

U.S. NATIONAL ACADEMY OF SCIENCE AND ITS SPACE POLICY AND PROGRAMMATIC ADVISORY ROLE

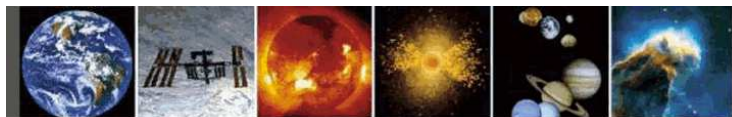
Michael H. Moloney

Director for Space and Aeronautics

Space Studies Board

Aeronautics and Space Engineering Board

National Research Council of the U.S. National Academies

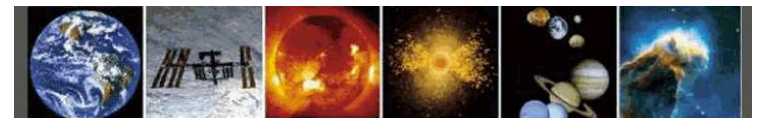


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Michael H. Moloney, Director for Space and Aeronautics

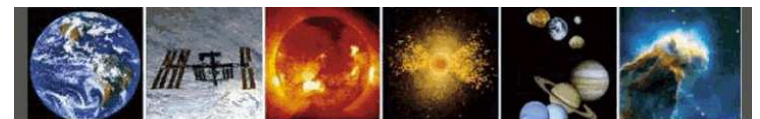
Outline

- >> *History of the National Academies*
- >> *Space Advisory Role of the National Academies*
- >> *International Role of the Space Studies Board*
- >> *Advice on Science Programs: Decadal Surveys*
- >> *What have recent SSB reports said about International Collaboration*
- >> *A Noteworthy Report on Human Spaceflight*
- >> *Concluding Remarks*





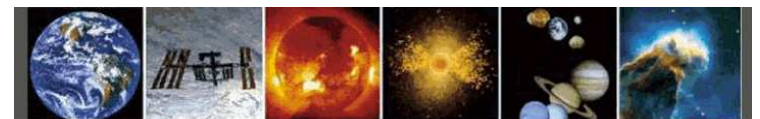
- ❑ **The National Academy of Science (NAS) was established on March 3 1863 by Act of the U.S. Congress, signed into law by President Lincoln in the midst of the Civil War.**
- ❑ **NAS was established to "investigate, examine, experiment, and report upon any subject of science or art" whenever called upon to do so by any department of the government.**
- ❑ **The National Academy of Engineering (NAE) was established in 1964 and the Institute of Medicine in 1970. The IOM will become the National Academy of Medicine on July 1, 2015.**
- ❑ **The National Research Council serves as the principal operating arm of the National Academies in providing services to the government, the public, & the scientific & engineering communities.**



National Academies

Foundational Strengths

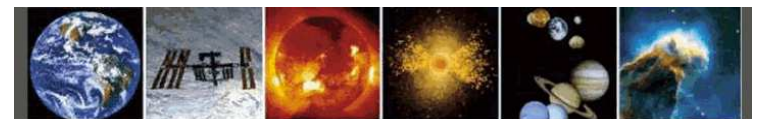
- **Stature of the academies' memberships**
- **Ability to get the very best to serve**
- **“Pro Bono” nature of committee service**
- **Special relationship with government**
- **Quality assurance and control procedures**
- **Reputation for independence and objectivity**



