

J U L Y - S E P T E M B E R

INSIDE THIS ISSUE



The Astro2020 Steering committee will hold its  
2nd meeting on December 9-11, 2019  
in Pasadena, California.

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*The National Academies of*  
**SCIENCES • ENGINEERING • MEDICINE**

# SPACE STUDIES BOARD NEWS

## THE BOARD AND ITS DISCIPLINE COMMITTEES

The Space Studies Board (SSB) did not meet this quarter. 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](http://sites.nationalacademies.org/SSB/SSB_052281).

The Committee on Astrobiology and Planetary Science (CAPS) held its scheduled September 10-12 meeting at the Keck Institute for Space Studies at the California Institute of Technology. The meeting was devoted to organizational issues associated with the planned initiation of the next planetary science decadal survey in 2020. The meeting was organized around a series of panel discussions addressing issues such as: input from the advisory/analysis groups; lessons learned from previous decadal surveys; survey organization; white papers; and community outreach and inclusion. CAPS also heard perspectives from NASA, NSF, ESA and JAXA. A major topic of discussion concerned alternative models for the organization of the decadal survey's supporting panels.

In late September, CAPS received a request from Lori Glaze, the director of NASA's Planetary Science Division (PSD), to draft a short report at its March 2020, meeting addressing topics related to the mission options for the announcement of opportunity for the fifth New Frontiers mission.

Committee staff participated in the September 15-20 joint meeting of the American Astronomical Society's Division for Planetary Science and the European Planetary Science Congress in Geneva, Switzerland. The activities at the event included: a town hall event to discuss the status of planning for the next decadal survey (committee staff with NASA/PSD Division Director Lori Glaze); committee staff participation (with representatives from NASA, ESA, NSF, and COSPAR) during the Space Exploration Night (a.k.a. Agency Night); and participation of committee staff during in the Ice Giants Mission Workshop and the OPAG splinter meeting.

The next meeting of CAPS will take place in Washington, DC, on March 31-April 2 as part of the 2020 Space Science Week. More information on CAPS and its activities is available at [http://sites.nationalacademies.org/SSB/SSB\\_067577](http://sites.nationalacademies.org/SSB/SSB_067577).

The Committee on Astronomy and Astrophysics (CAA) is in the process of finalizing its new membership. The CAA's fall meeting will be held by telecon, with a date to be determined soon. The next meeting of CAA will take place in Washington, DC, on March 31-April 2 as part of the 2020 Space Science Week. More information on CAA and its activities is available at [https://sites.nationalacademies.org/BPA/BPA\\_048755](https://sites.nationalacademies.org/BPA/BPA_048755).

During this period the Committee on Biological and Physical Sciences in Space (CBPSS) did not meet, but discussions continued with NASA and stakeholders on the details of tasks that should be incorporated into the next decadal survey on biological and physical sciences. Additional stakeholder input for this activity was collected during the July 29-Aug. 1 ISS Research and Development Conference in Atlanta, GA, which was attended by committee staff Sandra Graham and co-chair Rob Ferl. The committee will next meet October 29-31 in Irvine, CA to review and revise a statement of task for the decadal survey. More information on CBPSS is available at [http://sites.nationalacademies.org/SSB/SSB\\_145312](http://sites.nationalacademies.org/SSB/SSB_145312).

The Committee on Earth Science and Applications from Space (CESAS) did not meet during this quarter. As the quarter ended, the Committee was preparing for its fall meeting, which will take place on December 17-18, 2019 in Washington DC. The first day of the meeting will be devoted largely to sessions on emerging capabilities for unmanned aircraft systems for Earth observations, especially in support of NASA airborne science programs. The committee will also hear from NASA and NOAA officials regarding progress in implementation of the decadal survey, *Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space* (2018). For additional information

## SSB MEMBERSHIP

JULY 1, 2019—JUNE 30, 2020

**MARGARET KIVELSON**, *Chair*

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**

U.S. Senate (retired)

