

APRIL - JUNE 2019

INSIDE THIS ISSUE



The SSB's fall meeting will be held
November 6-8, 2019 in Irvine, California.

<i>The Board and Its Discipline Committees</i>	2
<i>SSB Membership</i>	2
<i>Discipline Committee Co-Chairs</i>	3
<i>Study Committees</i>	3
<i>Other Activities</i>	4
<i>Report Release</i>	5
<i>Committee on Space Research (COSPAR)</i>	5
<i>Summary of a Senate Hearing of Interest</i>	6
<i>SSB Staff News</i>	7
<i>SSB Staff</i>	7
<i>SSB Calendar</i>	8
<i>Selected Reports Available from the SSB</i>	9

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

SPACE STUDIES BOARD NEWS

THE BOARD AND ITS DISCIPLINE COMMITTEES

The **Space Studies Board (SSB)** met April 30-May 2, 2019. The first day was joint with the Aeronautics and Space Engineering Board. The Boards received updates on the activities of the National Space Council (Ryan Whitley, director of Civil Space Policy); the Office of Science and Technology Policy (Kelvin Droegemeier, OSTP director); the NASA Human Exploration Mission Directorate (William Gerstenmaier, associate administrator for HEOMD); NASA Space Technology Mission Directorate (Therese Griebel, deputy associate administrator for Programs for STMD); the Department of Commerce, Office of Space Commerce (Kevin O'Connell, director, OSC); and the FAA Commercial Space Transportation office (Kelvin Coleman, deputy associate administrator for CST). The boards also received an update on the National Academies' Space Technology Industry-Government-University Roundtable (STIGUR) from its chair Wanda Sigur and board member David McComas (Princeton Plasma Physics Laboratory) gave a science talk on "Our Heliosphere's Interstellar Interaction: Recent Observations and Discoveries."

Day 2 was devoted to the NASA Science Mission Directorate, the board's internal discipline committees, and a panel discussion on Lunar Space Science and Exploration. The SSB received updates from and had discussions with Thomas Zurbuchen (associate administrator for NASA Science Mission Directorate [SMD]), representatives from the four SMD divisions (Paul Hertz, astrophysics director; Paula Bontempi, Earth science acting deputy director; Nicola Fox, heliophysics director; and Lori Glaze, planetary science director). The board then received updates from co-chairs from its five discipline committees (Christopher House, CAPS; Steven Ritz and Vicki Kalogera, CAA; Robert Ferl, CBPSS; Chelle Gentemann, CESAS; and Sarah Gibson, CSSP). The board then had a panel discussion on Lunar Space Science and Exploration moderated by board member Steve Mackwell, including Jim Green (NASA Chief Scientist), Steve Clarke (SMD deputy associate administrator for exploration), Sarah Noble (NASA), Amanda Hendrix (Planetary Science Institute), and Orethal Tucker (NASA Goddard). The board also had a discussion with European Space Science Committee representatives Athena Cous-tenis (chair) and Nicolas Walter (staff). Day 3 was an executive session for closed committee discussions.

The board's next meeting is November 6-8, 2019 at the National Academies' Arnold and Mabel Beckman Center in Irvine, CA. More information on the board is available at http://sites.nationalacademies.org/SSB/SSB_052281.

The **Committee on Astrobiology and Planetary Science (CAPS)** did not meet during this quarter. Activities in this quarter were dominated by two topics. First, planning for the committee's September meeting, which will be devoted to organizational issues relating to the planned initiation of the next planetary science decadal survey in the first quarter of 2020. Second, planning for community outreach activities related to the initiation of the decadal survey in 2020. Proposals for splinter sessions at the Division for Planetary Science/European Planetary Science Conference (Geneva, Switzerland, 15-20 September) and the American Geophysical Union meeting (San Francisco, California, 9-13 December) were drafted, submitted and accepted. The committee's next in-person meeting will be held at the California Institute of Technology in Pasadena, CA, on September 10-12, 2019. More information on CAPS and its activities is available at http://sites.nationalacademies.org/SSB/SSB_067577.

