“How do we build connections with Chinese space science given the constraints on cooperation?”

SSB Chair David Spergel

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The Transit Expedition of 1769 and US-Chinese Cooperation in Space

How big is the Solar System? This profound question motivated the eclipse expeditions of 1761 and 1769. While sometimes called “The Apollo Project of the 18th century,” the ambitious multinational program of measuring the transit of Venus is more akin to the International Space Station or, perhaps, our multinational explorations of Mars.

Despite the Seven Years War, a true world war, British and French astronomers navigated the globe to observe the first of these transits from multiple vantage points. Russian and Swedish astronomers joined this first truly international effort. In 1769, a more ambitious program included observations from 400 viewing points with Benjamin Franklin leading the effort in the colonies. These measurements not only provided an accurate measurement of the distance to the Sun, but also began a new era of international scientific cooperation.

Captain Cook’s eclipse expedition may best epitomize the deep linkage between exploration and science. While one of the goals of Cook’s journey to Tahiti was to observe the transit through Tahiti’s clear skies, the expedition also had both military and commercial goals. Cook searched for the postulated Terra Australia, reached Botany Bay, and produced nautical charts of the Pacific. The scientific benefits of Cook’s journey went beyond astronomy and include Sir Joseph Banks’ botanical discoveries.

Two hundred and fifty years later, driven by profound questions, including “Is there life beyond Earth?,” and by the need to understand our planet in the midst of dramatic climate change, we are in the midst of a new age of exploration and scientific discovery. Just as in the 18th century, our program of discovery is international. However, as during the observations of Venus, frictions between the two leading economic powers of our age limit international scientific cooperation.

The relationship between the United States and China will play a central role in establishing the world order. Scientists form an international community within that paradigm, and space science has the potential to be a very visible area of international scientific cooperation. However, the U.S. Congress has limited NASA’s ability to work with China’s growing space program.

How do we build connections with Chinese space science given the constraints on cooperation? Just as the early European scientific associations played a leading role in organizing the eclipse observing program, one of the roles of the National Academy of Sciences is to organize conferences and workshops that bring together researchers from across the globe to exchange ideas and promote collaboration. In the same vein and as part of an effort of building stronger ties between early career space scientists in the United States and China, the Space Studies Board and the National Space Science Center of the Chinese Academy of Sciences have been organizing pairs of conferences held in the U.S. and China. The first Forum for New Leaders in Space Science, started under Charlie Kennel’s leadership of the SSB, focused on astronomy and heliophysics at its meetings in May and November of 2014. We are now in the midst of planning for the second meeting whose focus will be on Earth science and planetary science. Hopefully, some of these early career scientists will follow in the footsteps of their 18th century predecessors and build international collaborations that will address the profound scientific questions and challenges of our time.

David Spergel, Chair

The views expressed here do not necessarily reflect those of the SSB or the National Research Council.
On October 16, 2014, President Barack Obama announced his intent to nominate SSB Board Member Dava Newman to the post of Deputy Administrator for NASA. Dava Newman joined the SSB in 2013. She has served on many committees, including a panel on the Committee on Human Spaceflight, the Committee on NASA Technology Roadmap, and the Aeronautics and Space Engineering Board. She currently serves as professor of aeronautics and astronautics and engineering systems at the Massachusetts Institute of Technology.

SSB Chair, David Spergel and Marc Kamionkowski (Johns Hopkins University) won the 2015 Dannie Heineman Prize for Astrophysics. The award is given by the American Institute of Physics (AIP) and the AAS to recognize outstanding work in astrophysics (with funding by the Heineman Foundation). They were chosen for the award in recognition of their outstanding contributions to the investigation of the fluctuations of the cosmic microwave background, which have led to major breakthroughs in our understanding of the universe. David Spergel is an astrophysics at Princeton University. In addition to his current service a Chair of the SSB he has also served a on a multitude of NRC committees.

Meng Su, participant in the first Forum For New Leaders In Space Science, has been awarded the American Astronomical Society 2014 Rossi Prize. Meng Su is an Einstein/Pappalardo fellow of physics at the Massachusetts Institute of Technology (MIT). The award was shared with Douglas Finkbeiner of the Harvard-Smithsonian Center for Astrophysics and Tracy Slatyer of MIT for their discovery in gamma rays of the large, unanticipated galactic structure now called the “Fermi bubbles.”

