



APRIL — JUNE 2011

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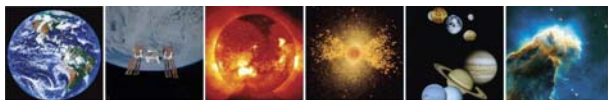


“I came to appreciate Johnson Space Flight Center’s magnificent archive of photos of Earth taken from space by astronauts, who told me that flying in space made them all Earth scientists.”

—Charles Kennel, Chair, SSB

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SPACE STUDIES BOARD NEWS



FROM THE CHAIR

I hope you might indulge my personal reminiscences, because as I write *Atlantis* is being prepared for space shuttle's final flight. I was a very young, very green new member of the Space Studies Board when I first saw a space shuttle—the *Enterprise*—about 2 weeks before its public rollout in Palmdale. *Enterprise*—an engineering model that would never fly—had been named for the spaceship in the now legendary TV series *Star Trek*. In retrospect, that tells a lot. Although my more wizened colleagues probably entertained doubts, I accepted without question what was said about the space shuttle—that it would make a flight a week, that human spaceflight would become routine, that its enormous cargo capability destined it to do great things. I was a little unclear about which great things, but there were going to be lots.

The space shuttle next got my attention when my scientific colleagues received a letter from NASA informing them that henceforth all scientific missions had to use the space shuttle. They dutifully sent a flood of conceptual proposals to NASA. Some of my space physics colleagues won grants. Those grants were career breakers. Even though NASA faithfully continued funding their projects for years, the promised flight rate never materialized, and my friends wrote quarterly reports on experiments that would never fly.

I recall watching the *Challenger* accident on television with colleagues at TRW Systems and sharing their grief at the loss of magnificent human beings. I first began to perceive that the space shuttle was about people. Richard Feynman was very ill at the time and staying at the UCLA hospital. We in the physics department hosted his colleagues from around the world who came to visit him. He also played hooky, spending his last energies on the Challenger Accident Investigation Board. Who can forget Feynman's explanation of what went wrong with the O-rings?

One of the great things the space shuttle was going to do was fly the Great Observatories and transform observational astronomy. This it did, but by the time the Hubble Space Telescope was launched, I too had become wizened. I recall a discussion with my SSB predecessor, Len Fisk, in his NASA office. The faulty Hubble optics were to be repaired by astronauts. I had my doubts, but I am glad I was proven wrong. Each subsequent repair mission created virtually a new Hubble telescope in space. Hubble (and the other great observatories) is one of the two greatest achievements of the space shuttle.

By the mid-1990s, I too was at NASA headquarters as Associate Administrator for Mission to Planet Earth. Although our office had abandoned the space shuttle as the launch vehicle for the Earth Observing System because of its cost, we still had developed impressive missions that made use of the space shuttle's weight-lifting capacity; of these, my favorites were the Shuttle Imaging Radar Mission (SIR-C) and its follow-on, the Shuttle Radar Topography Mission.

“To me, the most important thing about the space station is that human beings—an international team of human beings—built it.”

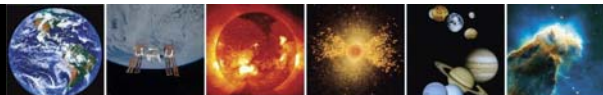
In my turn at the helm of NASA Earth science, I came to appreciate Johnson Space Flight Center's magnificent archive of photos of Earth taken from space by astronauts, who told me that flying in space made them all Earth scientists. They could see its fragile beauty. I also had the unique experience of being the senior executive at a space shuttle launch and simultaneously a member of an astronaut family group. By that time, I thought myself grizzled as well as wizened, but the launch brought tears to my eyes. I saw the decision, I knew the risks, I knew the people.

After returning to California, I joined the NASA Advisory Council (NAC), eventually to be its chair. By then, the NAC was warning that the low space shuttle launch rate and the high costs of each launch would make human spaceflight unsustainable. We commissioned a number of technology studies seeking an alternative to the space shuttle, but in the end we had to admit that the only feasible space shuttle replacement was a space shuttle

upgrade, and we endorsed a proposal to replace the fuel tanks and make other key modifications. This would kick the can down the road for another 10 years. Then came an early morning call from my astronaut relative. He and I relived once again the awful human drama of another space shuttle accident—*Columbia*. Once again, it came back to me: human spaceflight is all about people.