The **Committee on Astronomy and Astrophysics (CAA)** is in the process of identifying new members to replace those whose terms have ended. The CAA's fall meeting is tentative, date and location to be determined. Information about future meetings can be found at http://sites.nationalacademies.org/BPA/BPA_048755, including links to the committee's statement of task, its membership, and current and past meeting presentations.

SSB MEMBERSHIP

JULY 1, 2018—JUNE 30, 2019

MARGARET KIVELSON, *Chair (as of April 1, 2019)*
University of California, Los Angeles

JAMES H. CROCKER *Vice Chair*
Lockheed Martin Space Systems Company
(retired)

GREGORY P. ASNER
Carnegie Institution for Science

JEFF M. BINGHAM
Consultant

ADAM BURROWS
Princeton University

MARY LYNNE DITTMAR
Dittmar Associates, Inc.

JEFF DOZIER
University of California, Santa Barbara

JOSEPH FULLER, JR.
Futron Corporation (retired)

SARAH GIBSON
National Center for Atmospheric Research

VICTORIA HAMILTON
Southwest Research Institute

CHRYSSA KOUVELIOTOU
The George Washington University

DENNIS P. LETTENMAIER
University of California, Los Angeles

ROSALY M. LOPES
Jet Propulsion Laboratory

STEPHEN J. MACKWELL
Universities Space Research Association

DAVID J. MCCOMAS
Princeton University

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

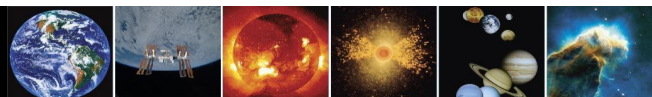
ERIKA WAGNER
Blue Origin, LLC

PAUL WOOSTER
Space Explorations Technologies

EDWARD L. WRIGHT
University of California, Los Angeles

LIAISON

CHARLES KENNEL
U.S. Representative to COSPAR



During this period the **Committee on Biological and Physical Sciences in Space (CBPSS)** did not meet, but work continued within the committee on laying the groundwork for the next decadal survey. In addition to regularly scheduled discussions between staff and SLPSRA on issues related to the decadal, discussions have been held with ASGSR leadership and stakeholders inside and outside of NASA. Currently, a statement of task is in development. 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)** did not meet during this quarter. Committee co-chair Chelle Gentemann testified on June 11, 2019 before the House Science, Space & Technology's Subcommittee on Space and Aeronautics (<https://science.house.gov/hearings/discovery-on-the-frontiers-of-space-exploring-nasas-science-mission>). The committee was asked by the Academies' Board on Atmospheric Science and Climate, ahead of its late July workshop, to comment on the impending rollout of fifth generation cellular network technology (5G) and its potential to interfere with remote sensing telemetry. CESAS staff is engaged informally with this activity. Dr. Gentemann and staff have had discussions with Sandra Caufmann, Acting Director of NASA ESD, and Jack Kaye from ESD; and Neil Jacobs, Acting head of NOAA on potential activities. The next meeting of the committee will be in fall 2019, location to be determined. More information on CESAS is available at https://sites.nationalacademies.org/SSB/SSB_066587.

The **Committee on Solar and Space Physics (CSSP)** is asking for community input for its fall short report on *Agile Responses to Short-Notice Rideshare Opportunities*. The report topics include: kinds of solar and space physics science that would be enabled by an agile response to rideshare opportunities; types of payloads suited to ridesharing; and considerations for the development and implementation of a new NASA Heliophysics Division program. Members of the CSSP are giving presentations on this topic at summer meetings of the CEDAR, GEM, and SHINE solar and space physics research communities. The CSSP's fall meeting is planned for October 22-24, 2019, in Washington, D.C. More information on the CSSP, including the full statement of task for the short report and a form to submit input to the CSSP can be found at http://sites.nationalacademies.org/SSB/SSB_052324.