A former member of the Astro2010 Panel on Optical and Infrared Astronomy from the Ground, Daniel Eisenstein (along with Shaun Cole and John A. Peacock) won the 2014 Shaw Prize for their contributions to the measurements of features in the large-scale structure of galaxies used to constrain the cosmological model, including baryon acoustic oscillations and redshift-space distortions. Dr. Eisenstein is a professor of astronomy at Harvard University. He was elected to the NAS in 2014 for his contributions to cosmology.
SSB ACTIVITIES

THE BOARD AND ITS STANDING COMMITTEES

The Space Studies Board (SSB) met November 5-6, 2014, at the Arnold and Mabel Beckman Center of the National Academies in Irvine, CA. On the first day of the meeting, the Board heard reports from the chairs of the standing committees they have oversight of, including CAA, CAPS, CESAS, CSSP, and CBPSS (see more information on the standing committees below) and then discussed the upcoming NRC Space Science Week (see more information on page 8). The Board was then briefed on international activities, including COSPAR (David Smith, COSPAR National Committee Executive Secretary) and recent ESSC activities (Jean Pierre Swings and Athena Coustenis, the outgoing and incoming chairs of the ESSC). The board next discussed current and future SSB activities, including the status of the 2014 workshop, Sharing the Adventure with the Student apotential upcoming study on the current state of space law and the next decadal survey in Earth science and applications from space. The Board was briefed by Robert Lightfoot and Lesa Roe from NASA on NASA’s Technical Capability Assessment and Capability Leadership Models. The first day ended with a focus session on the scope and nature of future mid-term decadal reviews, which included a presentation from Stacey Boland (former committee member of the Earth Science and Applications from Space Mid-term Assessment) on the process and outcomes of that mid-term decadal review; a presentation from Marc Allen, NASA, on things to be considered from NASA’s point of view; and a panel discussion with representatives of each of the completed mid-term reviews (Stacey Boland, Earth science; Megan Donahue, astronomy and astrophysics; Rod Heelis, heliophysics; and Wes Huntress, planetary science). The second day of the meeting started with a presentation from Marc Allen on NASA’s perspectives from the meeting and the SSB’s future agenda, followed by a discussion between the Board and Dr. Allen on potential future activities. The Board then heard from Chris Scolese, NASA Goddard Space Flight Center, on his perspectives on mission management and lessons learned at GSFC.

The SSB’s next full committee meeting will be held April 22-23, 2015, at the National Academy of Sciences Building in Washington, DC. Visit www.nasa.gov/ssb to stay up to date on board, workshop, and study committee meetings and developments.

The Committee on Astronomy and Astrophysics (CAA) met on November 3-4, 2014, in Irvine, CA. The committee received an update on the James Webb Space Telescope (JWST), a briefing on the NRC’s Evaluation of the Implementation of WFIRST/AFTA in the Context of New Worlds, New Horizons in Astronomy and Astrophysics report, and a Wide Field Infrared Survey Telescope (WFIRST)/AFTA Science Definition Team (SDT) update. NASA, National Science Foundation (NSF), and Department of Energy (DOE) updates were provided to the committee as well. Topics of discussion with NASA, NSF, and DOE pertaining to the mid-decadal study included timing, scope and charge, expected outcomes, and impact on other ongoing and future reports. Paul Hertz, NASA, discussed preparation for the 2020 decadal survey with the committee.

The second day of the meeting included updates on planning for the International Astronomical Union (IAU) General Assembly and the NRC ground-based optical and infrared (O/IR) study. The committee also discussed the draft NASA astrophysics implementation plan. The next meeting of CAA will take place March 31 - April 2, 2015, in Washington, DC as part of the NRC Space Science Week (http://sites.nationalacademies.org/SSB/SSB_153443). For more information about CAA and to learn about upcoming meetings, please visit http://sites.nationalacademies.org/BPA/BPA_048755.

Member appointments were completed for the Committee on Biological and Physical Sciences in Space (CBPSS) during this quarter, and plans were made for the first meeting of the committee which was held on October 7-8, 2014, in Washington, DC. The first meeting focused on presentations from and discussion with NASA regarding the content and plans for various research programs within NASA’s Space Life and Physical Sciences Research and Applications Division. The next meeting will be held as part of NRC Space Science Week. Information about the committee and its membership can be found at http://sites.nationalacademies.org/SSB/SSB_145312.htm.