The safety measures put in after *Columbia* to protect an aging space shuttle only worsened its flight rate and cost problems. But, the space shuttle had one remaining very important job—finishing the International Space Station (ISS). NASA had to keep its commitments to its 14 international partners, and to its very great credit, it did. To me, the most important thing about the space station is that human beings—an international team of human beings—built it. The ISS partnership persevered despite major changes in management, policy, and budget and the *Columbia* accident. The ISS has to be the most complex international engineering project ever.

(Continued on page 3)



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I had one final sad duty to perform for the space shuttle as a member of the Augustine Commission in 2009. We had to recommend to the president that the space shuttle be retired. I was happier to recommend extending the ISS to 2020 to see if the vision once held for the space shuttle could be achieved. Maybe we will finally learn whether routine access to experimental facilities in space can produce science and technology of great value to humans on Earth.

Looking back over the years, I think I should have thought through the goals of the space shuttle at the beginning. Would I have seen the essential contradictions? That great things are never routine? That you can build a system that can do a few great things or a system that does a lot of little things but it is hard to do both? That you are disingenuous when you claim you will routinely do great things?

I think we learned that it gets very expensive when you use a system built for great things to do little things, which maybe is why the life and microgravity sciences never prospered on the space shuttle. The space shuttle was built to do great things and it did them—Hubble and the ISS. And it taught us far more than we ever knew before about how human beings can live and function in space.

NASA plans to separate the routine and the great next time around. We will access the ISS with small, commercially developed space vehicles, and we will build a new heavy lift vehicle to do the great things. We haven't said yet what those great things are. When the space shuttle was rolled out, people never said what the great things would be either. Unless we think through the goals of human space exploration in the 21st century, we will repeat the space shuttle experience. The Senate has asked the National Academies to think about the goals, and we intend to give it a try.

—Charles Kennel, Chair, SSB



Workers at Kennedy Space Center in Florida accompany shuttle *Atlantis* as it is towed back to its processing hangar after landing at Kennedy's Shuttle Landing Facility, completing its 13-day mission to the International Space Station and the final flight of the Space Shuttle Program. Photo Credit: NASA/Bill Ingalls. July 21, 2011.

SSB MEMBERSHIP

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University of California, San Diego

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Space Systems/Loral (ret.)

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Battel Engineering

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Aerospace Consultant

ELIZABETH R. CANTWELL
Oak Ridge National Laboratory

ANDREW B. CHRISTENSEN
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The Aerospace Corporation

ALAN DRESSLER
The Observatories of the Carnegie Institution

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University Corporation for Atmospheric Research

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University of Michigan

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U.S. REPRESENTATIVE TO COSPAR

ROBERT P. LIN
University of California, Berkeley

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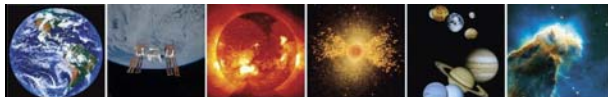
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For more information on the membership of the SSB please visit our website at
<www.nationalacademies.org/ssb>.



DIRECTOR'S CORNER



With the final flight of the space shuttle, if nothing else it is clear that a new phase of the U.S. human spaceflight program is beginning. As new directions are contemplated and new flight systems are being designed, many questions are being asked: What will this new phase look like? and What are the challenges we will face as we contemplate and choose new goals for the next steps of exploration? The recent SSB report *Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era* examines the fundamental science and technology that will underpin the successful development of future human exploration programs. The report concludes that the payoffs from pursuing this science and these technologies will be substantial, as the following examples illustrate:

