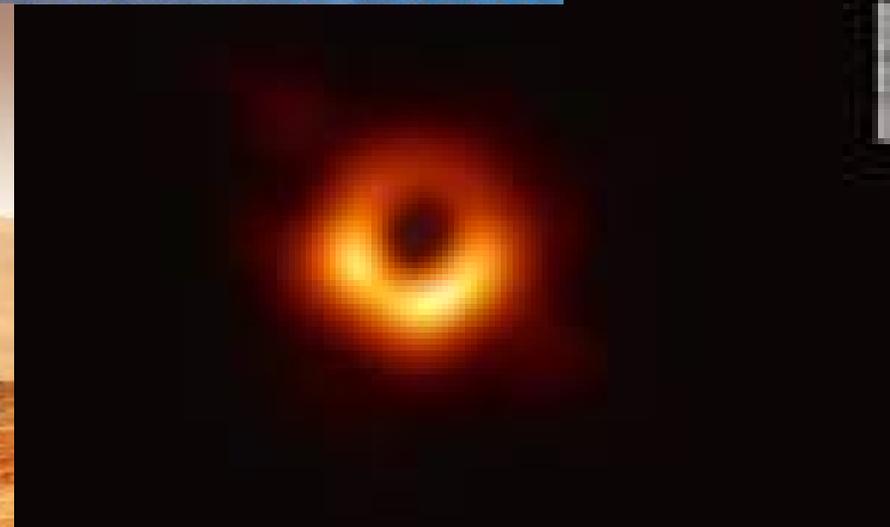
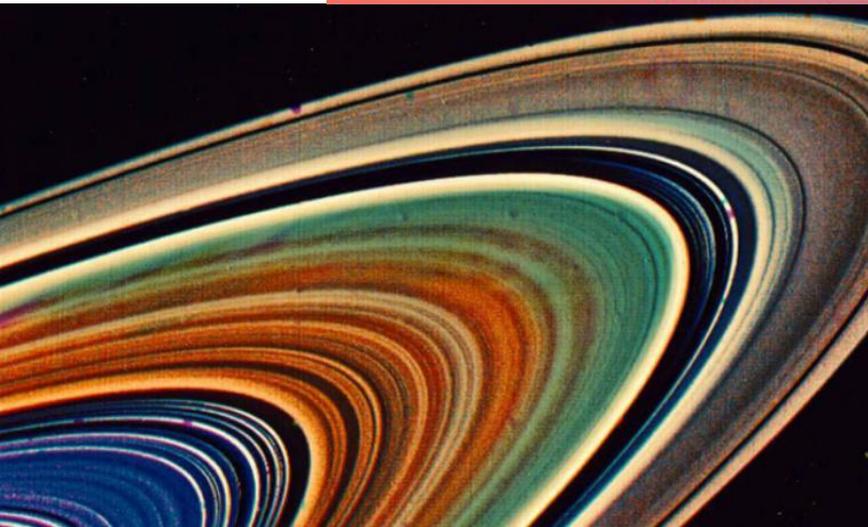
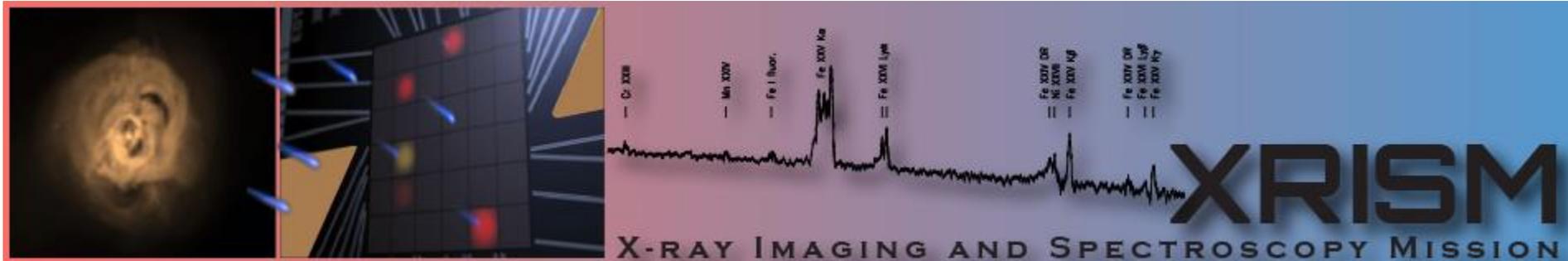


SPACE STUDIES BOARD UPDATE TO ESSC

COLLEEN HARTMAN, SSB BOARD DIRECTOR

MAY 2019 AMSTERDAM



New Space Studies
Board Chair:
Margaret Kivelson
(NAS)
UCLA, Galileo, participant
in magnetometer team for
the European JUICE
Mission to Jupiter, etc. etc.



