This image is of the surface of Venus, taken by the Magellan spacecraft using its Synthetic Aperature Radar instrument. The purple colors represent lower areas, while the closer to white, the higher the area. While Venus is very mountainus, much of the planet is lowlands and plains

### **SPACE ROCKS!**

#### WHAT IS ASTROGEOLOGY?

Astrogeology is simply the study of geology on other celestial bodies. This includes not just planets, but also moons, comets, and meteorites. Anything with rocks that can be looked at. When studying a celestial body, you commonly look at the same things you would look at here on earth, things like volcanoes and volcano activity, mountains, caves etc. There are some differing surface processes that differ from earth, specifically impact craters which are much more common on other planets. All of these fields are used to understand the



Apollo astonauts on the moon studying

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### MAPPING STRANGE NEW WORLDS

#### **GIS ON OTHER PLANETS IN OUR SOLAR SYSTEM**

Mapping new worlds is not an easy task. Having to launch a spacecraft into space and wait the many years it takes for said spacecraft to reach another planet takes time and money, which is why the data that it collects needs to be meaningful and expansive. The main forms of spectral data that is collected by these spacecraft are elevation models, visual color imagery, infrared imagery, and photographs.

NASA Magellan Orbiter

## **PLANNING THE FUTURE**

#### WHAT IS THIS USED FOR?

All this data is put to all kinds of important and interesting uses. They can be used to look for potential landing spots for spacecraft and colony construction zones. Using infrared sensors, a satellite can study geological activity, like volcanoes and earthquake prone areas. Using elevation, they can find low and flat areas of land that are perfect to construct buildings on. They can also find natural shelter using 3D SAR data, providing shelter from asteroids and solar radiation on places like Mars and Luna.

Satellites can also look for resources that are critical for human development. Most importantly these satellites use InSAR (Interferometric Synthetic Aperture Radar) to look for sources of frozen water under the Martian surface.



Artist's rendition of aerial venusian colonies

This data is collected through many different means. The Theia Satellites are equipped with various instruments to collect this information, using various methods of data collection. The most common method for elevation is



Synthetic-aperture radar or True Color surface map of Venus, captured by the Magellian Probe SAR. This uses a microwave pulse that is sent down to the planet being studied. Some of those microwaves are reflected by the surface, and the returning waves are recorded by the sensor. The satellite then uses the time that it took to return to interpolate the distance.

For color imagery it's a bit trickier and there are various methods to collection. For planets like Mars, it can be as simple as a type of passive radiometric sensor. These are usually part of a multi or hyperspectral sensor, that can detect the light that's reflected from the surface of a planet. However, for planets like Venus which are completely covered by clouds it's impossible to get a passive image of the planets surface. The Hyperspectral sensors on many imaging satellites, including Theia Satellites, can detect infrared frequencies from the planet's surface and in combination with SAR data, we can create a false color image of the surface.

USGS - Landsat 8



This image depicts the surface of venus, created using a method called stereoscopic imaging, which creates a 3d model from SAR data. This gives us a view of the surface of a planet completely covered in clouds.

#### EARTH IMAGING SATILLITES