**ADAM BURROWS**

Princeton University

**MARY LYNNE DITTMAR**

Coalition for Deep Space Exploration

**JEFF DOZIER**

University of California, Santa Barbara

**VICTORIA HAMILTON**

Southwest Research Institute

**CHRYSSA KOVELIOTOU**

The George Washington University

**DENNIS P. LETTENMAIER**

University of California, Los Angeles

**ROSALY M. LOPEZ**

Jet Propulsion Laboratory

**STEPHEN J. MACKWELL**

American Institute of Physics

**DAVID J. MCCOMAS**

Princeton University

**LARRY PAXTON, JR.**

Johns Hopkins University, Applied Physics Laboratory

**ELIOT QUATAERT**

University of California, Berkeley

**MARK P. SAUNDERS**

Independent Consultant

**BARBARA SHERWOOD LOLLAR**

University of Toronto

**HOWARD J. SINGER**

National Oceanographic and Atmospheric Administration

**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

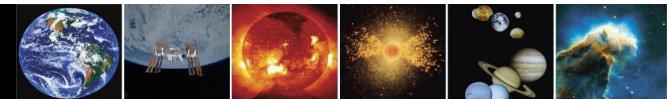
**EDWARD L. WRIGHT**

University of California, Los Angeles

**LIAISON**

**CHARLES KENNEL**

U.S. Representative to COSPAR



about CESAS and links to presentations at past committee meetings, please go to [https://sites.nationalacademies.org/SSB/SSB\\_066587](https://sites.nationalacademies.org/SSB/SSB_066587).

The **Committee on Solar and Space Physics (CSSP)** is holding their fall meeting, October 22-24, 2019, in Washington, DC, where they will be seeking input for writing a 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. General community input has been requested on these topics at summer meetings and via submission to the CSSP website. More information on the CSSP, including the full statement of task for the short report and a form to submit input to the CSSP is available at [https://sites.nationalacademies.org/SSB/SSB\\_052324](https://sites.nationalacademies.org/SSB/SSB_052324).

## STUDY COMMITTEES

The **Decadal Survey on Astronomy and Astrophysics 2020 (Astro2020)** has appointed six science panels and is in the process of appointing six program panels and a panel on state of the profession and societal impacts. The science panels held their first meetings in August and September 2019 and are planning their second, final meetings for September and October. One primary task for each science panel was to review the science white papers relevant to their topic areas. The program panels are anticipated to hold three meetings, the first in October or November, where they will review the activity, project, or state of the profession consideration (APC) papers. The second and third program panel meetings are expected to be held in January and March 2020. The survey steering committee will hold its second meeting on December 9-11, 2019, where they will hear reports from the science panels and from the first meetings of the program panels. Upcoming events include a webinar to be held on October 28, 2019, at 1:30 pm Eastern and a town hall meeting at the meeting of the American Astronomical Society in Honolulu, HI on January 7, 2020, as well as a listening session on the state of the profession to be held on January 6, 2020. More information on Astro2020 is available at <http://nas.edu/astro2020>.

The prepublication version of the **Committee on Continuous Improvement of NASA's Innovation Ecosystem's** report, titled “*Continuous Improvement of NASA's Innovation Ecosystem: Proceedings of a Workshop*” was delivered to NASA on July 17, 2019 and publicly released the following week. Editing and preparation of the manuscript for publication is nearly complete, and the printed copies of the report are expected to be available by the end of October.

The **Committee on the NASA Science Mission Directorate Science Plan** was formally appointed on July 16 in response to a June 12 request from NASA to review SMD's Science Plan, the sixth such request since the first such document was reviewed in 1997. A committee of ten members, under the leadership of Jeff Dozier (University of California, Santa Barbara) and Victoria E. Hamilton (Southwest Research Institute) respectively, the chair and vice chair, held its one and only meeting in Washington, DC, on August 1-2. A draft report was sent to reviewers on August 14 and ap-

proved for release on September 23. The committee's report, *Review of the Draft 2019 Science Mission Directorate Science Plan*, is scheduled to be delivered to NASA in prepublication format on October 4 and released to the public on October 17. More information about the committee and its report can be found at [http://sites.nationalacademies.org/SSB/CurrentProjects/SSB\\_194794](http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_194794).