Space Science Week 2019 (March 26-28)

- 5 Discipline Committees of the SSB (CAA, CAPS, CBPSS, CESAS, and CSSP) met in parallel sessions and together in the Plenary
 - **ESSC Chairs attended each of the plenary sessions and contributed greatly**
- Plenary
 - SMD budget reviewed by Thomas Zurbuchen
 - Two panels:
 - International: Fabio Favata, Xiaolong Dong, Masaki Fujimoto, Len Fisk
 - Human and Robotic Exploration and US Agency Reps: David Parker, Erick Dupuis, Steve Volz, Thomas Zurbuchen
- Eric Rignot (UC, Irvine) lecture: ***Sea Level Rise from Melting Ice Sheets and What We Should Do About It***, which drew over 200 attendees.
 - A recording is available at <https://livestream.com/NASEM/SeaLevelRise>

- Joint agenda focused on **SMD** planning and budget with talks from the AA and all 4 Division Directors.
- **Wonderful presentation by Athena Coustenis and Nicolas Walters**
- Update from the newly appointed head of **OSTP**: Kelvin Droegemeier
- Update from Gerst on **Gateway**
- Update from the **Office of Space Commerce/DOC**: Kevin O’Connell
- Panel discussion on **Lunar Space Science and Exploration**
- Dinner speaker, Rob Manning, JPL Chief Engineer on “**Innovation and Risk-taking on NASA’s Robotic Missions**”

The National Academies of
SCIENCES • ENGINEERING • MEDICINE



Works In Progress

- **Review of Progress Toward Implementing the Decadal Survey Vision in Solar and Space Physics: A Science for a Technological Society.** Report due December 31, 2019. Robyn Millan, Thomas N. Woods, Art/Mia/Andrea
- **Near Earth Object Observations in the Infrared and Visible Wavelengths.** H. Jay Melosh Dwayne/Sarah/AnesiaThe committee is working on its report draft and will have a third meeting April 17-18, 2019 in Washington, DC.
- **Astro 2020 Decadal Survey.** Committee co-chairs have been announced: Fiona Harrison and Rob Kennicutt, Abby/Art/Greg/Dionna. Co-chairs and staff are in the process of collecting committee nominations and determining the structure of the study.

Administrator BRIDENSTINE:

**NO COST ESTIMATE YET AVAILABLE
FOR MOON 2024, BUT IT WON'T BE
\$8 BILLION/YEAR**

- **TESTIMONY BEFORE THE SENATE
APPROPRIATIONS COMMERCE-
JUSTICE-SCIENCE SUBCOMMITTEE
MAY 1, 2019**



Gestenmeier Presentation to ASEB/SSB Meeting on Humans to the Moon, 2024

3 launches of SLS heavy-lift rocket and Orion spacecraft, starting with uncrewed

Exploration Mission 1 in development, but suffering delays assembling core stage of the rocket.

- Best-case launch of EM-1 is 2020
- A crewed test flight, **EM-2**, launch in 2022.
- The initial lunar landing mission in **EM-3**.
- NASA announced April 26 broad agency announcement, part of its Next Space Technologies for Exploration Partnerships program, that will now seek proposals for **integrated lunar lander concepts**.
 - Requesting a service of ascent, descent, transfer stages
 - Essentially an all-in-one service for landing

