

Practical Problems in Astrosociology

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Astrosociology is a newly-identified subfield that has historical roots going back half a century. The new tag also encompasses a variety of phenomena, ranging from the micro to the macro, from the social interactions of small human groups operating in the extreme environment of space, to the operations and activities of mission control/mission support teams on Earth, to the organizational challenges of multinational and transnational space projects, to the political-economic issues of multiyear funding continuity, and strategic partnerships between government agencies and private enterprises, to the relationship of the space community to the larger society of which it is a subset.

I. Crew Interactions

The aspect of astrosociology that perhaps most often comes to mind is that of crew interaction, both among crewmembers, and between the crew and Mission Control. The human-human interface is one of several aspects of what is grouped together as “human factors,” others being the human-technology interface and the human-environment interface. The latter two have historically received more attention in human spaceflight as being the more immediate and relevant concerns, given that in this venue humans are operating technology in a hostile environment. However, the social interaction of spaceflight has been given short shrift for the nearly half-century of human spaceflight. The attitude of Robert Zubrin, who holds a PhD in astronautical engineering, is not atypical of the aerospace community. His 1996 book, *The Case for Mars: The Plan to Settle the Red Planet and Why We Must*, has become the manifesto of the Mars Society, which he founded in 1998. He introduces the subject of human factors with the following paragraph:

One of the more bizarre dragons that mar the charts of Mars navigators goes by the name of “The Human Factors Problem.” Some people assert that the psychological problems associated with a round-trip piloted Mars mission are unique and probably a show stopper. Either very fast ships that reduce the round-trip to weeks, or else very large and luxurious ships that can accommodate large crews with ample social and physical space, must be used for the mission, they claim. Unless such concessions to the modern American suburban life-style are provided, they declare, the crew will surely “go crazy.” Unfortunately, since neither the ultra-fast space-warper nor the Club Med interplanetary cruise ship options are feasible, these concerned parties recommend that any Mars mission be postponed until substantial sums have been spent in areas of “psychological research” to solve “The Human Factors Problem.” (Once again we here the chorus of the now familiar song, “Oh, you can’t go to Mars until you give us the dough...”)¹

Let’s consider this paragraph point by point. To begin with, who characterizes human factors issues as show-stoppers? Some of us see the human factors of a three-year round-trip to Mars as a unique set of problems, which need to be identified, characterized, studied, and if necessary, solved. The only show-stoppers are the ones that go unaddressed. Secondly, Zubrin’s allusion to “the ultra-fast space-warper” and “the Club Med interplanetary cruise ship” is a farcical false dichotomy and a deliberate trivialization of this class of problems. The objective, as with any aspect of spaceflight, must be to carefully consider the problem and to define the space of system trade-off studies to arrive at a class of optimum solutions. To suggest otherwise is “bizarre,” even “crazy.” Thirdly, there is no reason why serious research into the human factors issues of long-duration, deep-space missions ought to postpone a mission to Mars. Rather, such research ought to be conducted in parallel with addressing the technological challenges of developing such missions. Fourthly, one wonders what Zubrin considers “substantial sums” in terms of “psychological research:” millions of dollars, perhaps, as compared to the billions that would be spent on developing the technology for a Mars mission? This is penny wise and pound foolish. Indeed, to propose sending humans on long-duration, deep-space missions without characterizing the humans in the system—in essence, denying their humanity—is a logical inconsistency. Would Zubrin send a computer chip to Mars without a complete understanding on how it would behave during the mission? Finally, regarding Zubrin’s parenthetical

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remark implying specious rationales for research in order to get on the government-funded gravy train, the less said, the better.

To cavalierly dismiss human factors as “not a problem” is an unscientific attitude. Moreover, from the viewpoint of an engineer, whose charge is to design a system and a mission that is safe to fly, such an attitude is an irresponsible risk of human lives. Throughout the history of human spaceflight we have had examples of supposed “non-problems” that killed crews. In 1967, a full-power test of the Apollo 1 spacecraft in a high-pressure, pure oxygen environment was “no problem.” In 1986, launching Challenger in cold weather was “no problem.” In 2003, a chunk of ice-laden foam insulation striking the wing of Columbia was “no problem.” The lesson is clear: anything that might be a problem must be investigated. In all of these cases, highly competent, highly motivated people failed to consider a problem that they considered too trivial. The common failure in these three disasters was a “failure of imagination.”

