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Abstract

The title of the application is Planet Earth and Space Conference, submitted to the EPA-C2008-BAA-C5: Technology funding opportunity. The full title of the conference is: Planet Earth and Space: Making the Connection between our planet's environmental future, technology and space". The conference is being organized by the National Space Society (www.nss.org), a 501(c)(3) not-for-profit organization based in Washington, D.C. The technical lead for the conference is Peter J. Schubert, Ph.D. (pschubert@packereng.com) and the conference manager is Ms. Bernessa Wilson (bernessa06@comcast.net). The project will begin on 11 July 2008, the conference will be held 15-18 June 2009, and the project will conclude by 30 June 2009. Total direct project cost to the EPA is \$75,000.

This will be a unique congress of environmental researchers, atmospheric scientists and aerospace engineers discussing ways that Earth's climate problems can be understood and addressed. From these diverse groups will emerge greater awareness of the application of technology to protect human health and safeguard the natural environment. The conference will feature six technical tracks to which researchers can submit original research and innovative reviews aligned with the conference theme. Each track will be chaired by an expert in the field, several of whom will give plenary talks at the general sessions. In the course of three months leading up to the conference, a special on-line study forum will be conducted on the impact of large-scale power production on climate change. The results of this pre-conference forum will be presented at a general session, followed-up with open-question forum discussions to further explore major new research topics which emerge from the study.

The conference will bring together a diverse interdisciplinary group to focus on learning how the science and technology of space impacts environmental protection on and above the surface of the earth. The six tracks cover the causes, effects, extent, prevention, reduction and even elimination of water pollution and air pollution. At the end of the conference, a website compendium will be published, including slides from the plenary lectures, formatted papers from the technical tracks, images of poster sessions, a summary of the findings of the pre-conference forum, and a digest of the new research topics and panel discussion high-points.

The tentative venue for the conference is Denver, Colorado, this being geographically central, and also nearby to a number of corporations, universities, federal agencies and national labs which will find interest in the Planet Earth and Space Conference. Colorado is now the second largest employer of aerospace engineers, and the state is home to at least 60 environmental organizations. The date of the conference includes a full moon, and the season promises pleasant weather. Attendance figures are budgeted at 800, although the National Space Society's annual International Space Development Conference, held for the past 26 years, has drawn up to 1300 attendees.

A number of the nation's top researchers have already agreed to present plenary lectures and to chair technical tracks. The Earth and Space Foundation has pledged their support. In the time NSS has been planning this conference, the response from our queries have been people excited at what we aim to accomplish, and interested to participate. The inaugural Planet Earth and Space Conference could become a major focus for advancing the science and technology of environmental protection.

CONFERENCE PLAN

Objectives

The Planet Earth and Space conference plan addresses three of the goals and objectives of the EPA Strategic Plan.

- Atmospheric studies conducted via satellites, airplanes, and high-altitude platforms are an essential part of clean air and global climate change, and this conference will enhance the science and research in this field (Goal 1, Objective 1.6).
- The operation of airplanes and space vehicles in the earth's atmosphere is a relatively new topic of concern, and will be the subject of one technical track. Multi-spectral satellite imagery has been instrumental in studying the origins and effects of water pollution (Goal 2, Objective 2.3).
- Of greatest interest to the organizers of this event is environmental stewardship, and enhancing society's capacity for sustainability through science and research (Goal 5, Objective 5.4).

Though targeted at the Technology research program area (5), the Planet Earth and Space conference also addresses the areas of: (2) ecosystems, water and security, (3) economics and sustainability, and (4) air and global climate change. The conference will advance scientific and technical research promoting environmental protection, explore current and emerging areas of research, and encourage collaboration the world's best scientists, engineers, and academicians.

Expected results are high-quality technical papers supporting environmental protection and human health, and identification of potential research needs. The topics to be discussed are of global importance. Humankind is learning that we are all downstream of ourselves. Spaceflight has shown us that the earth is a small place without the borders one sees on every map. This is called the Overview Effect, and has made a profound effect on astronauts for forty years. Monitoring from orbit provides us unprecedented visibility of the earth, clearly showing the results of human activity on our planet. Mother Earth and Father Sky come together in this unique confluence of atmospheric scientists, aerospace engineers, and environmental researchers.