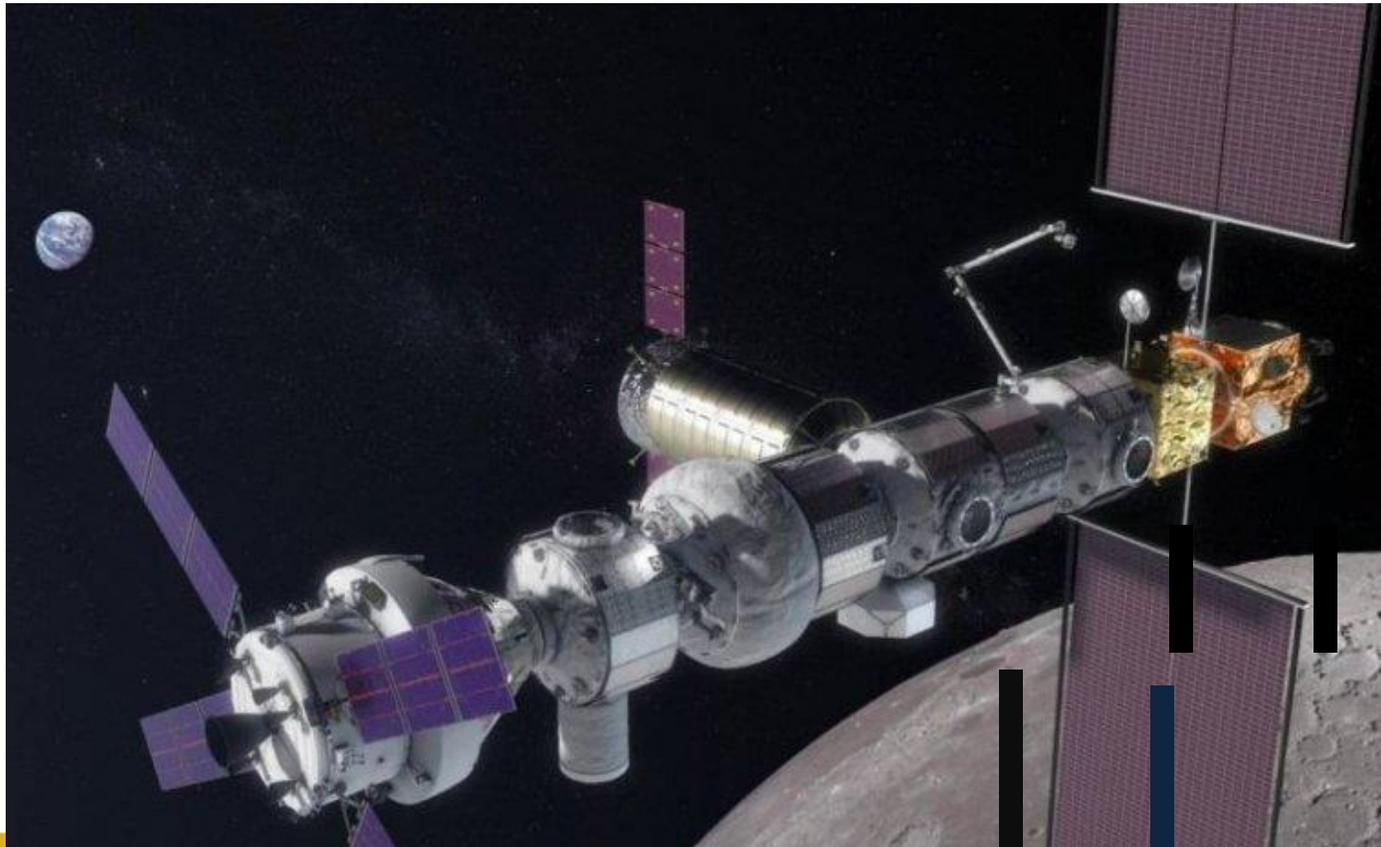


NASA Gateway Plans

- ▶ Minimal version of a Lunar Gateway.
- ▶ NASA is moving ahead with the **Power and Propulsion Element**, evaluating proposals submitted by industry in November.
 - ▶ A selection should come this summer, with the unit launched by the end of 2022.
- ▶ The only other element of the Gateway planned prior to a 2024 lunar landing is "**some kind of docking/habitation small module.**"
- ▶ "**That is all that is needed to essentially support a lunar landing.**"
 - ▶ Gerstenmier, AA HEOMD/NASA



March 26 directive by Vice President Pence to return astronauts to the Moon by 2024 instead of 2028



**Science
Opportunities
Enabled by the
Gateway: A
Workshop.**

Astro 2020



Decadal Survey on Astronomy and Astrophysics

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Academies of*

SCIENCES
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MEDICINE

nas.edu/astro2020



The National Academies of Sciences, Engineering, and Medicine are private, nonprofit institutions that provide independent advice to the nation on pressing science issues.

For each of our studies, committee members are chosen for their expertise and experience, and they serve pro bono to carry out the study's statement of task. The final report will represent the consensus view of the committee and will go through extensive peer review.

Astro2020 Co-Chair: Fiona Harrison



- Research interests: high energy astrophysics, compact objects, active galaxies, instrumentation
- Professor, Caltech (1995 - present)
- PI, NASA's NuSTAR mission
- Former Chair, NAS Space Studies Board
- Member JWST Independent Review Board
- Member Astro2010 survey committee
- Member NAS, AAAS

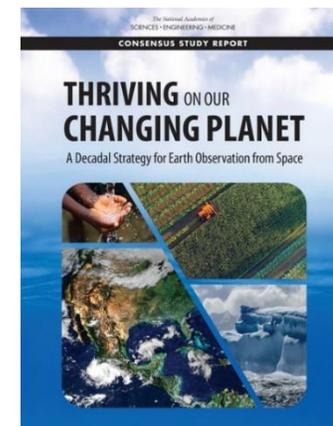
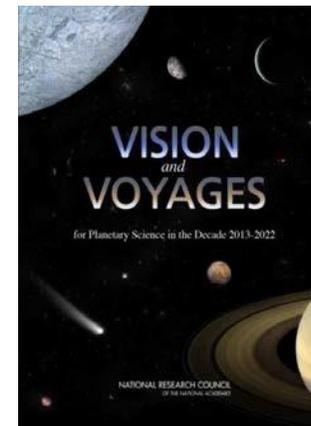
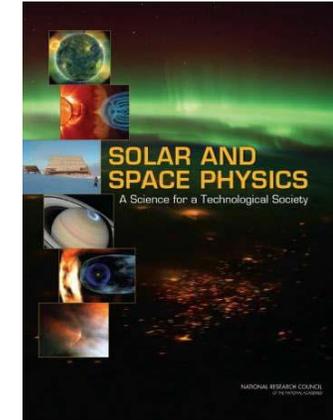
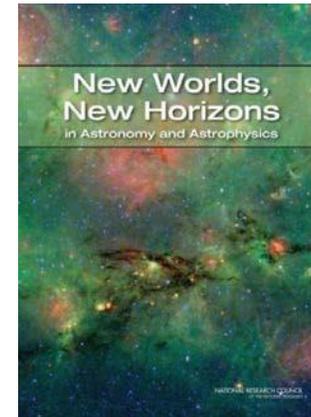
Astro2020 Co-Chair: Rob Kennicutt



- Research interests: multi-wavelength extragalactic astronomy, star formation and ISM in galaxies, cosmic distance scale
- Professor, University of Arizona
- Professor, Texas A&M University (TAMU)
- Emeritus Professor, University of Cambridge
- Former Editor-in-Chief, Astrophysical Journal
- Member Astro2010 survey committee
- Member NAS, AAAS, Fellow of the Royal Society

What is a Decadal Survey?