National Academies

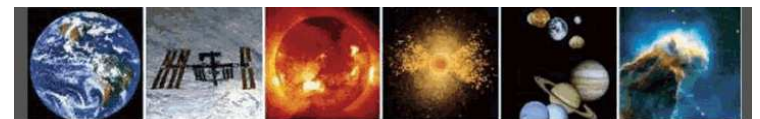
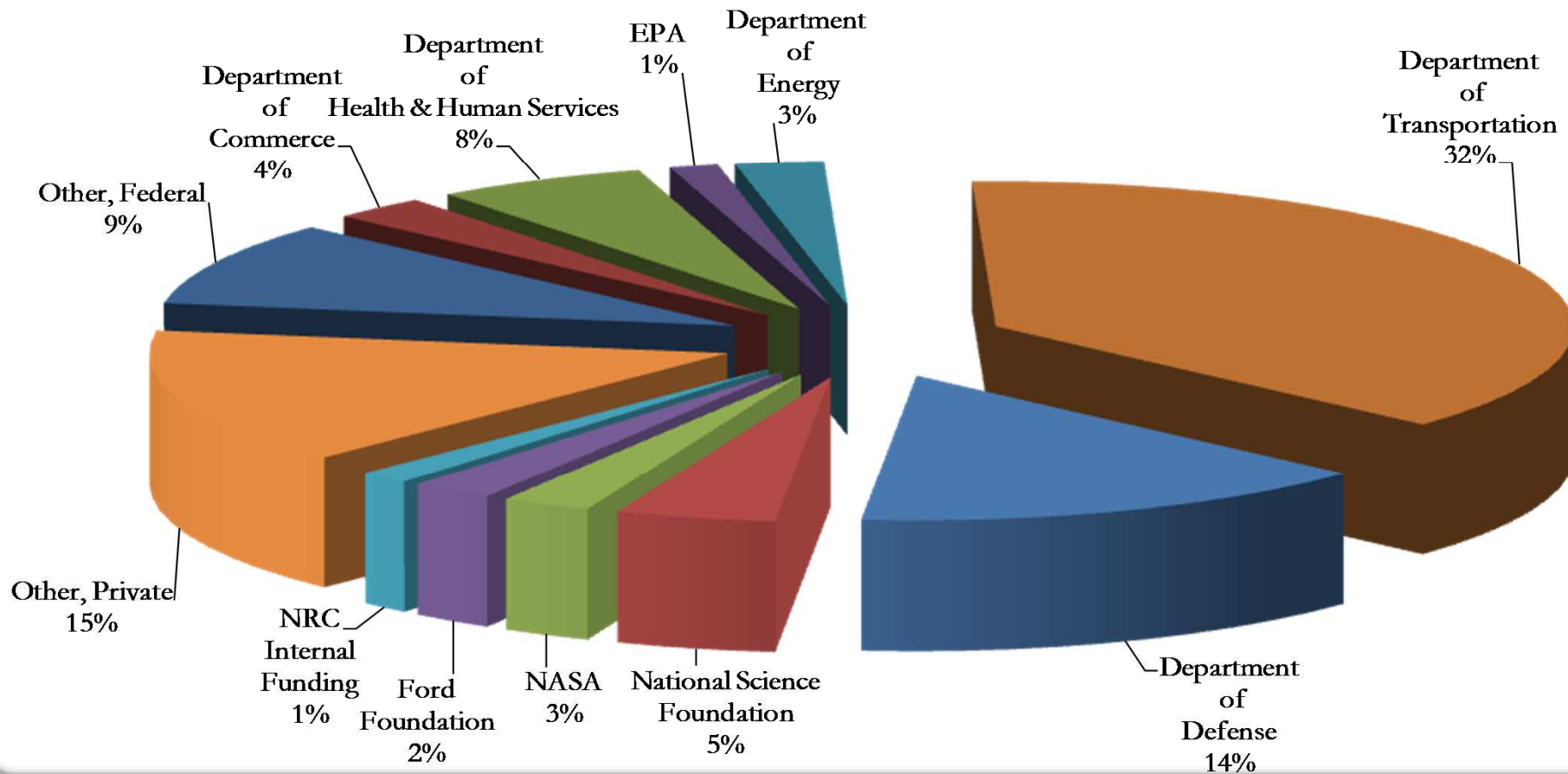
Level of Activity

- **500 – 600 committees in operation, involving ~6,000 volunteers.**
- **~200 – 250 reports produced per year.**
- **~1100 NA staff with around 63% working on NRC activities, 13% on NAS/NAE/IOM.**
- **~80-85% of operational budget comes from contracts and grants from Federal Government.**