STUDY COMMITTEES

The **Decadal Survey on Astronomy and Astrophysics 2020 (Astro2020)** is in the process of forming the 13 supporting panels to the Steering Committee. White papers on activities, projects, and state of the profession considerations (APCs) were accepted from June 4 to July 10, 2019. The survey's Steering Committee held their first meeting in Washington, DC, on July 15-17, 2019. The committee heard presentations on the perspectives from the sponsoring agencies NASA, the National Science Foundation, and the Department of Energy. Presentations were also given from staff of the House Subcommittee on Space and Aeronautics, the Senate Committee on Commerce, Science, and Transportation, and the Office of Management and Budget. The Aerospace Corporation presented an overview of the Technical, Risk, and Cost Evaluation (TRACE) process, and the committee heard lessons learned

from the chair of the Astro2010 Decadal and the chair of its subsequent Midterm Assessment. More information on Astro2020 is available at <http://nas.edu/astro2020>.

The **Committee on Near Earth Object Observations in the Infrared and Visible Wavelengths** delivered its report to NASA in early June and the report went public in mid-June, approximately 3-4 weeks earlier than originally planned. This study was requested by the NASA Chief Scientist's Office. More information on the project is available at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_190172.

The **Committee on Planetary Protection Requirements for Sample-Return Missions from Martian Moons**, 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, has completed its work and has been dissolved. The committee's report, *Planetary Protection Classification of Sample Return Missions from the Martian Moons*, was issued in prepublication format on January 18, 2019 and the final, printed version was published by the National Academies Press in early July. Committee staff are currently engaged in an extended series of dissemination activities related to the organization of a special session on planetary protection to be held at the International Astronautical Congress in Washington, D.C., on 21-25 October. More information on the project is available at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_181917. The report is available at <https://www.nap.edu/catalog/25357/>.

The **Committee on the Review of Progress Toward Implementing the Decadal Survey-Solar and Space Physics: A Science for a Technological Society** held its second in-person meeting April 3-5, 2019 in Boulder, Colorado. The committee heard from the agen-

SSB DISCIPLINE COMMITTEE CO-CHAIRS

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)

Vassiliki (Vicky) Kalogera, Northwestern University
Steven Ritz, University of California, Santa Cruz (through June 30, 2019)

Committee on Biological and Physical Sciences in Space (CBPSS)

(joint with the Aeronautics and Space Engineering Board)

Robert J. Ferl, University of Florida
Dava Newman, Massachusetts Institute of Technology

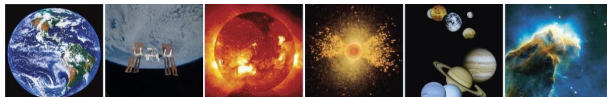
Committee on Earth Science and Applications from Space (CESAS)

Chelle Gentemann, Earth & Space Research
Steve Running, University of Montana (emeritus)

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.



cies addressed in the decadal survey, NASA (Nicola Fox, heliophysics director); NSF (Mike Wiltberger, Geospace section head); and NOAA (Elsayed Talaat, Office of Projects, Planning, and Analysis director). A final in-person meeting was held July 23-25, 2019 in Woods Hole, Massachusetts. Information about the committee and links to meeting presentations are available at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_188o88.

Membership was approved for the organizing committee for **Science Opportunities Enabled by Gateway: A Workshop** during this period and a meeting was held on June 10-11 in DC. The committee heard talks from Jacob Bleacher and Ben Bussey of NASA on the current Gateway plan and design, and the results of the NASA 2018 Gateway workshop. The majority of the meeting was devoted to understanding issues affecting Gateway and the workshop, determining the key questions and major focus areas that should be included the workshop, and developing a structure for the workshop. The committee worked closely with Michael New and Steve Clark of NASA SMD as it considered these issues during the meeting. After considering the various conflicting meetings at NASA and in the community, a date of Nov. 4-5, 2019 in Irvine, CA was set for the workshop. The committee is currently collecting Gateway information from NASA and working to develop a call for white papers to go out to the relevant research communities.