The Committee on Earth Science and Applications from Space met on September 17-19, 2014, and therefore did not hold an in-person meeting this quarter. Committee members continued their work in organizing the next NRC decadal survey in Earth sciences, and Mark Abbott, Co-Chair, presented a summary of progress to date on December 17, 2014, at a town hall meeting held in conjunction with the Fall meeting in San Francisco of the American Geophysical Union. The survey’s anticipated start is in Spring 2015; if structured in a manner similar to the 2007 inaugural decadal survey, some 100 community members will be invited to serve on the survey steering committee or one of its study panels. Nominations to the survey may be made by visiting http://tinyurl.com/nzmgozd. The committee’s next in-person meeting will take place as part of NRC Space Science Week, which is being held in Washington, DC, at the NAS Building on March 31-April 2, 2015. Information about the meeting will be posted on the committee’s website at http://sites.nationalacademies.org/SSB/SSB_066587.htm.

The Committee on Astrobiology and Planetary Science (CAPS) did not meet during this quarter. The committee will host its next meeting during NRC Space Science Week in Washington, DC, at the NAS Building on March 31-April 2, 2015. Further information about CAPS, including future meetings, is available at http://sites.nationalacademies.org/SSB/SSB_066587.htm.

The Committee on Solar and Space Physics (CSSP) met on October 7-8 at the NAS Building in Washington, DC. During the meeting, the committee received updates on programs at NASA’s Heliophysics Division (HPD) and NSF’s Division of Atmospheric and Geospace Sciences (GEO/AGS) from Jeffrey Newmark, Inter-
im Director of HPD, and Richard Behnke, Geospace Section Head in GEO/AGS, respectively. An update on the NASA HPD roadmap, which is about to be released, was delivered by WebEx by Ed DeLuca, chair of the 2012 Heliophysics Roadmap Committee. Karel Schrijver, Lockheed Martin, provided the committee with a review of the COSPAR International Living With a Star (ILWS) Roadmap.

The committee also heard a series of presentations as part of its examination of the probability of high-impact space weather events:

- Space Weather from Explosions on the Sun: How Bad Could It Be?, Karel Schrijver, Lockheed Martin Advanced Technology Center
- On the Probability of Occurrence of Extreme Space Weather Events, Pete Riley, Predictive Science Inc. (by WebEx)
- Uncertainties in the Estimation of the Occurrence Rate of Rare Space Weather Events, Jeffrey Love, USGS
- Estimation of Hazardous Electric Fields Induced in the Earth’s Lithosphere During Large Magnetic Storms, Jeffrey Love, USGS
- View from NASA, Lika Guhathakurta, Living With A Star Program Scientist
- Roundtable Discussions, All Participants

CSSP is also pleased to announce the publication of a 32-page booklet that summarizes—at a level appropriate for a broad audience of students, policymakers, and the interested public—the 2013 decadal survey report, Solar and Space Physics: A Science for a Technological Society. Hard copies of this booklet, Solar and Space Physics: A Science for a Technological Society: An Overview, are available from the Space Studies Board; free PDFs may also be downloaded at http://www.nap.edu/catalog.php?record_id=13060. The committee’s next in-person meeting will take place as part of NRC Space Science Week, which is being held in Washington, DC, at the NAS Building on March 31–April 2, 2015. Further information about CSSP, including future meetings, is available at http://sites.nationalacademies.org/SSB/ssb_052324.

**STUDY COMMITTEES**

During this quarter, the ad hoc Committee on a Framework for Analyzing the Needs for Continuity of NASA-Sustained Remote Sensing Observations of the Earth from Space completed its draft report, which entered external review in late November. Assuming there are no unanticipated difficulties in the review process, release to the public of an approved prepublication version of the final report is expected to occur no later than March 31, 2015. Additional information about the committee and its work is available at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_084733.

With funding from NSF, the NRC is conducting a study that will recommend a strategy to optimize the U.S. optical and infrared system in the era of the Large Synoptic Survey Telescope. The Committee on a Strategy to Optimize the U.S. Optical and Infrared System in the Era of the Large Synoptic Survey Telescope was appointed in July 2014 and is led by Debbie Elmegreen (Vassar College). Its first meeting was held on July 31–August 2, in Washington, DC. After its first meeting, the committee requested white papers from the astronomy community to aid its work. The second meeting was held on October 12–13, in Irvine, CA, and the third meeting was held on December 2–3, in Washington, DC. The report is expected to enter the review process in early February 2015. The report is anticipated for release in April 2015. For more information about the committee, please visit http://sites.nationalacademies.org/BPA/BPA_087934.

