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SPACE Monthly

A Bit about SPACE

Hi! We're SPACE, a space research and exploration institution founded in Jan. 2012 on the Isle of Man. We hope you enjoy hearing about SPACE with this newsletter!

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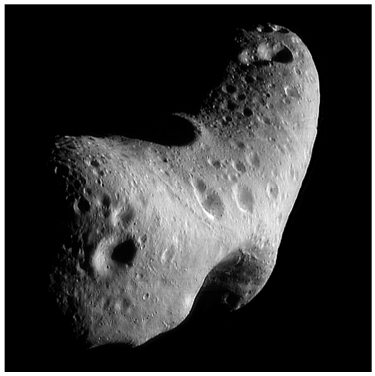
Meet the Interns: The Successes and Challenges of SPACE's Virtual Internship Program

In our Aug. newsletter, we described how SPACE began a search for participants in its first Virtual Internship Program in Mar. 2013. This program's application was open to anyone anywhere in the world who wanted to work for two months on a near-Earth asteroid mining spacecraft design project. The purpose of this project was to return the resources mined to Earth or near-Earth space for a profit. This project began on June 24, 2013. Due to the overwhelming success of this endeavor, the end date has been extended to Dec. 2013, rather than Aug.

In order to celebrate the successes and reflect on the challenges presented by this innovative endeavor, SPACE has included some of the participants' firsthand experiences for your reading pleasure below.

THE PARTICIPANTS

Kiran Tikare, India: Kiran obtained his Bachelor's in Electronics and Communication Engineering. He is currently employed as a software engineer at EF Information Systems Pvt. Ltd. While serving as an intern for SPACE, he worked as a Systems Engineer. His tasks included briefing each team (i.e., Economics, Astrodynamics, Propulsion and Mining) on the inputs from the other groups and developing a



developing a profitable Asteroid Mining Mission plan. Here is an account of his experiences:

"My Virtual Internship with SPACE was an amazing opportunity to learn about different aspects related to Space Missions, such as Asteroid Mining. Although the duration of this program was short, it was challenging in terms of coordinating with team members distributed all over the world…this opportunity was perfect because it helped me understand different modules and teams involved in space missions."

More About SPACE

In case you missed the first issue of our newsletter, here is some more information about us. SPACE is an up-and-coming institution created by young people from many countries, relying on grass-roots support as well as on aid from existing organizations. It offers both an education and, to those so inclined, a life-long career.

At SPACE, we strive to combine seamlessly a rigorous educational program with actual, hands-on space system development and exploration expeditions. Our central principles are that exploration is education, and scholarly instruction and research are merely two aspects of discovery. The ultimate goal of SPACE is to help build a space-faring society.

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teams involved in space missions."

Prasanna Deshapriya, Sri Lanka: Prasanna received his undergraduate education at the University of Colombo, where he obtained his degree in Physical Science; more specifically, his educational background is in Physics and Astrodynamics. While working for SPACE as part of this program, Prasanna was in the Astrodynamics team. His principal task was to study potential transfer maneuvers that would enable SPACE to send and subsequently retrieve an unmanned spacecraft from Earth to a designated asteroid. Additionally, he was involved in developing an optimal trajectory method for the above project's feasibility and at times collaborated with the Propulsion Team. Here are some of his experiences:

"During this internship, I was able to grasp the basics of the Hohmann Transfer, Conic Approximation, Planetary Flyby, etc....as...potential transfer maneuvers. Sometimes it was a challenge to digest the core ideas of these sophisticated maneuvers. But I could always contact Hyerim Kim of SPACE, my mentor, and get clarifications...I would like to thank her and everybody at SPACE for making it possible for me to be a part of this project...It was very exciting to be part of an international team with dynamic individuals dedicated to a unique goal."

Shail Satak, India: Shail received his Bachelor of Technology in Mechanical Engineering at Rajasthan University, India and is currently working in the Aerospace Department at the Indian Institute of Science. As part of the Virtual Internship program, Shail designed, analyzed and developed a plan for the propulsion system requirement of this internship's asteroid mining project. Below is a short account of his experiences:

"This task was new and ambitious for me as we were not given much information about Propulsion systems in our degree course; therefore, I had to find, learn about and work out the different propulsion systems available around the world by myself along with the invaluable help of our team leader, Hyerim Kim. There were some challenges in finding the experimental data of different propulsion systems, locating research being done in this field and setting out criteria for comparing these technologies prior to selecting the best system for the SPACE mission. But...we worked out a set of criteria for comparison and selection by the end of the internship."