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. In September, NASA announced plans to build a space-based infrared telescope for detecting and tracking near Earth objects. The value of such a telescope for that mission was the key conclusion of the report. The report was printed in October. More information on the project is available at [http://sites.nationalacademies.org/SSB/CurrentProjects/SSB\\_190172](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 on October 24 during the International Astronautical Congress in Washington. More information about this committee is available at <http://sites.nationalacademies.org/SSB/CurrentProjects/>

## 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  
Thomas Greene, NASA Ames Research Center

### 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

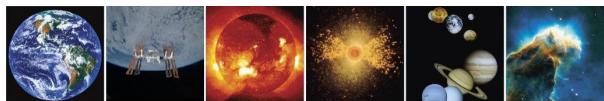
### Committee on Earth Science and Applications from Space (CESAS)

Chelle L. Gentemann, Earth & Space Research  
Steve W. 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](http://sites.nationalacademies.org/SSB/ssb_052296)>.



[SSB 181917](https://www.nap.edu/catalog/25357). 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 third and last in-person meeting on July 23-25, 2019 in Woods Hole, Massachusetts. The entire meeting was devoted to completion of the committee's draft report, which is expected to enter external peer review by the end of October 2019. Information about the committee and links to meeting presentations can be found at: [http://sites.nationalacademies.org/SSB/CurrentProjects/SSB\\_188088](http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_188088).

**The Committee on the Review of the Report of the NASA Planetary Protection Independent Review Board** is in the process of being established in response to a request received from NASA in late-August. Earlier this year NASA's Science Mission Directorate established an internal activity, called the Planetary Protection Independent Review Board (PPIRB) under the leadership of Alan Stern (Southwest Research Institute), to look at NASA's planetary protection policies. The establishment of the PPIRB was motivated, in part, by recommendations from the NASA Advisory Council and by the 2018 SSB report, *Review and Assessment of Planetary Protection Policy Development Processes*. It is anticipated that a committee of 8-10 members will be appointed in late October and hold meetings in late-November and mid-December and release its report by the end of the first quarter of 2020.

## The planning Committee for Science Opportunities Enabled by Gateway:

**A Workshop** continued to hold frequent teleconferences and conduct planning activities for a workshop in the early part of this period. However, in consultation with NASA, it was agreed in August that the committee would stand down to allow for expected NASA re-planning efforts that would affect schedule and science capability plans for Gateway. A new workshop date has not been selected, but is expected to be in the February 2020 timeframe.

Following a request from NOAA (NESDIS), NASA (Heliophysics Division), and NSF (Geospace Section), and approval by the National Academies, the Space Studies Board is establishing a **planning Committee for the Space Weather Operations and Research Infrastructure Workshop** that will consider options for continuity and future enhancements of the U.S. space weather operational and research infrastructure. The workshop will identify gaps and future needs for space weather products and services

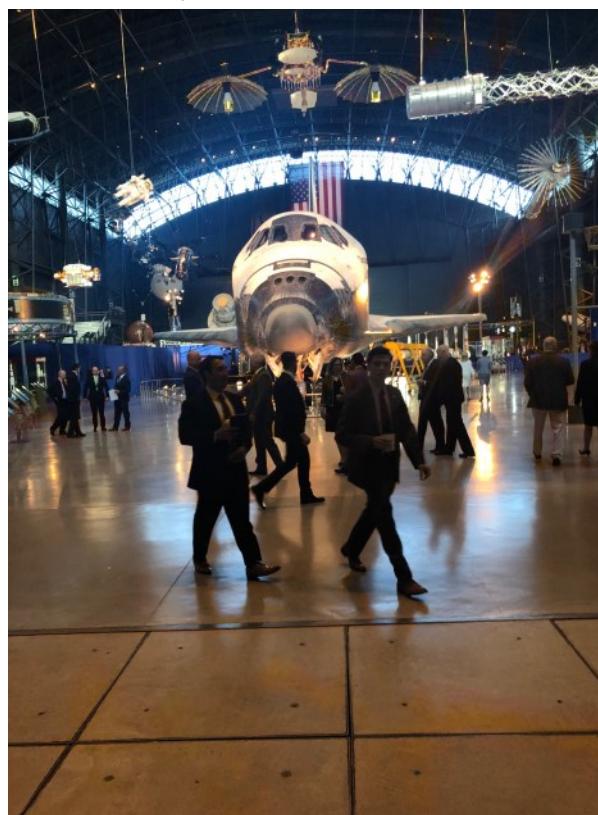
and, in response to the workshop's lead sponsor, NOAA, will give particular attention to the Space Weather Follow On program (SWFO) and options for future observing architectures. As the quarter ended, staff were working on nominations to the committee that will organize the workshop and produce a report of the proceedings. Tentatively, the workshop is planned for late Spring 2020.

