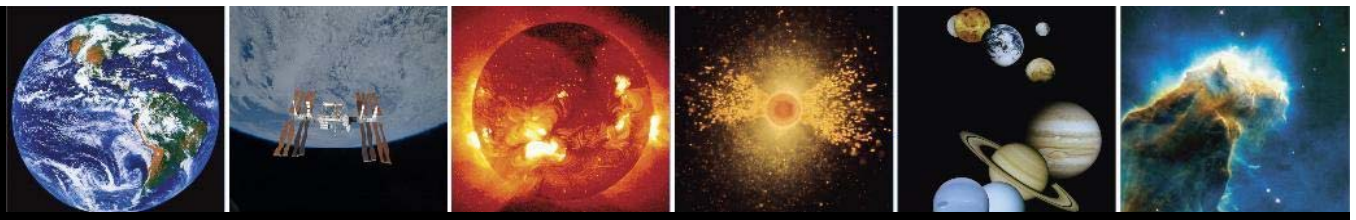
SPACE STUDIES BOARD NEWS



OCTOBER—DECEMBER 2017

INSIDE THIS ISSUE

Space Science Week, a meeting of all 5 of the Board's Discipline/Standing Committees, will take place on March 27-29, 2018 in Washington, DC.

The National Academies of
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SPACE STUDIES BOARD NEWS

FROM THE SSB CHAIR

It was an eventful fall for the Board, with a major scientific breakthrough affecting physics and astronomy, and the completion of the second Decadal Survey for Earth Science and Applications from Space.

On August 17, 2017, a new era in astrophysics was ushered in with the detection of a gravitational wave signal from two merging neutron stars that was accompanied 1.7s later by a flash of gamma-rays detected by NASA's Fermi mission. The follow up of the Advanced LIGO and VIRGO gravitational wave error volume over the ensuing hours to weeks revealed associated electromagnetic signals in the optical/infrared, X-ray and radio by a plethora of ground and space-based observatories. This event, dubbed GW170817, has already provided fundamentally new insights into the decades-old mystery of where many chemical elements heavier than iron are produced, and also yielded new clues about the nature of explosive events called short gamma-ray bursts.

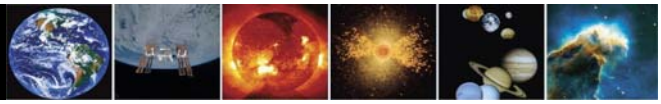
However, t-he transformative nature of this event lies not just in these scientific breakthroughs. GW170817 heralds the dawn of 'multimessenger' gravitational wave and electromagnetic astrophysics, bringing the experimental gravitational physics, and the ground- and space-based astronomy communities together in pursuit of a broad scientific program spanning fundamental physics and general astronomy. This uniting of fields will change the way these communities organize and interact.

The gravitational physics and astronomical communities have different planning processes for prioritizing large projects, and they have different emphases when deciding their scientific priorities. Yet, one of the most scientifically productive research fields in the next decade arguably lies at the intersection of these fields. Going forward, it will be important for the Space Studies Board, the Committee on Astronomy and Astrophysics, and the Board on Physics and Astronomy to ensure that future ground and space projects designed for gravitational wave detection and follow up have the appropriate forums for being evaluated. Most pressing is to consider how to prepare strategies for considering gravitational wave astrophysics in the upcoming astronomy and astrophysics decadal, which is slated to commence in late 2018/early 2019.

The field of exoplanets and the associated search life is another relatively new field that, like gravitational wave physics/astrophysics is inherently cross disciplinary. Addressing questions of exoplanet evolution and habitability requires drawing on astrophysics, Earth sciences, heliophysics, planetary sciences and astrobiology. To prepare input for the upcoming astronomy and astrophysics and planetary sciences decadals, the Space Studies Board has convened two committees to conduct studies on Exoplanet Science Strategy and Astrobiology Science Strategy. These committees will survey the respective fields and recommend scientific strategies, recognizing that progress will draw from many disciplines. Studies like this will become increasingly important as many areas of science increasingly cut across multiple fields.

The second Earth Sciences decadal survey, "Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space", was released on January 5, 2018. The report addresses a very broad range of Earth sciences, and provides recommendations that will advance Earth system science and deliver critical information to support a broad range of national economic and societal needs. The report has been well received by the sponsoring agencies who in the years ahead are expected to fold the decadal's recommendations into their longer-term strategic planning. The report was briefed to senior leaders from NASA, NOAA and USGS, as well as senior staff on Capitol Hill and at the White House—including the newly formed Space Council.