The ad hoc Committee on Survey of Surveys: Lessons Learned from the Decadal Survey Process held its third and final scheduled meeting at the National Academies Beckman Center in Irvine, CA on December 8–10. A full draft of the committee’s report is currently being assembled; release is currently scheduled for the second quarter of 2015. More information about the committee can be found at http://www8.nationalacademies.org/cp/projectview.aspx?key=49635.

The Space Studies Board and the Board on Science Education held a joint workshop “Sharing the Adventure with the Student” on December 2–3, 2014, at the NAS auditorium, which focused on the contribution of NASA’s Science Mission Directorate to K-12 science education. The workshop served as a venue for dialog between space and Earth scientists, engineers, education specialists ranging from high school principals to informal science education institutions, among others. Dr. John Mather (NAS member, Nobel Prize winner and senior project scientist for the James Webb Space Telescope) gave the opening keynote presentation. The workshop encouraged active participation from all 120 attendees during interactive panel discussions, a poster session, and audience breakout groups to discuss future enabling actions. A report of the workshop will be released in the spring of 2015. For more information, please visit http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_152563.

The ad hoc Committee for the Review of the Mars Exploration Program Analysis Group (MEPAG) Report on Planetary Protection for Mars Special Regions was established jointly by the NRC and the European Science Foundation to review the 2014 Mars Special Regions report issued by the MEPAG and suggest potential modifications to COSPAR’s current guidelines for the planetary protection requirements for such regions. The resulting report from the review shall include recommendations for an update of the planetary protection requirements for Mars Special Regions. The committee’s organizing meeting was held at the European Space Research and Technology Centre in Noordwijk, the Netherlands, on October 7. The committee held its first full, in-person meeting at the German Research Center for Geosciences in Potsdam, Germany, on December 16–17. The committee’s sec-
(Continued from page 5)

ond and final scheduled meeting will take place in Irvine, CA on February 12-13, 2015. The committee’s final report is currently scheduled for release toward the end of the second quarter of 2015.

### Other Activities

The SSB, acting in its role as the U.S. National Committee for COSPAR, is currently working to identify a new U.S. representative to COSPAR following the election of the prior incumbent, Lennard A. Fisk, as COSPAR President in August 2014. It is anticipated that a new U.S. representative will be formally appointed early in the new year. Meanwhile, preliminary work on the organization of COSPAR’s 2018 Scientific Assembly in Pasadena, California continues under the leadership of the chair of the local organizing committee, Gregg Vane, senior executive advisor for strategic planning in the Solar System Exploration Directorate at the Jet Propulsion Laboratory (JPL). Dr. Thomas Prince, director of Caltech’s Keck Institute for Space Studies, and Dr. Rosaly Lopes, senior research scientist and deputy manager for planetary science at JPL have been nominated as chair and vice chair, respectively, of the assemblies’ science program committee.

COSPAR also published Volume 190 of Space Research Today, its quarterly bulletin, in August 2014. Looking forward, the 41st Scientific Assembly will be held in Istanbul, Turkey, on July 30-August 7, 2016.

The SSB and the Chinese Academy of Sciences (CAS) held the second session of the 1st Forum for New Leaders in Space Science at the National Academies’ Beckman Center in Irvine, California on November 3-4. The forum is designed to provide opportunities for a highly select group of young space scientists from China and the United States to discuss their research activities in an intimate and collegial environment at meetings to be held in China and the United States. The first session was held in Beijing on May 8-9. The scientific scope of both events was limited to the general areas of space astronomy and solar and space physics. Both sessions included focused presentations by young scientists interspersed with topical presentations by senior scientists and group discussions. It is anticipated that the next two sessions of the 2nd forum will be held in China in 2015 and in the U.S. in 2016.