OTHER ACTIVITIES

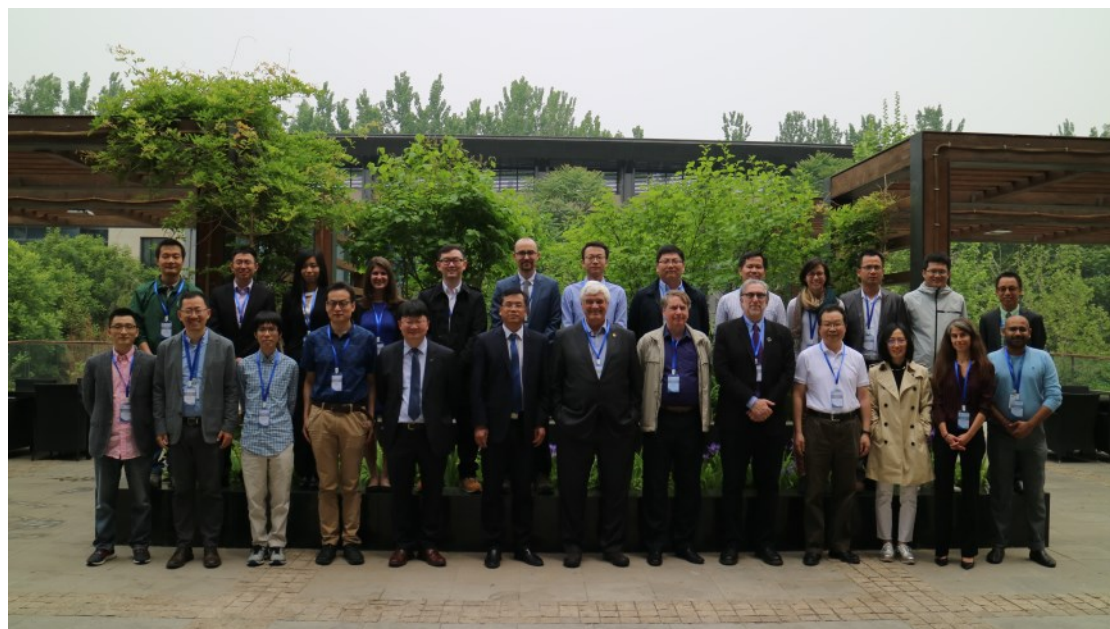
The **Committee on Space Research (COSPAR)**, for which the SSB is the U.S. National Committee, was not active during the current quarter. The next major scheduled events are the 4th COSPAR Symposium, to be held in Herzliya, Israel on 4-8 November and the 43rd COSPAR Scientific Assembly to be held in Sydney, Australia, on 15-23 August, 2020. The next round of annual COSPAR business meetings will be held in Paris, France, on 16-19 March, 2020. Additional information about COSPAR is available at <https://cosparhq.cnes.fr/>. And more information about COSPAR can be found on page 5 of this newsletter.

Planetary Protection of the Outer Solar System (PPOSS) is a 3-year activity, funded via the European Union's Horizon 2020 funding program and organized by the European Science Foundation (ESF); it concluded its activities at the end of 2018. The SSB is not formally engaged in this activity but did fund the participation of two U.S. experts in a subset of its activities. Additional information about PPOSS, including the various documents and reports it generated, is available at <http://pposs.org/>.

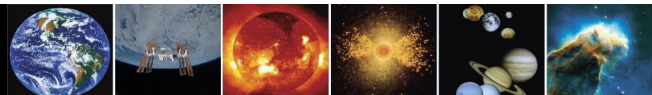
Science Strategy for Space Exploration of the Outer Solar System Icy Moons Oceans (ExoOceans) is a cooperative venture between the European Space Science Committee, the European Marine Board, and the International Space Science Institute (ISSI). It did not meet during this quarter. Its goal is to review 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 SSB is not formally involved in this activity but is funding the participation of two U.S. experts in its activities. More details about the ExoOceans project is available at <http://www.essc.esf.org/membership/exooceans-study-group-meeting/> and <http://www.issibern.ch/workshops/exooceans/>. The final report of the ExoOceans activity will be published by the International Space Science Institute in 2019.

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. Participants in the 9th and 10th forums—focusing on planetary science and Earth observation from space—were selected by an international organizing committee in March. Eight young (<40 years old) researchers based in the United States and a like number of their counterparts from Chinese institutions held the 9th Forum in Huairou, on the northern outskirts of Beijing on May 15-16. The same group will reassemble in Washington, D.C. on October 28-29 for the 10th Forum. Also participating in the meetings of the 16 young researchers are a smaller number of more senior members of the

relevant U.S. and Chinese scientific communities. The senior U.S. participants in the 9th and 10th forums include William B. McKinnon (Washington University) and Steven W. Running (University of Montana). Additional details concerning this activity are available at http://sites.nationalacademies.org/SSB/SSB_o86o17.