- An effective countermeasures program to attenuate the adverse effects of the space environment on the health and performance capabilities of astronauts would make it possible to conduct prolonged human space exploration missions.
- A deeper understanding of the mechanistic role of gravity in the regulation of biological systems (e.g., mechanisms by which microgravity triggers the loss of bone or cardiovascular function) can provide insights for strategies to optimize biological function during spaceflight as well as on Earth (e.g., slowing the loss of bone or cardiovascular function with aging).
- Game changers, such as architecture-altering systems involving on-orbit depots for cryogenic rocket fuels, are an example of a revolutionary advance possible only with the scientific understanding required to make this Apollo-era notion a reality. As an example, for some lunar missions such a depot could produce major cost savings by enabling use of a smaller launch system rather than a much larger heavy-lift type system.
- The critical ability to collect or produce large amounts of water from a source such as the Moon or Mars requires a scientific understanding of how to retrieve and refine water-bearing materials from extremely cold, rugged regions under partial-gravity conditions. Once cost-effective production is available, water can be transported to either bases or orbit for use in the many exploration functions that require it. Major cost savings will result from using that water in a photovoltaic-powered electrolysis and cryogenics plant to produce liquid oxygen and hydrogen for propulsion.
- Advances stemming from research on fire retardants, fire suppression, fire sensors, and combustion in microgravity can provide the basis for a comprehensive fire-safety system, greatly reducing the likelihood of a catastrophic event.
- Regenerative fuel cells can provide lunar surface power for the long eclipse period (14 days) at high rates (e.g., greater than tens of kilowatts). Research on low mass tankage, thermal management, and fluid handling in low gravity is on track to achieve regenerative fuel cells with specific energy greater than two times that of advanced batteries.

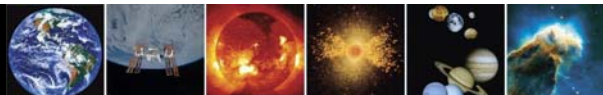
As we consider the future of exploration—a task the SSB is likely to be engaged in for some time along with the Aeronautics and Space Engineering Board—*Recapturing a Future for Space Exploration* gives us a comprehensive mapping of the scientific challenges to realizing humanity's next steps away from Earth. The report's executive summary summarizes the situation well when it concludes with these words.

Implicit in this report are integrative visions for the science advances necessary to underpin and enable revolutionary systems and bold exploration architectures for human space exploration. Impediments to revitalizing the U.S. space exploration agenda include costs, past inability to predict costs and schedule, and uncertainties about mission and crew risk. Research community leaders recognize their obligations to address those impediments. The starting point of much of space-related life sciences research is the reduction of risks to missions and crews. Thus, the recommended life sciences research portfolio centers on an integrated scientific pursuit to reduce the health hazards facing space explorers, while also advancing fundamental scientific discoveries. Similarly, revolutionary and architecture-changing systems will be developed not simply by addressing technological barriers, but also by unlocking the unknowns of the fundamental physical behaviors and processes on which the development and operation of advanced space technologies will depend. Thus this report is much more than a catalog of research recommendations; it specifies the scientific resources and toolboxes to define and develop with greater confidence the future of U.S. space exploration and scientific discovery.

—Michael Moloney, Director, SSB and ASEB



Space shuttle Atlantis lands for the final time at NASA's Kennedy Space Center in Florida. Image credit: NASA/Bill Ingalls.



SSB ACTIVITIES

THE BOARD AND ITS STANDING COMMITTEES

The **Space Studies Board (SSB)** met April 6-7 at the National Academies' Keck Center. The first day of the meeting was a joint session of the ASEB and the SSB (mentioned in the January-March newsletter in both the chair's column and the director's column), at which the boards were updated by and had discussions with a number of NASA representatives, including Administrator Bolden and NASA Chief Scientist Waleed Abdalati, congressional staff, and Executive Office of the President staff. The boards were also briefed by Wendy Kohrt, co-chair of the steering committee for *Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era*, which was publically released that day. The second day of the meeting included briefings on the programs and budgets for the NSF Geosciences, NOAA/NESDIS, and NASA/SMD; an update from the European Space Sciences Committee; a briefing from the chair of the planetary science decadal survey (Steve Squyres) and the chair of the astronomy and astrophysics decadal survey (Roger Blandford); and an evaluation of the decadal survey cost and technical evaluation process by Steve Battel (a member of the astronomy and astrophysics decadal survey committee and the solar and space physics decadal survey committee). The agenda and many of the presentations from the meeting can be found at http://sites.nationalacademies.org/SSB/SSB_054577.

