Astrosociology Research Institute (ARI)

Astrosociological Insights

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The Interstices of Astrosociological Learning: The Nexus Between STEM and Social Science Education

This newsletter represents the heart of ARI's purpose—which is to educate the public about astrosociology and the importance of studying astrosocial phenomena. In support of this goal, ARI proudly announces the *Astrosociology in the Classroom* program. The *Astrosociology in the Classroom* program will enable students to learn and instructors to teach astrosociology using resources developed by ARI staff. The program materials include a syllabus, lecture materials, course outline, assigned and suggested readings, and several video lectures viewable on our forthcoming ARI YouTube channel. Though initially designed for the undergraduate level, the program will expand to include K-12 as well as graduate-level materials.

The focus of this newsletter highlights not only astrosociology, but incorporates related views of U.S. and international educators and scholars. Our call for contributions yielded impressive submissions with topics ranging from the methods used to teach astrosociological type classes to the importance of STEM education. Universities with space focused programs that incorporate the social sciences into their curricula were also solicited to contribute to this newsletter. Given the importance of the subject, we wanted to offer all readers a sense of the types of programs that are currently available for students and academics. While not every school responded to the call, ARI made every effort to be as inclusive as possible. These contributions are included in the final pages of this newsletter.

We at ARI hope the contributions contained in this newsletter stimulate further dialogue about the importance of astrosociological education in the aerospace and social science communities. We certainly welcome ideas and suggestions to improve ARI's educational products and services. Moreover, we invite those interested in astrosociological based education to contact and cooperate with us so that we may continue to expand the astrosociological frontier.

Astrosociology in the Classroom: Program Overview

The primary mission of the Astrosociology Research Institute (ARI) is to develop and promote astrosociology as an academic multidisciplinary social science field that studies astrosocial phenomena (that is, social, cultural, and behavioral patterns related to outer space). As education is an essential component of ARI's mission, the *Astrosociology in the Classroom* program serves as ARI's flagship program.

Program Overview (cont.)

The creation and presentation of course materials and curricula for students of all ages establishes a permanent foothold in the astrosociological frontier, an academic landscape devoid of significant social science participation in the study of outer space issues. Review of university social science programs reveal that the human dimension of space exploration is greatly missing in mainstream academe. The *Astrosociology in the Classroom* program seeks to fill that gap.

Settling the astrosociological frontier, like any frontier, requires the presence and the hard work of pioneers. Besides attracting established professionals, a vital part of ARI's overall strategy involves attracting students to study astrosociology and inspiring them to later embrace the field as practicing social scientists – that is, as astrosociologists. To that end, ARI will create workshops for existing professionals, students, and interested professionals in the social and physical sciences arenas. The *human* dimension of space exploration is as important as rocket science because of the necessities that arise from humankind's plans to execute emigration into outer space in a successful and sustainable manner. The *Astrosociology in the Classroom* program incorporates traditional space exploration traditions; that is, physical science, technology, engineering, and mathematics (STEM). The two are intimately related even if the social sciences are not emphasized to the extent required.

Astrosociology, as much as traditional fields of study related to outer space, is not without problems. Two major problems exist with space education from an astrosociological perspective: (1) space materials are nearly absent in social science classrooms and (2) the human dimension is not emphasized enough in space-related physical and natural science classrooms. Furthermore, the collaboration between these two branches of science, which would instill both approaches in a purposeful manner into the curriculum, is not common and requires greater implementation. Both branches of science must collaborate with one another in a formal fashion in order to achieve synergistic progress that is unprecedented and impossible within either branch alone.

So, what are the prospects? The impact of space in the social science classroom has received very little attention, but it is not without precedent. For example, astrosociology has been the subject of courses independently taught by Renato Rusca Rivera at Meiji University in Japan and Jim Pass at Kepler Space University; Roger Launius has taught a "Space and Society" course at Johns Hopkins University; Peter Dickens and James Ormrod have taught a course on "Cosmic Society," which offers a "sociology of the universe" from a critical – or conflict – theory perspective; Hiroki Okada teaches the course "Space Culture Studies" at Kyoto University in Japan; Allen Abramson and Martin Holbraad teach "Cosmos, Society and the Political Imagination" at University College London; Al Harrison has advocated and participated in studying space exploration through a lens focusing on the human dimension for over thirty years; and the Search for Extraterrestrial Intelligence (SETI) field has a long history of participation by sociologists and other social scientists. Thus, there is ample evidence that discussion of the social influences of outer space in the social science classroom exists and continues to grow both in the United States and internationally. The *Astrosociology in the Classroom* program will hopefully provide a common web to these types of courses and offer materials to assist teaching students interested in space and society issues.

Space is an inspirational component that aids in the process of learning, and it becomes even more exciting when factoring in the human dimension. The whole purpose of ARI's *Astrosociology in the Classroom* program is to fill this void characterized by the absence of space curricula in social science programs and departments; and ultimately more importantly providing a strong social-scientific voice

Program Overview (cont.)

in the space community. More fundamentally, the development of the field depends on an educational approach that can both inspire students and instruct them about the significance of the human dimension of space exploration, settlement, resource exploitation, and terrestrial society benefit. This program is overdue and a top priority for ARI.

What does the program offer?

The *Astrosociology in the Classroom* program provides the opportunity for students and professionals interested in issues related to outer space to add a human perspective to their current knowledge and those in the social and behavioral sciences without exposure to space can appreciate how astrosocial phenomena enhance a traditionally STEM-based approach. This program is unique in its scope and its variety of formats. We plan to offer materials for insertion into existing courses focusing on physical and natural sciences such as astronomy, astrobiology, and planetary geology, which will add social and cultural elements to complement existing materials.

What materials will be included?

Materials provided for a particular course include a syllabus, lecture materials, course outlines, reference citations for required and optional reading assignments, YouTube and other types of videos, as well as access to *The Journal of Astrosociology* and ARI's Virtual Library. Educators are welcome to send ARI their own materials that may assist in moving the program forward. In addition, educators will receive support from ARI regarding any questions they may have about how to teach the course, the contents of the course, or any other relevant issues.

What will students learn?

Students will learn about the definition and significance of astrosociology and the impact of astrosocial phenomena in the lives of average people. The *Introduction to Astrosociology* course will provide a detailed presentation of the definition and relevance of the field and a basic overview of major subfields. Subfield-oriented courses will focus on related topics in detail. Examples of specialized courses include space law and policy, planetary defense, SETI and astrobiology, and applied astrosociology. The unique nature of all astrosociology courses is that they will pay strict attention to astrosocial phenomena and how they affect human behavior, cultures, and societies. This approach is complementary to those traditionally taken by physical and natural science courses focusing on space issues.

How will this help Educators?

The program will assist educators in presenting materials regarding astrosocial phenomena and the one- and two-way relationships between outer space and humanity, as well as provide examples of each to stimulate dialogue in the classroom. In general, most educators will learn about concepts that normally receive minimal attention in the courses they teach such as astrosocial phenomena and the astrosociological imagination; thus presenting a more holistic view of how traditional subjects are influenced by space activities and ideas. Social science educators will be exposed to new materials that they normally do not see yet can enhance students' interests in the social sciences. For example, they will be able to relate to their students how outer space influences various areas of society, culture, social institutions, social groups, and individuals. They will look beyond terrestrial social forces and realize that change comes from understudied sources. Natural and physical science educators will learn to appreciate the human dimension of STEM subjects and the value of collaboration with the social sciences. For example, medical astrosociology combines with space medicine issues and biomedical concerns with so-

Program Overview (cont.)