- Undertaken by the National Academies of Sciences, Engineering, and Medicine led **by community members** who analyze and prioritize science questions for the next decade.
- **Provides prioritized recommendations** for government investment in research and facilities, including space and ground-based activities.
- **Required by US Congress** under the 2005 and 2008 NASA Authorization Acts, including an evaluation of risks/budgets for major missions. Also reaffirmed in NASA Transition Authorization Act of 2017.



How is a Survey Conducted?

- A large group of experts selected and appointed by the national Academies—typically a **steering group** in overall charge and a series of supporting panels
- Specific actions taken to **engage the community** – community consensus is achieved via a host of outreach
- A **rigorous review conducted by outside experts** selected by the National Academies
- An **independent assessment** of the technical, fiscal, and schedule realism of ground- and space-based facilities recommended

Typical Elements of a Survey Report

- **Broad survey** of the current state of knowledge
- **Inventory** of the top-level science questions
- **Recommendations on optimum balance** between
 - large/medium/small missions, ground versus space, etc.
- Assessment of **infrastructure**
- Discussion of strategic **technology** development needs
- **Prioritized list** of recommended strategic space missions, ground-based facilities and supporting research

Survey's Goals

- The decadal survey process is aimed at articulating a program for the coming decade that represents as fully as possible the true consensus view of the relevant US space science community.
- The distinguishing features of the decadal survey process are inclusiveness and transparency
- In contrast to past decadal surveys, post-2009 surveys place a very strong emphasis on cost and technical realism
- Community participation in all aspects of the decadal survey was strongly encouraged

Statement of Task Highlights

- Review current state of astronomy and astrophysics
- Identify compelling science challenges for future
- Develop research strategy to advance scientific frontiers in 2022-2032
 - Recommend and rank high priority activities
 - Consider international and private landscape
 - Consider timing, cost, and risk
- Develop decision rules for robust program
- Assess the state of the profession
 - Provide specific, actionable and practical recommendations

Astro 2020 Survey Scope

- Ground and space-based observations, theory, computation, lab astrophysics
- Ground-based solar astronomy
- Gravitational-wave observations related to astronomy and astrophysics
- Multi-messenger astronomy and astrophysics
- Exoplanets & Astrobiology
 - Informed by recent NAS studies: *Exoplanet Science Strategy* and *Astrobiology Strategy for the Search for Life*
- Consider implementation and scope of WFIRST, Athena, LISA
 - Need not be ranked
- Excluded: direct dark matter detection, microgravity research, fundamental physics, projects under construction (JWST, DKIST, LSST, DESI)

Additional Scope Direction to NAS

The study will assess whether NASA's plans for WFIRST, Athena, and LISA play an appropriate role in the research strategy for the next decade. The study may include findings and recommendations regarding those plans, as appropriate, including substantive changes in NASA's plans. Recommendations may include, but are not limited to, actions ranging from increased investments (upscopes) to reduced investments (descopes) and termination. It is not necessary to rank WFIRST, Athena, and LISA among other recommended activities for space

Notional Decadal Survey Timeline Shown at Jan AAS

The government shutdown has impacted this schedule, rebuild in progress

- Co-Chairs Announced - End of November 2018
- Survey committee identified & appointed - Spring 2019
In progress
- Panels formed - Late Spring, 2019
- Panel deliberations - Late CY2019
- Survey deliberations and report writing - Spring 2020
- Public report released - Late 2020
- Presentations to stakeholders - continuing after public report released

Perspective from Sponsoring Agencies

- All 3 agencies (NASA, NSF, and DOE) & the National Academies want to see ambitious programs backed by strong science cases
- Need for clear decision rules
- NASA will deliver 4 flagship & 10 probe concepts for further evaluation

Science White Papers

Available at nas.edu/astro2020

- Science whitepapers showed robust interest from all segments of the community
 - Received ~**590 submissions** (vs. 337 for Astro2010)
 - Other communities (e.g., ESA VOYAGE 2050, Canada LRP2020) have adopted the same approach
 - Astro2020 is encouraging student journal club discussions, early career participation
 - Widespread discussion of papers ongoing

Activity, Project, or State of the Profession Considerations (APCs) White Papers

- ~300 Notices of Intent (NOI) received
 - Responses help with panel planning/expertise
- An NOI is not required before submitting an APC
- **5-10 page APCs will be due ~July 1**; announcement soon
 - APC White papers serve as useful guides for organizing requests for further info, and for defining inputs needed for the TRACE process.
 - Probe mission concepts should submit an APC white paper regardless of NASA sponsored study funding.
 - Large mission concepts (HabEx, LUVOIR, Lynx, Origins) should submit an APC white paper.

