



Astrosociological Insights

Newsletter of the Astrosociology Research Institute

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"A new combination of stakeholders in our twenty-first century mission to space."

Private Human Spaceflight is on its way . . .

The Spring issue of our newsletter is dedicated to private human spaceflight. As Virgin Galactic plans to launch its first space tourism flights and Mars One seeks to train "private astronauts" for one-way trips to Mars, sponsors of missions need to anticipate how a diverse group of private individuals will interact with each other in isolated ecosystems and the larger space environment.

There are many issues to address - before, during, and after the first private astronaut lifts off from Earth. Here are just a handful of them:

- What motivates individuals to apply to become private astronauts? Do these motives differ from those of "traditional" astronauts?
- What unique challenges face private individuals on short and long-term spaceflights? How is traditional astronaut training being adapted to address these challenges?
- How do the technological advances needed to support private human spaceflight - spaceports, space elevators, tourist vehicles, etc. - impact local communities, states or regions?
- What is the public's perception of private human spaceflight?
- What pressures will one-way or long-term space travel put on private astronauts and their families? How will they sustain their relationships with those back on Earth?
- What are the challenges in forming and managing collaborative relationships between public and private entities to foster private human spaceflight?
- How do broader social and cultural issues such as income inequality, ethnic differences, religious diversity, and gender relationships impact the success of entrepreneurial and private human spaceflight?

Many more questions remain, but the articles that follow begin the important task of considering answers, teasing out consequences, and proposing plans of action. The topic of private human spaceflight is so wide and deep and diverse that these articles necessarily only scratch the surface of the research that needs to be done and the plans that need to be made. Most importantly, it is the beginning of a crucial dialogue uniting scientists and engineers with their colleagues in the social and behavioral sciences, the humanities, and the arts. And indispensable to the success of this endeavor, of course, are the private investors who will provide the financial means to launch humans into space to research, mine, explore, and create off-world settlements. *Private. Human. Spaceflight.* A new combination of stakeholders in our twenty-first century mission to space.

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Shifting Dynamics?

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Considering Sociological and Cultural Influences on Private Spaceflight

The history of the private space industry is mainly centered on the United States, but given our globalized economy, the success of private human spaceflight will be dependent on participation worldwide. Disparities in income will be a major factor in determining who will foster and participate in private spaceflight. Differences in culture, religion, and gender will influence who chooses to become involved and the dynamic within the self-selected group.

In the current environment, private space innovators come from many different cultures. They can be found in the United Kingdom (e.g., Richard Branson and his company, Virgin Galactic), the Netherlands (e.g., Bas Lansorp and Arno Wielders of Mars One), and South Africa (e.g., Elon Musk of SpaceX). Additionally, investment in private spaceflight comes from an array of international corporations, and those willing to pay to be a part of privatized spaceflights represent both individuals and governments from around the world.

While we generally think of commercial spaceflight as a new innovation, a German company, Orbital Transport und Raketen AG (OTRAG), was working on private space initiatives over thirty years ago. (1) Political issues prevented the company from becoming more viable. Today, political issues are less of a problem as countries embrace private industry investment in the space sector through support of commercial off the shelf purchasing, increased use of private contractors, and government-corporate partnerships. While politics still play a role today, as private spaceflight moves forward, broader social and cultural issues may actually be the more important issues to consider, including income inequality, ethnic differences, religious diversity, and gender relationships.

Income inequality comes into play as the substantial cost associated with private human spaceflight is considered, since this endeavor relies on a strong desire to participate and requires a large, disposable income. Seats aboard private suborbital spacecraft are being advertised from \$100,000 (XCOR Lynx Mark II) up to \$250,000 (Virgin Galactic). Even though suborbital opportunities have decreased the cost dramatically from the first option for space tourists headed for the International Space Station aboard the Russian Soyuz (\$20-40 million), the cost is still prohibitive for most people, and trips farther afield are still only available for the wealthiest (tickets for two to the Moon are advertised at \$1.5B on Golden Spike.com). It is not clear if private spaceflight will ever be an option for the average person, or if instead it will be yet another experience to be enjoyed only by the wealthy.

It is possible for ethnic differences to arise, because spaceflight is more popular in some cultures

Shifting Dynamics? (cont.)

than others. Children of the space race grew up thinking anything was possible, and if they worked hard enough, space was the limit. This led some to become professional astronauts and others to excel at business. This latter class is the target group for the private space industry. However, even under national government sponsorship, only a fraction of ethnicities have been represented in outer-space travel. Therefore, it is uncertain whether privatization will open the door to new space travelers, or if historical precedent will guide the future of private spaceflight.

Generally, the intersection between religion and spaceflight is not a consideration, but there has been controversy in the crossover and likely there will be more to come. The U.S. space program, for example, has had issues regarding the separation between church and state. (2) A larger worldview question may be whether space is the right place for religion, and if so, which religion. Religious leaders have considered the concept of a space mission, and the decision is far from made. More importantly, there are issues regarding the goals of spaceflight and that of religion, as science and religion do not always share the same values. There is the issue of whether varying religions may be in agreement on their approval of spaceflight.

Gender's role in private spaceflight can be complicated and is often intertwined with the aforementioned topics. Historically, fewer women have been interested in going to space. Spaceflight also exposes some of the natural differences between men and women. Seven clients have funded their way to the International Space Station with the commercial spaceflight company Space Adventures. Of these seven, only one is female. However, the situation may be changing. Half of the most recently selected class of NASA astronauts are women. It is conceivable to think that private spaceflight may also shift in this way.