Threshold Criteria

The National Space Society (NSS) is an independent, educational, grassroots, non-profit organization dedicated to the space exploration, education and research. Founded as the National Space Institute (1974) and L5 Society (1975), which merged to form NSS in 1987, NSS is widely acknowledged as the preeminent citizen's voice on space. NSS is a tax-exempt, 501(c)(3) educational, not-for-profit corporation, with tax ID 23-7417411. NSS has over twelve thousand members (and more supporters) and over 50 chapters in the United States and around the world. The society also publishes Ad Astra magazine, an award-winning periodical chronicling the most important developments in space.

The proposed conference consists of activities within the statutory terms of EPA's financial assistance authorities, including 40 CFR Part 30 (Uniform Administrative Requirements for

Grants and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations), and OMB Circular A-110 (Uniform Administrative Requirements for Grants and Other Agreements with Institutions of Higher Education, Hospitals and Other Non-Profit Organizations) relocated to 2 CFR Part 215. The Planet Earth and Space conference addresses the causes, effects, extent, prevention, reduction and elimination of air pollution, solid waste and toxic substances, and how these impact water pollution.

The conference will advance scientific and technical research promoting environmental protection, explore current and emerging areas of research, and encourage collaboration the world's best scientists, engineers, and academicians. It is not uncommon to find technologists focused on a specific field but who have a great concern for larger issues. It is uncommon to find a conference that combines multi-disciplinary tracks of technical presentations and poster sessions as will be described below. The Planet Earth and Space conference has the potential to build better bridges between disparate research areas, bringing people together in a new way. Engaging speakers from a variety of backgrounds will address the plenary sessions, painting the broader picture for a reference frame within which the conference will operate. It should be expected that fresh, exciting research comes from this unique gathering. In particular, a pre-conference on-line study group will be formed from an interdisciplinary group, and their results shared at the conference. The results of this study will be advanced still further, on the conference's last day, while the issues are still fresh in everyone's mind, to identify key areas of needed research relating to environmental protection and human health.

Evaluation Criteria

The scientific research issues to be addressed are divided into six technical tracks. Each track will have two sessions in each of two days. Three tracks will be concurrent, but the grouping of tracks will be changed for the second day, to permit conference goers greater flexibility in attending multiple areas of interest.

TRACKS

1. Earth Imaging and Monitoring – *satellites orbiting the earth monitor key atmospheric measures, show us the effects of climate change, and help explain the role of the sun on our biosphere.*
 - a. Atmospheric radiation (IR balance in greenhouse effect)
 - b. Ozone detection (UV balance)
 - c. Photos of smog, pollution, ocean dead-zones from orbit
2. Space Habitat Simulators and Biospheres – *long tours of duty aboard the International Space Station, and terrestrial simulators of closed habitats teach us the cycles of life, show the consequences of our waste, and help us understand that, ultimately, we live downstream of ourselves.*
 - a. Mars
 - b. Moon
 - c. Arctic
 - d. Biospheres
3. Space Technologies ameliorating Climate Change – *human activity requires copious energy and massive use of material resources, and economic growth in developing nations accelerate the impact to our global climate, yet space-based technologies may show us a way through to a more sustainable future for us all.*

- a. Atmospheric cleaning
 - b. Solar Shield
 - c. Diverting Hurricanes
 - d. Compliance monitoring
 - e. Monitoring of ocean seeding
4. Reducing the Environmental Impact of Air & Space Travel - *increased air travel worldwide, and expanding activities in space leave effluents in the air which must be considered in the business of aerospace, the setting of public policy, and the choices made by each of us as individuals.*
- a. Contrails
 - b. Toxic propellants
 - c. Non-chemical launches
 - d. Space Elevator
5. Humanities and Planetary Consciousness – *images from space, and the testimony of astronauts show us the interconnectedness of all people and all life on earth.*
- a. Astronauts - “overview effect”
 - b. Space tourists
 - c. Philosophers, artists, writers, poets, visionaries
 - d. Policy analysts and international treaties
6. Space-based Sustainable Commerce – *satellites allow rapid and reliable communication of voice and data without the need for wires while other satellites provide valuable monitoring of land, water and air quickly and effectively. Eventually more value-added services and goods made in space may help sustainable commerce for all mankind.*
- a. Information technology and telecommunications
 - b. Manufacturing
 - c. Energy
 - d. Tourism & Settlement

