Supporting Planetary Exploration

Position Statement: The Geological Society of America (GSA) supports planetary exploration to advance research concerning the evolution of Earth; to deepen and expand human understanding of our place in the universe; to reinforce science, technology, engineering and math (STEM) education and effective training of the next generation of scientists; to increase U.S. competitiveness in science and technology development; and to enhance the quality of life through technological innovation.

Purpose: This position statement (1) summarizes the relevance and benefits of planetary exploration to national and international leadership in science and technology research, development, and education; (2) describes workforce development and the key role that geoscientists play in both historical and future exploration missions through continued civilian exploration programs; and (3) provides recommendations for policy decisions related to the importance of science support for both U.S. and international collaborative space exploration missions to the Moon and to other solar system bodies beyond Earth.

Rationale

Early planetary exploration missions (including the first human explorations on the Moon) were initially designed as demonstrations of technology development and global leadership in space. While science was a tertiary objective, the underlying science was inherently geologic and geophysical in nature. Through 50 years of space exploration, planetary exploration missions have supported a growing population of planetary scientists along with an increasing appeal to students, especially those in geology classes. Over this time, the U.S. and other nations have launched many successful exploration missions to planets, moons, comets, and other objects throughout the solar system, including returning samples of solar wind particles, asteroids, and comets to Earth. Today, planetary missions are designed to collect data to better understand the history and workings of the entire solar system, to gain insight into the formation and evolution of Earth and the other planets, to understand how life began on Earth, and to determine whether extraterrestrial habitable environments and life forms exist (or ever did exist) elsewhere in the solar system or beyond.

To support these missions, planetary scientists engage in both terrestrial field studies and Earth observation to examine geologic features and processes that are common on other planets, such as impact structures, volcanic constructs, tectonic structures, and glacial and fluvial deposits and landforms. Geochemical studies include investigations of extraterrestrial materials now on Earth, including lunar samples, tens of thousands of meteorites, cosmic dust particles, and, most recently, particles returned from comets and asteroids. It is clear that planetary exploration has successfully stimulated research across diverse geoscience topics and disciplines.

While most of the U.S. electorate know of and take pride in space program accomplishments, few reflect on or know about the fundamental scientific research conducted during exploration and the importance of geoscientists in determining new knowledge that bears directly on our understanding of the Earth's formation as well as that of other objects throughout the solar system. It is a natural extension of the basic goals of GSA to expand geosystems knowledge to encompass our solar system as well as the many planets now being discovered around other stars.

Public Policy Aspects

Exploration of other planets in the solar system requires major national and international initiatives, significant funding levels, and long timelines for mission planning and collaborative research. For scientists, the funding cycle is much shorter than typical mission cycles, and in particular, graduate student and career-development timelines are much shorter than mission timeframes. Therefore, the growth and continued development of a robust workforce capable of conducting complex space missions and analyzing the scientific data returned from such missions does not depend on individual missions as much as it depends upon a consistent, sustained program that educates and develops planetary scientists. Public expenditures and investments are often controversial, yet planetary exploration has a proven record of benefits that include stimulation of the general economy through public and corporate investment, educational investment in STEM, and technology spin-offs to industry.

The GSA membership includes many geoscientists who count planetary science studies as part of their research portfolio or who have entered the geosciences because of inspiration from the Apollo missions and spacecraft exploration of other planets. The involvement of GSA members in planetary exploration supports collaborative research and stewardship of extraterrestrial bodies like the Moon, the planets and their satellites, near-Earth objects, and other small bodies throughout the solar system. With the realization that planetary exploration requires significant levels of government funding, GSA should support planetary exploration through informed advocacy in focused, responsible, and collaborative ways.