There are many questions to be addressed in regard to how socio-economic and cultural factors may impact private human spaceflight and perhaps even more when considering the influence that private spaceflight may have upon people around the world. We have only highlighted a few of the issues that prior research has started to contemplate. There are many more matters for discussion and this area of study is ripe for discourse.

1. In English the company is known as Orbital Transport and Rockets, Inc.

2. For more on each of these incidents see: Aimee Larsen Stoddard, "NASA Astronauts Religion in Space Controversies," Suite101, 26 February 2010, available from <https://suite101.com/a/nasa-astronauts-religion-in-space-controversies-a206289>.

Sustaining Relationships with People on Earth: A Virtual Model for the First Martian Colonists

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As numerous would-be Martian colonists embark for the Red Planet, what would become of their relationships with the people they left behind on Earth? Since radio messages sent from Earth to Mars require round-trip travel times between 6 and 44 minutes (depending on the relative positions of the planets), a traditional telephone call is out of the question. Even after a long-established Martian colony would have achieved total self-sufficiency, visits from loved ones would be infrequent. The “gravity-assist” methods of travel currently available force the launch windows between Earth and Mars to occur only once every 780 days (2.135 years). Travel times to Mars range from 4 months to more than a year. We’re not likely to have near-future technology that gets us there faster, or allows us to depart whenever we wish.

The colloquialism “out of sight, out of mind” articulates well the cultural estrangement from the home planet that Martian colonizers would experience. However, modern communications technologies make possible virtual relationships between Earthlings and colonists in a fashion similar to online dating and electronic pen pals today.

The Infrequency of Visitors from Home

Current and near-future spacecraft rely, in large part, on gravity for propulsion. This strategy requires a lot less fuel than taking a straight path to Mars; the downside is that it significantly increases the travel times. Even if a trip to Mars were to be as technologically and financially routine as a transcontinental plane trip, visits would be an extreme rarity. People on Earth will be forced to continue with their daily lives uninterrupted. One-and-a-half to two-year leaves of absence from work are a lot to ask, and would rarely be granted.

Figure 1 offers a comparison of three visitation profiles. The Short Stay profile’s travel times to and from Mars are 225 and 290 days respectively; the visit is 40 days. In this scenario, the visitor would spend almost 2 weeks in transit for each day spent on Mars, and would be away from Earth for 74 weeks.

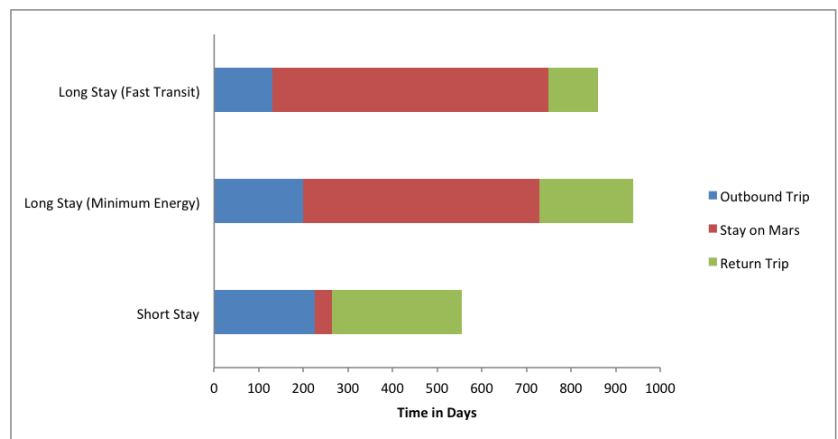


Figure 1: A Comparison of 3 Visitation Profiles.

The Long Stay (Minimum Energy) profile requires 200 days to reach Mars and 210 days to return to Earth. However, the visitor turns into a Martian house guest for 530 days (about 18

Sustaining Relationships with People on Earth . . . (cont.)

months)! The more than two and a half years spent away from Earth would likely dissuade many of even the most infatuated kin.

The Long Stay (Fast Transit) profile requires 130 days outbound and 110 days return. However, the intrepid vacationer has just become the “Man Who Came to Dinner” for 620 days! The houseguest is away from home for more than 31 months.

The Short Stay profile offers only 6 weeks on the Martian surface and nearly 74 weeks in transit, and is likely the least economical. While the Minimum Energy profile would most likely afford the lowest fuel cost (which would be attractive to many prospective travelers), supporting the vacationer for 410 days in transit would be expensive.

Whether the increased fuel costs of the Long Stay (Fast Transit) profile coupled with the reduction in housing costs along the way make for a less expensive overall package is difficult to ascertain. Although not the cheapest, this profile may be the most economically desirable one.

However, one thing is clear – the economic and personal costs of a voyage to Mars will prevent the colonists from receiving many houseguests. Just because a person is adventuresome enough to become initially a private astronaut and ultimately a Martian colonist does not carry over directly to their friends and family.

Virtual Relationships

Since the distances to Mars and the associated travel times make visits impractical, the relationships that early Martian colonists have with people on Earth will need to be virtual. Text and video messages, chat messenger messages, and emails, all traveling at the speed of light will take anywhere from 3 to 22 minutes to be received, depending on the relative positions of Earth and Mars. Real time conversations will not be possible.

However, the infrastructure for virtual relationships has a long history. In 1974, the online chat system Talkomatic, developed by Doug Brown and David R. Woolley at the University of Illinois, began the modernization of the pen pal relationship. With the development of the Internet, chat room use surged in the late 1990s. Chat rooms ultimately gave way to online dating sites. For the United States, statisticsbrain.com™ claims the more than 41 million users of online dating sites such as Match.com™ and eHarmony.com™ are spending annually in excess of \$1.2 billion. Long distance relationships continue to flourish, as video communication adds more of a personal touch to long distance correspondence.