## OTHER ACTIVITIES

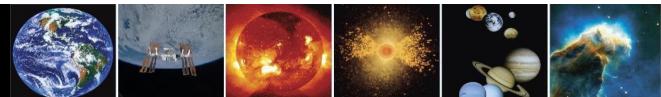
**The Committee on Space Research (COSPAR)**, for which the SSB is the U.S. National Committee, was not active during the current quarter. The next major scheduled events are the 4th COSPAR Symposium, to be held in Herzliya, Israel on November 4-8 and the 43rd COSPAR Scientific Assembly to be held in Sydney, Australia, on August 15-23, 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 six of this newsletter.

**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, DC 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\\_086017](http://sites.nationalacademies.org/SSB/SSB_086017).

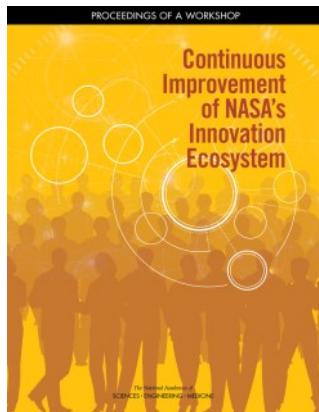


*Image from the 6th National Space Council Meeting which was held on August 20, 2019, at the Smithsonian's Udvar-Hazy Center in Dulles, VA and was attended by SSB Director Colleen Hartman.*



## REPORT RELEASES

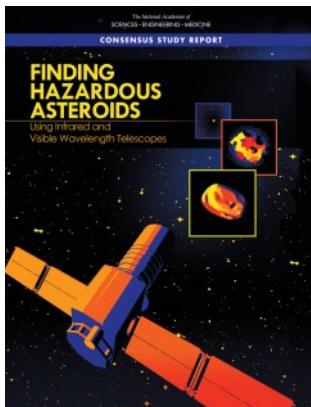
Copies of reports are available from the SSB office at 202-334-3477 or at <https://www.nap.edu/author/SSB>.



### Continuous Improvement of NASA's Innovation Ecosystem Proceedings of a Workshop (2019)

On November 29-30, 2018, in Washington, DC, the National Academies of Sciences, Engineering, and Medicine held the Workshop on the Continuous Improvement of NASA's Innovation Ecosystem. The workshop was requested by the National Aeronautics and Space Administration (NASA) Office of the Chief Technologist with the goal of identifying actionable and implementable initiatives that could build on NASA's current innovation culture to reach a future state that will ensure the agency's continued success in the evolving aerospace environment. Specifically, the National Academies planning committee was charged (see Appendix A) to "organize a workshop focused on understanding barriers to innovation at NASA and providing feedback on NASA's framework for creating an innovative ecosystem."

The report is available at <https://www.nap.edu/catalog/25505>



### Finding Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes (2019)

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.

The report is available at: <http://www.nap.edu/25476>

### Review of the Draft 2019 Science Mission Directorate Science Plan

NASA's Science Mission Directorate (SMD) ties together diverse researchers, sponsors, and resources to develop the science community's understanding of the universe. Within scientific organizations like NASA, it is important to establish clear strategies and goals to guide research and foster new discoveries across varying missions. SMD created a draft for their 2019 Science Plan, and a review of this draft is necessary to ensure that the plan establishes clear, attainable, relevant, and ambitious goals.

*Review of the Draft 2019 Science Mission Directorate Science Plan* provides comments on and recommendations for SMD's draft. Comments in this report focus on the level of ambition of the specified strategies in light of current and emerging opportunities to advance Earth and space science over the next 5 years, the ability of SMD to meet the science objectives in the most recent decadal surveys through implementation of specified strategies, additional strategies for SMD's considerations, and the general readability and clarity of the draft. Recommendations in this report identify important improvements for the 2019 Science Plan.