Survey Committee and Panels

- Steering committee ~20 members including co-chairs
 - Responsible for Decadal recommendations and final report
 - *>450 nominations were received*
 - *Nominations are in the approval process at NAS*
- Panel structure
 - 6 Science panels
 - 5 Programmatic panels for projects and activities
 - 2 State of the Profession panels
 - SoP 1: the health and climate of the field and its participants
 - SoP 2: the research portfolio
 - Final details TBD

Technical, Risk, & Cost Evaluation (TRACE)

- Independent evaluation of project/activity concepts to help the committee assess feasibility
- Formerly known as “CATE”
- TRACE contractor will provide an analysis of technology development needs and an estimated cost range
- Contractor required to have expertise on ground-based projects (can use a sub-contractor)
- Concepts to be evaluated are early stage (pre-Phase A)
- Request for Information closed- Contractor selection will be completed by end of April

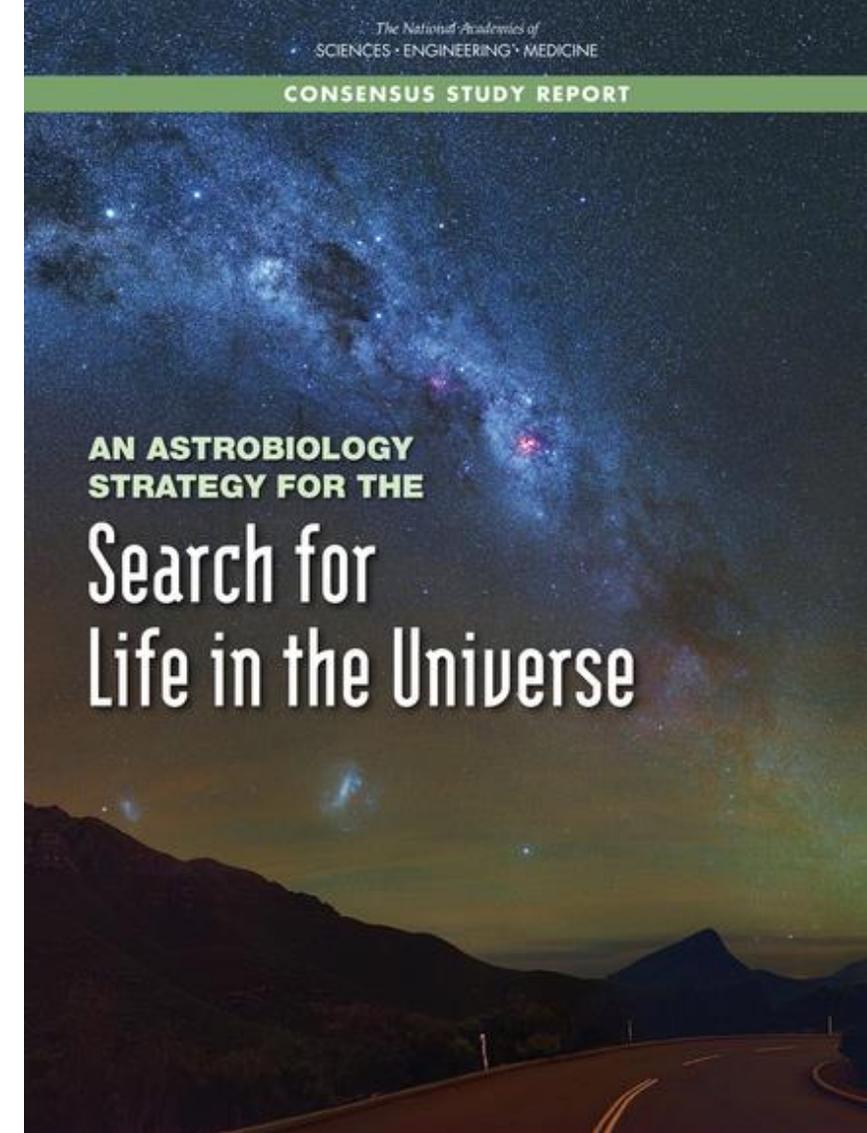
Community Engagement

- White papers
- Expand survey updates and information flow
 - Chairs' updates via Astro2020 website, Town Halls at AAS, etc.
 - **Mailing list signup at nas.edu/astro2020**
 - Live and web-based Town Halls
 - Local Town Hall meetings by survey committee members
 - Continuously updated FAQ page
 - Ongoing outreach to early-career community
 - National Academies held Early-Career Astro2020 Workshop (2018) and Chairs met with leaders to review recommendations.
 - Submit feedback at astro2020@nas.edu

Recently Released or Upcoming SSB Reports

An Astrobiology Strategy for the Search for Life in the Universe

- Offers a science strategy for astrobiology that outlines key scientific questions, identifies the most promising research in the field, and indicates the extent to which the mission priorities in existing decadal surveys address the search for life's origin, evolution, distribution, and future in the universe.
 - Makes recommendations for advancing the research, obtaining the measurements, and realizing NASA's goal to search for signs of life in the universe.
- Available at: <https://www.nap.edu/catalog/25252>