-cial, cultural, and behavioral complications that will always arise in various forms.

What will students and instructors walk away with after completing the program?

A new perspective will emerge, one inspired about the human dimension of outer space, more open to collaboration between traditional space community members and social scientists, not to mention learning about an important topic or topics rarely presented in academia. All those who participate in the program will be in a much greater position to make more informed contributions to the development of astrosociology and the positive outcomes that result from it. Furthermore, graduates of the program will receive certificates acknowledging their successful completion of the particular class in which they attend. Those interested will be encouraged to pursue astrosociology further, join the astrosociological community, and receive feedback and support from ARI to make this goal possible.

ARI . . . Reaching Out: *Introduction to Astrosociology*

Kathleen D. Toerpe, Ph.D.
Deputy Chief Executive Officer for Public Outreach and Education

Outreach literally means, “reaching out” and that is what the Astrosociology Research Institute will be doing much more of in the months ahead. As the new Deputy Chief Executive Officer for Public Outreach and Education, I'm focused on bringing ARI's commitment to astrosociology to the broader public of all ages. The foundation of this bold endeavor is our *Astrosociology in the Classroom* initiative. This initiative covers multiple programs aimed at students K-12 through college, and complements traditional STEM curricula with readings, lesson plans and classroom activities exploring the human dimensions of outer space.

A core component of our classroom initiative is a new college and professional-level course titled *Introduction to Astrosociology*, which was presented to educators and the scientific community at the 100 Year Starship 2013 Symposium in Houston in September. Designed as a competency-based and learner-centered course, the lessons utilize an inquiry-based approach promoting collaborative teamwork and the integration of both critical and creative modes of reasoning. Okay, lots of jargon there. Let me break it apart and show you what this course is all about.

- *Competency-based.* Students will demonstrate that they have mastered specific skills or knowledge that is essential to understanding the dynamic interrelationship between humans and space. Explaining the impact of space-related events from a human-centered *astrosocial* perspective, for example, is one of these basic competencies.
- *Learner-centered.* The focus is always squarely on student involvement - through discussion boards, projects and in-class activities. Students' own personal interests will direct much of their coursework with the goal of spotlighting how human social behavior has long been an interwoven and critical, if underexplored, component of space research and exploration.
- *Inquiry-based approach.* Each lesson opens with questions to guide students' research and inquiry. We are not handing out ready-made answers and hopefully students will end the course asking new, even more in-depth questions! Like all scientists, we are curious about how the physical world operates. But in the social sciences, arts and humanities, that curiosity extends to us humans as well, and the patterns of social behavior that we create, as part of the physical world.
- *Collaborative teamwork.* At its core, astrosociology is a multi- and inter-disciplinary field. Collabor-

Introduction to Astrosociology (cont.)

-ation is what we do best and students will be working with colleagues from many different fields: physical sciences, social sciences, arts and humanities. Many different perspectives lead to a fuller understanding of how humans affect and are affected by space.

- *Critical and creative reasoning.* We all know our brains are amazing machines capable of both highly analytical and amazingly innovative thought patterns. The study of astrosociology not only taps into these multiple intelligences, but also highlights the connections among intelligences that we sometimes overlook. Critical thought and creativity feed into each other, opening up new possibilities for further research and understanding.

Astrosociology is the study of cutting-edge, real-world challenges that explores and makes predictions about how humans interact with space. Not just decades into the future, but right here and now (and even in the past). Where do we put today's research dollars? Is space everyone's business? Who should go to space? What about the relationships and societies left behind on Earth? How do we create the laws today that we will need to govern ourselves tomorrow? What is it about space that intrigues us so much? What if we discover new life out there? What can we learn from space? Astrosociologists are tasked with helping society sort out these challenges, researching and understanding them, and in the field of applied astrosociology, helping to formulate responses. And the challenges will only grow as we mature in our efforts to become spacefaring civilizations.

This new course, *Introduction to Astrosociology*, serves as a gateway to the dynamic field of astrosociology for early-career college students as well as seasoned professionals in space-related fields. When looking up, it is easy to be enthralled by the amazing star-scape of our physical world, teeming with possibilities and unleashing a flood of questions. But let us not forget what is on the other end of the telescope - a person, a team, a community, a civilization. People are asking the questions and people have a stake in the answers. We both affect and are affected by that reality "out there" - and understanding that mutual bond enriches us all, furthers our knowledge of our universe and of ourselves, and points to possible pathways for our future. All we have to do is reach out.

Japan and Astrosociology in Education

Renato Rivera Rusca
Deputy Chief Executive officer for International Outreach and Education; Lecturer, Meiji University, Tokyo, Japan

In September 2010, I began administrating a course entitled "Our Entry into a New Space Age", as part of the "Special Themed Practicum" series of classes at the Meiji University School of Commerce. The reason for this was that, for a couple of years prior, I had been feeling an urgency in the global society for a discussion incorporating a wide variety of perspectives on the subject of the development of space technology and its effect on our everyday lives, as well as the relationship between society and space as a whole. The sense of urgency spawned from my own reactions to the rapid development of private enterprises and their increasing involvement in space missions. I believed that there were issues concerning the construction of spaceports, for example, to which many turned a blind eye. In Japan, 2010 was coincidentally the year that space began to once again have a presence in the public eye, through the Hayabusa phenomenon and the *Space Brothers* series and movie. Magazines began to carry articles on the future of "space business" and pontificate on the future of Japanese industry in the field of space. However, information in the Japanese language was still very scarce.

Japan and Astrosociology in Education (cont.)

Thus, when I began the course, the only materials I had to work with were the latest English language stories describing the Virgin Galactic ventures, or SpaceX, etc. Using these sources, the students – all of them from a background of business with very little to no experience in the fields of physics and the natural sciences – were asked to form their own groups and formulate a project of some sort or another that attempts to raise the level of public awareness regarding what is happening right now in terms of developments between space and society. The point of this exercise, and indeed the point of the "Special Themed Practicum" classes, is to allow the students to take centre stage and plan and conduct for themselves something that they can create from the ground up, based on their understanding of the world.

The course was later renamed "Constructing the Future Society #2: An Introduction to Astrosociology", in order to accommodate for another unit, "Constructing the Future Society #1: Re-structuring 'Cool Japan'". "Cool Japan" refers to the Japanese Government's Ministry of Economy, Trade and Industry's policy to capitalize on the exportation of popular culture, fashion and other forms of "soft power", to stimulate the economy. However, there seems to be a discord between the subcultures that consume those contents, the bureaucrats attempting to utilize it for their strategy, and the general population, which is mostly unaware or disinterested in the idea and/or the contents themselves. In the same way, the Astrosociology course casts its gaze upon not just the inner workings and technicalities of space exploration and development, nor the historical and political background behind the space race, but also the disparate sectors of society that are all being influenced in some way or another by space issues.

Ultimately, the course exists to stimulate the students in their outlook of the world, by attempting to showcase issues that have no precedent, the problems of which have to be tackled with creative solutions. In this environment, there is no right or wrong answer, and the best course of action comes from sharing information and logical discussion, thus developing analytical and critical thinking skills within the students, which not only will prove useful in their own future careers, but it is also hoped that they help to narrow the gaps within Japanese society so that the different areas which have come to drift apart can reunite on some level, bringing forth a new level of discourse.