Along parallel tracks, an innate sense of vicarious adventure is needed by people who seek out relationships with prison inmates who are on death row or sentenced to extremely long prison terms. They may never get to meet, and yet, the practical impossibility of a customary courtship is no deterrent to either party. This search for exhilaration via unconventional relationships is

Sustaining Relationships with People on Earth . . . (cont.)

by no means unique to those who seek out convicts. Many people are happily married to military service personnel whom they see infrequently.

Additionally, permanently departing from the motherland is not exclusively a modern phenomenon. For instance, European citizens who moved to North America prior to the first half of the 20th century knew that they would not likely ever see their homeland again. Regardless, the relocation was clearly justifiable. Despite the social and emotional costs of moving to another world to start anew, there will be people who seek extreme adventure, either first hand or vicariously, and beat a path (either themselves or virtually) to Chryse Planitia or the Tharsis Plateau.

No Risk, No Fun -

The Three Safety Issues of Suborbital Commercial Flights

The era of manned commercial sub-orbital flights is about to begin. Since 1957, when Sputnik was launched, there has been a growing interest in outer space being the “unknown unknowns.” Until recently, space was limited to select trained people only (*astronaut, envoy of mankind, or personnel*) but a window of opportunity has opened up for common people also. Obviously, it has become a valuable tool for business and thus for governments. Nevertheless, there are three fundamental issues which need to be addressed both at the national and international level: the legal status of passengers of sub-orbital flights (who they are), uniform medical standards for all passengers regardless of jurisdiction, and the legal status of aerospace vehicles (whether they fall under the legal definition of an aircraft or spacecraft). All of these raise the potential questions of liability and responsibility for both the spaceflight operators and the governments, especially when the sub-orbital flights are expanded to

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point-to-point travel (international sub-orbital flights between at least two countries).

There is no international or European regulation concerning the safety of sub-orbital flights. The safety is regulated by each individual launching state. Regrettably, US national space law (the most advanced domestic law in this field) does not have clear definitions. First, The Commercial Space Launch Amendments Act of 2004 defines space passengers as *space participants*. Are participants simply the passengers, and if so, why didn't the Act expressly say so? If they are not, who are they as they are not *astronauts*, and possess neither specific knowledge to be a *crew member* nor a second-class certificate to be a *pilot*? Second, the lack of compulsory medical checks by an independent aerospace doctor (for example, in the Federal Aviation Administration's Office of Aerospace Medicine), who understands the risk to which space tourists

No Risk, No Fun . . . (cont.)

space tourists are likely to be put to while on board the aerospace vehicle, and the lack of adequate physical training jeopardizes the space participant's safety. Third, there is a lack of consensus among states as to the legal status of aerospace vehicles. In fact, they are neither fully *aircraft* nor *spacecraft*. They take off like an airplane, but in outer space they "behave" as a spacecraft only to land again as an airplane. The application of both regimes—air and space law—simultaneously is not practical as they are completely different, especially when there is no agreed demarcation line between air zone and outer space. Thus, the European Union favors the application of air law regime in relation to sub-orbital spaceflights. Conversely, the US advances space law as the regulatory model for aerospace vehicles going into sub-orbit. The problem here is not at a national level but at an international level. This means that if a sub-orbital flight from New York to Moscow meets with an accident in Germany, which liability regime would apply to it? Then, we have got a potential conflict of regimes in the context of liability. Under international air

law, the flight's liability will be governed by the Montreal Convention of 1999 and under international space law by the Liability Convention of 1972.

Taking all matters into consideration, the risk component undoubtedly will be associated with sub-orbital flights. At the beginning, people will fly out of curiosity or for pure entertainment. Later, since sub-orbital flights ensure a fast movement from one place to another, there should be clarity in law regulating legal safety at the national level and then expanded to the international level. Bearing in mind its supremacy in commercial sub-orbital spaceflights, the United States should develop a model definition for *passengers*, along with the best practices and standards for medical checks and physical training. Additionally, the US can stir discussion at an international level on a uniform legal status of aerospace vehicles. No risk, no fun—yes, indeed—however within clear safety boundaries.

Upcoming Conferences 2014 . . .

ARI will be presenting papers or panel discussions at the following upcoming conferences:

March 20-23 - CONTACT 2014 (Mountain View and San Francisco, CA)

May 29-31 - Manfred Lachs International Conference on Global Space Governance (Montreal, Canada)

June 20-21 - SPACE Conference : Scientific Preparatory Academy for Cosmic Explorers (Orlando, FL)

August 4-7 - SPACE 2014: American Institute of Aeronautics and Astronautics (San Diego, CA)

September 29-October 3 - International Astronautical Congress (Toronto, Canada)

Diversity in Analog Mission Supports Private Human Spaceflight

Angélique Verrecchia (MSc)
Born for Space blog

Phillippa Blaber (MSc)
Born for Space blog

Private human spaceflight is theoretically independent from national space organizations, national space policies, and governmental funding. These flights may involve participants with many different backgrounds and experiences. Space exploration will enrich our knowledge of science as well as how humans interact in confinement for long periods. Analog missions help prepare minds for the challenge of long space journeys.

