Sending Digging Rover to Mars

Tom Orrel

Virginia Aerospace Science and Technology Scholars

Abstract

In order for a future colony to survive, there needs to be a rover sent to Mars that will provide information on the layer’s underneath. It is vital to know if there is or has been life on Mars and study how they survived. Knowing the composition temperatures of Mars will provide information for future human bases on Mars. In order to find out this information, a rover called Drillmaster will be sent to Mars to dig underneath the surface and study the layers of Mars for potential life, and possible underground base locations. The landing site of the rover will be located in a plains area with a layer of frost called Utopia Planetia. There is a layer of frost that can potentially be a water source. Digging underground will tell scientists on earth if the water is deeper and if it can sustain life.

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In order to have a human colony on Mars, three questions will provide further information under the four overarching scientific goals of the Mars Exploration Program. Where are there any chemicals or biological material that could potentially determine if life ever arose on Mars? What are the chemicals, metals, and materials under the surface of Mars? Can the material underground be used for sustaining a human colony on Mars?

The objective of the mission is to send a rover to Mars to search for past and possible present life on Mars underneath the surface. There have been a few robotic vehicles that surveyed the surface of Mars, but only one, called Insight, performs digging expeditions (Mars Exploration Program, 2019). Scientist do not have sufficient data on the layers of Mars under the surface, and nor do they know for certain whether the core of Mars is molten or solid. It is also a mystery how volcanoes had the ability to erupt while Mars does not seem to have tectonic plates. Learning about the layers below the surface of Mars and their location will greatly increase the knowledge and understanding of the potential of Mars to become a human colony in the future. This mission will only be used for underground research. Composition of soil, age of materials, temperatures, and radiation levels are some parameters of what can be learned and discovered about Mars. Just like archeologists learn a lot about earth from digging into the surface of the Earth, then so will the scientists be able to learn more “in-depth” information about Mars.

The landing site will be on the Utopia Planitia because this is a flat area of Mars with known possible water source (The Editors of Encyclopaedia Britannica, 2019). The Drillmaster will be able to dig and search for life, soil compositions as well as possible water source that people can use to survive if a human base is ever built on Mars. The drill should be designed to have the strength of digging through the crust of Mars, which in this region, is filled with rocks, soil and a thin layer of frost (NASA, n.d).

The duration of the mission will be five years from design to launch, plus at least another ten years for the mission to last on Mars. Leveraging advances in technology could help the mission with batteries that are efficient and can hold enough charge for the Drillmaster to dig deep for a long time without the need to return to the surface to recharge. After the rover has landed on Mars, the rover will begin to map the surface of Mars and identify the ideal location for digging under the crust. A team consisting of mechanical engineers and software engineers will control the Drillmaster to ensure the safety of the rover. The operational engineers will collaborate with geologists and material engineers to identify where the rover should be transported and where is should begin digging to take samples. The schedule for the mission will have the following milestones:

2020: Hire design engineers for the project

2021-2023: Design of the rover and digging equipment

2023: Design of the launching vehicle for the rover

2024: Testing of the rover and launching vehicle

2025: Training personnel to maneuver and manage the rover

2026: Launch and start of mission

Drillmaster will be a rover with a mining drill attached to the front. The body will be a large cylinder with a drill. The wheels on the rover will be four sets of two treads spaced evenly around the circumference of the cylinder. The cylinder will rotate with the drill and the treads will have the ability to either roll with it or stay stationary for moving on the surface. The rover will be able to move in any direction the scientists direct. It will be equipped with sensors that scan the soil composition and take samples. There will also be sensors to measure the depth, temperature and humidity. Attached to back of the Drillmaster, there will be solar panels. Humans on earth will be able to communicate and control the rover to examine the samples taken from the expeditions. A camera inside the rover can be used to convey to the team on earth if the drill is situated as desired prior to taking samples. The pictures and measurements will be sent to scientists on earth so that they can study the samples and use that information to more fully understand Mars.

Some of the assumptions that will be made is that the drill will be made of strong material that can survive the climate on Mars; satellite control will be powerful and reliable enough to control the rover remotely from distant areas on Mars itself, or even as far as earth; sensors will have the abilities to scan for possible lifeforms, soil compositions and temperatures; batteries will be efficient enough to sustain charge for weeks at a time to ensure the expedition can last for a long time before needing to return to surface for recharging.

The main constraint for this mission will be the budget required for design, build and test the equipment. Once the mission is launched, additional constraints may appear on Mars due to climate conditions, unforeseen damage to equipment, insufficient samples or unclear images of the samples for proper research by the team on earth.

Once scientists know and understand what chemicals, metals, biological material exists under the crust of Mars, it will be a step forward to identify which of the existing materials can be used for a future human colony on Mars, and which will need to be imported to Mars. If settlers decide to live underground, it would be important to know if the soil is malleable enough to dig in and if its consistency will protect humans from radiation. Ideally, Mars has metals that can be mined and refined to make tools, and maybe even the soil contains oxygen or water.

References

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