This is the reason the course is entitled "Constructing the Future Society" – because I believe the future is no longer a series of linear paths in history stretching into the distance, depending on the discipline, be it art, language, economics or technology. These days with the advent of globalization all our lifestyles, customs and traditions are becoming integrated, and with that we need recognition of this and a clearer understanding of how these areas intertwine. Astrosociology is a prime example of a subject with the potential of creating this multidisciplinary mindset within the young generation, so that our future may be faced responsibly, rather than haphazardly.

Recently, Ochanomizu Women's University's Yoko Iwata (formerly of JAXA) has been administrating such classes invoking critical thinking using space issues for younger children. Also, as of this year, anthropologist Professor Hiroki Okada has begun coordinating his own "Space Culture Studies" class at Kobe University, which I attended as a guest lecturer in June, to find that JAXA is involved in a large part. There is definitely a palpable increase in momentum recently with regards to education in Astrosociology, and since many of the instructors developing these programs are already acquaintances, one can be hopeful for further collaborations and expansion of the field in the near future.

The Significance of Space Education as "Citizenship"

Yoko Iwata
Ochanomizu University, Project Lecturer
**Translated by* Renato Rivera Rusca

In Japan, the role of "space" within educational courses as stipulated in the curriculum guidelines is extremely limited, to the point of insignificance. If we just focus on the elementary school level, we see that even in the science classes, only the topics "the stages of the moon", "the constellations" and "the relationship between the sun and the ground" are covered. Clearly, there are no courses tying together space and society anywhere to be seen.

On the other hand, the issue of "Citizenship" is raised in the "Society" courses, and there is effort being put into education in how to form opinions based on controversial social topics. This type of education for the development of skills to form adequate opinions as citizens regarding complex technological issues is extremely important to establish, in particular in these days when the technology and society is so intertwined.

Nuclear issues are a particularly good example. The difficulty here is not just the fact that nuclear power itself is complicated, but as soon as we consider nuclear power generation, we have to tackle the issue of the safety of the reactors, and the fact that there will be a margin of human error to take into account, in terms of the workers at the plants – thus, there are many problems that arise when humans interact with technology. This is why it is important that we citizens take the initiative and gain greater awareness of these social problems concerning technology, which cannot be completely solved only by scientists. To this end, we need to focus on citizenship education.

In the current situation, while space development is a national project, it is expected that the technology will be used for both public and private purposes. For example, in both the US and Russia, space technology is currently being developed for military purposes, but it has the potential to be utilized for both peaceful and military uses. In Japan, though the aims of space development were limited to "peaceful purposes", this was changed to "for defense purposes" to reflect the amendment in the "agency law" [or "agency act"] that governs the purposes of JAXA's activities. Essentially, this is a topic that invites a multitude of perspectives and for this reason – it is a very apt case study for use in citizenship education, as well as the formulation of viewpoints on science and technology issues. I would now like to introduce an example of what kind of lessons can be planned using materials on the subject of space development, and what kind of results we hope to see.

I constructed a curriculum for the development of opinions on the topic of space, for ninety (90) 6th grade students from Tomizawa Elementary School in the city of Sendai. The main flow of the curriculum was split into three main sections, as follows: 1) A lecture by an expert on space development (JAXA researchers), 2) A survey on "Space development and its pros and cons concerning our everyday lives", and 3) A debate concerning space development – encouraging the formation of viewpoints and opinions.

At the first stage, the children were very full of awe to the effect that "space development is wonderful" and "space development is something vital for our daily lives". During the survey in the second stage, while there were students who agreed with the positive impact of satellites and GPS in our everyday lives, there were others who feared the fact that people's lives were at risk during manned space missions. In other words, the absolute awe that the students had demonstrated in stage 1 had evolved into a questioning of space development. In stage 3, all the students were split into a "for" group and an "against" group and we began the debate. Having had the opportunity to experience this split in

The Significance of Space Education as "Citizenship" (cont.)

opinions, each member came to be aware of their own values, and became able to put forward their own viewpoints, instead of somebody having had it inputted into them, presenting their cases for and against. Here is an example of one of the children's opinions:

- An opinion "for":

I am for the development of manned space missions. I have three reasons. 1) People going out into space is a dream for humanity, and we have the technology to achieve this. 2) There are things that humans can do which robots cannot (using all five senses). 3) If, for example, we can expect humans to colonize Mars in the future, then the current budget seems really small in comparison.

- An opinion "against":

I am against the development of manned missions to space. I have three reasons. 1) The cost for manned missions is too high. The Hayabusa mission only cost 12.7 billion yen, while the Space Shuttle missions, at 2 trillion 290 billion yen, are much higher, proving that manned missions are much more expensive. 2) Manned missions have not had a particularly good record, whereas unmanned ones (such as Hayabusa) have. 3) Accidents in manned missions may result in loss of life.

As you can see from looking at the opinions of these children, by considering the nature of space technology, considering the issues concerning cost, and observing these issues from a social perspective and asking of themselves what they think about these issues, they are exhibiting the attributes of a real citizen expressing his/her own opinion. Additionally, the situation escalated to the appearance of the following viewpoint:

- As space beings ourselves, we have a necessity to know about space. Many Earth beings are aware of the incidents and problems occurring on Earth, but there are not many who are aware of space problems. If we learn about space, then we can solve the environmental problems and protect the Earth.
- What I learnt from this class was not "this" and "that", but rather, "this too, and this as well", and the fact that "when considering something, one must always do so in relation to a central line of logic". This goes not just for learning about space, but I believe it is also necessary for our normal life. Therefore, it is something I never want to forget.

Evidently, rather than simply learning about how to form opinions concerning space technology, they also learned about the significance of learning about space itself, as well as how to think about topics not limited to space.

In this way, I believe that it is extremely important to develop the education sector with a focus on the link between space and society. In addition, I would emphasize that space as a topic is an extremely appropriate learning material for developing viewpoints on technology issues within the Japanese public education system. The reason being that, for example, in the case of nuclear power, there are real and political problems deeply inherent, and thus they are difficult to manage due to the taboo factors of the usage of politics and religion within public education. However, with space, because it is a mostly unexplored field, one has the advantage to develop appropriate discussion without focusing on real-world and/or political issues. Thus, I believe that the way to move forward in space education is to do so within the framework of "Citizenship Education".

Citizenshipとしての宇宙教育の意義

お茶の水女子大学（*Ochanomizu University*）
岩田　陽子　（**Yoko Iwata**）

日本では学校教育カリキュラムの構築の指針として学習指導要領で取り扱われる「宇宙」は極めて限定的であり、かつ、僅少である。小学校に焦点を絞れば、宇宙の対象教科である「理科」ですら、「月の満ち欠け」「星座」「太陽と地面の様子」等で触れられるのみである。当然、宇宙と社会との関連を結びつける学習項目は見当たらない。

一方で、日本の「社会科」では公民的資質（Citizenship）の養成を掲げ、社会的論争問題に対する意思決定教育が展開されている。特に科学技術と社会が緊密な時代において、複雑な科学技術課題に対し、市民として適切に意思決定するという資質を養成することは極めて重要である。例えば原子力発電の問題などは良い例である。この問題の難しさは、「原子力」そのものの複雑さのみならず、原子力発電となると、たちまち原子炉の安全性やそこで働く作業者のヒューマンエラーの問題等、技術面や人間が介在したことによって多くの問題が生ずることにある。このように、科学技術の専門家だけでは太刀打ちできない科学技術課題に対し、我々市民が責任をもって意思決定していくことは極めて重要であり、科学技術社会に対する意思決定力を高めることは、Citizenship教育における重要課題なのである。