Vibha Srivastava is a young Indian aerospace engineer who earned a Master in Space Studies from the International Space University in 2013. She lived and worked for two weeks at the Mars Society's Mars Desert Research Station (MDRS) located in the Utah Desert, USA. Vibha was the Crew Scientist of the analogue astronauts who were part of the Mars Crew 134 from 18th January to 1st February 2014. She conducted experiments involving In-Situ Resources Utilization, extracting water from the ground for hydrogen collection by electrolysis in order to produce liquid fuel. She also contributed to team research by practicing meditation and yoga activities.

What does Vibha's experience teach us?

Vibha was born in a traditional Indian family practicing Hinduism. She has some food limitations and a strong relationship with her family. However, Vibha felt comfortable

among the other six international team members. Mars analog simulations help future space travelers to highlight and assess social situations involved in private human spaceflight. Crew diversity has two advantages: it supports the presence of all societies in space and increases knowledge of human behavior. International crews composed of members from different cultures and genders fosters international cooperation. Being willing to discover other cultures and comply with other customs is extremely important to successful exploration. Vibha appreciated sharing experiences with other crew members especially, talking and playing songs.



Vibha Srivastava in Mars analog mission, MDRS - Mars Crew 134

Diversity In Analog Mission . . . (cont.)

What can we understand?

Regarding Vibha, being a woman from India is harmonious with space missions: "Analog missions are good preparations for making each crew member understand that being positive and accepting of every kind of diversity is a vital part of any such long duration mission."

Explorers must have a state of mind compatible with group diversity in order to cooperate successfully during a long space mission.

Analog missions are very important to train

crews since during these missions they will experience intense and stressful situations and the team cohesion will be a key factor for the mission success. Analog simulations such as these demonstrate that diversity shouldn't hinder private human spaceflight.

We would like to give special thanks to Vibha Srivastava for her contribution and conclude with her words from Hindu mythology, "Vasudhaiv Kutumbakam" (*World is our Family*).

Because we are all Born For Space!

E.T. Phone Home

Adrienne Provenzano

S.T.E.A.M. Educator

As private individuals venture forth as space travelers in increasing numbers, it is worth considering how they can keep in contact with those back on Earth - and how those on Earth can connect with them. A number of strategies currently in place to connect those on the International Space Station to those on the ground may be applicable in a private travel context as well. In addition, other approaches common in the travel industry to connect tourists with friends and family may provide effective strategies to help spacefarers "phone home."

Common forms of space-to-ground communications for I.S.S. crewmembers and visitors include audio and video conversations with friends, family, and colleagues. While video chats are less frequent than audio-only communications, both are made on a regular basis. A particularly poignant example from 2011 is STS-134 Shuttle Commander Mark Kelly communicating with his wife, then Congresswoman, Gabrielle Giffords, while he was floating in the station's cupola and she was recovering from injuries sustained in a tragic shooting.

E-mail is also utilized to keep in touch, along with other Internet applications. In 2013, Karen Nyberg recorded daily videos while on station which she transmitted back to Earth so her husband Doug Hurley could share them with their son Jack. Since 2010, Citrix Systems, Inc. products used by NASA have enabled desktop virtualization and networking, which facilitate direct communications between the I.S.S. crew and Earth. NASA has annually provided opportunities for those on the ground to send virtual winter holiday postcards to the I.S.S. crew

E.T. Phone Home (cont.)

in addition to ways to connect via social media.

Social media has become a common way for I.S.S. crewmembers to keep in touch with fellow Earthlings. In 2010, the first to tweet from space unassisted by the ground team was Expedition 22 crewmember T. J. Creamer. Currently, Expedition 39 is commanded by Koichi Wakata, who frequently uses Twitter to share pictures and commentary. Karen Nyberg was the first to use Pinterest from the I.S.S. when part of the Expedition 36 and 37 crews and shared photographs through that platform. In early 2014, Roscosmos also began to establish a presence on social media.

Music is another way to connect people and has been part of space exploration for decades - including the musical wake-up calls that were a regular part of the Space Shuttle program. Many creative projects are possible using the arts. Expedition 27 crewmember Cady Coleman brought several music instruments to the I.S.S. and in 2011 recorded a performance using a flute belonging to Ian Anderson, founder of the band Jethro Tull. A performance was also recorded by Anderson on Earth, and the two videos were edited together as the first Earth-space flute duet. While in space, Coleman also played a flute loaned to her by Matt Molloy and a pennywhistle from Paddy Maloney, both of The Chieftains ensemble. A video of her performing on the I.S.S. is regularly included in The Chieftains' concerts, and Coleman has performed with them since her return to Earth, thus continuing her friendship with the musicians and connecting with a wider community.

More recently, in 2013, Chris Hadfield, the I.S.S. Commander for Expedition 35, created a music video of David Bowie's song "Space Oddity" with the assistance of several people, including his son Evan. The video, posted on YouTube shortly before Commander Hadfield returned to Earth, has received over 20 million hits. This unique project facilitated personal and public connections.

The transport of tangible items can provide a concrete sense of connection before, during and after a voyage. I.S.S. crewmembers are permitted to bring a limited amount of personal items with them. Often, these items provide a direct link to significant people, places, and even pets. Photographs, jewelry, stuffed animals, alma mater t-shirts, and banners are some of the items that have been brought to the station. For example, when Suni Williams commanded the I.S.S. in 2012, one item that often appeared in her public interviews was a stuffed animal that looked like her dog, Gorby - who was still on Earth. This item connected Commander Williams with Gorby, as well as with the person who made the unique object and also a wider audience.

Other ways those on Earth connect with those on the I.S.S. include educational programs, interviews with hometown media, research projects, and special events such as the *Live from Space* program aired on the National Geographic Channel in March 2014. As with eco-tourism on Earth, space travel could be linked with meaningful tasks beyond the individual's adventure experience. Anousheh Ansari performed research while a spaceflight participant in 2006, and

E.T. Phone Home (cont.)