—Fiona Harrison, SSB Chair



SSB ACTIVITIES

THE BOARD AND ITS DISCIPLINE/STANDING COMMITTEES

The **Space Studies Board (SSB)** met November 1-3 at the Arnold and Mabel Beckman Center in Irvine, CA. The meeting's first day included updates from the standing and discipline committee chairs; a status report from and discussion with Thomas Zurbuchen, NASA Science Mission Directorate; a session on international activities, including an update on the board's Forum for New Leaders in Space Science and an update from the European Space Sciences Committee Chair Athena Coustenis; and a focus session on research and analysis programs and improving peer review with Hal Arkes (The Ohio State University) and Scott Highhouse (Bowling Green State University). The second day included a session on planning for the SSB's 60th Anniversary including a discussion of the January 31, 2018 celebration of the Explorer I launch, the 2018 Space Science Week, COSPAR 2018, and the spring and fall board meetings and board workshop. The board also met jointly with the Board on Physics and Astronomy to discuss planning for the next Astronomy and Astrophysics decadal survey. In the afternoon the board had a focus session on Big Data with presentations from and discussions with Daniel Crichton (JPL), Ed Kearns (NOAA), Thomas Huang (JPL), George Djorgovski (CalTech), and Monica Bobra (Stanford). The board then received science talks on gravitational wave astronomy from Dave Reitze (LIGO) and Mansi Kasliwal (CalTech). The board's next meeting will be held in Washington, DC on May 1-3, 2018. May 1 will be a joint session with the Aeronautics and Space Engineering Board. More information on the SSB can be found at http://sites.nationalacademies.org/SSB/index.htm.

The **Committee on Astrobiology and Planetary Science (CAPS)** did not meet during this quarter. The committee's next meeting is scheduled to take place at the National Academy of Sciences Building in Washington, DC on March 27-29, 2018 during Space Science Week. More information on CAPS can be found at http://sites.nationalacademies.org/ssb/ssb_067577.

The **Committee on Astronomy and Astrophysics (CAA)** held its fall meeting on October 24-25 at the Beckman Center in Irvine, CA to discuss planning for the next decadal survey in astronomy and astrophysics and other topics. At the American Astronomical Society Winter meeting in Washington, DC (January 9-12, 2018), the co-chairs of the Committee on Astronomy and Astrophysics, Marcia Rieke and Steve Ritz, hosted a town hall meeting to provide an overview of the decadal process and next steps that will occur over the 2018 time frame. The co-chairs also answered many questions and took input from the committee. The committee's next meeting is scheduled to take place at the National Academy of Sciences Building in Washington, DC on March 27-29, 2018 during Space Science Week. More information on CAA can be found at http://sites.nationalacademies.org/BPA/BPA_048755.

The **Committee on Biological and Physical Sciences in Space (CBPSS)** met October 31-November 2, 2017 in Irvine, CA with an agenda organized around several topics relevant to microgravity research in the ISS transition era. On the first day of the meeting, a panel session was held with participants from four aerospace companies supporting NASA, in order to discuss their interests and concerns related to microgravity science research relevant to their exploration systems development. Each panelist gave prepared remarks responding to a prior set of questions developed by the committee, followed by a moderated discussion and questions from the committee and NASA participants. Panelists from Sierra Nevada, Paragon Space Development, Southwest Research Institute, and United Launch Alliance spoke candidly about the critical importance of having access to NASA's microgravity knowledge base and discipline experts during their design and development of exploration systems. They also stressed that it was not possible for their organizations to develop internal programs to supply the kind of fundamental phenomenological understanding needed to inform systems design. On the second day of the meeting the committee was given an update by the Director of ISS, Sam Scimemi, on planning for the ISS transition and Gateway, with a discussion of open questions and

SSB MEMBERSHIP

JULY 1, 2017—JUNE 30, 2018

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California Institute of Technology

ROBERT D. BRAUN, *Vice Chair*
University of Colorado, Boulder

JAMES ANDERSON
Harvard University

JEFF M. BINGHAM
Consultant

JAY C. BUCKEY
Geisel School of Medicine at Dartmouth

ADAM BURROWS
Princeton University

MARY LYNNE DITTMAR
Dittmar Associates, Inc.

JOSEPH FULLER, JR.
Futron Corporation

THOMAS R. GAVIN
Jet Propulsion Laboratory

SARAH GIBSON
National Center for Atmospheric Research

VICTORIA HAMILTON
Southwest Research Institute

ANTHONY C. JANETOS
Boston University

CHRYSSA KOUVELIOTOU
The George Washington University

DENNIS P. LETTENMAIER
University of California, Los Angeles

ROSALY M. LOPES
Jet Propulsion Laboratory

DAVID J. MCCOMAS
Princeton Plasma Physics Laboratory

LARRY PAXTON, JR.
Johns Hopkins University, Applied Physics Laboratory

ELIOT QUATAERT
University of California, Berkeley

BARBARA SHERWOOD LOLLAR
University of Toronto

HARLAN E. SPENCE
University of New Hampshire

MARK H. THIEMENS
University of California, San Diego

MEENAKSHI WADHWA
Arizona State University

EDWARD L. WRIGHT
University of California, Los Angeles

LIAISON

CHARLES KENNEL
U.S. Representative *TO COSPAR*

challenges. A roundtable discussion, previously requested by NASA, focused on current and potential synergies between the microgravity research work of NASA and the needs of other federal agencies. Acting Chief Scientist Gale Allen also presented the perspective from her office on issues that might affect ISS, microgravity research or human exploration planning. The committee also received a status briefing from NASA's Division of Space Life and Physical Sciences Research and Applications (SLPSRA) director Craig Kundrot and in-depth status briefings on each of the SLPSRA science program areas. SSB member Jeff Bingham also provided the committee with a general update on congressional policy issues related to NASA and ISS. NASA and the committee also engaged in focused discussions of potential symposium topics for Space Science Week, as well as NASA priorities for future advisory activities. The committee's next meeting is scheduled to take place at the National Academy of Sciences Building in Washington, DC on March 27-29, 2018 during Space Science Week. More information on CBPSS can be found at http://sites.nationalacademies.org/SSB/SSB_145312.