こうした中、宇宙開発は国家プロジェクトであり、官民両用技術であることから多様な使われ方が想定されることが掲げられる．例えば，宇宙開発は，アメリカ，ロシアでは軍事利用されているのが現状であり，平和的利用の可能性も軍事利用の可能性も両側面をもっている。日本においても、これまでは「宇宙開発」の目的を「平和的利用」に限定していたが、JAXAの活動目的を定める機構法の改正により、その限定が外れ、「防衛利用」も可能となった。つまり、こうした多様な見解が求められる科学技術課題である点において、Citizenship教育、さらには科学技術課題に対する意思決定教育における最適な題材であるといえるのである。それでは「宇宙開発」を題材することによってどのような授業が展開でき、どのような効果が見られるのか、この点について実践例を紹介する。

私は、仙台市富沢小学校に在籍する小学校6年生90名全員を対象に、宇宙開発を題材に意思決定教育を展開した。授業の流れは、①宇宙開発の専門家（JAXA研究者）によるレクチャー、②「宇宙開発と私たちの暮らしへの恩恵と弊害」についての調べ学習、③宇宙開発の是非に関するディベート→意思決定という3つの流れで実践した。

児童は、①の段階では、「宇宙開発の素晴らしさ」や「宇宙開発が私たちの暮らしには欠かせない」といった肯定感で一杯であったが、②の調べ学習に入ると、人工衛星やGPSに関する暮らしへの恩恵に共感する児童が多い中で、有人宇宙開発等で人命が危険にさらされていること等への弊害に共感する児童が現れた。つまり、①のときのような絶対的肯定感から、宇宙開発への疑念が生まれるに至った。③では児童全員に、敢えて賛成派と反対派と双方を体験させてディベートを展開したが、この双方の立場を経験したことで、自身の価値観が明確となり、誰に何を言われたからではなく、自分自身の意見として、賛成また反対を主張するに至った。代表的な児童の意見を紹介する。

- **賛成派の意見**

有人宇宙開発に賛成。理由は3つ。①人が宇宙に進出することは人類の夢であるし、実際に行く技術を持っているから。②ロボットでは追究できない人にしかできないこと（五感を使う）があるから。③例えば人が火星に移住するというような時代のことを見据えて長期的に見れば今使っている予算は大した金額ではないから

- **反対派の意見**

有人宇宙開発には反対．理由は３つ．①有人の方がコストが高いから．「はやぶさ」は127億円．スペースシャトルは2兆2900億円と有人の方がハンパなく高い．②有人はあまり好成績を収められていないから．無人（はやぶさ）のが好成績を収めている．③人命を失う事故が起こってしまうから．

Citizenshipとしての宇宙教育の意義 (cont.)

この児童の意見を見てわかるとおり、宇宙科学技術に関する根拠、費用に関する根拠を踏まえつつ、社会的に見て自分自身はどう考えるかという点、まさに市民としての自覚をもって意見していることがわかる。さらに最終的には、次の意見が出るに至った。

> 私たちは宇宙人として宇宙のことを知る必要がある．地球人は地球で起こっている事件や問題を知っている人が多いが，宇宙の問題を知っている人は多くない．宇宙を知ることが出来れば地球の環境問題を解決して地球を守ることができる．
>
> 私は，この学習をして学んだことは，「あれか，これか」ではなく，「あれもこれも」ということと，「何かを考える時には軸を中心にして考える」ということ．このことは，宇宙の勉強だけでなく，普段の生活にも必要なことだと思う．なのでこのことを忘れないようにしたい．

つまり、単に宇宙科学技術に対する意思決定について学んだだけでなく、「宇宙を学ぶ意義」や「宇宙に限らず物事に対する見方・考え方」までを学ぶに至ったのである。

このように「宇宙」と「社会」とを結びつけて展開する教育というものは極めて意義深いものになると考える。さらに強調するならば、日本の公教育において、こうした科学技術課題に対する意思決定教育を展開するにあたり、「宇宙」という題材は極めて最適な題材である。なぜなら、例えば、原子力技術の場合は、現実的かつ政治的な問題が深く孕み、政治や宗教の取扱いをタブーとする公教育では取り扱いづらいという背景があるからである。しかし、「宇宙」は、未開拓の分野ということもあり、こうした現実的・政治的な問題に焦点を絞らずとも適切な議論ができるというメリットがある。つまり、今後の宇宙教育の方向性は、こうしたCitizenshipとしての教育を発展させるべきではないであろうか。

From Summer Science Camp to Art College: Fusing Art, Space and STEM Education

Renate Pohl
Theatre/Visual Artist and Lecturer,
Memorial University of Newfoundland

Credit: Renate Pohl—GEO Centre

One of my favourite memories from childhood involves drawing pictures of the Emerald City of Oz, imagining the sunny yellow brick road leading to the mysterious city in the distance with its glittering faceted towers (which I saw as literally made of giant emeralds). Like many children, I was attracted to the saturated colours and rich textures winding through the magical narrative. The fact that I was learning skills of perspective rendering while doing this was secondary to the experience of the otherworldly story and the feeling of pulling colour across paper. This experience is indicative of the positive effect of the injection of the creative and imaginative process within education. Hands-on creativity married with the mystery of space exploration has the ability to spark excitement during STEM learning, while strengthening memory through emotive and sensory stimulation.

During July and August 2013, I facilitated a series of astronomy workshops for children aged 7 to 10 as part of the Johnson GEO Centre's Camp GEO! Summer Science Camp in St John's, Newfoundland,

From Summer Science Camp to Art College (cont.)

Canada. In order to experience sensory creative input while learning about space science, the students created their own "GEODial" while learning about sundials, the MarsDial, and how scientists use light and shadow as clues in astronomy research to understand the relationship between celestial bodies. While constructing individual GEODials, the children were given a restricted paint palette of black, white, and three primary colours. They were taught to mix three distinct values of grey paint, as well as one secondary paint colour to apply to their dials. They were given creative freedom to paint the "gnomon", or dial post, any colour or pattern they chose. While supported by a structured framework of mixing paint to a certain standard to apply to a specific template (the GEODial face), the students responded with great excitement to the small amount of creative freedom given in painting the gnomon; it was a word that was easily recalled at the end of the workshop.

During the second part of the workshop, the students were asked to guess the primary and secondary colours of light, and were shown a demonstration of light and shadow colour mixing using a larger scale GEODial. Their ability to comprehend and recall the difference between pigment and light mixing in relation to the GEODial object was incredibly successful. For the final section of the workshop, the students donned safety goggles covered with a variety of theatrical lighting gels in primary and secondary light colours. Outside in bright sunlight, the students were encouraged to look at the colour of the shadow cast by the GEODial gnomon, as well as the colour of the sky and surrounding rocky environment. While engaging in imaginative play that they were visiting yet-undiscovered (or already existing) planets of different colour, they were engaging in a sensory-rich, memorable experience.

Sensory stimulation and hands-on creative activity, married with the mysterious narrative of space was applied throughout all phases of the workshop. New STEM learning was woven directly into all activities, while topics from earlier workshops (basic optics) was reinforced through this creative application.

While the creation of this workshop was straightforward, and the benefits plentiful, the difficulty in implementation may lie in the fact that many artists or artistic educators are not, in fact, schooled in science or space education. The solution to this may be to also implement space science education workshops for artists.