Cirque de Soleil founder Guy Laliberté hosted a special event for the One Drop Foundation while visiting the I.S.S. in 2009.

Drawing on approaches used in the travel industry, an official photographer and videographer could be included on private space tourism flights to provide a record of the trip to share. Social media platforms can also share content. In the same way that a photo can be taken at a theme park by a staff photographer and then, possibly for a fee, e-mailed to a special recipient, such a service could be provided by space tourist companies for their clients.

Interpersonal communication is a vital part of the human experience. Strategies in place currently aboard the I.S.S. can be a useful starting point for the private space travel industry. By using the same technologies that facilitate ground communications, both ground-to-space and space-to-ground interactions can be accessible and available. Human creativity and ingenuity, determination, and curiosity will enable our species to generate, test, and develop many more communications concepts, systems, technologies, methods, products, and services in the coming years. As more and more Earthlings become extra-terrestrial--whether on one-way or two way trips, near or far--they will find, that like the fictional E.T., there is always a way to "phone home" - and have the message received loud and clear.

What the 6th Japan Space Elevator Conference Reveals about Japanese Attitudes to Manned Spaceflight

Renato Rivera Rusca

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The 6th Japan Space Elevator Conference, hosted by the Japan Space Elevator Association (JSEA), was held at the Tokyo Miraikan Museum of Science in the futuristic and ever-evolving man-made Tokyo Bay island of Odaiba, on February 22nd and 23rd, 2014.

There were several "firsts" for the Association with this sixth conference. Firstly, the conference was free of charge. This removed an invisible but stubborn wall, blocking the visibility of concepts such as the Space Elevator and its feasibility, possibilities, etc., from the public eye. In other words, the topic had been hitherto the domain of academics and aficionados, with steady progress in the



6th Japan Space Elevator Conference, February 2014

Japanese Attitudes to Manned spaceflight (cont.)

development of concepts and technology, but had suffered a clear lack of serious consideration by the general public. As a result, people of all ages, even some families, attended the conference.

Another “first” was that the two days were split into the “technical” side and the “sociocultural” side. Saturday featured academic presentations on systems and theories, whereas Sunday was a more open-ended approach to the idea of a Space Elevator, with perspectives on how society would be affected by its implementation. Lastly, and perhaps the most important “first,” was the final two-hour panel discussion wrapping up the second day, which I was honoured to have been a part of, and which was broadcast live on Nico Nico Douga to a peak audience of 20,000 viewers online. Though there are other Space Elevator Associations around the world, the JSEA is the only one which



6th Japan Space Elevator Conference, February 2014

functions without reliance on outside support funds, making these achievements all the more impressive. I shall save the details of the wide range of topics discussed by the panel for another time, and focus on one key point, in keeping with the theme of this issue of *Astrosociological Insights*.

The panel was made up of journalist and television debate show host Souichirou Tahara, journalist Shinya Matsuura, NHK commentator Tetsuya Muroyama, Next-Generation Space System Research Group member Kouji Yamaguchi, Japan Space Tourism Association chairman and Azabu University professor Patrick Q. Collins, JSEA chairman Shuuichi Ohno, and, representing ARI, myself. The main title and the axis along which the discussion would be steered by Asahi Shimbun science journalist Yutaka Kubota (who, incidentally, is currently working on a book on the cultural and social aspects of the Space Elevator), was “Why have a Space Elevator?”

The arguments which followed were those which are by now typical surrounding the issue of the space elevator: a cheaper, more efficient way out into space, leading to the development of space infrastructure and a boom in space businesses, from the entertainment sector to manufacturing and resource mining. Discussion on the feasibility of the elevator from the technical side, such as the topic of carbon nanotubes, was mostly omitted in favour of a debate on the political and economic climate within which construction of such a structure would be imaginable. Clearly, such a project would require the collaboration of many entities, be they nations or corporations on a monumental scale. Eventually, however, one topic reigned dominant.

Japanese Attitudes to Manned spaceflight (cont.)

Obayashi Corporation's official announcement that it would build a Space Elevator by 2050 made front-page news in February 2012. (1) Were Japan actually to attempt such a feat, and through some unforeseen circumstance suffer a tragic accident involving human (that is, Japanese) casualties, on the scale of the Challenger and Columbia disasters, it is my opinion that public support would diminish. The project would likely be scrapped, with all prior investments gone to waste. Many others on the panel shared this opinion.



Renato Rivera Rusca addressing the Conference

The importance of Japanese lives, especially those outside of Japan, is something well represented in the media, as seen in reports of Japanese casualties in international incidents and disasters. It can be said to be representative of a strong national identity, itself the result of a virtually homogenous nation, which puts great value and pride in its nationals' endeavours outside of their homeland. This lends itself very well to the theme of manned space exploration. A Japanese person in space as seen on television strengthens an emotional bond that can greatly narrow the vast distances involved, and to the general public, grounds the concept of space exploration in reality due to the relatable nature of the common point of "Japaneseness" – without which space would be (and often is) something considered irrelevant and/or a fantasy world, completely removed from everyday "real" life.

There are of course, two sides to this concept of the Japanese cultural identity outside its homeland – its inherent pride/honour, and its fragility. That is to say, the Japanese public and government would be very supportive of Japanese adventurers going into space, but only if any and all safety concerns have been discussed, tackled and contingency plans set in place to avoid tragedy.