Members of the 9th and 10th cohorts of the Forum for New Leaders in Space Science



REPORT RELEASE

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

Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes

Near Earth objects (NEOs) have the potential to cause significant damage on Earth. In December 2018, an asteroid exploded in the upper atmosphere over the Bering Sea (western Pacific Ocean) with the explosive force of nearly 10 times that of the Hiroshima bomb. While the frequency of NEO impacts rises in inverse proportion to their sizes, it is still critical to monitor NEO activity in order to prepare defenses for these rare but dangerous threats.

Currently, NASA funds a network of ground-based telescopes and a single, soon-to-expire space-based asset to detect and track large asteroids that could cause major damage if they struck Earth. This asset is crucial to NEO tracking as thermal-infrared detection and tracking of asteroids can only be accomplished on a space-based platform.

Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes explores the advantages and disadvantages of infrared (IR) technology and visible wavelength observations of NEOs. This report reviews the techniques that could be used to obtain NEO sizes from an infrared spectrum and delineate the associated errors in determining the size. It also evaluates the strengths and weaknesses of these techniques and recommends the most valid techniques that give reproducible results with quantifiable errors.

Available at: <https://www.nap.edu/catalog/25476>

SEEKING NOMINEES FOR COSPAR AWARDS AND MEDALS

COSPAR, the Committee on Space Research of the International Council for Science, is seeking candidates to be nominated for COSPAR awards and medals, which recognize the outstanding achievements of space scientists throughout the world. The awards will be presented at the 43rd COSPAR Scientific Assembly, to be held in Sydney, Australia, on 15-25 August, 2020.

It is important to honor the contributions of your colleagues. Please take a moment to consider nominees for the following awards and medals:

Space Science Award honors a scientist who has made outstanding contributions to space science. Recent recipients include: J. -P. Bibring and B. Tsurutani (2018), C.L. Bennett and A.I. Grigoriev (2016), D.J. McComas and J.-L. Puget (2014), and J. Luhmann (2012).

International Cooperation Medal is awarded to a scientist (or group of scientists) who has made distinguished contributions to space science and whose work has contributed significantly to the promotion of international scientific cooperation. Recent recipients include: S. Barabash (2018), L. Zelenyi (2016), C.M. Pieters (2014), and R.-M. Bonnet (2012).

William Nordberg Medal is presented to a scientist who has made a distinguished contribution to space-science applications. Recent recipients include: C. Reigber (2018), C.G. Shepherd (2016), M.Ya. Marov (2014), and H. Fischer (2012).

Massey Award is awarded in recognition of outstanding contributions to the development of space research, interpreted in the widest sense, in which a leadership role is of particular importance. Recent recipients include: J. Zarnecki (2018), F.A. Harrison (2016), E. Churazov (2014), and N. Gehrels (2012).

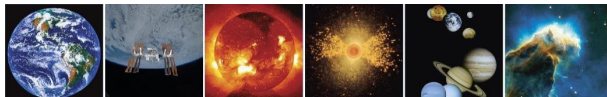
Distinguished Service Medal serves to honor extraordinary services rendered to COSPAR over many years. Recent recipients include: Mariano Méndez (2018), D. Halpern (2016), and P. Willmore (2012).

Vikram Sarabhai Award is awarded jointly by COSPAR and the Indian Space Research Organization for outstanding contributions to space research in developing countries. Eligible candidates for next year's award must have performed relevant work mainly in the period 2015-2019. Previous recipients include: Q. Zong (2018), K. Arai (2016), G.S. Lakhina (2014), and R. Navarro-Gonzalez (2012).

Jeoujang Jaw Award is awarded jointly by COSPAR and the Chinese Academy of Sciences and is intended to recognize scientists who have made distinguished pioneering contributions to promoting space research, establishing new space science research branches, and founding new exploration programs. Past recipients include: S.K. Krikalev (2018), C. Fang (2016), M. Sweeting (2014), and R.P. Lin (2012).

