

Technocogninetic Methods to Reduce Psychological Threats to Surviving Voyages To Mars

by Marshall Barnes, R&D Eng.

aet.radal.ssg@post.com

AET RaDAL

Yellow Springs, Ohio

United States of America

Abstract

From studies of people confined in tight quarters in harsh environments like Antarctica, and the experience of International Space Station expedition 6 flight engineer and science officer Donald Pettit, and research by Dr. Jeffery P. Sutton, head of the National Space Biomedical Research Institute, the psychological aspects of a manned voyage to Mars will be daunting and are yet to be completely resolved. It has been stated that human behavior is unpredictable however, as will be noted by this paper, methods to improve psychological testing exist and should be considered. In addition, technocogninetic technology is in commercial development now that could greatly reduce stress of long voyages, even solo, manned missions to Mars. Technocogninetics is the study of how devices affect human cognitive processes, as well as consciousness, and has been successful in analyzing and finding terminal flaws in studies from the Open University and Baylor College of Medicine. This paper will explore and further define the approaches and methodologies described above and reveal how they could be employed to ensure the psychological survival of voyages to Mars.

Studies of people confined in places such as Antarctica, show that even the most well balanced and emotionally sound people withdraw, feeling lonely and isolated. It is not uncommon for them to direct their anger toward headquarters or Mission Control. In some long term flights in the past, mild-mannered astronauts became mean and combative, not only with each other but also Mission Control, after less than a month had transpired.

According to the Associated Press in 2004(1), Dr. Jeffrey P. Sutton, head of the National Space Biomedical Research Institute, said solving the potential psychological issues of a Mars flight is critical to mission success.

The issue of crew dynamics has been looked at for a long time. Due to the extraordinary time that the crew are confined in close quarters with the impossibility of relief, the strain can be significant even for the most emotionally well balanced of crews. Screening has had limited success as in the 1999 incidents involving Russian, Canadian and Japanese crew members during a simulation. Two Russian men came to blows while another forced a Canadian woman to kiss him on New Year's Eve and the Japanese crew member demanded to be let out of the simulation. He was (2).

Vadim Gushchin, chief psychologist at the Russian Medical and Biological Problems Institute attributed these incidents to excessive irritability as the crew were beginning to adjust to the extended isolation induced by the simulation (3).

The incident echoes what Russian cosmonaut Valery Ryumin has said, "All necessary conditions to perpetrate a murder are met by locking two men in a cabin of 18 by 20 feet for two months..." (4)

At this time, another simulation is about to get under way. The Mars 500 simulation mission is being launched in Moscow Russia at the Russian Academy of Sciences' Institute of Biomedical Problems. A total of 640 experiment days have been slated for the crew to live and work in a mock-up of a spacecraft. There is a limited supply of food and communication with the outside world is limited as well. In fact, there is a 20 minute delay between communications to simulate the reality of communication during an actual space mission(5).

Benny Elmann-Larsen, co-ordinator of physiology in human space flight at ESA (European Space Agency) has said that "The human factor is the most uncertain factor". (6) That being the case, the psychological element of a long space mission is the key factor immediately beyond the technological feasibility of the spacecraft.

Although various research projects conducted during long term missions on space station Mir, aboard submarines and in isolated outposts in the Antarctica, have provided some solutions to the problem, the picture is still incomplete. Despite the fact that suggestions for psychologists being employed in mission control to ease tensions between crews in space and those on the ground, and

devising ways of dealing with onboard stress, such efforts will not have the same effect as immediate tactics to provide relief at the moment that it is required would.

Suggestions that crew members be encouraged to use email or audiovisual links to contact friends and family back on Earth also have hidden challenges as in fact, contact with family, under the certain conditions, could lead to depression as the sense of distance is reinforced by seeing what they are missing back at home(7). Contact with loved ones is important but should not be used as a panacea. Real solutions are required to deal with the problems at hand.

My solution to these challenges is two-fold. The first is purely psychological. The second is purely technocogninetic, a word that you may be unfamiliar with which I will explain shortly.

