Finding good spacemates for the Mars mission

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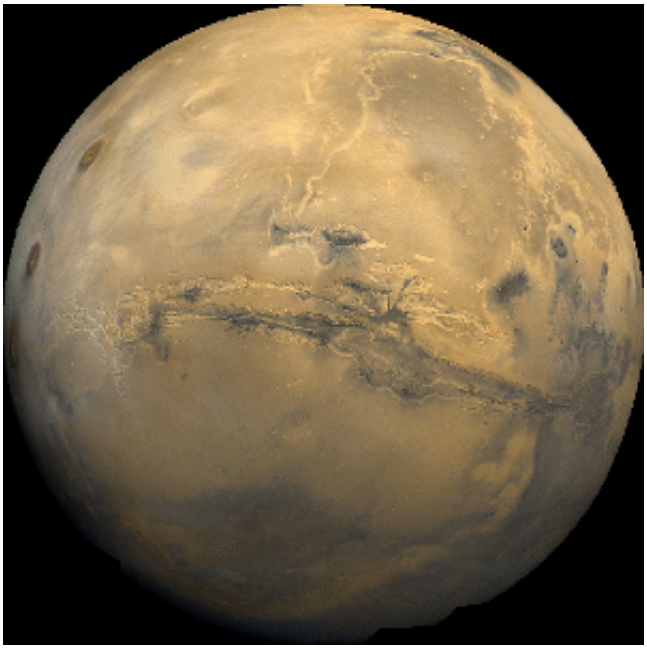

Valles Marineris, Mars. Credit: NASA

When NASA selects astronauts to travel to Mars sometime after 2030, they will need a small crop of candidates who are smart, skilled - and personable.

For a voyage almost 34 million miles one way, the astronauts will need to work well together in an isolated and uncomfortably tight environment, as well as cope with boredom and the continuous company of the same tiny group of people.

Researchers at the Johns Hopkins University recently won a NASA grant to help the nation's space agency develop a method of sorting elite candidates, identifying those who are also amiable people persons, for space missions that could last three years. Grouchy, moody types who value personal space probably will not be good candidates. Ditto chatty individuals who need lots of outside social interaction.

"NASA is already really good at picking people," said Michael Rosen, a Hopkins psychologist who is leading the effort. "But they'll need to be better."

The project is one of 11 NASA grants awarded to 10 institutions sharing in about $5.7 million in funding to investigate astronaut health and performance on future space missions over the next two or three years. The studies will add to what officials already know about the mental and physical health of astronauts.

Under the new grants, researchers are envisioning new or worsening problems: Missions to Mars, and even far flung asteroids, would take substantially longer than the 18 months or so astronauts now can spend on the International Space Station. They will have less room, no escape pod and far less communication with Earth. It will take more than 20 minutes for communications to reach mission control.

The results are expected to help NASA not only pick the right astronauts, but help preserve their health while they're in space and after they return home, according to NASA officials. The results also could help develop treatments and preventive measures for medical and behavioral problems.

None of these astronauts, however, are available for testing because most eventually chosen for the trip to the Red Planet are likely still in high school. Researchers say they will use their own research and the work of

others, conduct interviews, utilize simulators and employ stand-ins.

One project will study workers in a remote marine research station in Antarctica. It will look at what measures are necessary to counter the inevitable stress, fatigue and conflict experienced in space. Workers there will do a combination of cycling and playing a type of video game during their stays of up to 14 months, according to Dr. Mathias Basner, associate professor of sleep and chronobiology in psychiatry in the University of Pennsylvania Perelman School of Medicine.

"We believe this measure will counter some of the negative effects we see in isolated, confined and extreme environments," Basner said.

At the State University of New York, Stony Brook, researchers will examine proteins in blood samples taken from astronauts before, during and after space travel to determine how they might mitigate impacts to the space travelers' immune systems. The lack of gravity and radiation exposure from prolonged time in space causes chronic inflammation that can lead to immune system dysfunction. That can make the astronauts susceptible to infection, not to mention uncomfortable, said Kanokporn Rithidech, a professor of research in SUNY Stony Brooks' department of pathology.

Other researchers at the University of Miami will use NASA simulators that mimic lack of gravity to understand why astronauts develop a syndrome that can cause visual impairment. Deep space travel likely would compound the problem, said Noam Alperin, professor of radiology and biomedical engineering at Miami.

Ultimately researchers will seek to use Alperin's and Rithidech's findings to develop measures to counter the effects of space travel during or after flights.

At the University of Central Florida, C. Shawn Burke, a research scientist in the Institute for Simulation and Training, will work on ways that crews from different countries can handle cultural differences. She will use existing research and conduct interviews with people familiar with astronaut living and working conditions to develop training programs for astronauts before they travel and mechanisms they can employ if a conflict arises, a "refresher for in flight," she said.

Cultural differences can lead to difficult situations, such as when crew members are used to working for one designated leader and other crew members expect a more democratic approach, Burke said.

"When crews go up there, we want them to go as a cohesive team, remain a cohesive team and come back that way," she said.

Her research will complement the work at Johns Hopkins, where Rosen plans to partner with researchers at Rice University in Houston on a three-year, $975,000 project to develop a means of identifying the best team to send into deep space in the first place.

At Hopkins, Rosen plans to recruit surgical and critical-care residents who already spend a month at a time in Johns Hopkins intensive care units. They are smart, adaptable and faced with stressful and complex situations in socially isolated settings for up to 80 hours a week, providing good stand-ins for astronauts, he said.

The residents will answer questionnaires and also be subjected to sensors such as wrist bands and smartphone applications that track their heart rates and other physiological responses to their situations. Eventually, the researchers' assessment model will be tested in a spacecraft simulator at NASA in Houston.

The Johns Hopkins researchers hope to determine, for example, not just

how someone performs under pressure and what they contribute to the group, but how the group responds to that person.

If their voice is too loud, for example, "they may not be great to have on a long mission," said Rosen, an associate professor in Johns Hopkins' department of anesthesiology and critical-care medicine and a faculty member in the Johns Hopkins Armstrong Institute for Patient Safety and Quality.

Rosen said he and the team at Rice have long studied such team-based performance in high-risk environments, and he expects to use the findings not just to benefit NASA's astronaut selection process but perhaps to help customize doctor training at Johns Hopkins and beyond. Doctors with innate abilities in such stressful situations may need less time in training, while others may need more time and better coping mechanisms, he said.

The final tool won't be a one-size-fits-all assessment but a method of picking the proper team, with each member bringing complementary characteristics.

"What does this team to Mars need to be successful?" Rosen asked. "The right mix of people."