Zeldovich Medal is awarded jointly by COSPAR and the Russian Academy of Sciences to young scientists (less than 36 years of age on 31 December, 2020), for excellence and achievements. Medals are presented to a scientist in each of COSPAR's Scientific Commissions (SC). Recipients of the 2018 Zeldovich Medals are: B. Hamlington (SC-A), S. Kamata (SC-B), L.C. Chang (SC-C), R. Bhanu (SC-D), V. Savchenko (SC-E), A.A. Bahadori (SC-F), T. Yano (SC-G), and F. Francisco (SC-H).

Additional details concerning the awards, together with instructions and nomination forms, can be found at <https://cosparhq.cnes.fr/awards>. Completed nominations forms must be received by the COSPAR Secretariat in Paris no later than 30 November, 2019. Questions and assistance in securing necessary nomination endorsements can be addressed to David H. Smith, executive secretary of the U.S. National Committee for COSPAR, at dhsmith@nas.edu.



SUMMARY OF A SENATE HEARING OF INTEREST

NASA Exploration Plans: Where We've Been and Where We're Going

Committee on Commerce, Science, and Transportation, U.S. Senate

Subcommittee on Aviation and Space

This summary has been prepared by SSB Intern Stephen Tames as an overview 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.



Mr. Gene Kranz, Dr. Christine Darden, and Dr. Mary Lynn Dittmar during testimonies

In light of the 50th anniversary of the Apollo 11 mission, the Aviation and Space Subcommittee of the Senate Commerce, Science, and Transportation Committee held a hearing on July 9, 2019. The hearing probed the past and future of NASA's human spaceflight program, and featured a distinguished cast of witnesses, including several notable Apollo era figures.

Mr. Gene Kranz, Apollo 11 Flight Director

Dr. Christine Darden, Data Analyst and Aerospace Engineer Researcher, NASA

Dr. Mary Lynne Dittmar, President and Chief Executive Officer, Coalition for Deep Space Exploration

Mr. Homer Hickam, Author, *Rocket Boys (October Sky)*

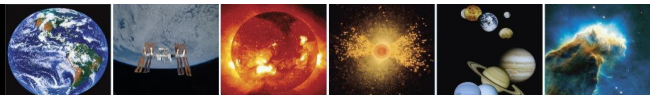
Mr. Eric Stallmer, President, Commercial Spaceflight Federation

Mr. Gene Kranz, the famed flight director for Apollo 11 and Apollo 13, initiated the hearing with his testimony. He highlighted the disparities between the Gemini-Apollo era programs and current exploration efforts. Mr. Kranz argued that a successful space program requires public unity, effective leadership, and a capable team. In contrast, he contended that the current program lacks substance in all three critical elements. When addressing the future Mr. Kranz championed his "Foundations of Mission Control" and programmatic quality goals: System Reliability, Sound Flight Plans, and Superb Crews.

The next witness, Dr. Christine Darden, one of NASA's "Hidden Figures," volunteered her insight as a former computer. Her testimony converged on the importance of the NASA-affiliated research centers for their scientific and technical research. Dr. Darden endorsed the Artemis program as a method to motivate the American people and induce an "Artemis Generation" of inspired engineers and scientists.

Dr. Mary Lynne Dittmar, the President and Chief Executive Officer of the Coalition for Deep Space Exploration, addressed the geopolitical backdrop of the Apollo program, comparing it to the present geopolitical challenges faced by the United States. She recommended a robust space exploration program to improve the security capacity of ourselves and our allies in space, noting recent momentum in expanding American strategic capacity in space. She further emphasized the technological and economic benefits of investing in NASA and implied support for the Gateway project as a testbed for Mars exploration.

Mr. Homer Hickam, the author of the award-winning book *Rocket Boys (October Sky)*, illustrated his dream for lunar exploration and exploitation. He argued that a nation qualifies as spacefaring when its citizens can work in blue-collar jobs on the Moon or Mars. Generally, Mr. Hickam called for greater support of commercial enterprises in space, and the advancement of the American space program through commercial providers.



(Summary of a Senate Hearing of Interest continued from page 6)

The final witness, Mr. Eric Stallmer criticized NASA's current agenda as overconfident without a budget increase. However, he endorsed exploiting commercial enterprise for general space infrastructure as a means of reducing expenses. He contended further that NASA must cease paying for effort and only pay for results. By interfacing aggressively with commercial space, NASA may both reduce its budgetary constraints and stimulate a competitive space economy.

