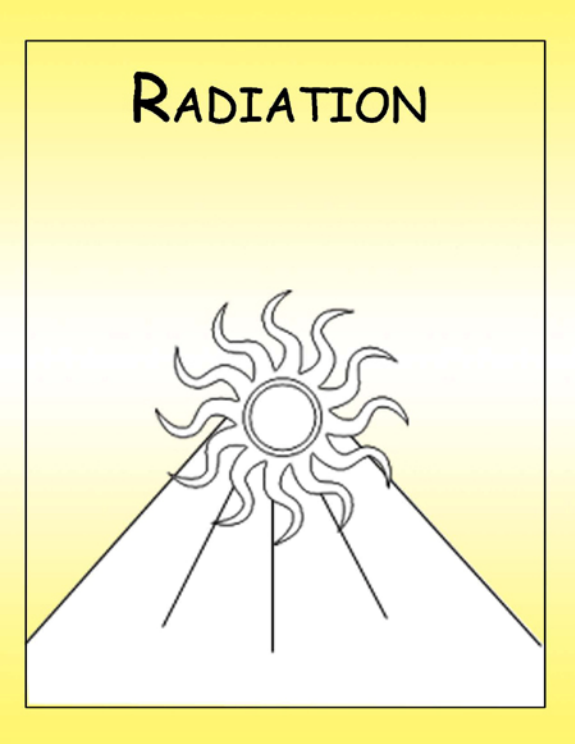
LRO's Diviner instrument will provide more information about the temperature ranges at this site.

Far Eastern

Radiation

Damaging radiation from the Sun will be a problem, especially for astronauts working outside for long periods of time.

An outpost will needed to provide protective cover.



LRO's CRaTER instrument will provide more information about lunar radiation at this site.

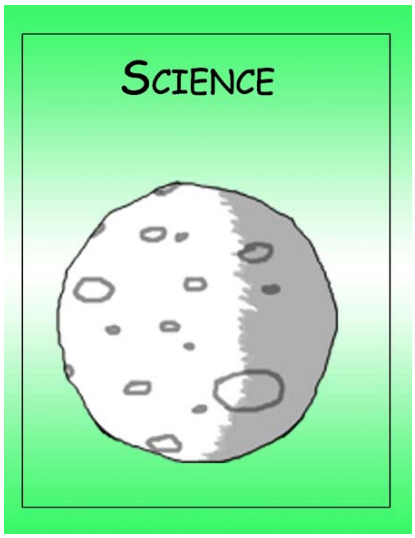
Far Eastern

Science

This is a very exciting location for science! Both of the main types of lunar landscape are within reach: the old, cratered, light lunar highlands (terrae), and the younger, dark volcanic basalt lunar lowlands (mare).

Scientists can study how the Moon's ancient crust formed and how large asteroid impacts created the big basins on the Moon. They can explore the flows of volcanic rock that filled the basins and build a history of our Moon.

There also are craters of different sizes that happened at different times in the Moon's history. Scientists can investigate how asteroid impacts change the surface of a planet, and how impacts may have changed through time.

