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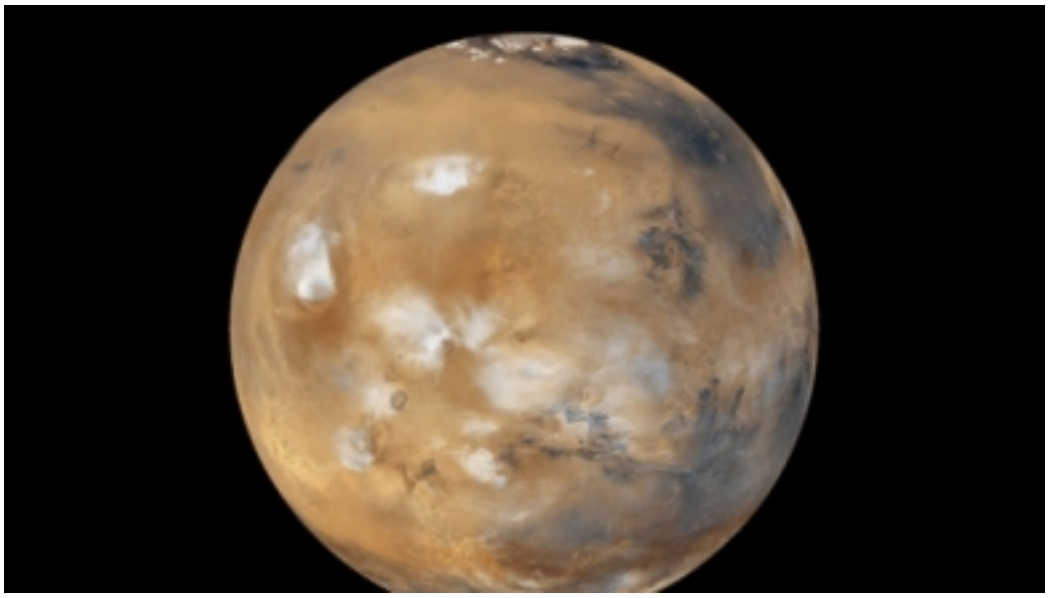
Do Mars Astronauts Need To Land?

Jun 26, 2017 Mark Carreau | Aerospace Daily & Defense Report



HOUSTON—Three space veterans are advancing the notion of "exploration telepresence," or scientifically skilled humans working hand in hand from Mars orbit with surface robots to hasten discovery with greater reach than operating on foot from a landing site.

This strategy also would feature less chance of introducing terrestrial contamination, reduced risk and perhaps a more manageable cost, according to Dan Lester, senior scientist at Austin, Texas-based Exinetics, Kip Hodges, director of Earth and Space Exploration at Arizona State University, and Robert Anderson, a planetary geologist at NASA's Jet Propulsion Laboratory.

"Mars exploration involving decision-making and iteration can be achieved much faster by nearby scientists than by time-delayed scientists on Earth," the authors write in "Exploration telepresence: A strategy for optimizing scientific research at remote space destinations," published June 21 in the journal Science Robotics. "This is in many ways superior to an astronaut on the surface in a bulky pressurized space suit with limited consumables."

Their approach purports to combine the advantages of human awareness and decision making in the exploration process with capable robotics. While NASA's Curiosity rover has proven an able explorer since its suspenseful touchdown in the geologically rich Gale Crater on Mars, radio communications with its human

science team on Earth experience a two-way time delay, or latency, that ranges from five to 40 minutes, stifling spontaneous scientific interaction.

By comparison, the Earth/Moon latency during the Apollo missions was 2.6 seconds, still ten times longer than human reaction times and somewhat awkward for astronauts roving and hiking across the cratered lunar terrain.

“Putting astronauts on the surface of Mars is difficult and dangerous,” the authors note. “However, putting astronauts in orbit around Mars, with control latency to the surface within the human reaction time, is more tractable and assuredly less expensive.”

The scientific trio is quick to characterize exploration telepresence as an expedited first step in the larger goal of supporting human visits to the Martian surface, and potentially settlement.

In a sense, exploration telepresence would be terrestrial technology—which famously benefitted from Apollo-driven computer/software, material and other technology spinoffs—giving back to the space program.

Telepresence currently features in the global operations of unmanned aircraft, robots assigned to undersea energy exploration, mining, hospital operating rooms, and office video conferencing.

And it’s no stranger to the ISS. In July 2013, NASA and European Space Agency astronauts Chris Cassidy and Luca Parmitano worked from the orbital science lab with ground-based experts at the Jet Propulsion Laboratory and Ames Research Center to remotely command the survey of a simulated lunar-like terrain at Ames with the K10 planetary rover.

In September 2015, ESA astronaut Andreas Mogensen demonstrated something similar from the ISS as part of the agency’s Meteron project, commanding one of two rovers at a simulated lunar base in the Netherlands. Among Mogensen’s activities was a haptic feedback demonstration in which the astronaut commanded a robot to insert a peg in a small opening in a circuit board to represent a precise electrical connection.

While it took Mogensen 45 min. to accomplish the connect task on the first attempt, the second required only 10 minutes.

In October, Hodges and Anderson helped guide a Keck Institute for Space Studies workshop on the exploration telepresence concept at Cal Tech by reviewing traditional planetary science techniques and exploring the potential of a new human-commanded robotics approach.

A second workshop planned for July will assess the knowledge gaps as well as future research efforts to close them. Meanwhile, NASA already has opened the door to possible human/robotics interactions on the lunar surface as part of its Deep Space Gateway mission.

Deep Space Gateway would be a crew-tended, lunar-orbiting habitat fashioned, launched and maintained by commercial and international partners in the 2020s. From this outpost, astronauts would prepare themselves and test key systems for the rigors of two- to three-year human missions to Mars a decade later, and eventually red planet settlement.