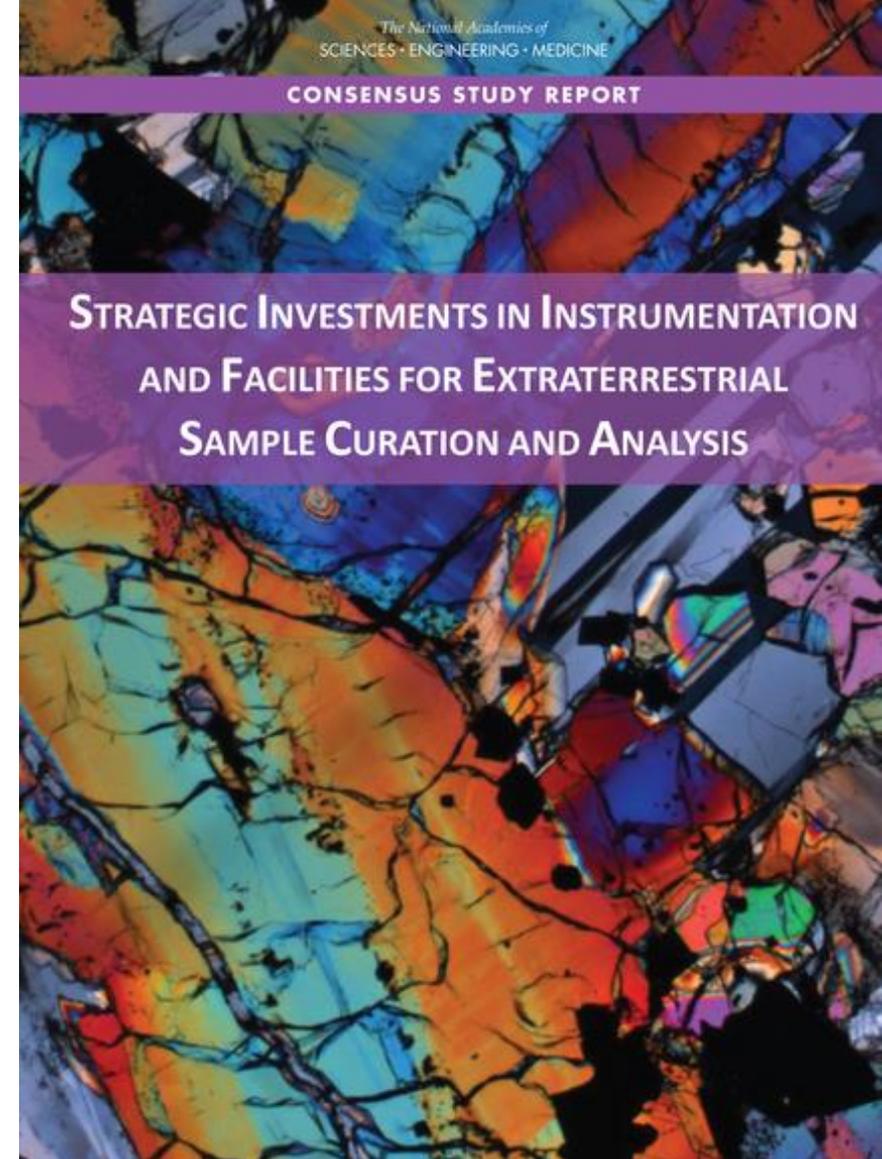


Strategic Investments in Instrumentation and Facilities for Extraterrestrial Sample Curation and Analysis

Assesses current capabilities for sample return analyses and curation, and what capabilities are currently missing that will be needed for future sample return missions.

- Evaluates whether current laboratory support infrastructure and NASA's investment strategy is adequate to meet these analytical challenges and advises how the community can keep abreast of evolving and new techniques in order to stay at the forefront of extraterrestrial sample analysis.

Available at: <https://www.nap.edu/catalog/25312>



Planetary Protection Classification of Sample-Return Missions from the Martian Moons

- Although the Martian moons themselves are not considered potential habitats for life or of intrinsic relevance to prebiotic chemical evolution, recent studies indicate that a significant amount of material recently ejected from Mars could be present on the surface of Phobos and, to a lesser extent, Deimos.
- Reviews recent theoretical, experimental, and modeling research on the environments and physical conditions encountered by Mars ejecta during certain processes; recommends whether missions returning samples from moons should be classified as “restricted” or “unrestricted” Earth return in the framework of the planetary protection policy maintained by COSPAR; considers the specific ways the classification of sample return from Deimos is a different case than sample return from Phobos.



Available at: <https://www.nap.edu/catalog/25357/>

NASA Update on Planetary Protection

- Bridenstine created a new **Regulatory and Policy Committee** (RPC) of the NAC last year to bring a private sector perspective to the NAC.
- In December, 2018, the NAC adopted a RPC recommendation that SMD form a task force to reassess the guidelines, called the **Planetary Protection Review Board**.
 - The PP Review Board will be chaired by **Alan Stern**
 - Report recommendations will to the NAC and then the NASA Administrator and then **ASEB/SSB for an independent look**.
 - Then it goes to COSPAR (Len Fish, President).
- Review Board work will begin in **June**
 - In August/September, an interim report will be delivered to the SMD AA.



Notional Decadal Survey Schedule *(as of February 2019)*

Note: Future dates are dependent on concurrence and contract negotiations with the applicable sponsors. These dates will be updated periodically to reflect the sponsors' schedule.