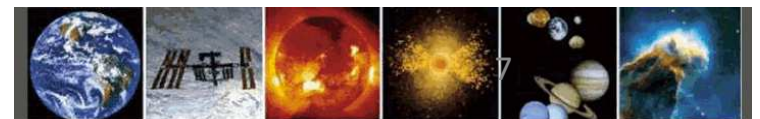
PROGRAM SUPPORT BY SOURCE FOR FY 2013

Total Actual Revenue of \$294M



Space at the National Academies

- The **Space Studies Board (SSB)** was established in 1958 to serve as the focus of the interests and responsibilities in space research for the National Academies. The SSB provides an independent, authoritative forum for information and advice on all aspects of space science and applications, and it serves as the focal point within the National Academies for activities on space research. It oversees advisory studies and program assessments, facilitates international research coordination, and promotes communications on space science and science policy between the research community, the federal government, and the interested public. The SSB also serves as the U.S. National Committee for the International Council for Science Committee on Space Research (COSPAR).
- The **Aeronautics and Space Engineering Board (ASEB)** was established in 1967 “to focus talents and energies of the engineering community on significant aerospace policies and programs.” In undertaking its responsibility, the ASEB oversees ad hoc committees that recommend priorities and procedures for achieving aerospace engineering objectives, and offers a way to bring engineering and other related expertise to bear on aerospace issues of national importance. Among these issues are: research and development aspects of the Next Generation Air Transportation System (NextGen); NASA’s aeronautics research program; national aeronautics R&D policy and its implementation; space policy and programs, with a focus on human spaceflight and space operations; commercial space activities; and other aerospace engineering topics.



Standing Activities on Space

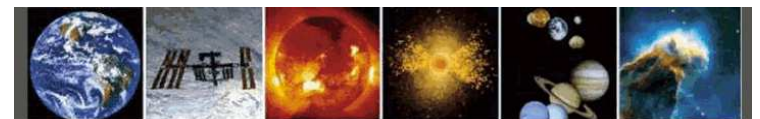
The SSB's standing committees provide strategic direction in the various space research disciplines. These committees oversee activities of ad hoc committees established by the NRC to author reports on specific issues, interact with sponsors, and serve as a communications medium between the government and the scientific community. The SSB currently has five standing committees:

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

Each Spring these committees meet during the **Space Science Week** in **Washington DC** – where expect international participation.

In addition the ASEB organizes the

- **Space Technology Industry, Government, University Roundtable**

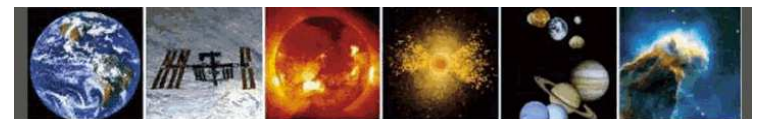


Ad-Hoc Study Committees on Space

Whenever the ASEB or SSB is asked to author a report or organize a workshop on a particular policy or programmatic issue, the National Academies appoints an expert ad-hoc committee of volunteers. Recent studies that have not yet reported out include committees on:

- 1. Decadal Survey for Earth Science and Applications from Space**
- 2. Review of Progress Toward the Decadal Survey Vision in New Worlds, New Horizons in Astronomy and Astrophysics**
- 3. NASA Science Mission Extensions: Scientific Value, Policies, and Review Process**
- 4. Achieving Science Goals with CubeSats**
- 5. NASA Technology Roadmaps**
- 6. A Framework for Analyzing the Needs for Continuity of NASA-Sustained Remote Sensing Observations of the Earth from Space**
- 7. Sharing the Adventure with the Student – A Workshop**
- 8. Survey of Surveys: Lessons Learned from Decadal Planning**

Typically the ASEB & SSB releases about 5-10 reports a year.



SSB - Decadal Surveys

Among the ad hoc studies the SSB conducts, the **NRC decadal surveys** stand out as the **signature products** of the SSB and its standing committees.