The report is available at <https://www.nap.edu/catalog/25587>



# 43rd COSPAR Scientific Assembly

**Committee on Space Research**

15 – 22 August 2020

International Convention Centre  
Sydney Australia

**[www.cospar2020.org](http://www.cospar2020.org)**

**Connecting  
space research  
for global impact**

Deadline for **Abstract Submission**

**14 February 2020**

Submissions @  
<https://www.cospar-assembly.org>

Deadline for **Early Bird Registration**

**16 May 2020**



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## SUMMARY OF A CONGRESSIONAL HEARING OF INTEREST

Hearing on NASA's Proposal to Advance Moon Landing by Four Years: October 16, 2019  
 Subcommittee on Commerce, Justice, Science, and Related Agencies  
 House Committee on Appropriations

*This summary has been prepared by Sarah E. Moran and Jordan McKaig, Space Studies Board Interns as an overview of what occurred at the hearing. The statements made are those of the authors and do not represent the views of the participants, the Space Studies Board, or the National Academies.*



*Photo Credit: <https://www.youtube.com/user/SpaceKSCBlog>*

*Witnesses: NASA Administrator James Bridenstine*

*Acting Associate Administrator HEOMD Kenneth Bowersox*

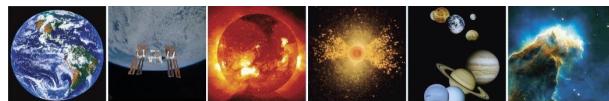
*House Subcommittee on Appropriations (present): Chair Serrano (D-NY), Congressman Aderholt (R-AL), Congresswoman Granger (R-TX), Congressman Cartwright (D-PA), Congressman Palazzo (R-MS), Congressman Case (D-HI), Congresswoman Meng (D-NY), Congresswoman Kaptur (D-OH), Congressman Crist (D-FL)*

Artemis, the planned spaceflight program to land human crew on the Moon, was recently accelerated to a 2024 landing goal from its original 2028 date. Because this accelerated timeline came after the budget deadline for FY 2020, NASA requested additional funds as part of an amended budget request in July. This date did not give the House a chance to discuss the consequences of such a request during its summer session; the purpose of this hearing was to provide a venue for such discussion.

Administrator Bridenstine insisted that NASA remain apolitical. However, discussion during the hearing was highly partisan. Chair Serrano (D-NY) stated "to a lot of members, the motivation appears to be just a political one, giving President Trump a moon landing in a possible second term" and not for scientific gain.

In response to Congresswoman Granger's question about the specific strategic benefits of human presence on the Moon, Administrator Bridenstine did not clearly elucidate the gains from the Moon in particular compared to LEO activities or current NASA SMD programs. The subcommittee (and Congress generally) seem theoretically supportive of a 2024 landing but are highly reluctant to devote monetary resources to the project. Specific topics covered during the hearing included the following:

- Congressman Serrano repeatedly worried that the funding necessary for an accelerated Artemis will come at the cost of social programs. Administrator Bridenstine made very clear that he will not "cannibalize" NASA by taking money from the Science Mission Directorate (SMD) or others to fund Artemis, hence the Agency's additional ask of \$1.6 billion once they accelerated the timeline to 2024.
- The subcommittee asked for clarification on the role of commercial partnerships in crewed lunar missions. Administrator Bridenstine's primary response was that NASA is actively reviewing proposals for the Human Landing System, a commercially built design. Detailed comment at this time is not possible in order to remain impartial during proposal review; however, the commercial space industry will clearly play a critical role in Artemis.
- The subcommittee wants a cost estimate for the Artemis program (broken down by year) as soon as possible. Administrator Bridenstine says this will be done by February 2020 with the President's Budget Request for FY 2021; Chair Serrano pushed back that this date was not soon enough for Congress to take the action needed.
- Congress is concerned about the effects of expediting the landing to 2024 on safety, quality, and cost effectiveness. Administrator Bridenstine responded with concerns about the political risk of a lengthy program. Historically, long-term programs have been more prone to cancellation, primarily due to loss of public confidence in mission feasibility.
- A claimed motivation for landing by 2024 is concern about national security. China plans on a crewed Moon landing by 2030 and is seeking to establish themselves as the global leader in lunar/space exploration. Administrator Bridenstine desires for NASA to maintain that role.