During questioning, Chairman Ted Cruz, R-Texas asked the witnesses where American space exploration should be in 2069. Although no concrete objectives were mentioned, proposals included developing a unified space exploration policy and rejuvenating NASA's leadership. Discussion transitioned to the state of NASA and its commercial partners' workforces which face challenges from retirement, lack of interest in aerospace, and poor STEM education. However, Mr. Stallmer contested this position, highlighting the vast well of skill and education available to NASA and the many international students who could be convinced to work in aerospace with the correct visa and immigration policies. During both the testimonies and questioning members of the subcommittee sought to determine how Mr. Kranz and Dr. Darden would go about reconstituting the institutional environment of the Apollo era.

Returning to the Moon before venturing to Mars remained a surprising central theme among the testimonies. The most convincing of the justifications included affirming our equipment and crews, generating public interest and investment, and better understanding the challenges of deep space extended travel. Moreover, there seemed to be significant backing among the witnesses for employing commercial space companies to the maximum advantage of NASA.

SSB STAFF NEWS

We are happy to announce that **Daniel Nagasawa** (Associate Program Officer) has joined the board.



Daniel Nagasawa is an associate program officer with the Space Studies Board. Before joining the SSB, he was a graduate research assistant specializing in stellar astrophysics, measuring the abundance of elements in the atmospheres of very old, metal-poor stars. Dr. Nagasawa began his research career as an undergraduate research assistant for the Cryogenic Dark Matter Search. When he began graduate school, he transitioned to designing and evaluating astronomical instrumentation, specifically ground-based spectrographs. He went on to specialize in high-resolution stellar spectroscopy and applied these techniques on stars in ultra-faint

dwarf satellite galaxies of the Milky Way to study the chemical history of the Galaxy as part of the Dark Energy Survey (DES). He also developed skills in education and public outreach by teaching an observational astronomy course and writing for an outreach initiative for DES. Dr. Nagasawa earned his Ph.D. in Astronomy and his M.S. in Physics at Texas A&M University; he earned his B.S. in Physics with a Concentration in Astrophysics from Stanford University.

Sara Crandall (Christine Mirzayan Science and Technology Policy Fellow) completed her fellowship and returned to the University of California, Santa Cruz.

In the past few months **Anesia Wilks** (Senior Program Assistant), **Nathan Boll** (Associate Program Officer) and **Sarah Brothers** (Associate Program Officer) have departed to explore new opportunities. We wish them well in all of their future endeavors.

SSB Staff

COLLEEN HARTMAN

Director

ARTHUR A. CHARO

Senior Program Officer

DWAYNE A. DAY*

Senior Program Officer

SANDRA J. GRAHAM

Senior Program Officer

GREGORY MACK*

Senior Program Officer (from January 7, 2019)

ABIGAIL SHEFFER

Senior Program Officer

DAVID H. SMITH

Senior Program Officer

NATHAN BOLL

Associate Program Officer (through April 19, 2019)

SARAH BROTHERS

Associate Program Officer (through August 7, 2019)

DANIEL NAGASAWA

Associate Program Officer (from July 15, 2019)

MIA BROWN

Research Associate

GAYBRIELLE HOLBERT

Program Assistant

ANDREA REBHOLZ*

Program Coordinator

ANESIA WILKS

Senior Program Assistant (through May 17, 2019)

DIONNA WISE

Program Coordinator

MEG KNEMEYER

Financial Officer

RADAKA LIGHTFOOT

Senior Financial Associate

CELESTE A. NAYLOR

Information Management Associate

TANJA E. PILZAK

Manager, Program Operations

SARA CRANDALL

Christine Mirzayan Science and Technology Policy Fellow (through April 12 2019)

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



SSB Meetings Calendar

J U L Y						
S	M	T	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

A U G U S T						
S	M	T	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

S E P T E M B E R						
S	M	T	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