In February 2013, in an effort to extend space education to artists, I conducted a Space Art workshop at Memorial University of Newfoundland, Grenfell Campus Fine Arts Department. The three-day workshop culminated in the Humans in Space Art Pilot Undergraduate Challenge, an opportunity for the students to showcase their artwork on a global level. Undergraduate theatre students participating in the workshop adapted Shakespeare's A Midsummer Night's Dream as a production intended for future space tourists. In doing so, they learned and applied basic physical space science and technology engineering to the design, characters, and narrative structure of the play. In addition, they wove five points about space history into the adaptation (a requirement of the challenge). In this university context, the students once again showed enthusiasm for science learning when applied in combination with tactile creative freedom, a certain amount of structure, and narrative play based on mystery and possibility.

It is important to note that the desired outcome of these workshops, whether in a summer science camp or university art department context, was not to coerce all students to necessarily become scientists, engineers, or technicians. The goal was to provide a context for STEM educational learning that

From Summer Science Camp to Art College (cont.)

was enjoyable and memorable, that engaged creativity and made use of the narrative and imaginative aspects of space education. While this alone may encourage many students to become involved in STEM careers, it is also the hope that if a student instead decides to become an artist, or involved in any other type of career, they will carry with them a respect for interdisciplinary learning that they may later apply as an educator, or as an advocate of interdisciplinary learning, to further improve STEM education.

Space Age STEM

Geoffrey Notkin
Advisor, Astrosociology Research Institute;
Host, STEM Journals and Meteorite Men

Credit: Elizabeth Egleson © Aerolite Meteorites, LLC
Challenger Space Center Arizona—Space Camp

In July, I served as the Keynote Speaker for the Space Frontier Foundation's 2013 NewSpace Conference in Silicon Valley. From the stage, looking out at the lively and enthusiastic audience, I realized that we were all standing at a pivotal moment in the history of space exploration. A large percentage of the several hundred attendees were under the age of thirty. Today's NewSpace movement is partially populated by highly educated, articulate, devoted, and forward-thinking young people and they did not become part of it as a result of classes taken at school, because the nation's first degree program in commercial space operations is starting, this very year, at Embry-Riddle University. These young scientists taught themselves about the space program using resources found outside of the classroom.

There is a parallel between the modern space program and emerging opportunities for STEM education. We are rapidly moving away from government-funded space operations to those run by the private sector. With companies like Deep Space Industries, Planetary Resources, Virgin Galactic, and others presenting opportunities ranging from space tourism to asteroid mining, we are devising the tools to colonize, explore, and exploit space for fun and profit.

In the entertainment world, we are abandoning a long-established system in which major networks exert complete control over what Americans see on their television screens. Quality programming is now being produced by non-traditional content providers, Netflix being an excellent example. A company that started out as little more than a savvy online version of Blockbuster is now so successful that it produces its own high budget, popular series such as *House of Cards* and the rebooted *Arrested Development*. We can see the same thing happening on a much larger scale with independent, web-based programming. A decade ago, producing a short documentary film was a complex undertaking, requiring considerable expertise as well as expensive equipment. Today, anyone with a portable video camera and an understanding of iMovie software can make their own film over a weekend and show it on YouTube.

Space Age STEM (cont.)

Students in middle school today have never known a world without the Internet; they watch Netflix and they look at videos on YouTube. Young people take for granted the ability to look up the spelling of a word, the date of an obscure event, or send an email anywhere in the world almost instantaneously. The Internet is the great facilitator of our times. And while much of the population spends their free time gossiping on Facebook, others are producing original educational programming in audio and video formats and making that programming freely available to anyone who wants to see it. All you need to do is look.

In an article entitled "The 95 Percent Solution," published in *American Scientist* (Nov.-Dec. 2010), John H. Falk and Lynn D. Dierking wrote: "Data suggest that the importance of school as a resource for learning is actually declining among the public as citizens utilize an ever-broadening range of information resources, including most dramatically the Internet, which now represents the major source of science information for all citizens, including young children."

We live in a country so large and so diverse it represents every conceivable viewpoint. American engineers built the rockets that took us to the Moon — the greatest technological accomplishment of all time — but the United States is also home to climate change deniers and Creationists. How can the federal government possibly find an educational compromise that will keep everyone happy? The sad truth is, they cannot. So, a brilliant child in the Midwest who wants to be a paleontologist might not be allowed to study evolution because it has been banned by his school. The hardworking small-town teacher trying to inspire her science class may not be allowed to purchase educational DVDs because there is no funding for such materials. Happily, teachers and students now have alternatives. If modern instructional programming becomes freely available, and we make its presence known, then dedicated teachers will use it in their classrooms and — if that programming is engaging enough — kids will watch on their own, or be encouraged to do so by their parents.

In my work as a television host, science writer and public speaker, I personally interact with tens of thousands of people each year, many of them students. I know from my own experiences that many, or possibly most, of these kids are not getting the STEM education they need at school. I also know that quality science programming is an effective tool because of the hundreds of emails I have received from parents who told me that my series, *Meteorite Men*, got their kids out of the house digging in the dirt and organizing play expeditions. A study by the Harvard Family Research Project on Complementary Learning stated: "Research shows that out-of-school, or 'complementary learning' opportunities are major predictors of children's development, learning, and educational achievement." (*quoted* in *American Scientist*, "95% Solution" (Nov.-Dec. 2010)) A child exploring his or her backyard in search of interesting rocks is a fine example of out-of-school learning.

I intend to be an active part of the coming renaissance in alternative education. To that end I accepted the position of host for *STEM Journals*, a smart, fast-paced educational television series aimed at middle school students and produced by the multi award-winning Cox Creative team in Arizona. Rather than just talking about STEM topics, the show looks at the stories behind careers in STEM-related fields. We talk to engineers, astronomers, archeologists, tech specialists, and others to show how they became STEM professionals and we encourage young viewers to embark upon similar paths.

Television and vodcasts are two of the tools we have. Hands-on learning experiences in unexpected venues are effective ways in which to get young people excited about science. Jeremy Babendure, Executive Director of the Arizona SciTech Festival, provided me with an example of how to facilitate this

Space Age STEM (cont.)

concept:

> "A star party will appeal to people who are already interested in astronomy. In order to expose others, we had an astronomy association set up a telescope at the Renaissance Fair. We created a Galileo character, in costume, and invited people to look through his telescope. The observers' experience expanded the role that astronomy plays in our everyday culture."

Along with STEM, I support the Astrosociology Research Institute (ARI) for adding the voice of social scientists to the important work of space exploration. I have advocated science in the past, and as a science writer I always try to write with a voice that includes the human dimension. I agreed to become an ARI Advisor so I could reach a greater number of scientists and scientists-to-be from a variety of perspectives, because studying space issues in the long term will be best accomplished when the physical and social worlds are considered together, rather than as separate realms. For example, in "STEM Journals," we speak with those who conduct science, whether they are using the latest technology to search for habitable exoplanets, or working directly with people to improve the quality of their lives here on Earth. One could say that astrosociology addresses how such work, particularly in space, might affect Earth's people, its cultures, and its societies.

Meaningful STEM education is not just the process of memorizing facts and figures and learning how to read. It is about inspiration. If a geologist had not taken me on my first field trip when I was seven years old, I likely never would have become the advocate for science education that I am today. It is my duty — and yours — to inspire kids now. With proper motivation and guidance, the middle school STEM students of today will become the space colonists of tomorrow.