## REFLECTIONS OF LLOYD V. BERKNER SPACE POLICY SUMMER 2019 INTERNS



*Interns Stephen Tames, Phoebe Kinzelman and Senior Program Officer, David Smith visited the Science in Japan event at the Cosmos Club in July 2019*

### Ben Cassesse

This summer I had the pleasure of serving as a Lloyd V. Berkner Space Policy intern on the National Academy of Sciences' Space Studies Board. To say I simply learned a lot from the experience is an understatement: I learned more about science policy, the relationships between academics and the government, the decision making structure of Washington, and so many other areas than I expected. To say I simply enjoyed and benefitted from the experience would also show too much restraint: the insights I gained here will certainly affect my career moving forwards, and I wouldn't be surprised if I look back at my time here as critical to shaping my perspectives on federal policy and the nature of science.

While I'm sure every ten week block in Washington feels historic, I feel particularly lucky that I had the chance to work in this place in this field in this specific summer. As a student of both science and history, the combination of national reminiscence surrounding the 50th anniversary of the Apollo 11 landing and national excitement supporting a possible return to the moon appealed almost too perfectly to my academic passions. I got to shake Gene Kranz's hand, listen in person to the surviving crew of Apollo 11, and cheer with hundreds of thousands of other Americans on the National Mall while watching the anniversary projection show on the Washington Monument. But interspersed with these moments of reflection and exposure to the aging greats of our earliest endeavors beyond earth, I experienced plenty of pivots towards the future. Between a presentation from the PI of the Dragonfly mission to Titan, the chance to sit in on Congressional hearings about America's upcoming support for commercial and crewed missions, and the opportunity to witness the first Astro2020 steering committee meeting, I repeatedly felt like I had a front row seat to the beginnings of projects people would cheer about in another fifty years. It was a good summer to be an American interested in outer space; it was a great summer to be an American student working for the people who will organize our next achievements there.

I have nothing but positive feelings for the incredible staff of the SSB, all of whom were supportive and friendly during my brief time as their colleague. I'm grateful for the opportunities I was given and will miss them all. Hopefully I'll come back again in some form; it would be an honor to return and continue advising the nation someday. Best of luck to everyone working on an SSB report, and many, many thanks again to the staff!

### Phoebe Kinzelman

I had been to Washington, DC twice before this summer — once when I was nine, and briefly when I was a senior in high school. However, those trips pale in comparison to the two months I spent living in the city and interning at the National Academy of Sciences. Just two weeks after starting work, I was walking across the National Mall, heading to a meeting of the NASA Advisory Council at NASA Headquarters. My days were often filled with exciting events like this. I found myself attending the annual Science in Japan event at the Cosmos Club, the Space Weather Enterprise Forum at the Department of the Interior, and a Space Diplomacy event at George Washington University, where I got to hear both Michael Collins and Buzz Aldrin speak. I was also lucky enough to be in DC for the 50th anniversary of Apollo 11 landing on the Moon, and it was so exciting to see the city's celebrations. I was able to sit in on a Senate hearing that included testimonials from Gene Kranz (Flight Director of Apollo 11) and Dr. Christine Darden (mathematician and aeronautical engineer at NASA) and even spoke to them afterwards!

When I wasn't attending meetings and events around the city, I was assisting the Space Studies Board in their day-to-day activities. One big project I worked on was a new report detailing the process of how a decadal survey is completed. I went through various decadal surveys the SSB had produced from the 1980s to present day, and documented what happened to recommended space projects (like ground and space telescopes, satellites, and science initiatives) decade to decade. I also worked on a report about hazardous asteroids released by the Committee on Near-Earth Object Observations. I collected additional information from authors to create a reference page and worked to obtain image and figure permissions.

