ROVERS

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1. What is a Rover?

A rover is a robotic, mobile vehicle that is used for planetary surface exploration. They are launched from a lander-type spacecraft to travel on the surface of a planet or extraterrestrial body. They exist primarily to collect scientific data, take photographs, sample rocks and soil. They send it back to Earth so scientists may observe far-off worlds without a human on site. Some of the first rovers, such as those deployed on the Apollo missions, were manned, but the rovers today are remotely controlled or autonomous.

2. Sensors used on a Rover:

In order to operate efficiently in an unfamiliar environment, rovers are provided with a set of advanced sensors. The sensors allow navigation, data acquisition and survival. Some of the most important sensors are:

i.)Cameras: Navigation cameras (Navcams), hazard avoidance cameras (Hazcams), and specialized mast-mounted cameras are used to provide visual data for navigation and scientific analysis.

ii.)Spectrometers: They help analyze the chemical and mineral content of rocks and soil.
iii.)Environmental Sensors: Atmospheric conditions, such as temperature, pressure, and humidity, are measured using sensors by rovers.
iv.)Radiation Detectors: Devices such as the Radiation Assessment Detector (RAD) quantify radiation on a planetary surface.
v.)Navigation and Motion Sensors: Gyroscopes and accelerometers assist the rover to monitor its motion and orientation. LiDAR (Light Detection and Ranging) and infrared sensors are also employed to detect objects and determine distance to prevent collisions.

3. **Difference between a Robot and a Rover:**

The primary difference between a general robot and a rover is their purpose and setting. A robot is a programmable device that can be used to perform a complicated set of activities automatically. This is a very general class that encompasses everything from assembly-line robots to surgical robots. A rover, on the other hand, is a highly specialized type of robot with a highly specialized purpose: planetary exploration. It is created with special characteristics to function in space vacuum, on uneven grounds,

and with delayed communications. Tho all rovers are robots, not all robots are rovers.

4. **Autonomous task rovers are expected to perform:**

Owing to the long time lag in communication between Earth and remote planets like Mars, newer rovers have to be highly autonomous. They are not commanded in real time but are pre-commanded to perform tasks autonomously. Some of these tasks are:

i.)Localization and Navigation: Capability to locate itself and navigate a safe route to a target destination by evading obstacles such as rocks, craters, and steep slopes.

ii.)Scientific Sampling: The rover is able to autonomously detect useful rocks or soil samples, move its robotic arm, and sample for analysis.

iii.)Data Analysis: There are rovers with onboard laboratories that are capable of analyzing samples and providing the results instead of raw data, which can be used to decrease the amount of data that has to be sent back.

iv.)Self-Preservation: The rover is programd to react to unforeseen circumstances, for example, a loss of

power or a mechanical malfunction, and go into a safe mode to wait for further orders from Earth. This allows it to endure extreme conditions.