Psychosocial Effects of Long-Duration Space Flight Analyzed in Shuttle/Mir Studies

A 4 1/2-year psychosocial study conducted on five Shuttle/Mir missions is providing the first quantitative data on interpersonal relationships and multicultural issues during long-duration space flight. The findings suggest strategies that may help to build stronger, more productive working relationships among crew members and among people of different cultural backgrounds on future long-duration space missions.

Imagine this scenario, six months into a multinational, multiyear manned mission to Mars: The exhilaration of the mission's initial phase has worn off, and the crew has grouped itself into two camps—U.S. astronauts on one side, Russian and European crew members on the other. Efforts by mission control staff to defuse the situation have failed, and the two groups have stopped speaking to each other.

Such a situation would jeopardize the crew's ability to successfully complete the mission and safely return to Earth. What could have been done to prevent it? What countermeasures might prevent the development of a situation like this on a future long-duration space mission?

A lengthy space mission is an isolated, stressful environment. Studies conducted in other so-called "analog" environments—on board submarines and in Antarctic research stations, for example—provide evidence that interpersonal and cultural issues can disrupt group cohesion, damage morale, and interfere with the performance of mission tasks. Tension, cohesion, and leadership have been identified from analog studies, simulations, anecdotal reports, and studies with astronauts and cosmonauts as interpersonal issues likely to surface during long space missions, especially during the second half of a mission. Social and cultural issues posed by multicultural crews are also a concern.

To determine the impact of these issues on an actual space mission, experiments were planned for the Shuttle/Mir program for the purposes of quantifying—for the first time—how these issues affected space crews and mission control personnel, and assisting in the development of countermeasures for future multinational space missions. No one before had conducted a rigorous scientific study in space of the impact of psychosocial issues on space missions.

First Empirical Psychosocial Study in Space

NASA's Shuttle/Mir program, in which U.S. astronauts served as visiting crew members on the Russian space station Mir, provided an ideal laboratory to study social and cultural interactions among space flight crews. Five Shuttle/Mir missions were studied between 1995 and 1998. Participating U.S. astronauts spent periods ranging from three to six months aboard the Russian space station. Most of the time the crew consisted of one U.S. astronaut and two Russian cosmonauts. The mission commander was always a cosmonaut.

Nick Kanas, professor of psychiatry at the University of California, San Francisco, headed an international research team that measured tension, cohesion, and perceptions of leader support among crew members and mission control personnel in the Shuttle/Mir program. The research team included scientists from the Institute of Biomedical Problems in Moscow. The study was supported by NASA.

Study subjects (five astronauts, eight cosmonauts, and 42 American and 16 Russian mission control personnel) completed a weekly questionnaire designed to examine their mood and their perceptions of the work environment, tension, cohesion, and support from those in charge of the mission.

Russian cosmonaut Yuriy Onufriyenko tries on a space suit glove during the Mir 21 mission. American astronaut Michael Clifford is on the right. The International Space Station will have many multicultural crews.

"We used standardized measures that have been validated in hundreds of studies of people's emotional state and perception of their work environment," says Kanas. "We took enormous confidentiality precautions to ensure that no individuals could be identified. We're interested in group behavior, not in individual psychology."

Findings

The study's most significant finding was that space crew members and ground personnel alike were strongly affected by a phenomenon that psychiatrists call displacement.

"When people are not getting along very well, they displace their tension and unpleasant emotions to the outside," says Kanas. "During weeks when the crew members reported tension and unhappiness, they thought the people on the ground didn't care about them. When the ground personnel reported tension and unhappiness, they thought that NASA management didn't care about them."

The study also found evidence of a decrease in perceived support from the crew's leader during the second half of the missions. Americans expressed more unhappiness than their Russian counterparts. In space, Kanas suggests that this was a consequence of being the sole American aboard a craft with a Russian commander and where the Russian language was spoken. "One of the most unstable groups you can have is a three-person group in which one individual is in a minority and the leadership is in the majority. That's exactly what the situation was on Shuttle/Mir."

Mission control personnel expressed more unhappiness with their work environment than space crew members did. The American ground personnel had been sent to Russia for the mission; they were away from their families and working in a foreign environment. Political turmoil in Russia at the time of the Shuttle/Mir missions meant that the Russian ground personnel were not paid regularly, contributing to their unhappiness.

Despite these difficulties, none of the missions were unsuccessful. Both crew members and ground personnel scored better on measures of satisfaction with their work environment than groups previously studied by other researchers in hospitals and other high-stress workplaces on Earth, says Kanas.

Before the Shuttle/Mir study, Kanas led a ground-based study (in a project funded by the European Space Agency) in which three Russians, including two cosmonauts, were confined to the Mir space station simulator for 135 days. In that study, in contrast to what was expected, tension decreased in the second half of the simulated mission. This was probably due to a mid-mission resupply event that brought food, letters, and supplies, an event that may have improved morale and decreased tension in the crew. At the same time, crew cohesion and perceptions of task-oriented direction from the leader diminished during the latter part of the mission. This study also found evidence of displacement of tension and unhappiness to the outside.

Lessons Learned

A key lesson from both of these studies, says Kanas, is that "negative interpersonal phenomena during space missions are due to environments that put people under stress." Among the countermeasures that he and his research colleagues suggest is pre-mission training for both crew members and ground personnel to help them better understand and deal with interpersonal and cultural tensions. The team hopes in the future to study the effectiveness of such a training program. More support needs to be provided to people who belong to a cultural and language group in the minority or, as an alternative, avoiding crews that include an individual who is different from the others in a major way. Other recommendations include addressing positive aspects of the crew environment that encourage expressiveness, independence, and self-discovery in the crew, and paying more attention to the needs of mission control personnel.

Kanas and his colleagues are now in the early stages of a second NASA-supported study that will examine tension, cohesion, and perceptions of leadership support among crew members and mission control personnel taking part in five early International Space Station missions. The influences of crew heterogeneity and culture and language differences will also be assessed in this study.

Cultural heterogeneity is an issue now facing many workplaces, notes Kanas. His own research team's collaboration with Russian co-investigators offers a case study in the development of cross-cultural scientific relationships, he says. In the process of learning to work together, American and Russian team members had to recognize and overcome numerous cultural differences.

"We learned a lot about diplomacy," he says. "We now have a very good relationship with our Russian co-investigators."

References

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