This was very well depicted in 1990, the year the first Japanese astronaut launched into orbit. His name was Toyohiro Akiyama, but he was not a NASDA (now JAXA) astronaut – he was a civilian with no prior aerospace training. He was a journalist for the TBS television network, to be precise, which is relevant because the launch and mission would be broadcast live on TBS as a major television event. The case is intriguing and telling of the time period as it came right on the cusp of the end of the Cold War. NASDA had arranged to launch a manned mission

1. <http://www.japantimes.co.jp/news/2012/02/23/national/obayashi-planning-nanotube-space-elevator-in-2050/>

Japanese Attitudes to Manned spaceflight (cont.)

first, and a likely candidate for the first Japanese in space would have been Chiaki Mukai, a female astronaut, but complications prevented the mission from launching on schedule and TBS's own privately-funded enterprise beat it to the punch, paying off the Soviets for the use of their launch site, Soyuz craft and emblazoning the rocket with all manner of corporate sponsor logos. The idea of a reality TV show tracking the adventures of people in space is on our minds now since Mars One announced their colonization program, but perhaps it is worth looking back at how Japan once tried that, when its bubble economy was in its prime two-and-a-half decades ago.

Of course, the situation being faced now in Japan is one of accountability. To return to the Space Elevator Conference discussion – what will happen when the public witnesses the first Japanese astronaut casualty? Can Japan overcome such a traumatic event? Though we cannot say for certain, the general consensus is that we are safer not finding out. Japan has a completely different cultural identity than the United States, whose manned exploration missions carry a “frontier spirit” or even a “colonial” undercurrent. Japan, on the other hand, cannot be said have such an inherent attitude, and within the current political climate, any movements of such a nature would be viewed with caution by its neighbours. Ultimately, the argument boils down to this: the risk for Japan is too great to gamble on a pioneering venture in many sectors, and manned space exploration is quite possibly the most risky of all. It is most telling that of the 200,000 applicants to the Mars One program, only a handful were Japanese.

Editor's Note *Our last issue--dedicated to astrosociology in the classroom--profiled undergraduate and graduate programs in fields related to astrosociology. We will continue to share program profiles whenever we receive them.*

University of Mississippi School of Law LL.M. in Air & Space Law

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Long known for its contributions to the field of air and space law, the University of Mississippi School of Law (UM Law) is continuing to provide first rate education to those interested in learning more about this evolving nexus of law and policy. For decades, the faculty at UM Law has been at the forefront of both academic and practical legal applications of air and space law, and its opinions on law and policy continue to shape the field. With more than 45 years of combined air and space law experience, UM Law professors are working to ensure students, both J.D. and LL.M. alike, receive an indelible educational experience that will propel them into successful careers in industry, practice, and academia.

To that end, UM Law offers two paths of study that immerse students in aviation and space law. One such

University of Mississippi School of Law (cont.)

path is the new LL.M. in Air & Space Law, a novel program available to both domestic and international students, whether on-campus students or at a distance. This hybrid approach allows the faculty the flexibility to share its knowledge and expertise with a wide range of both traditional and non-traditional students, and current classes comprise of law students, practicing attorneys, and academics. The faculty members hail from across the globe, with instruction coming from scholars based in the United States, Canada, The Netherlands, Dubai, and China. Ten courses are offered: Comparative Space Law, International Aviation Finance and Leasing Law, International Telecommunication Law, Private International Air Law, Public International Air Law, Remote Sensing Law, Space Security Law, U.S. Aviation Law, U.S. Space Law, and Thesis courses. The goal of the LL.M., in addition to general educational benefits, is to engage the special skills and interests of the students by culminating in a written thesis that can help them move forward with their career and life goals.

For J.D. students, UM Law offers an option to obtain a Certificate in Remote Sensing, Air & Space Law, signifying the students' special dedication to the subject while simultaneously completing the core and elective courses that they take to complete their studies. All of the courses available to LL.M. students are open to J.D. students pursuing the Certificate, with the exception of a written thesis. Certificate students must complete an externship in air and space law, granting them practical experience in the field before graduation. J.D. students are also exposed to the Manfred Lachs Moot Court, and teams from UM Law have fared well in this prestigious international

competition.

The students of the programs at UM Law are encouraged to explore the societal impacts of law on human activity in both aviation and space, and are assisted by several unique resources. The University houses archival collections of several prominent air and space lawyers, including works and correspondence from Steven Gorove and Andrew Haley. These collections contain historical information of inestimable value, including Haley's numerous concerns about human life in space—beliefs which culminated in his book on *Space Law and Government*.

UM Law also publishes the *Journal of Space Law*, an internationally recognized publication that was begun in 1973 by Steven Gorove. This resource provides rich source material from which the students in the LL.M. and J.D. programs may draw inspiration for their own works. The *Journal of Space Law* also occasionally highlights the work of students by publishing student-authored articles.

Finally, the *Res Communis* blog, operated by faculty, continues to provide a constant stream of new and developing information concerning aviation and space law, including technical, legal, sociological, and policy aspects. The blog (<http://rescommunis.olemiss.edu/>), and the website for the LL.M. program (<http://law.olemiss.edu/academics-programs/llm/>), are accessible both to the public and student body alike. UM Law, along with its students, aims to continue its commitment to studying aviation and space law, and to always contribute to the global conversation on where it is that we find ourselves in this exciting field, and where we will be in the years to come.