### Outreach

The SSB in conjunction with the Division on Earth and Life Sciences exhibited at the American Geophysical Union (AGU) Fall meeting on December 15-19, 2014, in San Francisco, CA. While at the meeting the SSB distributed over 1,000 reports and copies of the Space Studies Boards Compilation of Selected Reports 1958-2014 DVD’s to the attendees. The AGU Fall meeting is a gathering of more than 24,000 people interested in, working, or researching issues related to Earth, atmospheric, oceanic, hydrologic, space, and planetary sciences. Other outreach activities include participation at the American Astronomical Society in Seattle WA, in January 2014, and the Lunar and Planetary Science Conference in The Woodlands, TX in March 2015.
ESA’s Rosetta mission landed a small spacecraft on Comet 67P/Churyumov-Gerasimenko in November 2014 with the world watching. The small craft—named Philae—bounced off the comet, as far as 1 km, before coming to rest in the shade next to a slope. While this shade prevented the craft from recharging its batteries, the little lander was able to send back valuable data before entering hibernation mode. Rosetta team members have already announced that Philae detected organic molecules on the surface and a layer of ice as hard as rock beneath the surface. More announcements about organic molecules and measurements of the comet’s magnetic field, among others, are expected.

Related NRC Reports:

Assessment of Planetary Protection Requirements for Spacecraft Missions to Icy Solar System Bodies
Vision and Voyages for Planetary Science in the Decade 2013-2022

NAE Celebrates Its 50th Anniversary

The year 2014 marks the 50th anniversary of the National Academy of Engineering, and to celebrate, NAE instituted several activities that showcase engineering contributions to human welfare and the needs of society. During its annual meeting in October, NAE gave away $55,000 in prizes to the winners of the Engineering for You (E4U) Video Contest. The Grand Prize winner, which also won the General Public category, was awarded to “Engineering Is Amazing” by Adrian Berger from Cape Town, South Africa. Five additional category winners and two honorable mentions were also announced at the meeting. Additional highlights of the meeting included discussions from three plenary speakers: Secretary of the U.S. Department of the Interior Sally Jewell, Google Executive Chairman Eric Schmidt, and California Institute of Technology Bioengineer Frances Arnold.

A forum, “Celebrating the NAE’s 50th Anniversary: The History of Engineering Over the Past 50 Years and a Look Forward,” took place on the second day of the meeting and was moderated by Ali Velshi from Al Jazeera America. A panel of NAE members discussed engineering accomplishments that have enhanced the quality of life in past 50 years and considered those that may lie ahead.

Carrying on the theme of “past and future,” NAE has released a new collection of essays called “Making a World of Difference: Engineering Ideas Into Reality”, which discusses the integration of engineering into society and our daily lives and presents a vision of what it may deliver in the next half century. – Nicole Flores, courtesy of NAE.
NRC Space Science Week
March 31-April 2, 2015
Washington, DC

The National Research Council’s (NRC) Space Studies Board and Board on Physics and Astronomy invite you to attend a joint meeting of their standing advisory committees. The NRC Space Science Week will take place at the National Academies NAS Building in Washington, DC, March 31-April 2, 2015. At this meeting, the standing committees will convene in plenary, joint, and individual sessions to discuss issues and advances in their fields:

- Committee on Astronomy and Astrophysics (CAA)
- Committee on Astrobiology and Planetary Science (CAPS)
- Committee on Biological and Physical Sciences in Space (CBPSS)
- Committee on Earth Science and Applications from Space (CESAS)
- Committee on Solar and Space Physics (CSSP)

For more detailed information on each of the standing committees, view the individual committee’s website (linked above). This meeting is open to the public.

View more information online at the following website:
http://sites.nationalacademies.org/SSB/SSB_153141

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Our Place in the Universe
As Seen Through Past, Present, and Future Telescopes

The NRC Space Science Week Public Lecture

Wednesday, April 1st, 2015 @ 6:30pm
National Academy of Sciences Building
2101 Constitution Ave., N.W., Washington, DC

Featuring Jason Kalirai
of the Space Telescope Science Institute

Scientist on the James Webb Space Telescope project

nas.edu/SSWLecture
SUMMARY OF A CONGRESSIONAL HEARING OF INTEREST
Committee on Science, Space and Technology
U.S. House of Representatives
Subcommittee on Space
An Update on the Space Launch System and Orion: Monitoring the Development of the Nation’s Deep Space Exploration Capabilities

This summary has been prepared by SSB intern Angela Dapremont as a summary of what occurred at the hearing. The statements made are those of the author and do not represent the views of the participants, the Space Studies Board, or the National Academies.