The **Committee on Astronomy and Astrophysics (CAA)** is on hiatus during the course of the astronomy and astrophysics decadal survey. The NRC is in discussions with NASA, NSF, and DOE to stand up the committee.

The **Committee on Earth Studies (CES)** did not meet during this quarter; however, several members of the committee were appointed to an ad hoc committee (see below) that will assess Earth science programs at NASA at the mid-point of the decadal survey cycle (the first NRC decadal survey in Earth science, *Earth Science and Applications from Space*, published in January 2007).

The **Committee on the Origins and Evolution of Life (COEL)** held its 35th and final planned meeting at the National Academies' J. Erik Jonsson Center in Woods Hole, MA, on June 7-8. The scope of the meeting was both retrospective and prospective in that the committee reviewed how exo/astrobiology had been represented in SSB activities over the past 50 years and how it might be handled in the future. Discussions concerning the latter focused on the possible merger of COEL and the Committee on Planetary and Lunar Exploration (COMPLEX) to create a new Committee on Astrobiology and Planetary Science (CAPS). The committee's discussions were enlivened and enriched by the participation of several former chairs and co-chairs of both COMPLEX and COEL and stimulated by the inclusion of topical agenda items on creationism and the ORIRIS-Rex, SAGE, and EPOXI missions. All NRC committees are ultimately ephemeral and are best remembered by their legacy of published reports. COEL was particularly active during its 11 years of existence. Its track record of eight full-length studies and one letter report, plus another study currently in progress (see Icy Bodies below) is as good if not better than that of any comparable committee during the past decade.

For more information

on the SSB and ASEB Board Meetings go to sites.nationalacademies.org/SSB/SSB_054577 (for the SSB) or sites.nationalacademies.org/DEPS/ASEB/DEPS_058923 (for the ASEB)

The Committee on Planetary and Lunar Exploration

(COMPLEX) is on hiatus until the completion of the planetary science decadal survey. When the committee stands back up it will be as a merger of COMPLEX and COEL. The new committee will be the Committee on Astrobiology and Planetary Science (CAPS).

The **Committee on Solar and Space Physics (CSSP)** is on hiatus until the completion of the solar and space physics (heliophysics) decadal survey.

STUDY COMMITTEES

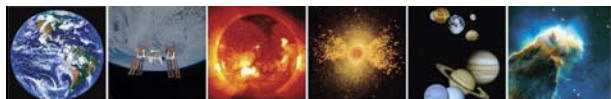
An edited and final version of the prepublication report issued late last year from the ad hoc **Committee on the Assessment of Impediments to Interagency Cooperation on Space and Earth Science Missions** was completed. On June 7 the committee co-chairs, Daniel Baker, University of Colorado, and D. James Baker, William J. Clinton Foundation, gave a second briefing of the findings of the report to staff of the White House Office of Science and Technology Policy and the Office of Management and Budget. The final report is available at http://www.nap.edu/catalog.php?record_id=13042.

The ad hoc **Committee on the Assessment of NASA's Earth Science Program** was formed to review the alignment of the NASA Earth Science Division's program with previous NRC advice, primarily the 2007 NRC decadal survey report, *Earth Science and Applications from Space*.

In carrying out this study, the committee is directed to neither revisit or alter the scientific priorities or mission recommendations provided in the decadal survey and related NRC reports; however, the committee may provide guidance about implementing the recommended mission portfolio in preparation for the next decadal survey. The committee began work in March 2011 and held meetings on April 27-29 in Washington, DC, at the National Academies' Keck Center and on July 6-8 in Seattle, WA. The committee is scheduled to hold its third and final meeting on September 21-23 in Irvine, CA, at the National Academies' Beckman Center. Delivery of a prepublication version of the committee's report is scheduled for January 31, 2012. For more information, go to <http://www8.nationalacademies.org/cp/projectview.aspx?key=49354>.