These technical tracks will attract the world’s best researchers working on mankind’s most pressing problems. Independent research brought to the conference will be supplemented by active research to identify new areas for further study, providing a solid foundation for the year two. In this way, the conference becomes organic, adapting to the needs and interests of the attendees and the EPA. Year by year, the participation will grow as scientists and engineers find a forum to bring their own work into a larger effort to strengthen environmental protection and to protect human health in our biosphere.

A web page associated with the NSS website (www.nss.org) will be used to post the output of the conference. Five such output categories will be published and disseminated broadly: (1) peer-reviewed technical papers; (2) slides from plenary speakers; (3) images of artwork from the Student Poster session and from the Artist Poster session, (4) results of the pre-conference on-line study; and (5) a digest of the open forum discussion on the pre-conference study identifying and clarifying new avenues of scientific and technical pursuit.

The National Space Society annually puts on the ISDC, or International Space Development Conference. This international conference is in its 27th year, and 2008 attendance is estimated at more than 1,500. The ISDC has brought recognized leaders as keynote speakers, including Elon Musk, CEO of Space Exploration Technologies, named by Inc magazine as the

Entrepreneur of the Year in December. Other speakers include General Pete Worden, head of NASA Ames Research Center, famous for his work (with Roger Angel) to study a solar shade installed between the earth and the sun, to modulate climate change. The NSS Board of Governors, chaired by former anchorman Hugh Downs, includes seven astronauts, as well as more terrestrial stars passionate about environmental issues, such as Tom Cruise and Tom Hanks. Forward thinkers such as Sir Arthur C. Clarke, Peter Glaser and Freeman Dyson also serve on the Board of Governors. The international network of concerned scientists and engineers reachable through the NSS gives the Planet Earth and Space conference incredible leverage to attract the best people in their fields.

Speakers for the proposed conference enlisted to date include **Prof. Berrien Moore**, Distinguished Professor at University of New Hampshire, former chairman of the Nobel Peace Prize winning International Panel on Climate Change. Prof. Moore chaired the 2001 Open Science Conference on Global Change in Amsterdam, and has published more than 150 papers on the carbon cycle, global biogeochemical cycles, and global climate change. Another speaker, and organizer of Technical Track 2 is **Prof. Eugene Hargrove**, Professor at University of North Texas. Prof. Hargrove has published a book, many book chapters and over 150 papers on areas such as environmental ethics and the relation of the environment to space. With considerable experience organizing and running conferences, Prof. Hargrove will be an invaluable asset. **Frank White** of Harvard University has also agreed to speak. His book, The Overview Effect, brought to the world the profound experience of astronauts who have orbited the earth, looking down from a hundred miles high, moved by the beauty and the connectedness our precious planet. **Mr. Howard Bloom** has also agreed to contribute. Mr. Bloom has published three books which have won critical acclaim, including The Lucifer Principle: A Scientific Expedition into the Forces of History. He founded the Space Development Steering Committee in 2006 at the urging of astronaut Dr. Buzz Aldrin. Mr. Bloom's involvement in the conference was recommended by astronaut Dr. Edgar Mitchell.

The technical organizer of the conference, Dr. Peter J. Schubert, has published over 50 technical papers, and been granted 26 US patents in fields as diverse as integrated circuit technology, holography, crash-sensing algorithms, space-based manufacturing, in-space propulsion, artificial intelligence, system modeling and simulation, and engineering education research. Together with other NSS members, Dr. Schubert brought together the multidisciplinary intent of the conference representing atmospheric scientists, aerospace engineers and environmental researchers. He serves as Senior Director for Space, Energy and Education Research at Packer Engineering, Inc., a consulting engineering firm in Naperville, IL. Dr. Schubert has served as principal investigator on grants from NASA, from the DOE, and from the GSA.

