Less restrictive 'bioburden' rules would make some Mars missions simpler

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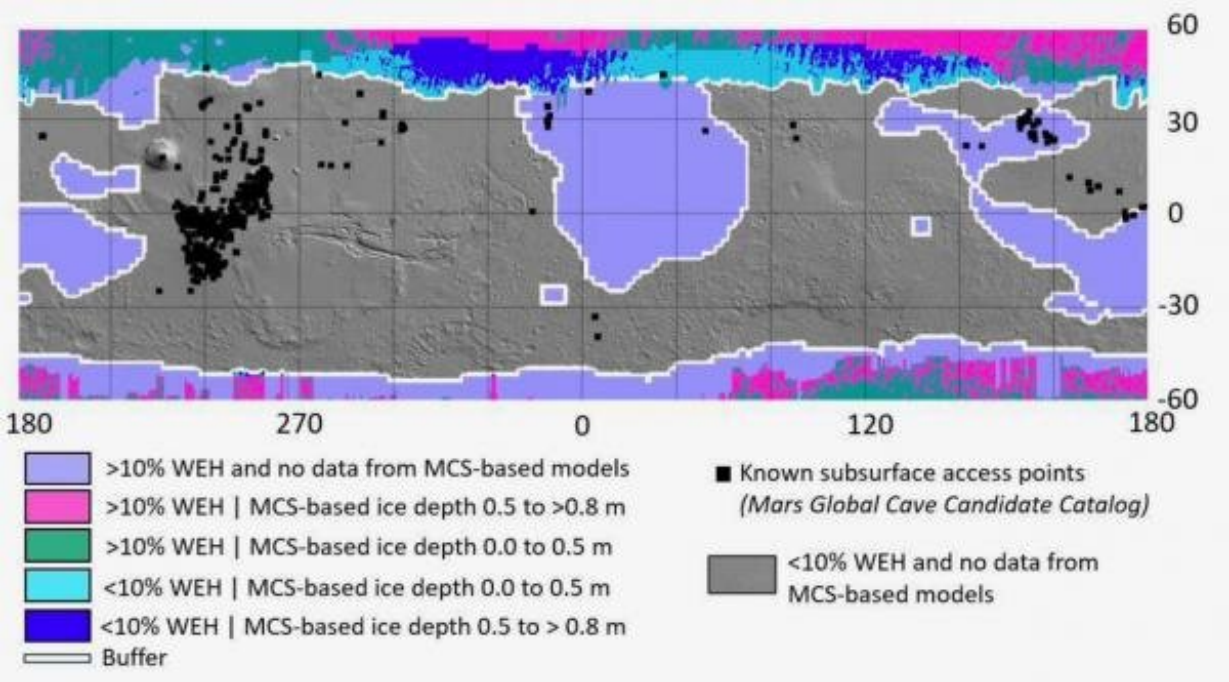

This map of Mars shows locations where ice is potentially located within 1 meter of the surface, based on neutron spectroscopy data (Mars Odyssey) or thermal infrared (IR) spectra (Mars Climate Sounder), and includes known subsurface access points from the Mars Candidate Cave Catalog. The gray regions are those lacking IR data and yielding water equivalent hydrogen (WEH) contents less than 10% from neutron spectroscopy. In the gray areas, closed-system ice or brine could potentially be present in the top 1 meter, but it is likely to be low in abundance and patchy in distribution. Gray regions may be appropriate for missions planning subsurface activities (as deep as 1 meter) with reduced bioburden requirements, if landing sites are a conservative buffer distance from subsurface access points. Credit: A. Deanne Rogers, Stony Brook University,

A new report that could make it simpler to send spacecraft to some areas of Mars while still protecting the planet from Earth-based contamination was presented today at a press conference at the 53rd annual meeting of the American Astronomical Society's Division for Planetary Sciences by Planetary Science Institute Senior Scientist Amanda Hendrix.

The report from the National Academies of Sciences, Engineering, and Medicine identifies criteria that could allow robotic missions to certain locations on Mars to be carried out with less restrictive "bioburden" requirements, which are designed to prevent harmful contamination by Earth-based microbes at Mars.

"The Committee on Planetary Protection, a standing committee of the National Academies Space Studies Board, was tasked by NASA to write a report discussing criteria that could be used to designate regions on Mars where missions can land with less stringent bioburden requirements than currently in place. Currently, meeting planetary protection requirements—for instance, using rigorous sterilization techniques—can be seen as imposing, costly and complex, and it could be that these restrictions can be simplified and modernized, in some cases, which can help make some areas of Mars more accessible," said Hendrix, co-chair of the committee that wrote the report.

"The report suggests techniques for modernizing and providing flexibility in planetary protection implementation. One way to do this is by utilizing a risk management approach, that could be tailored to individual missions' needs," Hendrix said. "The Committee's findings can lead to making portions of Mars more accessible to both commercial and government endeavors by relaxing planetary protection requirements

while remaining careful about access to potential habitable zones."

In this report, the Committee focused on regions on Mars that might not be negatively impacted if visited by spacecraft that are not stringently sterilized. For missions that do not access the subsurface, such regions could include a significant portion of the surface of Mars, because the UV environment is so biocidal that terrestrial organisms are, in most cases, not likely to survive more than one to two sols, or Martian days. For missions that access the subsurface (down to 1 meter), regions on Mars expected to have patchy or no water ice below the surface might also be visited by spacecraft more relaxed bioburden requirements, because such patchy ice is likely not conducive to the proliferation of terrestrial microorganisms.

The report finds that it is imperative that any mission sent to Mars with reduced bioburden requirements remain some conservative distance from any subsurface access points, such as cave openings. Furthermore, though less stringent than current requirements, these missions with relaxed bioburden requirements would still need some level of cleanliness, which could be achieved for instance using standard aerospace cleanliness practices.

"The whole purpose of planetary protection protocols is to minimize the risk of harmful contamination; this means minimizing the risk of introduction of terrestrial biological material that could confound future life detection experiments. This is really important in the case of Mars," Hendrix said. "At Mars we know that the surface is almost certainly uninhabitable for terrestrial microorganisms, due to the harsh UV environment; however, subsurface regions such as caves, shielded from radiation, could be habitable zones, for terrestrial and/or indigenous Martian life.

"The report will help in the search for life on Mars by identifying those

areas on its surface for which planetary protection standards for spacecraft must be most restrictive," Hendrix said. "Also, by potentially easing planetary protection burdens in the exploration of other areas, NASA could enable more missions to Mars that help us understand the planet and its environment, even if these missions are not pursuing astrobiological studies."

The committee's findings apply specifically to missions for which NASA has responsibility for planetary protection. For commercial missions in which NASA has no role or connection, the U.S. government still needs to designate a regulatory agency to authorize and continually supervise space activities in accordance with the Outer Space Treaty, the report says. The study was funded by NASA.

Provided by Planetary Science Institute