On December 10, 2014, Mr. Bill Gerstenmaier, Associate Administrator for Human Exploration and Operations Mission Directorate at the NASA and Ms. Cristina Chaplain, the Director of Acquisition and Sourcing Management at the Government Accountability Office (GAO), provided testimony pertaining to NASA's Space Launch System (SLS) and Orion Multipurpose Crew Vehicle (Orion).

Following opening statements from subcommittee members, in which they congratulated NASA for the successful Orion capsule flight test, Mr. Gerstenmaier began with a video demonstrating the work being accomplished at the agency with regard to the exploration program. The images demonstrated that there is a lot of work going on, and significant progress is being made. Ms. Chaplain congratulated NASA and explained that SLS is generally doing a good job with stability; she noted however, there are short and long-term concerns about NASA’s human space exploration program as well as cost concerns.

The archived webcast, including questions from the members related to the NRC report Pathways to Exploration: Rationales and Approaches for a U.S. program of Human Space Exploration is available at:

Testifying before the committee were Mr. Bill Gerstenmaier, Associate Administrator for Human Exploration and Operations Mission Directorate at NASA, and Ms. Cristina Chaplain, Director of Acquisition and Sourcing Management at the Government Accountability Office. [Photo credit: http://democrats.science.house.gov/press-releases]
Future Meetings

SSB Fall 2015 Meeting – November 3-4, 2015, Irvine, CA
NRC Space Science Week, March 29-31, 2016
SSB Spring 2016 Meeting – April 26-27, 2016, Washington, DC

More information on the SSB and ASEB Board meetings is at
<http://sites.nationalacademies.org/SSB/SSB_054577> (SSB) and
<http://sites.nationalacademies.org/DEPS/ASEB/DEPS_058923> (ASEB)
SELECTED REPORTS AVAILABLE FROM THE SPACE STUDIES BOARD

For a complete list of titles visit our website at <http://sites.nationalacademies.org/SSB/ssb_051650>

Free PDF versions of all SSB reports are available online at <http://www.nap.edu> and on the DVD (listed below)

Hardcopy versions of all SSB reports are available free of charge from the SSB while supplies last. To request a hardcopy of a report, send an email to ssb@nas.edu and include your name, affiliation, mailing address, and the name and quantity of each report that you are requesting.

Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration (2014) DVD Only
Space Studies Board Annual Report 2013 (2014) Book and CD
Opportunities for High-Power, High-Frequency Transmitters to Advance Ionospheric/Thermospheric Research: Report of a Workshop (2014)
Lessons Learned in Decadal Planning in Space Sciences: Summary of a Workshop (2013) CD
Landsat and Beyond: Sustaining and Enhancing the Nations Land Imaging Program (2013)
Solar and Space Physics: A Science for a Technological Society (2013) Book and CD
NASA's Strategic Direction and the Need for a National Consensus (2012)
Vision and Voyages for Planetary Science (2012) Booklet
The Role of Life and Physical Sciences (2012) Booklet
Assessment of Planetary Protection Requirements for Spacecraft Missions to Icy Solar System Bodies (2012)
Assessment of a Plan for U.S. Participation in Euclid CD Only

Technical Evaluation of the NASA Model for Cancer Risk to Astronauts Due to Space Radiation
Sharing the Adventure with the Public—The Value of Excitement: Summary of a Workshop (2011)
Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era (2011) Book and CD
Assessment of Impediments to Interagency Collaboration on Space and Earth Science Missions (2011)
Forging the Future of Space Science: The Next 50 Years (2011) CD Only
Panel Reports—New Worlds, New Horizons in Astronomy and Astrophysics (2011)
New Worlds, New Horizons in Astronomy and Astrophysics (2010)
Revitalizing NASA’s Suborbital Program: Advancing Science, Driving Innovation, and Developing a Workforce (2010) CD Only
Defending Planet Earth: Near-Earth Object Surveys and Hazard Mitigation Strategies (2010) CD Only
An Enabling Foundation for NASA’s Space and Earth Science Missions (2010)
Severe Space Weather Events—Understanding Societal and Economic Impacts: A Workshop Report (2008) CD or Executive Summary

If you are unable to email your request, please send a copy of this form to the address or fax number below. Remember to enter the number of reports you wish to receive in the space to the left of each report.

Space Studies Board
The National Academies
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Washington, DC 20001
or fax a copy to: 202-334-3701

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