The **Committee on Earth Science and Applications from Space (CESAS)** met in Boulder, Colorado on October 23-24, 2017. Agenda items for the meeting included updates from NASA's Earth Science Division and NOAA NESDIS and discussions on the potential involvement of the committee in organizing a suggested task to a National Academies study ("Independent Study on Future of National Oceanic and Atmospheric Administration Satellite Systems and Data") requested in section 301 of the Weather Research and Forecasting Innovation Act of 2017 (https://www.congress.gov/bill/115th-congress/house-bill/353). In addition, committee members continued to support activities of ESAS 2017, the 2017-2027 decadal survey for Earth Science and Applications from Space. At the Boulder meeting, the committee met with the survey co-chairs to discuss dissemination of the survey report and report derivative products. They also reviewed an initial draft of a popular version of the survey report, a highly illustrated report summary intended for a broader audience than the rather lengthy and technical report itself. Several members of the survey are participating on various survey committees: Joyce Penner, CESAS Co-Chair, University of Michigan; Steven A. Ackerman, University of Wisconsin, Madison; Stacey W. Boland, Jet Propulsion Laboratory; Efi Foufoula-Georgiou; University of California, Irvine; Everette Joseph, University of Albany, SUNY; Eric J. Rignot, University of California, Irvine; Christopher S. Ruf, University of Michigan; and David L. Skole, Michigan State University. Towards the end of the quarter, the committee was engaged in planning for its next meeting, which will take place at the National Academy of Sciences Building in Washington, DC on March 27-29, 2018 during Space Science Week. More information on CESAS can be found at http://sites.nationalacademies.org/SSB/SSB_066587.

The **Committee on Solar and Space Physics (CSSP)** held its fall meeting on October 24-25, 2017, in Irvine, CA. The committee heard updates from NASA Heliophysics, NSF Geospace, NSF Astronomy, NOAA's Space Weather Prediction Center, and on the activities of the Space Weather Operations, Research, and Mitigation Subcommittee. The committee also held a focus session on data including discussions of long-term synoptic data, neural nets and adaptive learning, teaming machines and humans for deep learning, and the past and future of the NASA Heliophysics Data Environment. The committee also heard a presentation on the current state of research in the habitability of extrasolar planets. The CSSP will hold its next meeting as part of Space Science Week, March 27-29, in Washington, D.C. More information on CSSP can be found at http://sites.nationalacademies.org/SSB/SSB_052324.

STUDY COMMITTEES

The **Committee on an Astrobiology Strategy for the Search for Life in the Universe** has been formally appointed and is being chaired by Barbara Sherwood Lollar of the University of Toronto. The committee was established as the response of NASA's Science Mission Directorate to direction from the U.S.Congress contained in the NASA Transition Authorization Act of 2017. The committee will hold its first and second meetings on January 16-18, 2018 (Irvine, California) and March 6-8, 2018 (Washington, D.C.), respectively. The committee's third and final planned meeting will take place in Washington, D.C., in late-April or May. A report is due to NASA by the end of August 2018. More information about the project is available at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_180812.

The **Committee on Best Practices for a Future Open Code Policy for NASA Space Science** held its first meeting November 14-16, 2017, in Washington, D.C. Highlights of the committee's meeting include hearing from Thomas Zurbuchen, NASA Associate Administrator for the Science Mission Directorate (SMD) about current policies and study expectations, and a panel discussion among representatives from each SMD division about unique needs for each division. The committee also received several presentations about initiatives for and perspectives on open science and open code in different communities. The committee's next information-gathering meeting was held

SSB DISCIPLINE/STANDING COMMITTEE CO-CHAIRS (January-December 2017)

Committee on Astrobiology and Planetary Science (CAPS)

Christopher H. House, The Pennsylvania State University
William B. McKinnon, Washington University, St. Louis

Committee on Astronomy and Astrophysics (CAA)
(joint with the Board on Physics and Astronomy)

Marcia Rieke, University of Arizona
Steven Ritz, University of California, Santa Cruz

Committee on Biological and Physical Sciences in Space (CBPSS)
(joint with the Aeronautics and Space Engineering Board)

Elizabeth Cantwell, Arizona State University
Robert J. Ferl, University of Florida

Committee on Earth Science and Applications from Space (CESAS)

Michael D. King, University of Colorado, Boulder
Joyce E. Penner, University of Michigan

Committee on Solar and Space Physics (CSSP)

Sarah Gibson, National Center for Atmospheric Research
Maura E. Hagan, Utah State University

For more information, go to <http://sites.nationalacademies.org/SSB/ssb_052296>.