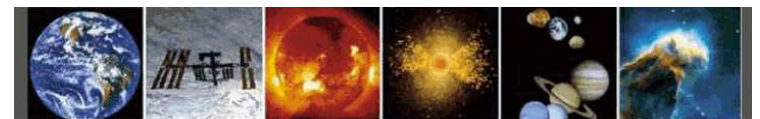
The foundation of decadal surveys was the first astronomy decadal survey report in 1964. Now expanded to all of the space sciences and Earth science and applications from space and, most recently, the biological and physical sciences in space.

At the most fundamental level, decadal surveys are community-driven, **bottom-up studies** that aim to formulate a community consensus on the **most compelling science** questions for the decade ahead in each of the disciplines.

The studies also identify **prioritized lists of missions** and, in some cases, ground-based research activities that can address the highest-priority science.

Involve the appointment of a steering committee and a set of 4-9 topical panels (no two surveys are the same) involving a total of up to 80-120 volunteers.

The studies involve **extensive community input** via hundreds of white papers, community forums, and other outreach activities, and the most recent round included an independent **Cost Assessment and Technical Evaluation** (the so-called **CATE** process) of proposed initiatives and recommendations made within defined budget scenarios.



SSB - Decadal Surveys – Sample Impact

ASTROPHYSICS
Decadal Survey
Missions

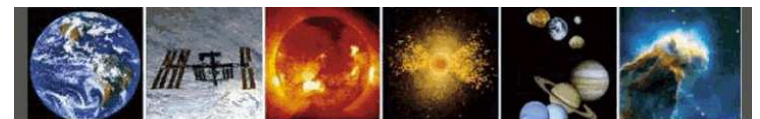
1972
Decadal Survey
Hubble

1982
Decadal Survey
Chandra

1991
Decadal Survey
Spitzer, SOFIA

2001
Decadal Survey
JWST

2010
Decadal Survey
WFIRST

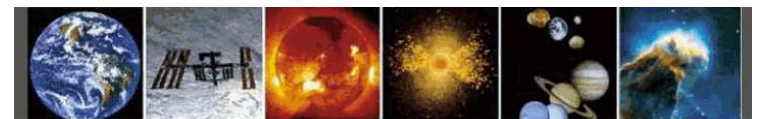


International Role for the Space Studies Board

Part of the charge to the Space Studies Board (SSB) from the National Academies is to “**facilitate international research coordination**”.

How does the SSB carry out this task?

- The SSB serves as the U.S. National Committee for the International Council for Science Committee on Space Research (COSPAR).
- Maintains relations with:
 - ICSU Committee on Space Research
 - International Academy of Astronautics
 - International Astronautical Federation
 - European Space Agency and JAXA
 - European Space Sciences Committee
 - Chinese Academy of Sciences – NSSC
 - Other international space partners such as: Canadian Space Agency, Roscosmos, CNES, ISRO, UNOOSA, etc
- Always interested in reaching out to similar advisory bodies around the globe.



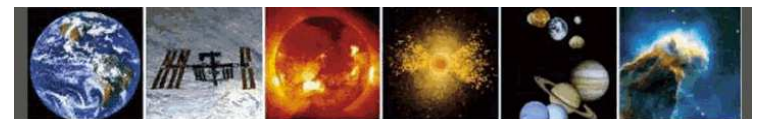
What have SSB reports said about International Collaboration?

Planetary Decadal (2011) summarized well the views from many SSB reports over the years:

“New alliances and mechanisms for cooperation are emerging, enabling partners to **improve national capabilities, share costs, build common interests, and eliminate duplication of effort.**

But international agreements and plans for cooperation must be crafted with care, because they **also can carry risks. The management of international missions adds layers of **complexity** to their technical specification, management, and implementation. Different space agencies use different **planning** horizons, funding approaches, selection processes, and data dissemination policies.**

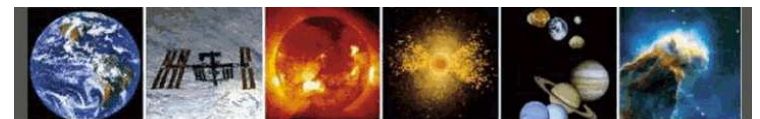
Nonetheless, international cooperation remains a **crucial element of the planetary program; it may be the **only realistic option** for undertaking some of the most ambitious and scientifically rewarding missions.”**



What have SSB reports said about International Collaboration?