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*STEM Enables Engineering of Global Leadership***

James D. Rendleman*

Supervising Attorney, Operations, Space, and International Law, US Strategic Command's Joint Functional Component Command for Space. Member, State Bar of California and International Institute of Space Law.

*(The views expressed in this essay are those of the author and do not reflect the official position of the US Government, US Air Force, or US Strategic Command.)

The United States began its path toward becoming a great power well before the 20th Century. Innovation, invention and exploration defined the spirit of the nation, even in its early colonial days. Called the "American Spirit," its people have never seemed satisfied with the status quo. They always look for the next best thing, and seek to understand and improve the world in significant and meaningful ways. One need only review the successes of Founding Father Benjamin Franklin to get this sense of the American Spirit. He is revered as more than a diplomat, printer, entrepreneur and patriot. He was celebrated throughout America and Europe for his inventions and scientific endeavors—lightning rods, electricity, the effects of heat conduction, Franklin stoves, the concept of cooling, bi-focal glasses, the glass harmonica, urinary catheters, and the study of Atlantic Ocean currents.

While innovation and technical achievements have served as the cornerstones of great empires, the economic greatness the United States achieved in the last half of the 20th Century was not assured at

***Editor's Note:** *This essay seizes upon significant thoughts conveyed in Thomas D. Taverney and James D. Rendleman, "Engineering Global Leadership," Astropolitics, Volume 9, Numbers 2-3 (May-December 2011), pp. 119-139.*

STEM Enables Engineering of Global Leadership (cont.)

the end of World War II. Its ascension was secured, however, by three seminal events: (1) the passage of the G.I. Bill; (2) the Soviets' Sputnik launch and the start of the Space Age; and (3) John F. Kennedy's challenge to go to the Moon and the Moon Race.

At the conclusion of World War II, securing national prosperity despite austere global conditions demanded wise decision-making. The United States sidestepped economic disaster threatened by a post-war industrial and military demobilization by implementing a program that stimulated great change. It implemented the G.I. Bill. With the G.I. Bill, the country became more than just a clever nation with vast resources. "The men and women who had fought in the war were transformed by the act from poor working-class citizens to middle-class citizens, from citizens who worked with their hands to professionals who worked with their minds…" (Reginald Wilson, "The G.I. Bill and the transformation of America," National Forum: Phi Kappa Phi Journal, Fall 1995, http://findarticles.com/p/articles/mi_qa3651/is_199510/ai_n8720508 (*accessed* January 2011)) As a result, when our parents and grandparents, now veterans, re-entered the labor market, they were better prepared. The legislation transformed America into a well-educated, technically literate nation. All the country needed then was a bit of focus to leverage this growing human capital asset.

Before Sputnik, the Eisenhower Administration had hoped to avoid run-away budgets, and, as a result, limited budget submissions related to developing space systems. Responding to a fear of falling behind the Soviets in the Space Race, however, the President and the Congress came together. They opened a spigot of funding for space science and technology (S&T) and research and development (R&D). With this funding, America experienced dramatic changes. Government, academia, and industry activities were revamped and previously unimaginable programs began. Money poured into R&D of new space systems and into education related to science, technology, engineering, and mathematics (STEM). The investments enabled the development and improvement of fantastic new capabilities, and the expansion of a whole new space community was underpinned with the technologies they produced. With new society-wide technology activities, the United States was able to surpass the Soviets in terms of satellite program successes. These first steps led to even more spectacular successes as the United States developed sophisticated remote sensing, communications, weather and precision-navigation-timing systems.

Despite the investment in its people, the United States still lacked an overarching inspiration to grab ahold of the benefits that STEM education would provide it. A spark was needed to inspire the nation to achieve even more greatness. This spark came in 1961 in the form of a challenge from John F. Kennedy. On 25 May 1961, the President redefined the goal of the Space Race in an address to a special joint session of Congress:

> I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth. No single space project in this period will be more impressive to mankind or more important in the long-range exploration of space; and none will be so difficult or expensive to accomplish. (President John F. Kennedy, "Special Message to the Congress on Urgent National Needs," 25 May 1961)

He framed the challenge as part of the larger ideological contest between the United States and the Soviets:

STEM Enables Engineering of Global Leadership (cont.)

> If we are to win the battle that is going on around the world between freedom and tyranny, if we are to win the battle for men's minds, the dramatic achievements in space which occurred in recent weeks should have made clear to us all, as did the Sputnik in 1957, the impact of this adventure on the minds of men everywhere who are attempting to make a determination of which road they should take... We go into space because whatever mankind must undertake, free men must fully share. (President John F. Kennedy, "Special Message to the Congress on Urgent National Needs," 25 May 1961)

Kennedy argued that a Moon Race was also vital to national security and it would focus the nation's energies in important scientific and social fields. His speech came at a special moment and helped inspire overall American S&T and R&D efforts in aerospace engineering, electronics and telecommunication fields. These, in turn, led to many advances and then secured the global dominance of the United States economy during the last half of the 20th Century. The technical capacity and inspiration led to the United States becoming preeminent in medicine, transportation, communications and information technologies, and in nearly other measures of success. Commenting on the impact of Sputnik and the Space Age, Michael Mandelbaum said:

> Our response to Sputnik made us better educated, more productive, more technologically advanced and more ingenious... Our investments in science and education spread throughout American society, producing the Internet, more students studying math and people genuinely wanting to build the nation. (Thomas L. Friedman, "What's Our Sputnik," *New York Times*, 16 January 2010, *citing* John Hopkins foreign policy expert Michael Mandelbaum, http://www.nytimes.com/2010/01/17/opinion/17friedman.html?_r=1&scp=2&sq=&st=nyt (*accessed* January 2011))

The G.I. Bill, Sputnik, and Moon Race spurred the United States to seize and retain leadership in space technology development and space activities. They encouraged the nation to invest in STEM education. This brought out the best from its engineers and scientists through competition and inspired important efforts. The resulting technical genius fostered advances in a wide variety of other technologies, improving the nation's quality of life. The United States now faces a hard road ahead unless something is done to reverse 21st Century American trends in science, technology, engineering and math education. The author asks: where is our next G.I. Bill, Sputnik or Moon Race?

The Future of Space-Related Education: STEM and Astrosociology Together

Jim Pass, Ph.D.

Chief Executive Officer, Astrosociology Research Institute

At present, what I previously described as the "astrosociological frontier" in 2009 still largely reflects the true nature of astrosociology education; that is, the potential of astrosociology in the classroom remains nearly fully unexplored (*see* Jim Pass, Pioneers on the Astrosociological Frontier: Introduction to the First Symposium on Astrosociology (2009), http://www.astrosociology.org/Library/PDF/Pass2009_Frontier_SPESIF2009.pdf) The implication of this is that very little progress has been made in terms of breaking the barrier to integrating the social and behavioral sciences, humanities, and the

The Future of Space-Related Education: STEM and Astrosociology Together (cont.)

arts into existing programs and creating new courses that focus on some aspect of space. This is slowly changing, however, and the Astrosociology Research Institute (ARI) intends to contribute heavily to this trend, and accelerate it, even while the physical and natural sciences receive by far the greatest level of funding support.

Space-related educational reform efforts currently focus most strongly on the expansion of STEM programs that cover non-social-scientific categories of **S**cience, **T**echnology, **E**ngineering, and **M**athematics; and, of course, the recruitment of new students to pursue them. The impetus fueling this movement can be found in the well-established tradition of the U.S. space program, which has paid much more attention to rocket science than social science for more than half a century. STEM education and research have important roles to play in the future of space education. Hardly anyone disputes that. All the same, it is incomplete when it comes to the study of *human* space exploration and settlement. Humans do the exploring, even while on Earth and space impacts them, and everyone else, on a daily basis. Robots, space probes, and other technologies are still merely tools.