January 17-19, 2018 in Washington, D.C. More information about the project is available at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_178892.

The draft report from the **2017-2027 Decadal Survey for Earth Science and Applications from Space** committee (ESAS 2017: www.nas.edu/esas2017) was approved on December 30, 2017. A pre-publication version of the report, "Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space," may be read online or downloaded at no cost via a link on the survey website or directly from National Academies Press at: https://www.nap.edu/catalog/24938/thriving-on-our-changing-planet-a-decadal-strategy-for-earth. As the quarter ended, the survey steering committee was preparing for public release of the report on January 5, 2018 and Town Hall discussions on January 10, 2018 at the 98th annual meeting of the American Meteorological Society in Austin Texas and on February 14, 2018 at the 2018 AGU Ocean Sciences meeting in Portland, Oregon. Some 100 members of the community served on one or more of the survey's committees. In addition to a link to the pre-publication report, links on the survey's website describe activities during the quarter in more detail. Also posted on the website are survey newsletters to the community, links to community responses to survey RFIs (requests for information), information on the organization of the survey and its members, and archives that include presentations made to the committee and previous Town Hall presentations. A final version of the survey report is expected to be published in early spring 2018. A popularization of the survey is expected to be published somewhat earlier.

Former intern Caroline Juang at the SSB booth at AGU. *Photo courtesy of Celeste Naylor.*

The **Committee on an Exoplanet Science Strategy** co-chairs (David Charbonneau, Harvard University, and B. Scott Gaudi, Ohio State University) were approved in January. The full committee was appointed February 14. This study was requested by NASA's Science Mission Directorate in response to direction from a Congressional mandate contained in the NASA Transition Authorization Act of 2017. It is anticipated that the committee will hold its first meeting in the first quarter of 2018. The final report is due to NASA by the end of August 2018. More information about the project is available at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_180659.

The **Committee on Extraterrestrial Sample Analysis Facilities** held its first meeting November 19-21, 2017, in Irvine, CA. The committee heard presentations about current and proposed future NASA sample return missions, including the planned architecture for Mars Sample Return, the OSIRIS-Rex asteroid sample return mission, the CORSAIR comet surface sample return mission concept, and the MoonRise lunar sampler return mission concept. The committee also heard from the Curation and Analysis Planning Team for Extraterrestrial Materials, from the Astromaterials Acquisition and Curation Office at Johnson Space Center, and about the Smithsonian Institution's meteorite collection and curation. The committee's next information-gathering meeting was held January 22-24, in Houston, T.X. More information about the project is available at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_178893

The **Committee on Large Strategic NASA Science Missions: Science Value and Role in a Balanced Portfolio** delivered its report, *Powering Science – NASA's Large Strategic Science Missions to NASA* in August and the report was printed in December. In December, committee co-chair Kathy Thornton and study director Dwayne Day briefed the report to numerous people at JPL who were interested in how the report's recommendations may affect future large strategic missions.

The **Committee on a Midterm Assessment of Implementation of the Decadal Survey on Life and Physical Sciences Research at NASA** worked to respond to report review comments from an extensive set of external reviewers during this period and the report completed the approval process in early December. The committee report, *A Midterm Assessment of Implementation of the Decadal Survey on Life and Physical Sciences Research at NASA*, was subsequently delivered in prepublication form to NASA on Dec. 12, 2018 and released to the public on Dec. 15, 2017. Committee chairs Daniel Dumbacher and Robert Ferl briefed the report separately to both NASA and Hill staff on Dec. 14, 2017, and additional government briefings and dissemination activities are expected in early 2018. The report is currently being edited for final publication in the spring of 2018.

The **Committee on Planetary Protection Requirements for Sample-Return Missions from Martian Moons** is a joint activity between the Space Studies Board and the European Space Science Committee of the European Science Foundation (ESF), with some participation by Japanese scientists. The committee is the result of parallel requests sent by the Planetary Protection Offices of NASA and the European Space Agency to the National Academies and ESF, respectively, to assess the results of research jointly sponsored by NASA and ESA on whether or not hypothetical martian organisms can survive ejection from the surface of Mars during a giant impact and subsequent emplacement on the surfaces of Phobos and Deimos. A major goal of this activity is to determine whether or not samples returned from the martian moons receive a planetary protection classification of "restricted" or "unrestricted" Earth return. The joint committee held its single planned meeting in London on November 7-9, 2017. More information on the project can be found at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_181917.

The **Committee on the Review of Planetary Protection Policy Development Processes** did not meet during this quarter. The committee schedule calls for a report to be delivered to NASA in the spring of 2018. Additional information about the committee and its activities can be found at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_175768.

The **Committee on the Review of Progress Toward Implementing the Decadal Survey Vision and Voyages for Planetary Sciences**

held its third meeting August 28-30, 2017 in Woods Hole, MA, its fourth meeting in Irvine on November 29-December 1, 2017, with a fifth meeting scheduled for February 26-28, 2018 in Washington. The introduction of a new NASA architecture proposal for Mars sample return during the August meeting complicated the committee's work and the committee requested additional information on Mars sample return technology development for its Irvine meeting. The committee was impressed with the detail it received on the Mars technology development and has begun writing its final report. The committee aims to deliver its report to NASA in summer 2018. Additional information about this project can be found at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_177619.