Recommendations

The Geological Society of America recommends the following:

- *Informed public advocacy of continued government investment in planetary exploration missions.* Support for planetary studies, of necessity, requires large expenditures at local, state, national, and international levels.
- *Increased interactions between the geoscience community and all elected government officials and lawmakers, managers, and scientists at all space agencies (e.g., NASA, ESA, etc.), as well as higher education institutions (especially those with planetary sciences in their curricula), space grant consortia, K–12 educators, and, most importantly, the general public.* Planetary exploration and research require scientific literacy, intellectual support, and thoughtful dialogs with policy makers.
- *Expansion of public programs that utilize space exploration results to maintain science and technology growth.* Most of the world populace does not appreciate how planetary exploration has stimulated advances in numerous fields of study and supported the development of new technologies and economic growth across a broad portfolio (e.g., imaging systems, geographic information systems, new materials).
- *Expansion of education programs using examples and results from planetary missions.* The integration of all basic sciences (i.e., chemistry, physics) into planetary research endeavors is essential to the scientific literacy of the populace, and a major emphasis should be placed on engaging the STEM student population.

References and Resources

- **National Aeronautics and Space Administration**, www.nasa.gov. For information specific to planetary exploration, see either www.nasa.gov/topics/moonmars/index.html, or www.nasa.gov/topics/solarsystem/index.html.
- **European Space Agency**, www.esa.int/esaCP/.
- **Planetary Science Decadal Survey**, http://sites.nationalacademies.org/SSB/CurrentProjects/ssb_052412. Results of a recent survey of planetary scientists for plans for the next ten years.
- **NASA Planetary Photojournal**, http://photojournal.jpl.nasa.gov/index.html. Site to access images and explanatory text for publicly released planetary data.
- **Chronology of Lunar and Planetary Exploration**, http://nssdc.gsfc.nasa.gov/planetary/chrono.html.
- **NASA Spinoffs**: www.sti.nasa.gov/tto/ or www.thespaceplace.com/nasa/spinoffs.html.

About the Geological Society of America

The Geological Society of America, founded in 1888, is a scientific society with more than 25,000 members from academia, government, and industry in more than 100 countries. Through its meetings, publications, and programs, GSA enhances the professional growth of its members and promotes the geosciences in the service of humankind. GSA encourages cooperative research among earth, life, planetary, and social scientists, fosters public dialogue on geoscience issues, and supports all levels of earth science education. Inquiries about the GSA or this position statement should be directed to GSA's Director for Geoscience Policy, Kasey S. White, at +1-202-669-0466 or kwhite@geosociety.org.

Opportunities for GSA and GSA Members To Help Implement Recommendations

To facilitate implementations of the goals of the position statement, The Geological Society of America recommends that its members take the following actions:

- Become informed about opportunities to meet with elected officials at all levels; tell them about the importance of sustained support by space-faring nations for exploration missions and the analysis of scientific data obtained from planetary exploration efforts. Elected government officials need to hear from their constituents that continued support is essential for the maintenance of a healthy planetary exploration program with specific information regarding planetary exploration initiatives. Highlight the broad scientific value derived from planetary exploration, and emphasize the need for consistent funding levels to sustain long-term exploration efforts. Letters, phone calls, and emails to representatives make a difference, particularly when they come from constituencies not in proximity to a major space facility.
- Encourage all scientists to take more active roles in various governmental agencies and in interactions with Congress. Not every GSA member can be a congressional liaison, but everyone can take an active role in participating in various governmental efforts at local, state, and federal levels. In particular, planetary scientists should get involved in whatever aspect of government might interest you, and watch for any opportunity to highlight the broad scientific value derived from planetary exploration.
- Look for any opportunity to share the results of planetary exploration. The GSA community represents a very special intellectual medium through which the science knowledge of all people can be expanded. GSA members can play a pivotal role in communicating both the scientific and educational benefits derived from space exploration missions to the worldwide populace, including to elected officials. Members are encouraged to take advantage of all venues of communication regarding what has been learned during five decades of planetary exploration. Both in the classroom and in public forums, GSA members can be proactive in emphasizing how results from planetary exploration have contributed to science in general and the geosciences in particular and how this exploration has provided exciting new media for education. GSA members should consider including planetary exploration subjects in their public lectures, in talks given to K–12 school classrooms, as well as within undergraduate or graduate level science courses, particularly any subject related to the geosciences.
- Be prepared to explain how technological spinoffs derived from planetary exploration are a part of modern life. For example, spacecraft camera design has stimulated many developments in charge coupled devices (CCDs), the basis for practically every modern imaging device, whether used in a pocket camera, a smart phone, or security systems. The scientific and technological advancement of a nation is often greatly benefited by developments used to support various aspects of planetary exploration.