The committee and panels for the **Decadal Survey on Biological and Physical Sciences in Space** worked extensively with editors in this period to prepare the manuscript of the report *Recapturing a Future for Space Exploration: Life and Physical Sciences Research*

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for a *New Era* for final publication. (The report was publicly released in prepublication form on April 5). Briefings on the report findings continued in this period, including a joint briefing to the Office of Management and Budget and Office of Science and Technology Policy staff, a briefing to the NASA Advisory Council, and a briefing to a European Science Foundation workshop.

Many activities occurred this quarter in connection with the second **Decadal Strategy for Solar and Space Physics (Heliophysics)**. These included the third meetings of the three discipline-oriented study panels that are supporting the steering committee: Atmosphere-Ionosphere-Magnetosphere Interactions (AIMI), Solar Wind-Magnetosphere Interactions (SWMI), and Solar and Heliospheric Physics (SHP); two meetings of the survey steering committee in April and June; a meeting of the Working Group on Theory, Modeling and Data Exploitation; and a meeting of the Working Group on Education and Workforce. Outreach events also occurred in connection with several NSF-sponsored summer schools. At the June meeting of the steering committee meeting in Boulder, CO, the Aerospace Corporation, operating under contract to the NRC, presented an initial cost and technical analysis of selected survey-developed concepts. As the quarter ended, the steering committee was reviewing the results of this analysis and was also preparing for its August 29-31 meeting in Irvine, CA. Panels and working groups are expected to finish most of their work prior to this meeting. The survey remains on schedule for delivery by March 31, 2011, of a prepublication version of its report; however, a recent NASA request for additional consideration of "decision rules" related to survey mission recommendations, now including the Solar Probe Plus mission, could result in a short delay. More information about the survey is available at: http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_056864.

The ad hoc **Committee on Planetary Protection Standards for Icy Bodies in the Solar System** is developing recommendations for planetary protection standards for future spacecraft missions, including orbiters, landers, and subsurface probes, to the icy bodies in the outer solar system. The committee held a conference call on May 13 and convened its third and final meeting at the National Academies' Arnold and Mabel Beckman Center in Irvine, CA, on June 14-16. The committee's schedule calls for the assembly of a draft report in July/August and the delivery of a final NRC-approved document to NASA in February 2012.

The **Planetary Science Decadal Survey** issued a prepublication draft of its report, *Vision and Voyages for Planetary Science in the Decade 2013-2022*, completed its initial dissemination activities, and is currently focused on the preparation of the text for publication by the National Academies Press. The latter is scheduled for late-summer 2011. An illustrated version of the survey report intended for a popular audience is currently in preparation for publication in the fall 2011.

A slate of candidates for the **Committee for Evaluation of Space Radiation Cancer Risk Model** was approved in this period and the committee held its first on meeting on June 13-15 in Washington, DC. The committee heard a large number of briefings describing various aspects of the proposed NASA risk model for radiation-

induced cancer in astronauts and on recent research relevant to that model. After a subsequent discussion of issues related to the model with NASA participants and invited speakers, the committee went into closed session on the second day. The committee reviewed the model and identified questions and areas where additional information was needed. A report outline and writing assignments were developed and plans were made for activities leading up to the next committee meeting, which will be held on August 3-5 in Washington, DC.

Workshop details for **Sharing the Adventure with the Public: The Value and Excitement of "Grand Questions" of Space Science and Exploration** can be found on the SSB Web site at http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_057195, along with videos of each session. A workshop summary is expected by late-summer 2011.

The organizing committee for **The Effects of Solar Variability on Earth's Climate: A Workshop** gathered for a planning meeting on April 25 to be briefed by the workshop's sponsors, NASA and the NSF, and to hear updates on current research in solar physics, climate, and the Sun-climate connection. The workshop itself is scheduled for September 8-9 in Boulder, CO. All speakers at the workshop will be invited; however, the public is welcome to attend. For public registration go to http://sites.nationalacademies.org/SSB/CurrentProjects/SSB_061983.

OTHER ACTIVITIES

The next scientific assembly of the **Committee on Space Research (COSPAR)** will be held in Mysore, India, on July 14-22, 2012. The 2014 assembly will be held in Moscow, Russia.