Co-chairing the conference will be Prof. Charles Cockell. Dr. Cockell is a Professor and the Chair of Microbiology at the Open University in the United Kingdom. He has published widely, and his most recent book, 'Space on Earth', explores the links between environmentalism and space exploration.

Dr. Cockell is the Chairman of the Board of the Earth and Space Foundation, which will serve as co-host of the conference. He founded the Earth and Space Foundation in 1994. Prof. Cockell has led or participated in many expeditions around the world with different organizations, including the British Antarctic Survey, NASA, the U.S. Antarctic Program, and the U.S. Fish and Wildlife Service. In 1990, he led the first western expedition to visit post-communist Mongolia. His team covered 2,500 kilometers across the steppes and mountains of the country. In 1993, he led an expedition to Indonesia, where he piloted an insect collecting ultra-light aircraft above

the rainforest canopy. More recently, he has undertaken biological work with the NASA Houghton-Mars Project, a NASA Mars analog project in the Canadian High Arctic. Prof. Cockell received his first degree in Biochemistry from Bristol University and his doctorate in Molecular Biology from Oxford University. He was a National Academy of Sciences Associate at the NASA Ames Research Center in California for two years, and spent two years as a Visiting Scientist at Stanford University and the University of Arizona. He then spent four years working at the British Antarctic Survey. He is an alumnus of the International Space University's 1991 summer session. He is a Fellow of the British Interplanetary Society, the Royal Geographical Society, the Royal Astronomical Society and the Explorers Club of New York. He was a 1993 Fellow of the Winston Churchill Memorial Trust and recipient of the 1993 Pol Roger Award.

This proposal has the whole-hearted support and generous contributions by the NSS Executive Director, George Whitesides. Mr. Whitesides is known to the space community worldwide, as the leader of the world's largest citizen space organization. Through his contacts, the speakers above have come forwards, and many more are expected.

Ms. Bernessa Wilson will serve as the conference manager. Ms. Wilson has a BA in Marketing plus 10 years experience with event planning and managing, working with companies such as RR Donnelley, Pepsi, and many others. She will also be able to draw upon the experience base at NSS headquarters to put on a really great event. Marketing the program is important to reach all the interested parties. In addition to advertising in the NSS publication *Ad Astra*, Ms. Wilson will conduct targeted mailings, web advertising and print ads in selected trade magazines.

Additional leverage comes as in-kind contributions from Dr. Schubert, who will volunteer time to organize the technical portion of the conference. The dollar value of this contribution is expected to be over \$10,000.

Past performance on federally funded assistance agreements is demonstrated by projects completed by Dr. Schubert, as well as the legacy of successful conferences put on by the NSS. Projects in the last 3 years for which Dr. Schubert served as principal investigator are:

- Edison Materials and Technology Center (EMTEC, Dayton, OH), Hydrogen Program Agreement, grant number EFC-H2-03, entitled "Hydrogen Storage using Porous Silicon," for \$87,939 in direct funds, plus \$87,939 of in-kind cost sharing by Delphi Corporation (Dr. Schubert's employer at the time) from July 2005 through March 2006. The project was completed under budget and on-time, with all deliverables being received by EMTEC before 22 March 2006. Final payment was received by Delphi.
- National Aeronautics and Space Administration (NASA), Small Business Innovation Research program, Phase I award, grant number NNM07AA54C, project 06-X4.02-9797, entitled "Lunar Oxygen and Silicon Beneficiation Using Only Solar Power," from 19 January 2007 to 23 July 2007 for \$99,998. The project was completed on-time and on-budget, with all deliverables provided on 23 July 2007. Packer Engineering received final payment.
- General Services Administration (GSA), Office of the Chief Architect, fixed price contract, PJ6P00436 entitled "3D Laser Scanning Pilot Project," for \$24,604, starting 16 October 2006. All deliverables were provided before 13 October 2007, and final payment was received by Packer Engineering.