A Short Course on Hunting for Asteroids

Roy Tucker, Senior Engineer, University of Arizona's Imaging Technology Laboratory

By the middle of the 1990s, three events occurred to bring about a new era of asteroid studies by both amateurs and professionals. The CCD imaging device began to be applied to astronomical observations in the early 1980s in professional observatories and became available to amateurs in the 90s. The precise X-Y array of pixels of this device permitted the precise determination of position. A CCD camera could now see objects as faint as 20th magnitude in only a few minutes with a moderately large amateur telescope in the 12" to 16" aperture range. Moreover, home computers became readily available, relatively inexpensive and computationally powerful. These

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computers could manipulate the images produced by CCD cameras and precisely centroid the positions of asteroids using surrounding stars as reference points. Finally, high quality star catalogs, such as the Hubble Guide Star Catalog, became available on CDROM that extended to extremely faint magnitudes and provided accurate celestial coordinates for listed stars. With these resources, even observers with modest instrumentation could contribute to asteroid studies by providing precise position or astrometric reports and determinations of light variations or light curves as asteroids move in their orbits and discovering previously unknown asteroids.

In the late 1980s, Dr. Tom Gehrels of the University of Arizona's Lunar and Planetary Laboratory was the first to apply CCD imaging to asteroid search efforts. For instance, the Space Watch Camera achieved some very notable accomplishments with regard to the discovery of new near-Earth Asteroids. Even as an amateur observing asteroids in the mid-90s, if you had a telescope/camera combination that could see as faint as 17th or 18th magnitude, you could image a random field in the opposition region of the ecliptic, and perhaps half the asteroids that would be revealed would be previously unknown or "lost" objects. Due to newly-available instrumentation and the recent realization that impacts had a profound influence on the biological history of our world, the field of asteroid studies exploded.

In 1999, Richard Kowalski, an amateur astronomer at that time, established an email forum, the Minor Planet Mailing List, in order to share his pursuits with others like him. Surprisingly, the professional community discovered this mailing list and began to use it as a worldwide "intercom" for communications with all asteroid observers, amateur and professional alike. It was superbly well-suited for the public announcement of collaboration opportunities, for the exchange of questions and answers, requests for high-priority astrometric observations in support of radar studies and describing new research results. Journalists also discovered this mailing list was an excellent way to get an early warning of newly-discovered, possibly earth-threatening objects. Please go to http://tech.groups.yahoo.com/group/mpml/ in order to request to join this list.

RULES OF THE ASTEROID DISCOVERY GAME

The Minor Planet Center, located at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, has full authority, granted by the International Astronomical Union, to establish the rules whereby one may claim discovery of an asteroid. The Center also maintains records of the reported positions of hundreds of thousands of known objects and calculates orbital elements based on these reports. Their instructions to observers regarding the measurement of asteroid positions, securing discovery credit, naming citations, etc. may be found at http://www.minorplanetcenter.net/iau/info/Astrometry.html.

THE CURRENT STATE OF GROUND-BASED ASTEROID SEARCHING

The professional surveys in this field have become very good; as a result, it has become extraordinarily difficult for amateurs to discover new objects. To have a good chance of finding something, one needs instrumentation that will reveal objects down to about magnitude 20 or 21 and examine many square degrees per night. One may also have to hunt in the Milky Way where star densities are so high that professional surveys do not waste time hunting there or one should perhaps observe small solar elongations. Meeting these requirements will involve the use of a telescope of at least 0.5 meter-aperture with a thinned, back-illuminated CCD of 2k x 2k pixels. Additionally, a dark observatory location would certainly increase one's success rate. The professional surveys typically employ telescopes of one to two meters aperture and 4k x 4k CCD arrays, which is beyond the scope in terms of money and manpower of most amateur efforts.

Representations of Spaceflight in Sacred Visual Art and Architecture

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This article examines the relationship between space exploration and sacred visual art, demonstrating that religious iconography and church architecture evolved by assimilating humankind's entry into the physical heavens as a living parable. Nonetheless, the incidences of space themes in religious visual arts, as well as the fervor of reception, vary greatly among denominations. The interaction between spirituality and space exploration is an important bridge between inner space and outer space. Our entry into space is not just a technological feat; this human journey interacts not only with the physical, real universe, but also with the various transcendental, mythical universes as imagined by different cultures and religions. Herein, I investigate the interaction between space exploration

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and sacred visual art, specifically religious iconography and church architecture. In what follows, a non-exhaustive, exploratory survey of instances of space-inspired and space-themed subjects in visual sacred art and architecture is presented, along with the motivations behind these occurrences.