O C T O B E R						
S	M	T	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

July 15-17	Decadal Survey on Astronomy and Astrophysics 2020 (Astro2020) Steering Committee	Washington, DC
July 23-25	Review of the Progress Toward Implementing the Decadal Survey—Solar and Space Physics: A Science for a Technological Society	Woods Hole, MA
August 1-2	Review of the NASA Science Mission Directorate Science Plan	Washington, DC
August / September	Astro2020 Science Panels—see www.nas.edu/astro2020 for more information	Washington, DC
September 10-12	Committee on Astrobiology and Planetary Science (CAPS)	Pasadena, CA
October 22-24	Committee on Solar and Space Physics (CSSP)	Washington, DC
October 28-29	Forum for New Leaders in Space Science	Washington, DC
October 29-31	Committee on Biological and Physical Science in Space (CBPSS)	Irvine, CA

Upcoming Events

November 6-8, 2019	Space Studies Board	Irvine, CA
March 31-April 2, 2020	Space Science Week	Washington, DC
April 28-30, 2020	Space Studies Board	Washington, DC



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



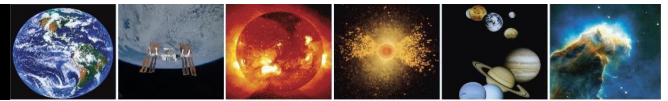
Keck Center
500 Fifth St NW,
Washington, DC



Arnold and Mabel Beckman Center
100 Academy Drive
Irvine, CA



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



SELECTED REPORTS AVAILABLE FROM THE SPACE STUDIES BOARD

For a complete list of titles and free PDF versions of our reports visit <https://www.nap.edu/author/SSB>

Hardcopy versions of 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.



- ☐ Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes
- ☐ Continuous Improvement of NASA's Innovation Ecosystem: Proceedings of a Workshop (2019)
- ☐ Report Series: Committee on Astrobiology and Planetary Science: Review of the Planetary Science Aspects of NASA SMD's Lunar Science and Exploration Initiative (2019) **Available online only**
- ☐ Report Series: Committee on Astrobiology and Planetary Science: Review of the Commercial Aspects of NASA SMD's Lunar Science and Exploration Initiative (2019) **Available online only**
- ☐ Planetary Protection Classification of Sample-Return Missions from the Martian Moons (2019)
- ☐ Strategic Investments in Instrumentation and Facilities for Extraterrestrial Sample Curation and Analysis (2019)
- ☐ An Astrobiology Strategy for the Search for Life in the Universe (2019)
- ☐ Open Source Software Policy Options for NASA Earth and Space Sciences (2018)
- ☐ Exoplanet Science Strategy (2018)
- ☐ Visions into Voyages for Planetary Sciences in the Decade 2013-2022: A Midterm Review (2018)
- ☐ Report Series: Committee on Astronomy and Astrophysics: Mission Concept Studies (2018) **Available online only**
- ☐ Review and Assessment of Planetary Protection Policy Development Processes (2018)
- ☐ Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space (2018) **Available online only**
- ☐ A Midterm Assessment of Implementation of the Decadal Survey on Life and Physical Sciences Research at NASA (2017)
- ☐ America's Future in Civil Space: Proceedings of a Workshop-in Brief (2017)
- ☐ Searching for Life Across Space and Time: Proceedings of a Workshop (2017)
- ☐ Powering Science: NASA's Large Strategic Science Missions (2017)
- ☐ Report Series: Committee on Astrobiology and Planetary Science: Getting Ready for the Next Planetary Sciences Decadal Survey (2017) **Available online only**
- ☐ Report Series: Committee on Astronomy and Astrophysics: Small Explorer Missions (2017) **Available online only**
- ☐ Report Series: Committee on Solar and Space Physics: Heliophysics Science Centers (2017) **Available online only**
- ☐ Review of the Restructured Research and Analysis Programs a NASA's Planetary Science Division (2017)
- ☐ Assessment of the National Science Foundation's 2015 Geospace Portfolio Review (2017)
- ☐ 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)
- ☐ Continuity of NASA Earth Observations from Space: A Value Framework (2015)
- ☐ Review of the MEPAG Report on Mars Special Regions
- ☐ The Space Science Decadal Surveys: Lessons Learned and Best Practices (2015)
- ☐ Sharing the Adventure with the Student: Exploring the Intersections of NASA Space Science and Education: A Workshop Summary
- ☐ 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)
- ☐ 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)