On behalf of the SSB, this quarter, Michael Moloney attended the Space Weather Enterprise Forum 2011 held on June 21 at the National Press Club in Washington, DC. The theme of the forum was "Solar Maximum: Can We Weather the Storm?" In addition, Lewis Groszwald attended the Secure World Foundation's release of the *Space Security Index 2011* on June 22 in Washington, DC.

SSB STANDING COMMITTEES

COMMITTEE ON ASTRONOMY AND ASTROPHYSICS (CAA)*

COMMITTEE ON EARTH STUDIES (CES)†

COMMITTEE ON THE ORIGINS AND EVOLUTION OF LIFE (COEL)‡
Co-Chairs: Robert T. Pappalardo (through 6/30/11)
J. Gregory Ferry (through 6/30/11)

COMMITTEE ON PLANETARY AND LUNAR EXPLORATION (COMPLEX)§

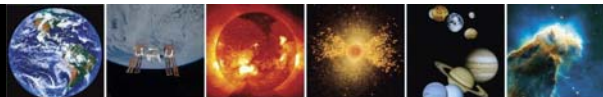
COMMITTEE ON SOLAR AND SPACE PHYSICS (CSSP)§

*Joint with the Board on Physics and Astronomy; on hiatus during the Astro2010 decadal survey.

†Membership is pending a renewal of the NASA contract in August.

‡Joint with the Board on Life Sciences. COEL was disbanded on June 30, 2011, when the members terms expired; under the new NASA contract COEL and COMPLEX will be merged into a new standing committee, the Committee on Astrobiology and Planetary Science (CAPS).

§COMPLEX and CSSP are on hiatus during the planetary science decadal survey and the solar and space physics decadal survey, respectively.



SUMMARY OF CONGRESSIONAL HEARING OF INTEREST

House Committee on Science, Space and Technology
A Review of NASA's Space Launch System
 July 12, 2011

Attended and summarized by Rachael Alexandroff and Katie Daud

Witness: The Honorable Charles F. Bolden Jr., NASA Administrator

The House Committee on Science, Space and Technology convened a hearing to ask NASA Administrator Charles Bolden about NASA and its seemingly uncertain future, in particular its human spaceflight program. Congress also requested more information on the Space Launch System (SLS)—NASA's back-up plan in case the commercial companies tasked with resupplying the International Space Station (ISS) in the post-space shuttle era are unable to do so. In particular, Congress requested information on cost, performance, and schedule. Administrator Bolden responded to these requests by saying that NASA has a plan for its next steps in spaceflight and wants to make sure that all of its decisions are affordable, sustainable, and realistic before he gives them any definitive costs and dates.

Administrator Bolden informed Congress that NASA has been aggressively working on a timeline as part of a flexible path option using commercial providers Space Exploration Technologies (SpaceX) and Orbital Sciences Corporation to carry out resupply missions to the ISS while NASA focuses its launch vehicle design efforts on a heavy-lift system for beyond low-Earth-orbit exploration. This timeline will have an uncrewed test flight of the SLS and the multipurpose crew vehicle (MPCV) by 2017, a crewed flight by 2020, a crewed expedition to an asteroid by 2025, and then finally a mission to Mars by the mid-2030s. So far there has been no elaboration on what the agency's plans are for Mars, beyond a human mission to orbit the planet. Administrator Bolden assured Congress and the American people that NASA is not abandoning human spaceflight.

The MPCV architecture has already been selected, based around the Orion crew exploration vehicle designed by Lockheed Martin. Orion is finishing assembly with environmental tests to start soon. Administrator Bolden confirmed that a specific design was approved for the SLS on June 20, and that cost estimates were being reviewed by the Office of Management and Budget and consulting firm Booz Allen Hamilton. He was adamant that this was the most important decision of his career at NASA and could not be rushed. In response to a question from Rep. Ralph Hall (R-TX), Mr. Bolden clarified that the SLS will be designed for deep space operations. He confirmed that the vehicle would be able to travel to the ISS, but that the only two situations in which he saw that occurring were if all commercial operators went bankrupt or a rescue mission was deemed necessary. Mr. Bolden told Congress that while NASA is making progress on the SLS, the agency's budget has been declining. NASA has had to descope the SLS several times and put a cost ceiling on the technical team. Because the budget keeps changing, the SLS program needs to be continuously re-visited and updated, which extends the timeline for completion.