A 1998 SSB report on international collaboration, conducted in cooperation with the European Science Foundation, recommended that international cooperative missions involve the following:

- Scientific support through **peer review** that affirms the scientific integrity, value, requirements, and benefits of a cooperative mission;
- An **historical foundation** built on an existing international community, partnership, and shared scientific experiences;
- **Shared objectives** that incorporate the interests of scientists, engineers, and managers in common and communicated goals;
- **Clearly defined responsibilities** and roles for cooperative partners, including scientists, engineers, and mission managers;
- An agreed-upon **process for data** calibration, validation, access, and distribution;
- A **sense of partnership** recognizing the unique contributions of each participant; and
- Recognition of **the importance of reviews** for cooperative activities in the conceptual, developmental, active, or extended mission phases—particularly for foreseen and upcoming large missions.



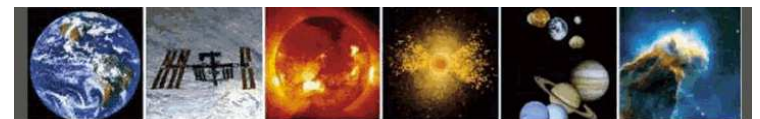
Major Report on Human Spaceflight.

Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration – I

The NRC was asked to “study to review the long-term goals, core capabilities, and direction of the U.S. human spaceflight program and make recommendations to enable a sustainable U.S. human spaceflight program.”

The committee concluded (refer to the report for complete texts):

- No single rationale alone seems to justify the value of pursuing human spaceflight. Yet, **aspirational rationales**, when supplemented by the **practical benefits** associated with the **pragmatic rationales**, do argue for a continuation of the nation’s human spaceflight program.
- Public opinion about space has been generally favorable over the past 50 years, but much of the public is inattentive to space exploration and spending on space exploration is not a high priority for most of the public.
- For the foreseeable future, the only feasible destinations for human exploration are the Moon, asteroids, Mars, and the moons of Mars. Among this small set of plausible goals, the most distant and difficult is a landing by human beings on the surface of Mars. **Thus the horizon goal for human space exploration is Mars.** All long-range space programs, by all potential partners, converge on this goal.



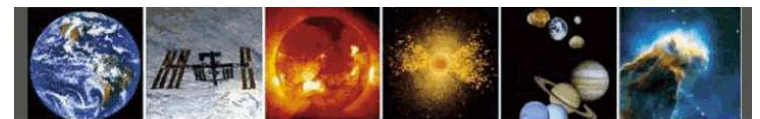
Major Report on Human Spaceflight.

Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration – 2

The NRC was asked to “study to review the long-term goals, core capabilities, and direction of the U.S. human spaceflight program and make recommendations to enable a sustainable U.S. human spaceflight program.”

The committee concluded (refer to the report for complete texts):

- International collaboration has become an integral part of the space policy of essentially all nations participating in space around the world. Given the scale of a human mission to Mars, contributions by international partners would have to be of unprecedented magnitude to defray a significant portion of the cost.
- Having completed assembly of the International Space Station, the nation must now decide whether to embark on human space exploration beyond LEO in a sustained and sustainable fashion. Having considered past and current space policy, explored the international setting, articulated the enduring questions and rationales, and identified public and stakeholder opinions, the committee draws on all this information to ask a fundamental question: **What type of human spaceflight program would be responsive to these factors? This committee argues that it is a sustainable human exploration program beyond LEO.**
- The committee has concluded that the best way to ensure a stable, sustainable human spaceflight program that pursues the rationales and enduring questions is to develop a program through the rigorous application of a set of **Pathway Principles**.