Astronomy and Astrophysics

CY 2016 August 2010 **Midterm** Delivered to Sponsors
CY 2018 November **Decadal 2020** Task Starts
CY 2020 2nd half **Decadal 2020** Delivered to Sponsors

Solar and Space Physics

CY 2018 July **Midterm** Task Starts
CY 2019 2nd half **Midterm** Delivered to Sponsors
CY 2022 1st half **Decadal 2024** Task Starts
CY 2024 1st half **Decadal 2024** Delivered to Sponsors

Biological and Physical Sciences

CY 2017 December **Midterm** Delivered to Sponsor
CY 2019 2nd half **Decadal** Task Starts
CY 2022 1st half **Decadal** Delivered to Sponsors

Earth Science and Applications from Space

CY 2017 December **Decadal 2017** Delivered to Sponsors
CY 2022 2nd half 2017 **Midterm** Task Starts
CY 2023 2nd half 2017 **Midterm** Delivered to Sponsors
CY 2025 1st half **Decadal 2027** Task Starts

Planetary Sciences

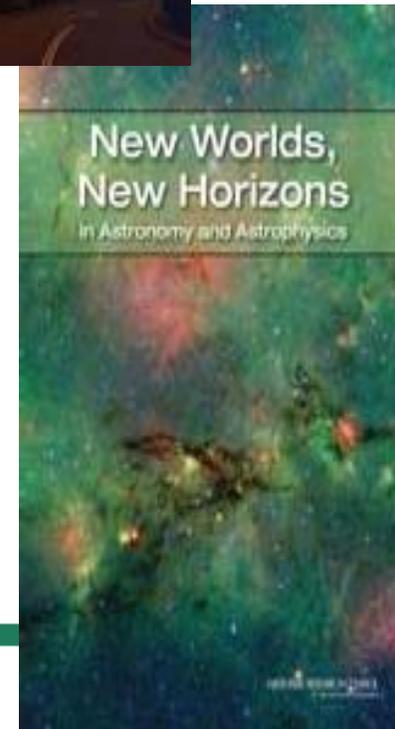
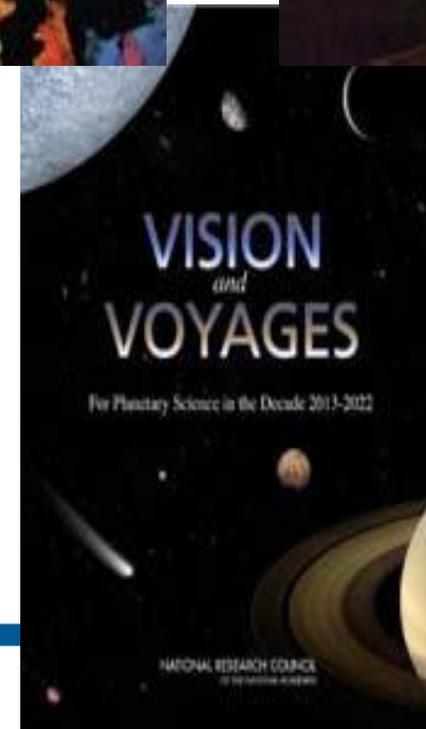
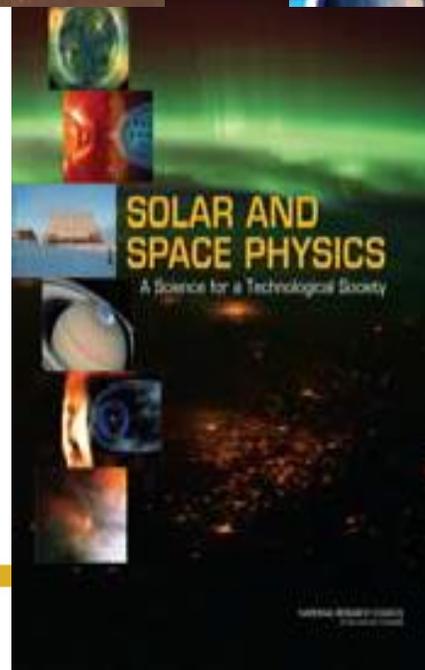
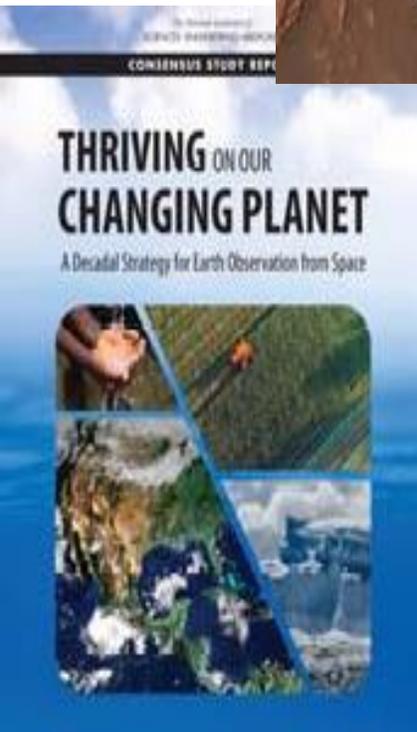
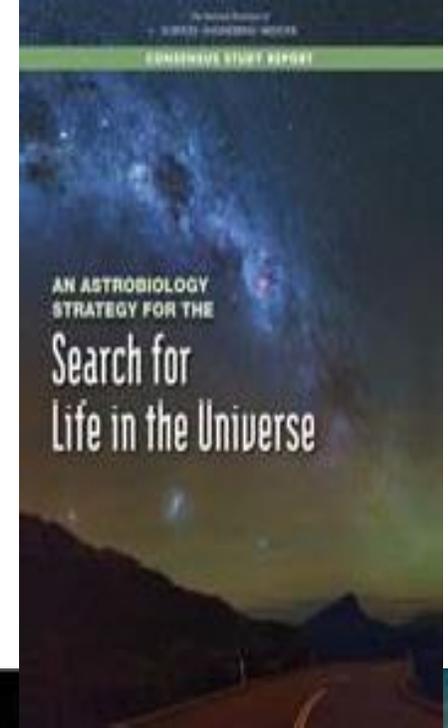
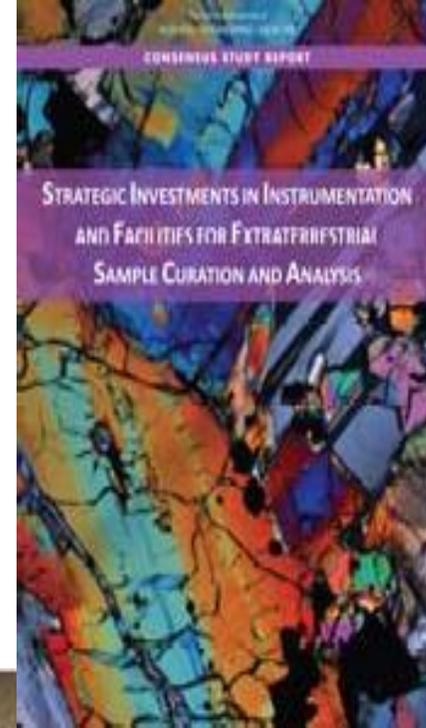