Budget Justification

Conference registration will be \$50 for all attendees. This will generate program income of \$40,000 figuring attendance at 800. An optional banquet dinner will be offered at \$50 per plate. The banquet dinner is planned to be budget neutral, and does not figure into the request to the EPA or the program income, since these monies will be passed directly to the catering service.

The \$36,900 for Personnel includes expenses and a \$500 honorarium for 6 key speakers, expenses for NSS staff, the conference manager salary, and the on-site staff at the conference. The travel expense of \$7,700 covers the key speakers and the NSS staff. Equipment of \$19,290 includes rental of audio-visual and communications equipment, plus purchase of small items needed to organize the conference. Under Supplies, a subtotal of \$51,110 covers three meal/social events (juice and cheese reception, lunch on day 1, and a continental breakfast on day 3); funds for handouts and notepads for each attendee, and a marketing budget of \$10,000 (print ads, web ads, mailings), and a miscellaneous expense fund of \$3,110 (as needed for software to support on-line peer review of submitted papers).

The Earth and Space Foundation

"Environmentalism for a Space-faring Civilization"



Dr. Charles Cockell
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Open University
Milton Keynes
MK7 6AA


January 8, 2008

Dear EPA Reviewer,

The Earth and Space Foundation strongly supports the proposal by the National Space Society for a technical conference on environmental science and space engineering. This is an important and novel approach, sure to generate fresh and relevant results in research and development. We recommend that the EPA approve this request.

Sincerely,

Charles Cockell

<p>The Moon Society</p>  <p>www.moonsociety.org</p>	<p><i>An international nonprofit 501(c)3 educational and scientific organization formed to further the creation of communities on the Moon involving large-scale industrialization and private enterprise.</i></p> <p>P.O. Box 940825 Plano, TX 75094-0825</p>
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Dear EPA Reviewer,

The Moon Society strongly supports the proposal by the National Space Society for a technical conference on environmental science and space engineering. This is an important and novel approach, sure to generate fresh and relevant results in research and development.

We recommend that the EPA approve this request.

Sincerely,

Peter Kokh, President
kokhmmm@aol.com - (414) 342-0705

Data Statement

The starting website for the conference will be a sub-folder of the NSS website (www.nss.org), and will migrate to its own domain (likely name www.planetearthandspace.com) as it develops. This is analogous to how the ISDC conference is run, having its own domain at <http://isdc.nss.org/2006/>. As part of the marketing effort, we will solicit hotlinks on the websites of professional societies in the sciences and engineering of space, environment and atmosphere including, but not limited to, the following:

- American Geophysical Union
- American Meteorological Society
- American Society of Agronomy
- International Union of Soil Sciences
- National Weather Association
- Soil Science Society of America
- Soil and Water Conservation Society
- National Registry of Environmental Professionals
- Ecological Society of America
- Environmental & Water Resources Institute (part of Am. Soc. Civil Engrs.)
- American Astronautical Society
- Aerospace Industries Association
- The American Physical Society
- American Institute of Aeronautics and Astronautics
- Society of Professional Engineering Employees in Aerospace
- The Planetary Society
- Space Frontier Foundation
- The Mars Society
- The Moon Society
- Students for the Exploration and Development of Space
- Society of Automotive Engineers
- The X-Prize Foundation

The website will include registration, on-line abstract and paper submission, calendars, special event and venue information. By including links to such a wide variety of well-visited websites, the weighting factor for search engines will be increased, bringing our link to the top of searches using Google, Yahoo or Dogpile (a meta search engine).

After the conference, the results (listed above) will be posted on the website, with hotlinks to the front page. In this way, interested persons who learn about the conference too late will still be less than 2 mouse-clicks from technical content. A pleasant aspect of the Planet Earth and Space conference is the abundance of beautiful imagery. These will be used to create a website both beautiful and functional.