OTHER ACTIVITIES

The **Forum for New Leaders in Space Science**, a cooperative activity between the National Academies of Sciences, Engineering, and Medicine and the Chinese Academy of Sciences (CAS), 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. Continuing support for this activity from CAS and the National Academies Presidents' Committee permitted the recruitment of a fourth cohort of young U.S. and Chinese scientists to begin during the third quarter of 2017. The fourth cohort, drawn from the space astronomy and astrophysics and solar and space physics communities, will meet in Guangzhou in southern China on January 23-24, 2018 and in Pasadena, California on July 12-13, 2018 (i.e., immediately prior to the July 14-21 COSPAR Scientific Assembly). Additional details concerning this activity can be found at http://sites.nationalacademies.org/SSB/SSB_086017.

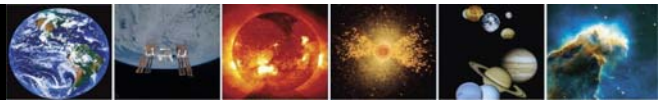
COSPAR The next round of COSPAR business meetings (i.e., the Pasadena Assembly Science Program Committee, the COSPAR Scientific Advisory Committee and the COSPAR Bureau) will be held in Paris on March 19-21, 2018. The 42nd Scientific Assembly will be held in Pasadena, California on July 14-21, 2018. The 43rd Scientific Assembly will be held in Sydney, Australia on August 15-23, 2020.

Planetary Protection of the Outer Solar System: This 3-year activity, funded via the European Union's Horizon 2020 funding program and organized by the European Science Foundation (ESF), was formally initiated in January 2016, and is designed to address a series of closely related topics in the general area of planetary protection for the icy bodies of the outer solar system. Although the National Academies' is not formally involved in this project, the Space Studies Board has observer status on the PPOSS steering group and has agreed, with NASA's concurrence, to sponsor the participation of two U.S. experts in activities associated with PPOSS' Work-Packages 3 and 5. Activities associated with Work-Package 5—a review of the current planetary protection regulation structure for the icy bodies of the outer solar system—will commence at a meeting to be held in London on February 7-9, 2018. The two US experts—Geoffrey Collins (Wheaton College, Massachusetts) and Mark Saunders (NASA Langley Research Center, retired)—are participating in their personal capacity as scientific and technical experts and their work and that of PPOSS is not officially endorsed by the SSB or the National Academies. Additional information about PPOSS can be found at http://pposs.org/.

Science Strategy for Space Exploration of the Outer Solar System Icy Moons Oceans (Exoceans) held the first of its three planned meetings at Observatoire de Paris on 13-14 November. The goal of this European activity is to review and synthesize the current status of astrobiological knowledge about the outer solar system with particular emphasis on the icy satellites of the giant planets. The Exoceans project is a cooperative venture between the European Space Science Committee, the European Marine Board, and the International Space Science Institute (ISSI). The Space Studies Board is not formally involved in this activity but has agreed, with NASA's concurrence, to fund the participation of two US scientists--Christopher House (Pennsylvania State University) and Alexander Hayes (Cornell University)--in Exoceans activities. The ExoOceans group will hold meetings in Bern, Switzerland, in June and September 2018. The outcome of this activity will be a book in the ISSI Space Science Series, published by Springer.

The SSB in conjunction with the Division on Earth and Life Studies exhibited at the **American Geophysical Union (AGU)** Fall meeting on December 11-15, 2017 in New Orleans, LA. The SSB circulated information about current and past reports, distributed over 600 reports and DVD's of the Space Studies Boards Compilation of Selected Reports 1958-2017 to the attendees. The AGU Fall meeting is a gathering of more than 24,000 individuals interested in issues related to Earth, atmospheric, oceanic, hydrologic, space, and planetary sciences. Other outreach activities include participation at the American Astronomical Society in Washington DC, in January 2018, and COSPAR in Pasadena, CA in July 2018.

Celeste Naylor preparing to staff the SSB exhibit. *Photo courtesy of Celeste Naylor*



NEW RELEASES

Copies of reports are available from the SSB office at 202-334-3477 or at <http://www.nap.edu/>.

Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space

We live on a dynamic Earth shaped by both natural processes and the impacts of humans on their environment. It is in our collective interest to observe and understand our planet, and to predict future behavior to the extent possible, in order to effectively manage resources, successfully respond to threats from natural and human-induced environmental change, and capitalize on the opportunities – social, economic, security, and more – that such knowledge can bring.

By continuously monitoring and exploring Earth, developing a deep understanding of its evolving behavior, and characterizing the processes that shape and reshape the environment in which we live, we not only advance knowledge and basic discovery about our planet, but we further develop the foundation upon which benefits to society are built. *Thriving on Our Changing Planet* presents prioritized science, applications, and observations, along with related strategic and programmatic guidance, to support the U.S. civil space Earth observation program over the coming decade.