In trivializing the human factors issues of a human mission to Mars, Zubrin is guilty of a “failure of imagination” of monumental proportions, one that is reminiscent of the old saw about generals fighting the previous war. What we are considering here is an entirely new type of space mission, with radically different problems. That sending a small crew in a spacecraft with a small habitable volume on a three-year mission to Mars and back presents unique social and psychological problems ought to be obvious on its face. On the hundreds of short-duration missions that have been flown in near-Earth orbit, and the nine short-duration missions to the Moon, technological problems have dominated. Nevertheless, there have been notable incidents of deviant behavior on the several dozen long-duration, near-Earth orbit missions. Such human problems are latent challenges to near-Earth space missions, whether of short-duration or long-duration, but they are indicative of a class of manifest challenges to long-duration, deep-space missions. No one has yet been in space for three years, either continuously or cumulatively, but beyond the quantitative consideration, deep-space missions will be qualitatively different from near-Earth missions in a number of respects.

The crew will blast out of near-Earth orbit on trip to the other side of the solar system with the certain knowledge that they will not see another human being for the next three years. Every day outbound from Earth, the communication delay will lengthen. The “speed of light” will become for them “the sloth of light.” After a week, real-time voice communication will become tedious. After several weeks, it will become impractical, and thereafter the connection to Earth will assume the character of telephone tag, Internet chat, and email. By the time they reach Mars, eight months later, it will take about 20 minutes to receive a reply from Earth, and during their 500-day stay on Mars, the delay will stretch to about 40 minutes. In a sense, the Mars crew will be living in a different time from the rest of humanity. These delayed voices from Earth from entities not directly experienced by the crew for many months will become increasingly less real to them, until finally the only completely real human beings in the universe will be the crewmates. They will be more alone than any human group has ever been. If this scenario is not a unique problem in sociology, what possibly could be? However, Zubrin considers it unworthy of study. After all, the crew will have plenty of DVDs to entertain them.

II. Mission Control

Another problem in astrosociology will be the wrenching change in the culture of Mission Control that deep-space missions will necessitate. For nearly half a century, nearly every minute of every flight has been scripted and directed by Mission Control. Although there has been some loosening up during long-duration, near-Earth orbit missions, sometimes forced by a revolt of the crew, this culture of control remains largely intact and well entrenched. Human spaceflight is expensive, and the culture of control is inevitably driven to squeeze every last drop of value from every minute of human labor in space. The rate of exploitation in space would make even the most venal Earth-bound capitalist blush.

Deep-space missions will force a change in labor relations. The illusion of control from Earth will drop away as the home world shrinks in the rear-view window, as the communication delay increases, and as discussed previously, as the voices from Earth become more virtual than real. “Mission Control” will become “mission support,” performing something more akin to a helpdesk function. It would be wise to plan for this inevitability, and to structure missions on the basis of a considerable degree of crew autonomy. This seems obvious; however, there is a long history of doing business in a way that one day will become outmoded. How do we get there from here? How do we manage the change in culture?

III. Time Architecture

Yet another aspect of the astrosociology of Mission Control involves the difference in the length of the day on Earth and Mars. Some notable dysfunction (cognitive dissonance, domestic conflict, et cetera) has been reported

among Mars Exploration Rover (MER) mission control crews owing to the difficulties created by scheduling crew shifts in synchronization with the Martian solar day (known as the “sol” to distinguish it from the terrestrial solar day), thus phasing crews in and out of local time.² This scheduling has been deemed necessary in order to interact with the MERs. This problem resembles rotating shift schedules in air traffic control and other venues. However, its solution is unique to consideration of the Earth-Mars diurnal interface and organizational behavioral analysis.

The temporal regulation of human activity on Mars and other planets is yet another problem that can be informed by astrosociology. During the past 125 years, more than a hundred ideas have been put forth regarding the division of the Martian sol and the Martian year into smaller units. What should be the structure of a Martian clock and a Martian calendar? The question has too often been addressed from the viewpoint of astronomy alone, with little or no awareness of the history of horology and calendrics. Thus, many of the ideas that have been generated probably cannot survive outside the laboratory. To understand the design implications of the architecture of time requires a working knowledge of astronomy and mathematics, as well as a thorough understanding of how cultures have designed and used time throughout history. Time architecture is at the intersection of the space, the biomedical, and the social sciences. If we recall that Auguste Comte, the founder of sociology, proposed the Positivist calendar as a replacement for the Gregorian calendar, we can see that astrosociology can—and should—be brought to bear on the debate regarding how to organize the rhythms of societies on other worlds.

