

Conscientiousness key to team success during space missions

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Analog astronauts Joao Lousada and Stefan Dobrovolny before sunset. Credit: ÖWF/Florian Voggeneder

NASA is working toward sending humans to Mars by 2030. If all goes according to plan, the flight crew's return trip to the red planet will take

about two-and-half years. That's a long time to spend uninterrupted with co-workers. But imagine if the astronauts don't get along with each other.

To ensure that doesn't happen, a new study led by Western University tested team dynamics of five astronauts during an analog Mars mission staged by the Austrian Space Forum in 2018 in Oman, a country that shares borders with Yemen, United Arab Emirates and Saudi Arabia.

The study found that conscientiousness is a key requirement for a crew to achieve its extraterrestrial tasks, outdistancing other potential traits like honesty, humility, emotionality, extraversion, openness and agreeableness.

"Conscientiousness, an individual personality trait, can be thought of as a pooled team resource," said Julia McMenamin, a Western psychology Ph.D. candidate and first author of the paper published by *Astrobiology*. "The more conscientiousness a team is, the better they will likely be at accomplishing tasks."

On the other end of scale, counterproductive behaviors like social loafing—the tendency for people to exert less effort when working as part of a team than they do when working alone—will likely mean a no-go for launch for potential astronauts heading to Mars.

Counterproductive or negative behaviors that commonly cause trouble in teams should be non-negotiables for long duration spaceflight, and great efforts must be made to reduce their likelihood, says McMenamin.

Strategies to reduce counterproductive behaviors include careful selection of crew members, detailed planning and work processes, and an emphasis on effective communication between team members—factors that should be incorporated into all teamwork

experiences.

McMenamin and Western psychology professor Natalie Allen teamed up with Mission Control Space Services chief science officer and Western alumna Melissa Battler on the study. Mission Control is an Ottawa-based space exploration and robotics company.

Before, during and after the four-week AMADEE-18 analog space mission, which simulated a Mars environment featuring isolated and extreme conditions, the analog astronauts completed surveys assessing team conflict, team performance and stress levels. The final survey asked the analog astronauts to rate each of their teammates and themselves on citizenship behavior, in-role behavior, counterproductive work behavior and social loafing.

"Anyone who has worked on a team knows conflict amongst team members can harm team performance and make for a negative experience. When people argue about how to get things done, or get into personal disagreements, there is less time and energy left for completing tasks," said McMenamin.

"What's interesting is that there are different types of conflict, and so long as interpersonal issues and arguments about how to go about accomplishing tasks are avoided, differences in views and opinions might actually improve team performance, likely because this allows for the team to benefit from each member's knowledge and perspective."

Beyond conflict, acute stress can also impact teams negatively on Earth and apparently in space, says McMenamin. Stress creates distractions, contributes to task overload, increases destructive emotions or feelings of anxiety and worry and makes it difficult for team members to coordinate their work.



Analog astronauts Iñigo Muñoz Elorza and Carmen Köhler performing the “FieldSpec” experiment (spectrometry experiment) of the Italian Space Agency (ASI). Credit: ÖWF/Florian Voggeneder

The study also showed the crew of AMADEE-18 analog space mission worked very well together, but McMEnamin says the results were not surprising, as the analog astronauts were well prepared, had the support of a field crew and mission control team, and were familiar with one another heading into the mission, major determinants of team success here on Earth.

"How familiar team members are with one another has been shown to help teams work better together, likely because it provides [team members](#) with knowledge about each other and helps them communicate better and more efficiently," said McMEnamin.

Since the AMADEE-18 analog mission spanned just a few weeks, McMEnamin says it's uncertain how team dynamics and performance would have changed over a longer time period.

"Major issues caused by psychological distress and interpersonal problems don't tend to show up until months or even years spent in an isolated, confined and extreme environment, which highlights the need for longer-duration simulations," said McMEnamin.

Moving forward, McMEnamin would also like to see teamwork studies focused on the [mission control](#) environment, an interest fueled by her participation in CanMoon Mission, a lunar sample return analog joint [mission](#) between Western, the University of Winnipeg and the Canadian

Space Agency.

More information: Julia McMenamin et al. Team Processes and Outcomes During the AMADEE-18 Mars Analog Mission, *Astrobiology* (2020). [DOI: 10.1089/ast.2019.2035](https://doi.org/10.1089/ast.2019.2035)

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