Available at: http://www.nap.edu/catalog/24938/thriving-on-our-changing-planet-a-decadal-strategy-for-earth

A Midterm Assessment of Implementation of the Decadal Survey on Life and Physical Sciences Research at NASA

The 2011 National Research Council decadal survey on biological and physical sciences in space, *Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era*, was written during a critical period in the evolution of science in support of space exploration. The research agenda in space life and physical sciences had been significantly descoped during the programmatic adjustments of the Vision for Space Exploration in 2005, and this occurred in the same era as the International Space Station (ISS) assembly was nearing completion in 2011. Out of that period of change, *Recapturing a Future for Space Exploration* presented a cogent argument for the critical need for space life and physical sciences, both for enabling and expanding the exploration capabilities of NASA as well as for contributing unique science in many fields that can be enabled by access to the spaceflight environment.

Since the 2011 publication of the decadal survey, NASA has seen tremendous change, including the retirement of the Space Shuttle Program and the maturation of the ISS. NASA formation of the Division of Space Life and Physical Sciences Research and Applications provided renewed focus on the research of the decadal survey. NASA has modestly regrown some of the budget of space life and physical sciences within the agency and engaged the U.S. science community outside NASA to join in this research. In addition, NASA has collaborated with the international space science community.

This midterm assessment reviews NASA's progress since the 2011 decadal survey in order to evaluate the high-priority research identified in the decadal survey in light of future human Mars exploration. It makes recommendations on science priorities, specifically those priorities that best enable deep space exploration.

Available at: http://www.nap.edu/catalog/24966/a-midterm-assessment-of-implementation-of-the-decadal-survey-on-life-and-physical-sciences-research-at-nasa

SSB Staff

MICHAEL H. MOLONEY
Director

ARTHUR A. CHARO
Senior Program Officer

SANDRA J. GRAHAM
Senior Program Officer

DAVID H. SMITH
Senior Program Officer

DWAYNE A. DAY*
Senior Program Officer

DAVID LANG*
Senior Program Officer

ABIGAIL SHEFFER
Program Officer

NATHAN BOLL
Associate Program Officer

SARAH BROTHERS
Associate Program Officer

MA BROWN
Research Associate

MARCHEL HOLLE
Research Associate

ANDREA REBHOLZ*
Program Associate

ANESIA WILKS
Senior Program Assistant

DIONNA WISE
Program Associate

CARMELA J. CHAMBERLAIN
Administrative Coordinator

MEG KNEMEYER
Financial Officer

CELESTE A. NAYLOR
Information Management Associate

TANJA E. PILZAK
Manager, Program Operations

MADISON BORRELLI
Lloyd V. Berkner Space Policy Intern

ALLISON MCGRAW
Lloyd V. Berkner Space Policy Intern

** Staff of other Academies boards who are shared with the SSB.*

SSB Staff News

The SSB (jointly with the BPA) welcomed in January a Christine Mirzayan Science and Technology Policy Graduate Fellow, Emily Moravec.

Emily Moravec is currently completing a Ph.D. in astronomy at the University of Florida. She holds an MS in astronomy from the University of Florida and a B.A. in physics from St. Olaf College. Her dissertation work focuses on determining the shape and size of enormous jets of matter expelled from the black holes at the centers of active galaxies in order to study the complex, unique environment of massive galaxy clusters through data analysis of radio and infrared images. Her previous research projects focused on understanding the structure and components of active galaxies. She is passionate about science education and outreach. She organizes and participates in large community astronomy focused events, travels to rural communities with educational astronomy events, visits schools and summer camps with a portable planetarium and educational activities, and engages in multimedia efforts in order to promote scientific literacy and encourage a wide range of ages to engage with science. She strives to foster effective and insightful communication between scientists and the public. In her spare time, she enjoys outdoors activities, training for triathlons, and attending performing art performances.

Allison McGraw and Jacob Robertson completed their terms as Lloyd V. Berkner Space interns in August 2017. Their reflections on their experiences with the SSB are below.

My late summer and fall of 2017 was beyond well spent at The National Academies of Sciences, Engineering and Medicine's Space Studies Board. This has been truly an experience of a lifetime with large amounts of exposure to congress people, policy making, NASA representatives, DARPA representatives, Decadal Surveys, and various significant scientists and engineers in the field. Every single day on the internship job was filled with gaining valuable experience that will forever make me a more robust scientist, equipped with policy and management expertise. It has fortified my knowledge of the need for scientists becoming involved with policy. With the crest of the new space age upon us, it is vital that scientists are aware of what components and factors contribute to space exploration and space policy.