IV. The Globalization of Space

Casting the astrosociological net more widely, one can consider the organizational challenges of multinational and transnational space projects, ranging from the formation of the International Telecommunications Satellite Consortium (INTELSAT) in the 1960s to the development and present operation of the International Space Station (ISS). Also, as human space projects become larger, more complex, and more expensive, programmatically spanning several decades, the political-economic issues of funding continuity, and strategic partnerships between government agencies and private enterprises should be studied.

V. Space and Public Awareness

Another topic for astrosociological study is the relationship of the space community to society as a whole. This relationship is surprisingly underdeveloped.

The general public is ignorant of space to a large degree. As a society, we have a poor understanding of our place in the solar system: the relative distances between Earth, the Moon, the sun, and the various planets and their moons; the relative sizes of these celestial bodies; the environmental conditions on them. In the past two years, this author observed first-hand how bogus satellite imagery of the destruction of Columbia and the electrical blackout of the northeastern US passed uncritically through the email system among engineers at one of the nation’s largest utility companies. One would have thought that such technically-trained people would not have been so easily duped. The public generally supports the civil human space program, although it has little knowledge of what it is actually doing. And not only does the public not know what it is getting for its tax dollar, neither does it have any idea of what it is paying. Polls show that the only about ten percent of the public correctly estimates that the National Aeronautics and Space Administration budget represents less than one percent of federal spending, whereas approximately twenty percent of the public believes that the NASA budget accounts for more than a quarter of federal expenditures.³ This suggests that there would be much greater support for the civil space program if the public knew what a bargain they were getting, and might support spending levels several time higher than the actuals.

Unfortunately, public relations is hardly NASA’s strong suit. The NASA cable TV channel ought to be the best source of information about its activities, and it is. But then, the bar isn’t set very high. In reporting on the flight of an unpiloted test vehicle, Cable News Network (CNN) commentators stated that it exceeded “the sound of speed,” a remarkable achievement for a vehicle that “carried no fuel onboard.”⁴ As an aside, this example points up the responsibility that the mass media bears for the dumbing-down of its audience. In the early days of human space flight, the broadcast media had correspondents who had a fairly good grasp of the technical issues; today, they just don’t seem to have a clue. In any case, there are several problems with the NASA Channel. First of all, is its limited availability. If one lives near a NASA field center, one may be fortunate enough to have it included in the local cable TV service. Another problem is that its programming is sporadic rather than continuous, reminiscent of local public education TV stations in the early 1960s.

But the larger problem with NASA’s attempts at public outreach is that it has no more understanding of the public than the public has of it. Now, one might imagine that those whose academic focus is the study of the public and of social forces might be able to lend a hand, but the hand is rarely extended, and often it is bitten off.

Sociologists would be the logical choice for consulting in terms of successful public outreach to make space ventures more desired by the public. NASA has historically done educational outreach, and of course little Jason and Tiffany are all enthused about living and working in space when they grow up. However, it is their parents who are the taxpayers and the congressional constituents, and they read much the same propaganda in the Weekly Reader when they were in school. There has to be educational outreach to the adult population, and its content has to be credible. In short, there needs to be public astrosociology.

VI. Space and Progressivism

As astrosociologist Marilyn Dudley-Rowley has written:

Stewart Brand labeled the space satellite “an engine of the ecology movement.”⁵ Imaging the planet, a direct product of space exploration, has enabled our larger awareness of the biosphere. How like fetal imaging it has been! When fetal imaging became possible, the rights of the unborn were championed on a massive scale and abortion issues became a social problem. How like that process has been the images of the Earth from space. While conservation of regional resources was certainly a forerunner of today’s environmental movement, conservationism flowered into modern environmentalism owing to imagery from space and other instruments and processes of space research and development.⁶

In essence, Dudley-Rowley argues a correlation between the development of fetal imaging technology and the development of the rights of a fetus as a legal person, and between the imaging of the Earth from space and the beginning of a legal personality for Earth. The images of the Earth that we brought back from the Moon are timeless and universal, because they are the first images of all of us. Ever since then, because of those images, we have looked at ourselves, each other, and the Earth in a new way. In particular, the image of the full Earth brought back by the last crew to return from the Moon is an enduring icon of environmental responsibility and human unity.