SPACE EXPLORATION AS AN INTEGRAL PART OF HISTORY

One of the main reasons for incorporating space exploration imagery into church art is the fact that the artwork of many shrines chronicles historical landmarks, and the conquest of space is part of human history. Frequently, Christianity goes hand in hand with the secular "civil religion" where astronauts are celebrated as national heroes.[1] Besides this, sacred art can convey the related message that technology is a part of human life and that the church—a living and evolving entity, far from being earth-bound—is instead embracing space exploration as a God-sanctioned pursuit.

The most famous stained-glass window depicting a space theme lies in the Washington National Cathedral. One of its windows, dedicated to scientists and technicians, contains a lunar sample returned by the crew of Apollo 11. The "Scientists and Technicians Window," or the "Space Window" as it is commonly known, commemorates U.S. exploration of space and humankind's first steps on the Moon. The artist of this window, Rodney Winfield, wanted to symbolize by its design the minuteness of humanity in God's universe.

ASTRONAUTS AS EMBODIMENTS OF CHRISTIAN VIRTUES

The depiction of astronauts in churches is meant to inspire others to follow in these individuals' footsteps by upholding the same values. In a chapel at the Pentagon in Washington, DC, a panel shows an astronaut on the Moon with the first line from the Book of Genesis stenciled beside him, symbolizing an act of courage.[2] In addition, one of Saint Mary's Episcopal Church of Los Angeles'[3] windows, the Ascension Window, depicts a cross grasped by the hands of all races, Martin Luther King's "I Have a Dream" speech, the scales of justice, and an astronaut.[4] The astronaut here, as associated with the other depictions, seems to symbolize the ascension of the human species towards a fairer world and its hopes of unity embodied in an "envoy of mankind."[5]

ASTRONAUTS AS MORTAL BEINGS

Sacred art has shown an awareness of the mortality of astronauts and sought to convey the message that humankind's entry into space did not do away with his mortality, and that death is an inescapable part of human fate. Even before any astronaut had passed away, the Basilica of Saint Peter in the Vatican gained a new Porta della Morte ("Door of Death"), used as the exit for funeral processions. Among the scenes of passing beyond, Sudden Death occurring in outer space is depicted.[6]

CONCLUSION

Religious art is able to evolve by assimilating space exploration as a living parable. The reception of space-themed visual sacred art is, nonetheless, not uniform across the spiritual spectrum. The artwork of many shrines chronicles the exploration of space as a part of human history; the iconography of other sacred places celebrates heroes of the secular "civil religion," such as astronauts, and often the feats of these are culturally appropriated by the Church. There are also instances where religious art depicts "the astronaut" as an archetypal embodiment of certain Christian virtues with the aim to inspire others to follow in their steps by upholding the same values. The ability of most Western traditions to assimilate space exploration themes in their visual religious art is not to be confused with a universal embrace of the former by the latter. It is true that there are numerous examples of space-themed Western iconography but, on the whole, these are still rare when taken in the context of the vastness of the religious arts of these traditions. In general, the word that best describes this situation is "acceptance" rather than "fervor."

NOTES

1. Richard K. Fenn, Beyond Idols – The Shape of a Secular Society (New York: Oxford University Press, 2001), 75.

2. David Shukman, Tomorrow's War: The Threat of High-Technology Weapons (San Diego, CA: Harcourt Brace, 1995), 95. Shukman considers the lunar scene as being rather "an image of celestial conquest." Also, see Diane M. Rousseau, "Transformation at the Pentagon," The Institute of Spiritual Sciences, institutespiritualsciences.org, 2004, http://bit.ly/116Ogfw (accessed November 2012).

3. See St. Mary's Episcopal Church of Los Angeles, http://stmarys-la.org (accessed November 2012).

4. Joanna B. Gillespie, "Japanese-American Episcopalians During World War II: The Congregation of St. Mary's Los Angeles, 1941–1945," Anglican and Episcopal History 69 (2000): 168.

5. As per Article V of the 1967 Outer Space Treaty, which proclaims that "States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space," and the Apollo 11 plaque left on the moon proclaiming " We came in peace for all mankind." It is to be noted that Astronaut Ellison Onizuka, who perished in the 1986 Challenger tragedy, was a Japanese-American, and that actor George Takei, who portrayed Star Trek's Mr. Sulu, hails from Los Angeles.

6. Nicolo Suffi, St. Peter's - Guide to the Basilica and Square, http://saintpetersbasilica.org/Docs/ Basilica-Square1.htm (accessed November 2012). For a picture of the "Death in Outer Space," see flickr.com, 28 December 2005, http://bit.ly/SxHpXz (accessed November 2012).

See the 11:79-99, 2013 issue of "Astropolitics" for the full article