However, one of the most exciting parts of this internship was attending the meeting of the Committee on the Review of Progress Toward Implementing the Decadal Survey-Solar and Space Physics: A Science for a Technological Society in Woods Hole, Massachusetts. I spent the last week of work at the Jonsson Center in Quissett Harbor, sitting in on the meeting and getting to experience what writing a decadal survey is like (lots of editing!). Like with the hazardous asteroids paper, one of my tasks was to make sure citations of the paper were correctly formatted. The area around the center is beautiful, and we even got some time to walk



around nearby Falmouth and watch the boats pull in to the harbor. The committee members were all so friendly and knowledgeable, and I can't thank them enough for welcoming me.

I would sincerely like to thank everyone at the Space Studies Board and the Aeronautics and Space Engineering Board for giving me an incredible experience in Washington, DC. The staff was always incredibly friendly and so eager to teach me more about what they do. This internship afforded me valuable opportunities to learn about how space policy is created and managed on a governmental level, and I am excited to use this knowledge in some of my studies when I return to Purdue in the fall. Thank you all for a wonderful summer!

## Stephen Tames

The summer of 2019 was an important time for human space exploration and the growing commercial space sector. While I served as a Lloyd V. Berkner Space Policy Intern, the nation and congress were introduced to the Artemis Program, commercial enterprises faced both challenges and triumphs, and we all celebrated the 50th anniversary of the Apollo 11 Mission. Throughout this lively period, the Space Studies Board allowed me the opportunity to observe the meetings that will shape the future of American space exploration, from private conference rooms to crowded senate hearings. The world of space policy is a rapidly evolving landscape, and I am grateful to have been given the opportunity to experience it firsthand.

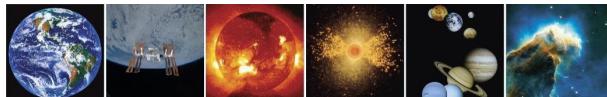
Although perhaps an unsung hero, The National Academies has been the leading force behind many of the greatest scientific initiatives in the history of our nation. Employing our deeply knowledgeable scientists and engineers to refine and distill the fundamental aspects of not only national space-science policy but overall scientific policy is critical to ensuring that we stay competitive. I am proud to have been a small part of this organization, which has an unappreciated role in the process of national science prioritization.

Personally, my time at the Space Studies Board has been deeply rewarding. I had the opportunity to attend numerous congressional hearings, professional events, and advisory meetings. In all of these things, I could see the contributions of scientists to society and our understanding of the universe, and it was inspiring. I began my position not knowing precisely what I wanted to do in my career, but I leave knowing that space policy could be a home for me. I am still not certain exactly where I will end up, but the context I have gained working at the SSB will be invaluable in my future decisions. The knowledge and experience I have gathered while interning at the Space Studies Board will contribute significantly to my future career goals in space policy and beyond. I am exceedingly grateful for the opportunity to work at the SSB and to the SSB and National Academies staff.



The Space Studies Board and Air Force Studies Board staff toured Johns Hopkins APL and heard presentations on Parker Solar Probe, Interstellar Probe, and the Dragonfly Mission; and toured the Intelligent Science Center and Satellite Integration Center.

*Pictured: Mia Brown, Ryan Murphy, Dan Nagasawa, Abby Sheffer, Ben Cassesse, Colleen Hartman, Jason Kalirai, Andrea Rebholz, Michael Paul, George Coyle, APL Staff, Kim DeRose, Celeste Naylor, and Ellen Chou*



## SSB STAFF NEWS

We are happy to announce that **Megan Chamberlain** (Senior Program Assistant) has joined the board.

**Megan Chamberlain**, senior project assistant, joined the Space Studies Board and the Aero-nautics and Space Engineering Board in September 2019. She began her career at the Academies in 2007 working for the Transportation Research Board in the Cooperative Research Programs. She has assisted with meeting facilitation and administrative support of hundreds of research projects over the course of her career. Ms. Chamberlain attended the University of the District of Columbia and majored in psychology.