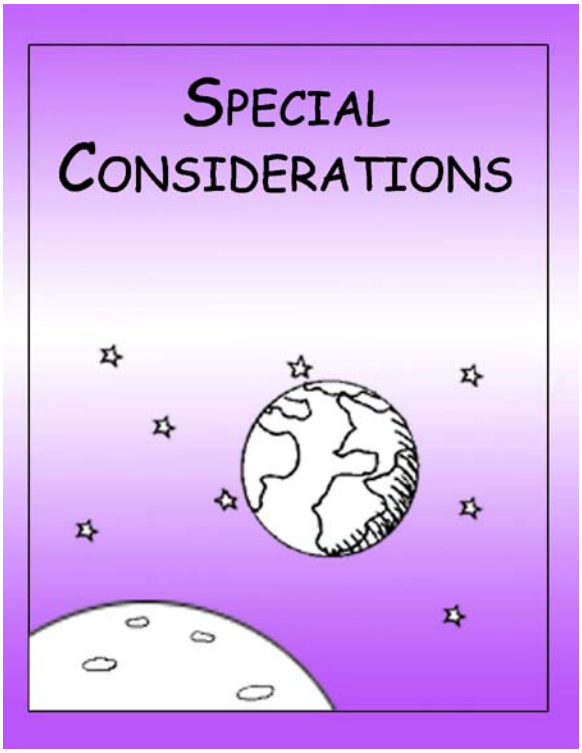


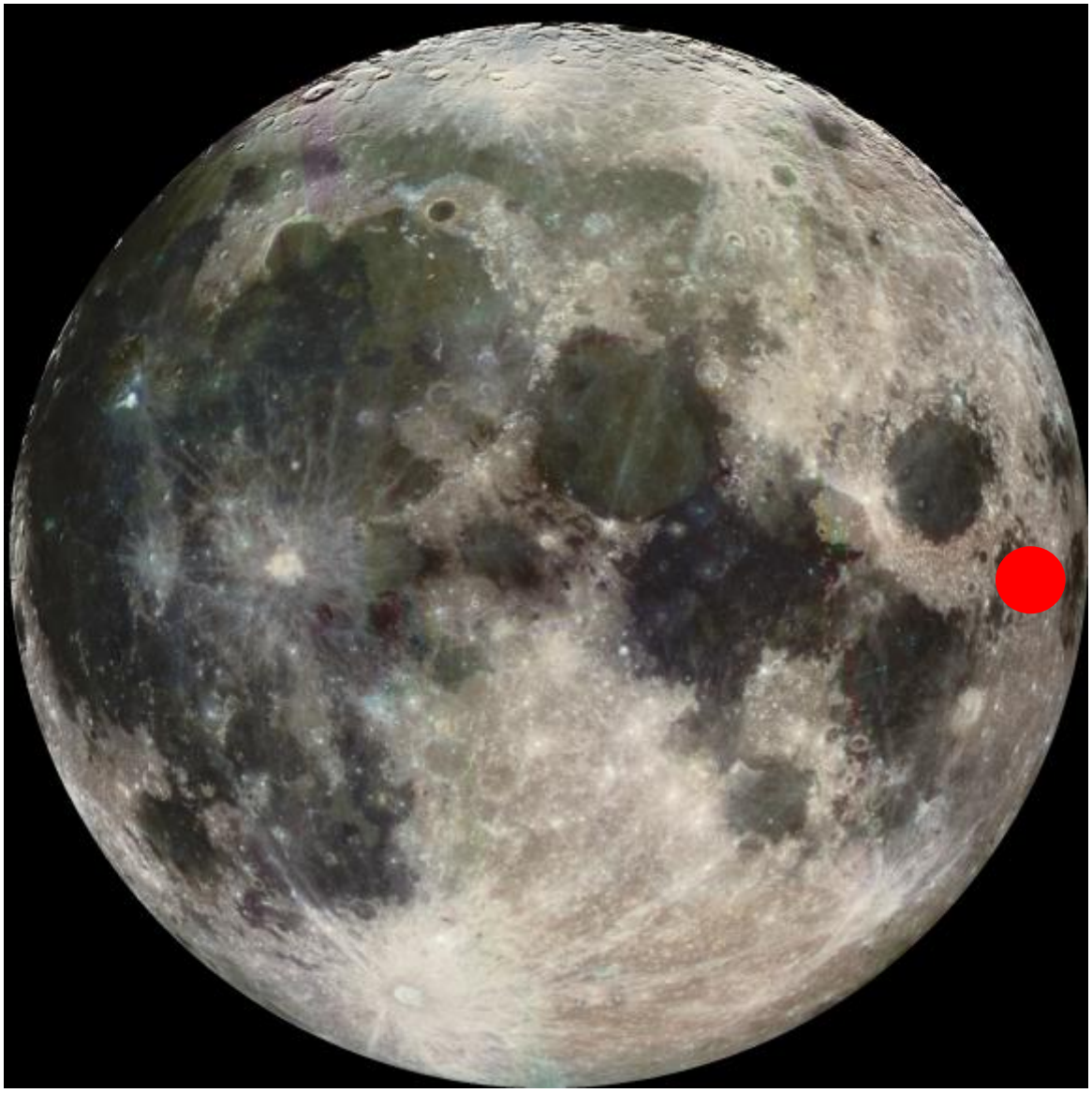
Far Eastern

Special Considerations

This is a good site for lunar astronomy as the *whole sky* is visible and the Earth stays just at the horizon. Telescope arrays could be placed on the flat areas.

Depending on exactly where the outpost is placed, there may be times when Earth is not visible from the outpost. This means that communications between Earth and outpost will need some other way to communicate; relay stations or a satellite network will need to be put into place.





Far Eastern Outpost