Living On Mars: An Analog Astronaut Experience - Pioneering Space Surgery And Wellness For Space Exploration And Colonization

Susan Ip Jewell, MD

- *International Space Surgery Consortium*
- *MarsCrew134 Analogue Astronaut Expedition*
- *Mars Desert Research Station*
- *The Space Clinic*



Analog environments are isolated terrestrial locations on earth that simulate off-world, planets such as Mars. These analogs are used by academic institutes, government organizations, space agencies and space programs as a way to conduct analog astronaut training, sociological and psychological research to develop mitigation countermeasures for safety, health and wellness of astronauts, food studies and to test new concepts, technologies, equipment for integration into future space missions and space-related programs.



Fig 1 MDRS night



Fig 2. MDRS day



Fig 3 Concordia, Antarctica

The MarsCrew134 Analogue Astronaut Expedition recently simulated a mission to Mars over the course of two weeks at Mars Desert Research Station (MDRS), part of the non-profit organization, The Mars Society, in the remote high elevation desert of Utah, USA. One of several research projects conducted during the expedition focused on developing space surgery procedures and protocols for space exploration and a pre-pilot project looking at integrating complementary medicine, such as, yoga and meditation as possible psychological mitigation countermeasures for maintaining crew health and wellness during long duration missions and eventual colonization of off-world planets, such as, Moon and Mars. These projects were led by Principal Investigator, Dr Susan Ip Jewell MD, assigned as the Crew Medical Officer (CMO) and Executive Officer. Dr Jewell, Founder of the International Space Surgery Consortium, ISSC, and The Space Clinic, was supported by expert teams of surgeons, anesthesiologists and physicians from the ISSC consortium (experts from Stanford University, UCSF, McGill Medical Centre, Canada, Ohio University, Lille Hospital, France, Microgravity Centre, Brazil, and the medical team from European Space Agency, ESA, sponsored Concordia Station in Antarctica). The multi-site collaborations from various experts across the globe participated in a successful orchestrated and synchronous operation to play out the simulation scenario. Additionally, several medical extravehicular activities, MEVA, were rehearsed and practiced to develop crisis management intervention procedures for future "search and rescue" operations on the "Martian" surface. The

simulation involved retrieving the wounded “Marsonaut” from outside the “hab” base during a MEVA.



Credit: Kai Staats. MarsCrew134

The medical simulations utilized a realistic mannequin used in hospitals which acted as the “Marsonaut” in need of aid while non-medical trained crewmembers of MarsCrew134 prepared to perform emergency interventions acting as surgical assistants to Dr Jewell. The MarsCrew team was guided through the simulation anesthesia induction protocols and basic surgical procedures via a remote telementoring skype communication platform. The simulations incorporated a five minute time delay to simulate a “Mars-to- Earth” connection. The goal of this experiment was to see whether untrained or minimally trained crew personnel can perform telesurgery-anaesthesia under guidance of remote teams of experts.



Credit: Kai Staats, MarsCrew 134

Another project conducted during the two weeks simulation focused on the integration of complementary medicine modalities to develop mitigation countermeasures for astronaut crews on long-duration space missions and for crews living in remote extreme environments like Antarctica. Analogue astronauts living in isolated confined and remote settings like MDRS necessitate the development of countermeasures to mitigate possible negative problems that could arise under such conditions from increase tensions, anxiety or conflicts within the crew. The main objective of the pilot project was to investigate the incorporation and practice of meditation and yoga into the crew's daily schedule to help maintain health and wellness of MarsCrew134. The results are to be published at a later date with plans to further expand the study for a longer duration analog expedition.

Analogue astronauts face many challenges, which simulate similar conditions for future space explorers, whilst living under such remote, isolated, extreme conditions. The psychological, physical, emotional and technical challenges experienced by crew teams are major obstacles that require more research. Therefore, pioneering new area of research in the areas of human space exploration is important if we are to move forward in our pursuit of expanding our visions for future long-duration missions and off-world colonization of other planets. Some major challenges encountered during the MarsCrew134 simulations, for example, were poor image quality transmissions for the mission support medical teams for interpretation during telesurgery operations. Another challenge encountered was the respective role of the crew personnel performing the procedures and the surgical assistant could be more defined to gain in efficiency and speed. However, this will require more training before and during the mission to make sure everyone remembers what he/she has to do. Skills can be expected to fade out quickly without constant review and practice.

In conclusion, we are challenged with having to pioneer work in an environments that is still unknown to humans, ie, microgravity, deep space and off-world planets such as Mars. But the importance is in the vision and the goals to continue and pursue the work in a steady and meticulous fashion and working through the challenges and obstacles. That is part of becoming an analog astronaut, scientist-researcher, pioneers or explorer. Our human curiosity is fascinated by the "X-factor" in the equation of life and our own human existence within this paradigm as we know it. We want to discover, to evolve and to move forward with the hope of new discoveries and, one day, to become a multi-planetary species. Wherever humans travel to new frontiers, to uncharted territories, such as deep space, then the safety and protection of human life is necessary. That is why analog astronaut training and experiences acquired during training at MDRS and other analog expeditions, such as the current NASA funded Hawaii Space Exploration Analogue Simulation (HISEAS), are important research work that should be continued and expanded upon into longer duration expeditions. The research projects conducted during the MarsCrew134 expedition at MDRS are "seeds" that will germinate to become something significant and beneficial for future space explorers, for terrestrial Earth and for the human race and humanity.

About this Issue's Contributors

Angélique Verrecchia and **Phillippa Blaber** both earned a Masters from the International Space University (2013). They write a blog entitled *[Born For Space](#)*, promoting Human Space Exploration. They also write for the *[Space Safety Magazine](#)*.