## Lloyd V. Berkner Space Policy Interns Fall 2019



**Jordan McKaig** is a recent graduate of the University of Michigan (UM), where she double majored in Biology and International Studies. There, she developed rover-based life detection techniques for implementation at the Mars Desert Research Station in Utah, and studied the evolution of antibiotic resistance in hospital pathogens. She spent the last two summers interning at NASA Ames Research Center with the Space Life Sciences Training Program, where she studied how terrestrial bacteria survive in Mars-like environments, what genetic changes occur in bacteria flown in space, and how high-altitude balloons can be used for astrobiological and atmospheric studies. Additionally, she loves swimming, yoga, hiking, and traveling. Jordan is thrilled to be a part of the Space Studies Board for the fall, and is looking forward to learning more about the role of policy in space exploration, particularly in relation to planetary protection.



**Sarah E. Moran** is a 4th year Ph.D. student in Earth and Planetary Sciences at Johns Hopkins University. Previously, she completed her undergraduate studies in Astrophysics and Science & Public Policy at Barnard College of Columbia University. In her graduate research, she is studying planets around other stars, which are known as exoplanets. Through laboratory experiments and computer models, she investigates clouds and hazes in exoplanets to figure out how they affect the overall atmosphere and how they impact habitability. She also works closely with observational astronomers to help them interpret her theoretical and experimental cloud and haze results in the context of transiting exoplanet observations. Sarah is passionate about science communication and science policy, and is very pleased to join the Space Studies Board this Fall to gain insight into and learn how to strengthen the connections between scientists, policy-makers, and the public.



**Osase Omoruyi** graduated from Yale University with her B.S. in Astrophysics and will pursue her Ph.D. in Astronomy and Astrophysics at Harvard University in the fall of 2020. She has worked on many research projects from bubbles in the interstellar medium to gravitational wave-detected black holes with LIGO. She is also passionate about combating socioeconomic inequality in her field. Osase is happy to join the Space Studies Board this fall so that she may learn about policy's role in astronomy. As the 2020 Astronomy and Astrophysics Decadal Survey unfolds, she is particularly excited to see what goes into preparing for the next decade of astronomy.

## 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

## ABIGAIL SHEFFER

Senior Program Officer

## DAVID H. SMITH

Senior Program Officer

## DANIEL NAGASAWA

Associate Program Officer

## NIA JOHNSON\*

Senior Research Associate (from May-October 2019)

## MIA BROWN

Research Associate

## MEGAN CHAMBERLAIN

Senior Program Assistant (from September 2019)

## GAYBRIELLE HOLBERT

Program Assistant

## ANDREA REBOLZ\*

Program Coordinator

## 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

## JORDAN MCKAIG

Lloyd V. Berkner Space Policy Intern (from September 2019)

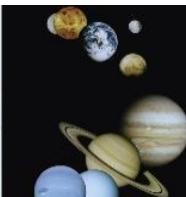
## SARAH MORAN

Lloyd V. Berkner Space Policy Intern (from September 2019)

## OSASE OMORUYI

Lloyd V. Berkner Space Policy Intern (from September 2019)

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



## SSB Meetings Calendar

O C T O B E R						
S	M	T	W	Th	F	Sa
			1	2	3	4
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		

N O V E M B E R						
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29	30	31				

J A N U A R Y						
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26	27	28	29	30		

Astro2020 Panels—see [www.nas.edu/astro2020](http://www.nas.edu/astro2020) for more information

Washington, DC

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

November 6-8 Space Studies Board Meeting Irvine, CA

November 20-22 Committee on the Review of the Report of the NASA Planetary Protection Independent Review Board TBD

December 9-11 Decadal Survey on Astronomy and Astrophysics 2020 (Astro2020) Steering Committee Irvine, CA

December 16-17 Committee on the Review of the Report of the NASA Planetary Protection Independent Review Board TBD

December 17-18 Committee on Earth Science and Applications from Space (CESAS) Washington, DC

## Upcoming Events

March 31-April 2, 2020 Space Science Week Washington, DC

June 9-11, 2020 Space Studies Board Washington, DC

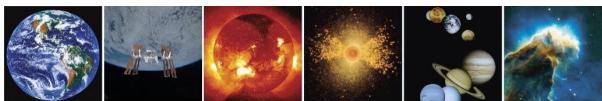


National Academy of Sciences Building  
2101 Constitution Ave NW  
Washington, DC

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



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- 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](#)
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- 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)
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- Exoplanet Science Strategy (2018)
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- 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)