With this in mind, a major objective is to bring the social sciences, humanities, and arts into the classroom alongside – and in collaboration with – traditional space-related courses and curricula. As I have emphasized elsewhere, including via Twitter, the improvement of space-related education is not a competition between the two branches of science, but rather, dependent on a new unwitnessed level of cooperation and collaboration. STEM and astrosociology must exist, and thrive, *together*. ARI's *Astrosociology in the Classroom* program is vital to the pursuit of the well-balanced approach needed to advance humankind as a spacefaring species (*see* Dr. Kathleen Toerpe's piece in this newsletter for details regarding ARI's college- and professional-level course). It provides a good synopsis of our inaugural approach and its justification.

In today's academic climate, ARI can take advantage of new pedagogical models that provide additional opportunities utilizing the internet, social media, and various other forms of communication. Geoffrey Notkin provides a good argument for supporting the trend and the need for alternative education to supplement traditional in-classroom learning, which ARI supports. Thus, ARI's *Astrosociology in the Classroom* program should not be taken literally, as it simply refers to increasing the presence of astrosociology education, whether in the classroom or utilizing any other design, and not the actual physical classroom. New alternative approaches are being reported all the time now, and the practice of education is becoming increasingly innovative.

A renewed dialogue now exists in which advocates proclaim that society benefits ever more as a greater number of its citizens become adequately versed in science. They almost always refer to the "hard" sciences, and this is understandable, but a truly well-versed scientific background includes the "hard" sciences *and* the "soft" sciences. In the case of space-related education, this means being well versed in both STEM subjects and astrosociological subfields, together. An additional benefit is that the two branches of science have a way of interacting with one another so that learning occurs from a hybrid perspective, an expanded worldview and understanding, which is impossible to gain when utilizing the traditional scope of subjects alone.

The artificial boundary between the social sciences and physical sciences has produced decreasing benefits for space exploration for some time now and it will only become worse over time. The best

The Future of Space-Related Education: STEM and Astrosociology Together (cont.)

approach in my view is to proceed with space-related education in a way that embraces the collaboration between STEM subjects and astrosociology. The human dimension, which takes into account social and cultural patterns as well as human behavior, must become more pronounced by far than at any other time in history. We are human beings, and we must gain a better understanding about how our species is affected by astrosocial phenomena so that we may understand it and take advantage of it to benefit humankind as space becomes increasingly influential in the lives of average citizens.

Contributions from Universities

Editor's Note—This final section includes descriptions of existing departments and programs that emphasize, or at least recognize, the connections between space and society, and thus take the human dimension into account. Their existence demonstrates that this approach does in fact exist, and can be supportive of, and collaborative with, ARI's *Astrosociology in the Classroom* program and its mission of making astrosociology education and research available to society.

As part of our effort to reach out to universities that teach social science subjects in the various space fields, we solicited a call for contributions and asked administrators to provide an overview of their program and how social science is used in their curriculum. We reached out to the University of North Dakota's Space Studies Program, the University of Mississippi School of Law's LL.M. Program in Air and Space Law, George Washington University's Space Policy Institute, the University of Nebraska-Lincoln's LL.M. Program in Space and Telecommunications Law, McGill University's Institute of Air and Space Law, the International Space University, and Leiden University's Air and Space Law Program. We received the following contributions.

Finally, the Editor takes full responsibility if communication failed to result in a contribution and invites administrators to provide a contribution under this call in a subsequent issue.

The University of North Dakota—Space Studies Program

Paul Hardersen, Ph.D.
Associate Professor

Understanding the universe of space exploration and its practical implementation requires both discipline-specific knowledge to accomplish individual missions while also utilizing an interdisciplinary perspective to grasp wider insight into the causes and purposes for the broader collection of space activities. This micro- and macro-level look at space is embodied in the University of North Dakota (UND) Department of Space Studies (http://www.space.edu), which has the goal of educating today's space practitioners to apply their broad-based knowledge to more effectively accomplish missions in the space industry.

With eight faculty members whose expertise includes decades of experience in satellite communications, space life sciences, space and planetary sciences, astronomy, space suit development, history, policy, management, and small satellite and engineering projects, the department offers M.S. and Ph.D. programs for both campus and distance students. The program currently supports ~150 M.S. students and three Ph.D. students, as well as offering a minor for UND undergraduates.

The M.S. program integrates both social and physical science courses to give students – who arrive

The University of North Dakota—Space Studies Program (cont.)

with a diverse range of undergraduate degrees – the basic knowledge to be conversant across the many sectors of the space business that converge to create, implement, and operate specific programs and missions. Having historical, policy, and management knowledge allows students to understand the origins and evolution of space missions and programs while also learning about the pitfalls and difficulties experienced in developing and operating those same missions and programs. Issues such as national imperatives, political calculations, international considerations, scientific priorities, technology requirements, private sector needs, and budgetary limitations intermingle and often conflict at any given time and for any given program.

This social area focus on the human element in space exploration is embodied in courses and topics that include international space programs, space economics, management of space enterprises, military space programs, public administration of space technology, space politics, science policy, history of astronomy, and remote sensing policy. Coupled with STEM courses that teach the science and practice of astronomy, space and planetary science, astrobiology, space mission design, orbital mechanics, Earth system science, space engineering, human factors in space, and Earth remote sensing, the social science emphasis in UND Space Studies helps students understand that space missions do not happen in isolation and require professionals with a variety of skill sets and abilities.

In addition to the broad curriculum, UND Space Studies also offers focused thesis research opportunities for campus and distance students. Some social topics of successful research by M.S. students include a historical biography of Homer Newell and his role in the development of U.S. space science, psychological stressors in astronauts on long-duration missions, an appraisal of the NASA technology transfer process, the societal effects of the operational disruption of the Anik E2 satellite, and how U.S. presidential approval of the Apollo and space shuttle programs influenced the subsequent evolution of NASA.

UND Space Studies has also been increasing its infrastructure and research capabilities in the last decade, which is exemplified by the growth of space suit and astronomical facilities in the department. The department's Human Spaceflight Laboratory (http://human.space.edu), led by Dr. Pablo de Leon, has been developing and testing spacesuits (such as the NDX-1/2) for use on planetary surfaces such as the Moon and Mars. This type of research embodies both engineering and human factors (i.e., social) aspects that must be successfully mastered if humans are going to conduct long-duration mission beyond near-Earth space.

The UND Observatory (http://observatory.space.edu) is another capability-enhancement project that has been in development and renovation since 2005. The facility now includes three Internet-controllable telescopes that are used for education and basic research projects. Daytime solar observational capabilities are in development while nighttime research is currently focusing on asteroid rotational studies (i.e., light curves). Variable star photometry, stellar spectroscopy, and CCD color imaging are other education and research areas that can be conducted with observatory assets.

The doctoral program at UND Space Studies began during the Fall 2012 semester and has the goal of continuing an interdisciplinary curriculum in doctoral student education while also fostering the traditional Ph.D. research emphasis in specific fields and disciplines that produce high-quality, publishable research.

Through the past 15 years, UND Space Studies has evolved its curriculum and capabilities to pro-

The University of North Dakota—Space Studies Program (cont.)