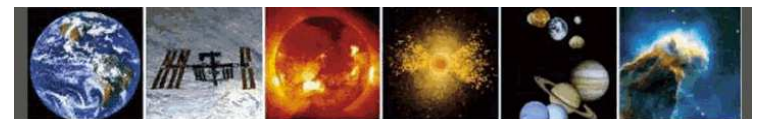


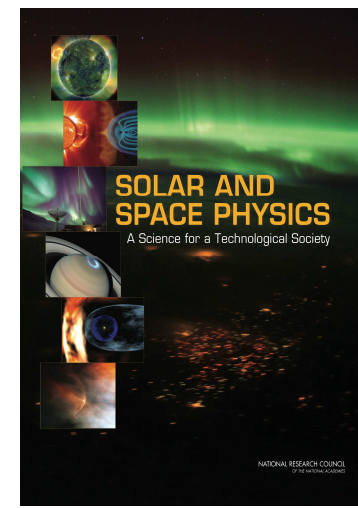
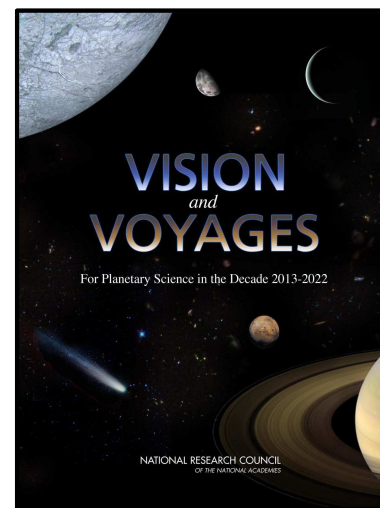
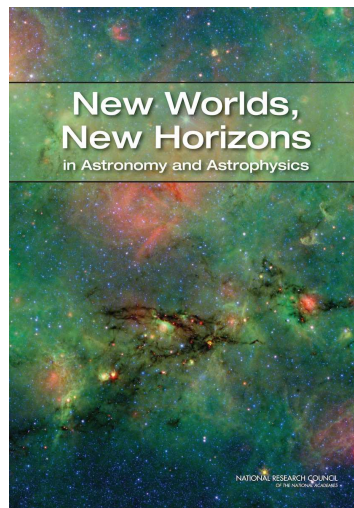
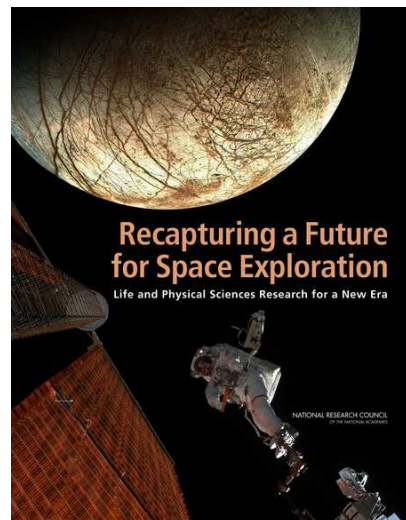
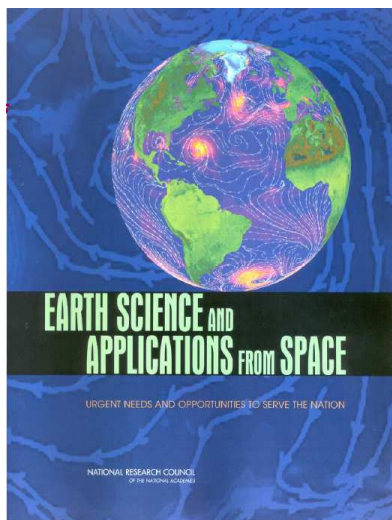
Summary

The U.S. National Academies has played a key advisory role in the US space program for over 55 years.

That role will continue in the years ahead and will be supplemented by an increasing level of activity on the international scene.

Many ASEB and SSB reports, while usually focused on the U.S. program, can also provide important scientific and technical reviews of interest to other nations.





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