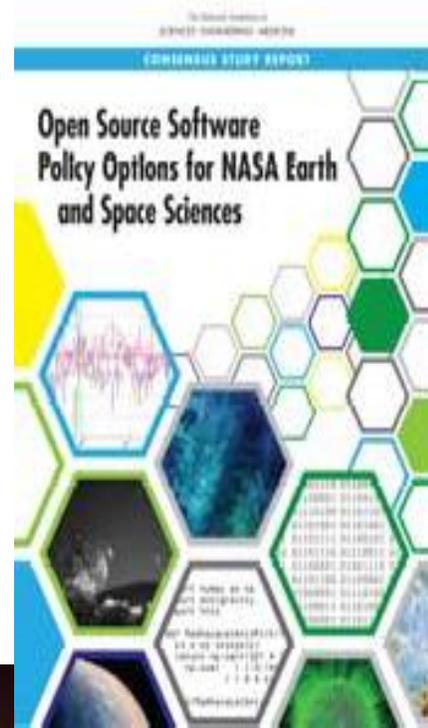
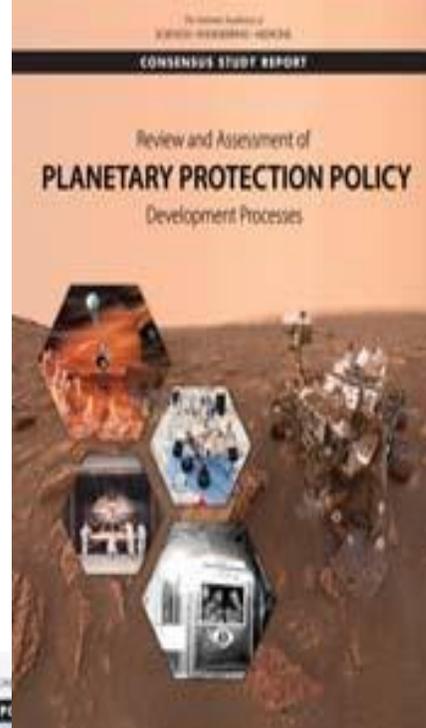
CY 2018 July **Midterm** Delivered to Sponsors
CY 2020 1st half **Decadal 2022** Task Starts
CY 2022 1st half **Decadal 2022** Delivered to Sponsors

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 & Joint SSB/ASEB, Washington, DC

Possible Joint Activities for ESSC and SSB for Discussion

- **Partnering in Space: A Workshop**
 - Provide basic budget and decision information to aid collaboration between international scientific partners.
 - Follow up to 1998 NAS study *US-European Collaboration in Space Science*
- **Emerging Space-faring Nations Workshop**
 - The SSB and ESSC might investigate a 2 day workshop with a report as the product.
- **Next Generation Scientists & Engineering Conference**
 - The SSB/ASEB and ESSC might investigate funding of a 2 day event bringing together early-career scientists with a focus on diversity with seasoned space veterans.



SpaceX two-stage Falcon 9 launch
May 2019



Blue Origin New Shepard Test Flight May 2019



Thank You!
Questions?