The first solution is the more intense scrutiny over who is allowed on a mission to begin with. Instead of relying on apparent psychological dispositions as a basis, intense testing should be administered. If the crew is to be mixed genders you want to have males onboard that would never sexually assault a female even if their life depended on it. An example of such a test would involve an attractive female strapped in a chair alone in a room that is visible on a TV monitor, with various cables attached to her clothing. The person being tested doesn't know that the female is a professional actress. The person, however is told that they will be given a shock if they do not push a button that will yank off an item of clothing when a signal is given. The problem is that with each item of clothing that comes off, the female becomes more alarmed and begins pleading to be let go. However, each time a signal is ignored, the severity of the shock goes up.

The test is a chivalry measurement test and is designed to see how much resistance the subject will put up to disrobing the female against her will. The subject that rebels against the test itself while not disrobing the female, despite the shocks given, would be considered having passed with flying colors.

Another test is for isolation is akin to the Mars 500 but without the length requirement. Subjects are told that when they wake-up they will be in an environment that will be fatal if they attempt to leave the compartment they're in. They will not be told where they are nor how long they will be there. There will be a month's worth of food onboard that they should make last longer if at all possible as they will not be resupplied. When they wake-up they find that

they are in what looks like a space ship akin to the space shuttle but without windows. If they turn on any of the TV monitors inside they will see what looks like outer space, including stars. If they try to turn on the onboard lights for the outside they will see the effects of the lights appearing on the monitors. The only reason they will know they aren't in space is the fact that gravity will still be in effect, but they will not know where they really are and they will not be told. They will not have any clocks onboard nor cell phones or anything that can be used as a time piece. This exercise is to test how well the candidates can deal with uncertainty. After a week, the test will be concluded and the crew will be removed from what is a huge water tank with blacked out sides and special lights to simulate stars. Those that had the ability to remain focused and kept their composure, pass.

My background includes twenty years of research into the effects of auditory and visual stimulus on people, consciousness and developing technologies that would create specific effects. This began when I was a young rock musician influenced by techno wizard Todd Rundgren and moved from, just creating music, to intense involvement in music production and then the creation of technologies for use with electric guitar and digital sampling keyboard. I simultaneously became a video director/producer/cameraman/editor/special effects designer and hit my zenith in that field when I created the first, and as of this date - still only, psychoactive rock music video album. That means that it will get the viewer high if watched in a dark room while staring at the TV, especially if done so while wearing the special glasses that came with it which caused the visual images to project out of the TV screen. This was created in the 1990-1991 time period (8) when virtual reality was first coming to public attention, and there were many comparisons between my work and that. However, I knew better. While both were viewed as immersive approaches, mine was more enveloping than immersive. There was always the knowledge that you could get up and walk away at a moments notice without taking anything off, as is required of VR helmets and gloves. The TV screen is not the only thing you see and your immediate environment is not cut-off by the experience. Simultaneously, my production featured realistic, live action footage with special effects while VR was mainly little more than sophisticated versions of 80s clunky computer graphics.

This background led me in 2006 to coin the term, technocogninetics (9), which is the study of the effect of things on human consciousness without the prerequisite feedback of cognitive technology. This approach came from my conversations with Dr. Itiel Dror, then of the University of Southampton in the

UK who saw a value in my research in that area but realized that it did not meet the strict definition for cognitive technology used in the psychological field. This approach, of looking at the psychological effects of devices and things during experiments and tests, has already proved itself. The best example was in the exposure of terminal flaws to the theory of Dr. David Eagleman of the Baylor College of Medicine that duration dilation is simply a function of elongated memory. Technocogninetic analysis revealed that not only was the experiment fraught with problems but the key element, upon which Eagleman rested his conclusion as pertaining to memory elongation, was null and void because the device he employed, called a Suspended Catch Air Device, rendered all estimates, of how long a fall lasted within the device, to be too long because it turns out that the device is designed so you can't tell when you've landed. It is the technocogninetic question of "what is the effect of landing in the device on the subject?" that turned up this bit of critical information(10).