Yet, as the historian Walter S. McDougall⁷ has observed, the environmental movement has often been hostile toward the space program, viewing it as “macho and polluting.” There is a lack of awareness of the tremendous amount of environmental monitoring of Earth from space. It was a polar-orbiting satellite that helped to better characterize the ozone holes over the Arctic and Antarctica. Environmentalists and supporters of a vigorous space program ought to be natural allies, yet they are not.

In the larger context, where is the progressive constituency for space? It is this author’s experience that those who are most in favor of a vigorous program of human space exploration tend to be better educated and more socially progressive than the average person. However, a study of the voting records of the California delegation to the US House of Representative reveals that conservative Republican legislators have a strong tendency to vote for NASA budgets, while progressive Democrats vote against them. Again, these are questions for astrosociology to explore.

VII. Toward a Spacefaring Culture

The disconnection between our efforts in space and the awareness of our society lends credence to astrosociologist Jim Pass’ contention, that as we approach the 50th anniversary of human spaceflight, we are still not truly a “spacefaring” culture, but merely a “space-capable” one.⁸⁻⁹ The analogy I draw is of a coastal culture that puts out to sea in small boats and returns with catches of fish, as distinct from a seafaring culture that as a matter of regular commerce voyages between the continents. Likewise, a true breachment of the planetary cradle means voyaging to other planets on a routine basis and establishing permanent, self-supporting settlements on them.

When will that time come? Shortly after the first human landing on the Moon in 1969, the Nixon administration asked NASA to draft a plan for a post-Apollo era of space exploration. NASA’s response included a proposal to launch an expedition to Mars in 1981. The White House’s assessment of the NASA report concluded that NASA had demonstrated the technical expertise and organizational ability to achieve such a goal. All that was required was the political commitment to that goal. Thirty-five years later, the mission to Mars still awaits the “go” signal. It has not been technological challenges or physical forces, but social forces, that have kept us from going to Mars. The Apollo program was the child of the Cold War rivalry between the United States and the Soviet Union, and was specifically the child of the events of 1961. As aerospace historian Roger Launius¹⁰ has described it, in May of that year the cosmic tumblers fell into place that enabled a decision to commit the nation “to achieving the goal, before this decade is out, of landing a man on the moon.”¹¹ The words were John Kennedy’s, but the decision would as likely have been Richard Nixon’s had he won the previous year’s election, had he been the president who had been embarrassed by the failure of the Bay of Pigs invasion and the Soviet Union’s success in placing the first human in space. What social forces are present today that might someday propel us to Mars and beyond? This question is yet another for astrosociology to investigate.

The most important thing that we discovered on the Moon was part of ourselves. In the few hours that a few of us spent on the Moon between 1969 and 1972, we became better Earthlings. As the poet Archibald MacLeish wrote,

we were “riders on the Earth together.”¹² We realized that we were our brother's keeper, and we remembered that God had appointed us stewards of the Earth. And yet, a third of a century later, we must reflect on how pitifully less we have done with that revelation than we should have. But of course, we stopped going to the Moon. We forgot our brief glimpse of that distant perspective, so we never adequately integrated the new vision into our lives. It may be that regaining that planetary perspective is integral to our survival on Earth.

The science fiction novelist Robert A. Heinlein wrote that “the Moon is a harsh mistress.”¹³ All of the new worlds will be harsh. We will live close to the edge of extinction out there, and learning to survive on those other worlds will bring us closer to immortality. We will learn to depend on each other for our very lives as never before--Africans, Americans, Asians, Australians, Europeans, all of us. The New Frontier will be punctuated by tiny habitat modules, not sprawling with the wide-open spaces of the American Old West. We will live in enclosed places, in each other's faces. All the pretentious barriers that we erect here on Earth will melt away in space. We will come to know each other--and ourselves--as we have never done before. We will push the outside of the envelope of what it means to be human. Living together so closely, so intimately, so inescapably, will tear down social and psychological walls that we need not and dare not consider here on our comfortable, capacious, suburbanized, subdivided Earth. There will be new challenges to human dignity, privacy, individuality, intimacy, and polity, and these will be rich fields of inquiry to the social sciences. As Kennedy said in the first years of human spaceflight, “We set sail on this new sea because there is new knowledge to be gained and new rights to be won.”¹⁴

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