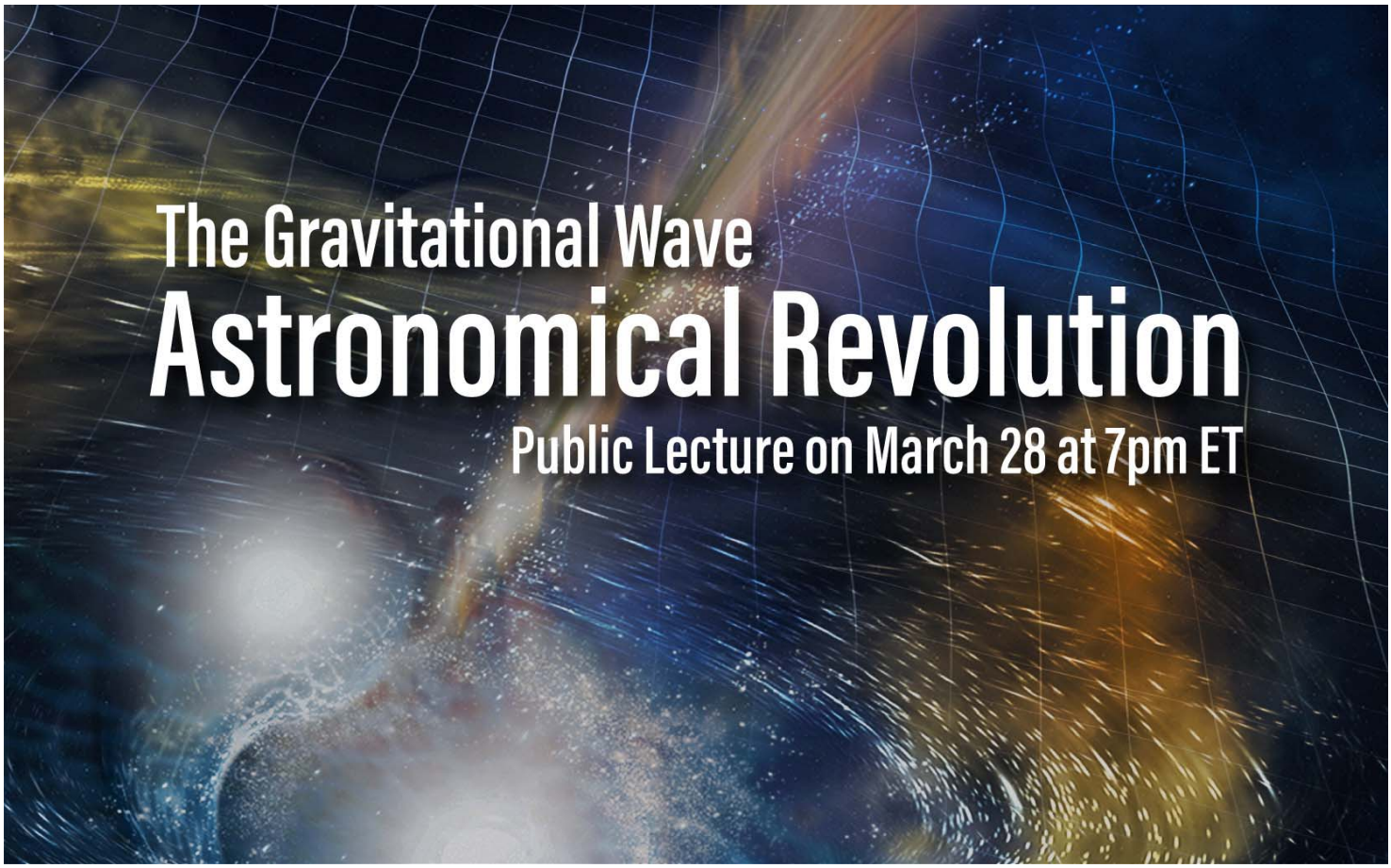
I now feel the influence of knowledge that The National Academies of Sciences has instilled into our great nation. Scientifically advising the nation is so critical in decision making, risk mitigation, understanding how the dynamics of Earth change over short and long timescales, and determining where in the Solar System we should traverse to next. From down here on our pale blue dot, to the far reaches of the Kuiper Belt; we can be assured that the Space Studies Board and the entity of The National Academies has compiled the research from the best scientists our nation has to offer to produced reports, and has thus made the most robust of recommendations and advisements. My time fulfilling the Lloyd V. Berkner Space Policy internship position with the Space Studies Board has opened my eyes to this backbone structure that has been scientifically advising since 1863. I now look at reports in a new light and perspective, and this induces a deep appreciation of the vast amount of knowledge and time that has been invested for the report-making.

I came from the far reaches of the Sonoran Desert to fulfill this position in Washington, D.C. Although vastly dissimilar from my hole in the desert, and to some degree disorienting at moments, I fell in love with the District of Columbia within a matter of hours. The large buildings, rich history, and the feeling of the lifeblood driving the nation captivated me. I think our U.S. Government has mined more than a few mountains of marble, limestone and granite to physically construct D.C.; but I have really enjoyed this elaborate architecture and design that this area of the country holds and proudly exhibits. This will not be my last experience in Washington, D.C., and I can be rest-assured that the Space Studies Board will continue to propel the space community towards new light and understanding into the dawn of the new space age.