-vide both interdisciplinary breadth and focused research opportunities for its broad student base. Efforts to enhance and improve the program will continue in the years ahead. The program is working hard to become an active part of the space community and to foster, improve, and expand space activities around the world.

The George Washington University—Space Policy Institute

For over forty years, The George Washington University (GW) has been one of the world's leading centers for research, graduate study, and informed discussion related to issues of science, technology, and public policy. GW established a Space Policy Institute (SPI) (http://www.gwu.edu/~spi/) in 1987. It is a research, policy and teaching program of the Center for International Science and Technology Policy of GW's Elliott School of International Affairs, but draws on all University resources that can contribute to its work.

The Space Policy Institute focuses its activities on policy issues related to the space efforts of the United States and cooperative and competitive interactions in space between the United States and other countries. The Institute provides a setting in which scholars, policy analysts, practitioners, and students can work together to examine and evaluate options for the future in space. The Institute welcomes short and long-term visitors from the United States and overseas and offers them a congenial environment in which to pursue their research interests as well as access to U.S. space policy decision-makers. The Institute encourages women and individuals with diverse backgrounds to apply.

The Institute conducts research on space policy issues, organizes seminars, symposia, and conferences on various topics, and offers graduate courses on space policy. The curriculum centers on the social sciences, including political science, history, law and economics, but technical courses are also available to complement and enhance a student's interests and specialization. The Space Policy Institute offers its students courses led by experts in their respective fields, all with a lifetime of experience in space related affairs. Students not only engage with stellar faculty but also with people currently working in their related fields, including experts based here in Washington D.C. as well as abroad. The program is professionally-oriented, encouraging students to take advantage of the many nearby work, research, and networking opportunities at the cross-section of space and public policy, law, economics, and international affairs.

The Space Policy Institute currently awards one to three new fellowships at the beginning of each academic term to full-time master's policy students. The awards consist of a stipend of $16,000 and 10-20 hours of tuition credit each year and may be for one year or renewable for a second year. It is expected that students will intern or work in industry, government, or at not for profits in the Washington, D.C. space community on a part-time basis while pursuing their degree to meet the financial burden of attendance while gaining professional experiences.

McGill University—Institute of Air and Space Law

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Created in 1951, McGill University's Institute of Air & Space Law (IASL) provides cutting-edge graduate legal education to students from around the world. Located in Montreal, a bilingual city in a civil law province (Québec) of a common law country (Canada), McGill's Faculty of Law (of which the

McGill University—Institute of Air and Space Law (cont.)

IASL forms part) is committed to the trans-systemic teaching and study of law. Montreal also doubles as the aviation capital of the world. The International Civil Aviation Organization (ICAO) (a specialized agency of the UN established in 1944 to foster the safe and orderly development of civil aviation) as well as the International Air Transport Association (IATA), the Canadian Space Agency, Air Canada, and several aerospace manufacturers (including Bombardier, the third largest aircraft manufacturer in the world) are all headquartered in Montreal. Experienced practitioners from these organizations are always on hand to give guest lectures to IASL students.

Over the past half century, the IASL has produced more than 1,000 graduates who, today, occupy some of the most senior positions in law firms, corporations, and governmental and intergovernmental institutions in more than 120 countries around the world. IASL graduates hold high positions in institutions such as the United Nations, the Office of the US President, ICAO, IATA, INTELSAT, NOAA, CSA, ESA, JAXA, European Commission, the armed forces of various nations, leading global law firms, and private commercial enterprises. With our closely-knit alumni associations, our students have real-time access to an extensive global network of air and space law professionals wherever they find themselves in the world which, in turn, creates vast opportunities for job placements all over the world.

The principal objectives of the IASL are to: (a) educate the next generation of air and space lawyers to serve the needs of the aerospace community worldwide; (b) offer IASL students the best graduate education in air and space law available anywhere in the world; (c) publish interdisciplinary research valuable to all stakeholders; and, (d) serve the professional educational needs of the aviation and space law bar. Academic programs offered by the IASL lead to the award of: (a) a Graduate Certificate in air and space law; (b) a Master of Laws (LL.M.) degree in air and space law; and a Doctor of Civil Law (D.C.L.) degree in air and space law. McGill University and its Faculty of Law are consistently ranked among the top 20 educational institutions in the world. As such, McGill's academic degrees carry the highest level of credibility and are recognized everywhere in the world. Over the last 25 years, the US air force has sponsored at least one officer each year to study at the IASL for the LL.M degree.

All 10 IASL courses are taught in English by some of the world's most accomplished experts, mostly holding doctoral degrees in law and having extensive practical experience in air and space law. Given their expertise, IASL faculty members have repeatedly been consulted by the United Nations, the Permanent Court of Arbitration, the World Economic Forum, the International Telecommunication Union, the International Civil Aviation Organization, the Canadian and European Space Agencies, numerous governmental departments, universities, airlines, and space agencies as well as private companies.

Recently, the IASL received grants totaling more than $5 million from the Boeing Corporation and the Erin J.C. Arsenault Foundation. From time to time, funds for cutting-edge research on issues such as militarization of space and arms control, regulatory aspects of radio frequency management for space services, space security and sustainable space development, Canada's international aviation policy, aerospace transportation and space debris have also been provided by numerous endowments, foundations, research agencies, government departments, private corporations, alumnae of the IASL, and individuals. As a result, the IASL has the most extensive and generously funded academic research and outreach program in the field of air and space law. Further, the IASL offers the highest number of well-funded scholarships and fellowships for the study of air and space law, both at the graduate and post-doctoral levels. These include the Arsenault, Boeing, Matte and Sekiguchi Fellowships that pro-

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-vide up to $20,000 annually for masters students; up to $30,000 per year for doctoral students; and, up to $50,000 annually for post-doctoral researchers. IASL students have the rare opportunity to participate in our extensive research and outreach activities thereby gaining valuable research experience, earning additional money, networking with highly accomplished experts from around the world and traveling abroad. IASL students are encouraged, guided and often financially supported to present their research at various conferences around the world.

The IASL organizes many workshops, seminars and conferences on different aspects of air and space law around the world. We also publish numerous books and periodicals including the Annals of Air and Space Law, a highly respected and valuable compendium of research that has been published annually since 1976. McGill's law library hosts a unique and invaluable collection of official documents and manuscripts on air and space law that are available nowhere else in the world.

For more information on the IASL, visit: http://www.mcgill.ca/iasl/.

Message from the Editor

For the last year, the Astrosociology Research Institute has published this quarterly newsletter under the Editorship of Christopher Hearsey. He will now pass the torch to Kathleen Toerpe who succeeds him as Editor-in-Chief of *Astrosociological Insights*.

The focus of the next newsletter will be on astrosociological research. In particular, the newsletter will solicit contributions from the aerospace and social science communities that focus on the types of astrosociological research that is taking place around the world. Further, the newsletter will dedicate space to investigate astrosociological issues associated with private human spaceflight.

This latter aspect includes soliciting contributions from aerospace and social science researchers, enthusiasts, and developers and pioneers who seek to take two-way or one-way trips into outer space or to celestial bodies. As Virgin Galactic plans to launch its first flights next year and Mars One seeks to train "private astronauts" for one-way trips to Mars, it thus becomes necessary to investigate the astrosocial phenomena that will manifest from these activities.

The call for contributions for the next newsletter will go out in the coming weeks and we invite all those interested to think about the subject of the next call and send contributions to Kathleen Toerpe at ktoerpe@astrosociology.org.

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