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Susan Jewell, MD has trained as a space medicine physician-scientist (NASA Johnson Space Center and University of Texas Medical Branch: Aviation & Space Medicine Program), STEM educator and a biomedical engineer. Her research focus is in Human Space Exploration, Survival and Colonization of off-world planets. She is affiliated with the International Space Surgery Consortium, MarsCrew134 Analogue Astronaut Expedition, Mars Desert Research Station, and The Space Clinic. She can be reached at drjewellmd@gmail.com

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Provenzano is also part of the Jet Propulsion Laboratory's Solar System Ambassadors program. [The Astrosociology Research Institute is an Educational Nonprofit 501\(c\)\(3\) organization incorporated in the State of California.](#)



Notes from the CEO

Jim Pass, Ph.D.

Private Human Spaceflight

This issue covers an important contemporary issue, and especially one that will become ever more important over the coming years. While NASA and other government space agencies continue to send humans into space, private human spaceflight will increase alongside of it. What does this mean for humankind's future in space? For one thing, it will provide a greater number of opportunities for humans to experience spaceflight rather than the current vicarious experiences that most of us share. Once private human spaceflight becomes truly operational on an ongoing basis, an important question arises. How inclusive of a shared social reality can this trend become? One important element involves how low we can reduce the cost of spaceflight, especially all the way to a proper Earth orbit. Additionally, how will this change the perspectives of participants and what social changes will that produce? No space activity occurs in the human experience that does not impact on humankind and its societies, so changes are coming. Thus, it is important for humankind to understand their character and implications.

The Need for a More Organized Effort

The social sciences, the humanities, and the arts have addressed space-related activities and influences for a very long time. Nevertheless, one may trace a major problem with their approach to the fact that too many of these efforts have occurred on an individual basis within their own disciplines without major support from the mainstream. In fact, I founded astrosociology initially based on my frustration within the sociological discipline characterized by an indifference toward space issues, which largely continues today.

However, with the advent of the formation of the Astrosociology Research Institute (ARI) in 2008, that pattern characterizing the status quo has begun to change. The space community has been the most accommodating while the social science community has remained largely disinterested despite the obvious relevance and need for the development of astrosociology. Today, astrosociology is a multidisciplinary field within the social and behavioral sciences, humanities, and the arts – and importantly, a collaborative field with the space-based physical and natural sciences.

One may view astrosociology and STEM fields/disciplines as two sides of the same coin that involves space issues, and so both are necessary to move forward in forging a future in which humankind better understands astrosocial phenomena, thereby allowing itself to benefit from this currently obscured knowledge. One side of the coin means it is only possible to gain half of the knowledge, and no potential interactive synergies in our understanding of human/society space issues. Both branches of science must cooperate as astrosocial

Notes from the CEO (cont.)

phenomena – social, cultural, and behavioral patterns related to outer space – increase in terms of ubiquity and influence.

Astrosociology is missing, overdue, needed in academia and in collaboration with traditional space agencies, companies, groups, and individuals. Bringing the social sciences and humanities more firmly into the space age is in everyone's interest. Humankind developed the social sciences to understand human behavior in terrestrial societies. What makes people think that the same need will not arise in space societies (settlements)?

Many Subfields from which to Choose

There is something for everyone at the crossroads of social science and outer space within the field of astrosociology. There is a strong need for social and behavioral scientists, humanities scholars, and artists to get involved in space education and research, and we need to press hard on making this happen before too many human beings leave the Earth's atmosphere. Humankind must be ready to make certain that social systems in space function positively or at least attempt to understand them, just as much as they must comprehend the engineered systems that keep them alive. That is, both physical and social environments must function properly based on some standard imposed upon them.

Ensuring a Future for Astrosociology

Awareness is the key for astrosociology's growth. It is equally important within the social science and space communities. ARI's mission specifically seeks to develop astrosociology as an academic field, and to provide education and research that ensures that humankind recognizes the importance of astrosocial phenomena, all while training astrosociologists to take on the challenge of placing the social sciences in their rightful place as major contributors to space education and research. This is the only way to ensure a positive future for astrosociology.

The purpose of this particular article is not to describe the programs and projects underway or planned, though they are vital for implementing and coping with the issues raised herein, but rather to acquaint the reader with some of these important issues on a more general level. For more details about ARI's undertakings, please see our programs and projects page: <http://www.astrosociology.org/ariprojects.html>. We have many exciting and long overdue activities going on, as you will see. Next time, I will review some of these programs and projects in detail.

Are the Social Science and Space Communities Ready to Embrace Astrosociology?

Finally, it is important to consider a practical matter. We know that every space-related nonprofit organization is asking for financial assistance. However, ARI is unique among the majority of organizations in the very important sense that the social-scientific approach to the study of space issues remains severely underrepresented in both the "old" space age and the "new" space age, though the latter seems to accept astrosociology more readily than witnessed

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Notes from the CEO (cont.)

in the past. Another difference, one that exists among organizations that include social science issues, is the effort to develop astrosociology as a multidisciplinary academic social science field carried out by social scientists in collaboration with members of the space community.

Physical and natural scientists, technologists, engineers, and mathematicians (STEM-related contributors) engaged in space education and research should support ARI and astrosociology because space affects human beings; and they can either shape these effects to their advantage or become shaped by them on a random, and potentially harmful, basis. It is important to understand how astrosocial phenomena affect terrestrial societies, as they have done for millennia, as well as activities in space. The reluctance of space community people to donate to the social sciences is understandable; but humankind needs both branches of science to contribute if it is to send humans into space in significant numbers, especially during long duration and permanent missions and expeditions. This is not a zero-sum game as both branches are complementary.

*"There is something
for everyone at
the crossroads of
social science and
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-Jim Pass