(Staff News continued from page 8)

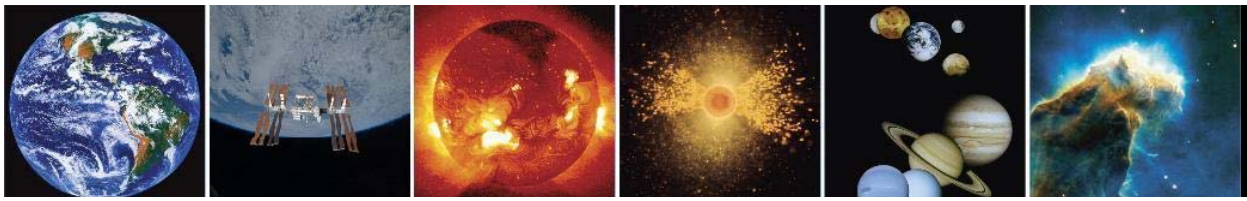
Interning with the Space Studies Board has been an experience not reproducible in a classroom setting. During my internship, I saw firsthand how the National Academies serves as the scientific community's voice to the nation. This insight gave me a new-found appreciation for the institution and the experts who volunteer their time to serve on committees. With the SSB, I contributed to the study process by conducting background research for committee members, providing support at committee meetings, and helping prepare reports for publication. Since my background is in physics and astronomy, one highlight of the fall was attending a meeting of the Committee on Astronomy and Astrophysics in Irvine, California. It was exciting to see the Committee in early discussion for the 2020 Decadal Survey in Astrophysics. In addition to supporting studies on topics from planetary protection to unmanned aerial vehicles, I was also encouraged to attend and report on various space events in Washington, D.C. A notable moment was sitting in on Representative Jim Bridenstine's contentious nomination hearing for the role of NASA Administrator. Through this immersion into the space policy community, I was able to further understand the activities of the SSB in a greater context. By interacting with people from industry, academia, government, advocacy groups, and even other advisory bodies, I gained a more comprehensive understanding of the space community than I could have imagined. The Lloyd V. Berkner Space Policy Internship has greatly enhanced my undergraduate experience. I am excited to continue into a space career and build on the skills and experience I gained at the SSB.

Andrea Rebholz, Program Coordinator, completed the requirements and earned the designation of Certified Government Meeting Professional in December.



For more information on the lecture or to register go to http://GravWaves.eventbrite.com

For information on Space Science Week
go to http://sites.nationalacademies.org/ssb/ssb_177653



SSB Meeting Calendar

February

S	M	T	W	Th	F	Sa
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
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March

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April

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22	23	24	25	26	27	28
29	30					

May

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6	7	8	9	10	11	12
13	14	15	16	17	18	19
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27	28	29	30	31		

February 26-28	Review of Progress Toward Implementing the Decadal Survey Vision and Voyages for Planetary Sciences	Washington, DC
February 26-28	Best Practices for a Future Open Code Policy for NASA Space Science	Irvine, CA
March 6-7	Exoplanet Science Strategy	Washington, DC
March 6-8	Astrobiology Science Strategy for the Search for Life in the Universe	Washington, DC
March 27-29	Space Science Week 2018 Committee on Astrobiology and Planetary Science Committee on Astronomy and Astrophysics Committee on Biological and Physical Science in Space Committee on Earth Science and Applications from Space Committee on Solar and Space Physics	Washington, DC
May 1-3	Space Studies Board	Washington, DC

Upcoming Events

July 14-21	COSPAR 42nd Scienctific Assembly	Pasadena, CA
November 7-9	Space Studies Board	Irvine, CA

National Academy of Sciences Building
2101 Constitution Ave NW
Washington, DC

Keck Center
500 Fifth St NW,
Washington, DC

Arnold and Mabel Beckman
100 Academy Drive
Irvine, CA

J. Erik Jonsson Conference Center
314 Quissett Ave
Woods Hole, MA

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- ☐ Searching for Life Across Space and Time: Proceedings of a Workshop (2017)
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- ☐ Review of the Restructured Research and Analysis Programs a NASA's Planetary Science Division(2017)
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- ☐ Extending Science—NASA's Space Science Mission Extensions and the Senior Review Process (2016)
- ☐ New Worlds, New Horizons: A Midterm Assessment (2016)
- ☐ Achieving Science with CubeSats: Thinking Inside the Box (2016)
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- ☐ Solar and Space Physics: A Science for a Technological Society: An Overview (2014) Booklet
- ☐ Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration (2014) DVD Only
- ☐ Evaluation of the Implementation of WFIRST/AFTA in the Context of New Worlds, New Horizons in Astronomy and Astrophysics (2014)
- ☐ Review of the Draft 2014 Science Mission Directorate Science Plan (2014)
- ☐ 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
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- ☐ The Effects of Solar Variability on Earth's Climate: A Workshop Report (2012)
- ☐ Vision an Voyages for Planetary Science (2012) Booklet
- ☐ The Role of Life and Physical Sciences (2012) Booklet
- ☐ Earth Science and Applications from Space: A Midterm Assessment of NASA's Implementation of the Decadal Survey (2012) Book and CD
- ☐ Assessment of Planetary Protection Requirements for Spacecraft Missions to Icy Solar System Bodies (2012)
- ☐ Report of the Panel on Implementing Recommendations from the New Worlds, New Horizons Decadal Survey (2012)
- ☐ Sharing the Adventure with the Public—The Value of Excitement: Summary of a Workshop (2011)

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