

## NASA's VIPER Mission

The Volatiles Investigating Polar Exploration Rover or VIPER is NASA's lunar rover that will explore the water ice and other resources available on the surface of the Moon.

This mission will pave the way for the National Aeronautics and Space Administration's Artemis program which aims to establish the traces of sustainable existence of human life on the Moon by 2028.

Given below are a few key facts about the NASA VIPER Mission for candidates preparing for the upcoming IAS Exam:

<b>VIPER Full Form</b>	Volatiles Investigating Polar Exploration Rover
<b>Launch Date</b>	Late 2023
<b>Mission Duration</b>	100 Days
<b>Landing Site</b>	South Pole of the Moon
<b>Objective</b>	<ul style="list-style-type: none"><li>• Study the origin and distribution of water on the moon surface</li><li>• Help in the determination of Moon's resources for future human space exploration</li></ul>

### About VIPER - Key Facts

Given below is an illustration of the Volatiles Investigating Polar Exploration Rover as depicted on NASA's official website (<https://www.nasa.gov/>):



- The size of the lunar rover is approximately the same as a golf cart, with dimensions 5 feet by 5 feet by 8 feet and a weight of 430 kilograms

- It is NASA's first mobile lunar rover which will explore water ice and other resources on the surface of the Moon
- The rover shall comprise the following instruments:
  - A 3.28-foot drill to detect and analyze various lunar soil environments at a range of depths and temperatures
  - 3 Spectrometers
- The rover will venture into permanently shadowed craters, some of the coldest spots in the solar system, where water ice reserves have endured for billions of years
- Other important scientific measurements that shall be taken by the rover, includes:
  - Determine the distribution, physical state and composition of ice deposits to apprehend the sources of lunar polar water
  - Give insights into the distribution and origin of water and other volatiles across the solar system.
- The VIPER rover will be delivered to the Moon as part of NASA's Commercial Lunar Payload Services, or CLPS, initiative

## NASA's VIPER - Objectives

- VIPER will analyse four regions on the lunar surface. These include:
  - **Surface region** - soils on the surface where ice is expected to be stable
  - **Shallow region** - soils where ice is expected to be stable within 20 inches of the surface
  - **Deep region** - soils where ice is expected to be stable at depths of 20-40 inches
  - **Dry region** - soils where no ice is expected within the top 40 inches
- It will study the form in which water is available on the lunar surface, if actually present
- The research will be done on other resources available which can help in future human experiments and projects on the Moon
- Scientists will study the origin of water on the surface of the Moon
- **VIPER will create resource maps to help determine locations where water and potentially other accessible materials could be harvested** to sustain humans over extended stays

## Significance of VIPER Mission

Ever since NASA's Apollo 11 mission to the Moon in 1969, many space agencies across the globe have launched their lunar missions.

This time, with VIPER, NASA aims to analyse water ice on the surface and subsurface of the moon, varying within four main soil environments. This will enable them to **analyse future prospects and landing sites for their Artemis program**.

The presence of water on the lunar surface can be a game-changing discovery for the upcoming human exploration projects.

## Challenge with VIPER Mission

The mission to the Moon comes with its share of challenges and is more complex in comparison to the missions launched for Mars. Given below are the key challenges that might be faced by the VIPER Mission:

- **Extreme Temperature** - The rover will have to experience rough conditions with the surface temperatures varying by 500 degrees Fahrenheit between sunlight and shade. Thus, the hardware, radiators and heat pipe will help the rover sustain between extreme cold and overheating
- **Real-Time Drivers** - Since the moon is closer to earth, in comparison to Mars, the drivers managing the rover from Earth will have to be more alert as the transmission will be more interactive
- **Mobility** - There is no evidence of the surface of the moon towards its south pole. It may be rigid or may be fluffy, thus, the rover has been designed in a manner that it can easily move on the lunar surface
- **Complex route planning** - The rapid change between light and darkness on the surface is another challenge that the rover and its handlers will have to deal with. The movement of the rover and its parking on the lunar surface will have to be well planned
- **Requirement of Headlights on the Rover** - As per the objectives of the mission, the rover will study and analyse the deep craters on the lunar surface where even sunlight cannot reach them. Thus, this will be NASA's first rover which will comprise both, cameras and headlights