Although I am a technologist and have worked with a variety of technologies all my adult life, I view the computer as a tool with limitations. My imagination, however, is not limited and I have seen how audio and visual experiences, superior to the limitations of computer graphics, can be created for the kind of realism that no machine can actually create on its own. Toward that end, I spent 2002-2005 working the solutions to the problems inherent to creating the types of devices featured in such sci-fi movies as Brainstorm, Strange Days and Total Recall and have since solved enough to be able to have the working foundations for what might be called a vacation simulator, somewhat a kin to the device in Total Recall but without the requirement for a medical implant.

Verifiable information that points to the technological basis for this claim can be found in the research of Michael Persinger, PhD of Canada's Laurentian University. Persinger is known for his research with exposing the brain to weak magnetic fields to induce hallucinatory effects that include perceptions of humanoids and a feeling of being somewhere else. These fields are delivered to the brain through a variety of headpieces that he has devised, including one that he calls the God Helmet because supposedly creates spiritual-like experiences in the mind of the wearer (11). My approach is not as primitive and although trade secrecy prevents my revealing the actual functioning of the device, my experience and expertise in being able create psychoactive entertainment should be able to give credence to my claims.

My solution is to use technology that I have already developed which can be adapted to the mission requirements and psychological needs of the crew. It is an alternate version of a mind-machine technology that I have been developing to allow for simulated vacation experiences. The apparatus is too large to go on a spacecraft but I have been able to configure a version that would work with a motorcycle helmet. The helmet would deliver pre-programmed experiences that would be based on interviews with the crew prior to launch. These experiences would be based on psychological analysis focusing in on those things that the individuals see as being a part of their core being, outside of family and friends. This key element is what is missing in most evaluations in regards to psychological stress issues for long space missions. In other words, each of us has a core with which we find ourselves in times of loss. Who are you after your lover or spouse leaves? Who are you at your core and how do you regain yourself to move on. This is what must be psychologically emphasized so that the individual crew members can feel that they are centered with themselves and not reliant upon family contact, etc in order to go on.

The experiences programmed into the system will vary wildly because of the variations between the crew members, but they can include everything from musical experiences to vacation simulations to memorable and sentimental locations. There would almost be no limit. The experiences would come after the crew member donned a helmet and activated the system. The helmet will be plugged into a playback system that will deliver the selected pre-programmed experience to the helmet. The result will literally be like a Holo-deck in a helmet, the Holo-deck being the room made famous on Star Trek: The Next Generation where the crew could engage in realistic, holographically generated fantasy. This will enable the crews of long space flights to have the advantages of a Holo-deck without having the space requirements as seen with the original concept on TV. The entire architectural platform technology would be no larger than 17"x4"x6", small enough to easily fit onboard a space craft.

Again, this is not sci-fi, this is a solution that would be ready within a year after the appropriate funding were acquired to finish the research, or when I get around to finishing development on my own. This type of technology, partnered with robust and critical psychological reviewing of potential crew members, would go a long way toward eliminating psychological challenges to long manned space missions.

References

1. *Manned Trip to Mars Would Have Unique Hazard*, Associated Press Jan. 2004
2. *1 Small Space for a Test Crew, 1 Giant Leap to Mars*, RedOrbit October 2007
3. *Fights During Space Test*, BBC News March 29, 2000
4. *The Psychological Dangers of Long-Duration Spaceflight*, John Corwin May 28, 2002
5. *Staying Put On Earth, Taking A Step To Mars*, New York Times, March 30, 2009
6. *Only Human - Biggest Risk Factor In Long-term Space Missions*, The Sunday Times Online February 25, 2007
7. *People Make Space Exploration Tricky*, Discovery News, February 21, 2007
8. *Seeing the Breykiot*, Marshall Barnes, New York Times Online, November 19th 2008
9. *Technocogninetics: A Definition*, Marshall Barnes, Nature Network Forums, July 25, 2010
10. *Duration Dilation and the Flawed Frightening Experiment*, Marshall Barnes February 2, 2008
11. *God On the Brain*, BBC Home, November 1, 2010
12. *Holodeck* Wikipedia.org