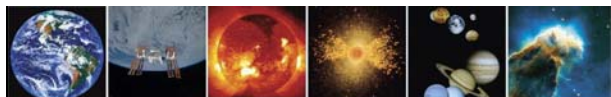
When asked by Rep. Steven Palazzo (R-MS) to explain why it was necessary to test vehicles before launch, NASA Administrator Bolden replied, "I would rather be on the ground wishing I was in the air than be in the air wishing I was on the ground."

Rep. Roscoe Bartlett (R-MD) asked Mr. Bolden to help him make the argument for human spaceflight to his constituents. Mr. Bolden said that NASA was good at making spaceflight look easy, and he went on to discuss some of the spin-offs from NASA research, including the synthetic aperture radio, which will soon be adapted to study breast cancer tumors. He also mentioned that NASA puts a high priority on science, technology, engineering, and mathematics (STEM) education with downlinks from astronauts on the ISS with classrooms around the country almost every day. Finally, he pointed out that while robots make good precursors, they lack the sophistication to make decisions that can be crucial on more advanced space missions.



Full Committee Hearing, A Review of NASA's Space Launch System, July 12, 2011. Credit: Committee on Science, Space and Technology.

Most members of the committee were worried about job losses in the aerospace industry. Representatives spoke on behalf of the spaceflight center that they represent. Mr. Bolden acknowledged the problem and told Congress that NASA is



The Honorable Charles F. Bolden Jr., NASA Administrator, testifying at the July 12, 2011 hearing. Credit: Committee on Science, Space, and Technology.

trying to transition people into other workforces such as at Embraer, an aeronautics company. NASA will also try to sustain the jobs of those who will continue working on programs such as the SLS and MPCV.

Mr. Bolden was also asked to comment on the role of international collaboration in manned spaceflight by Rep. Frederica Wilson (D-FL). His response was that these interactions were “critical for deep space exploration” as well as STEM education, especially in tough economic times. In particular, he mentioned that “Russia is an incredibly valuable partner,” since NASA will rely on the Russian *Soyuz* to take U.S. astronauts to the ISS until commercial alternatives are available around 2015. He also singled out the Canadian Space Agency (CSA), which is set to perform a robotic refueling test using the Dextre robotic manipulator, with hardware delivered on the final shuttle mission STS-135.

Questions about the fate of the James Webb Space Telescope (JWST) were also addressed. In particular, Rep. Dana Rohrabacher (R-CA), suggested that NASA should be focusing its current resources on present concerns, such as the JWST and orbital debris, rather than the distant human exploration of the solar system. Mr. Bolden stated his belief that new astronomical discoveries from the United States would be lacking should JWST not launch. In response to Rep. Hansen Clarke’s (D-MI) concern that the end of JWST would mean the loss of 8,000 jobs, Mr. Bolden re-

plied that for the same cost (adjusting for inflation) as the Hubble Space Telescope they would launch JWST. He also cited new management changes, the JWST re-plan, and the fact that 75% of the hardware has already been delivered.

When asked by Rep. Chip Cravaack (R-MN), “What is the chief threat to our safety in space?,” Mr. Bolden answered simply, “the economy.” A firm and consistent budget that would last over multiple congresses and multiple administrations would be helpful and appreciated by NASA. In conclusion, Mr. Bolden made three promises: NASA would maintain its leadership in space, take Americans to space on American rockets with the help of American innovation, and begin a program of deep space exploration.

Off-Year Symposia: A New COSPAR Initiative

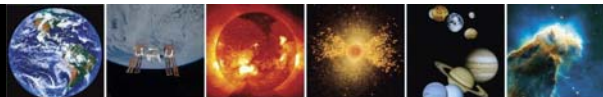
Prepared by David H. Smith

COSPAR Scientific Assemblies are not what they used to be. In 1970s they were annual events. They attracted about 500 participants and were frequently spread over two consecutive weeks. Today, the events are biannual and span just one week. Nevertheless, all assemblies since 2000 have accommodated 2,000 participants. Moreover, the recent assembly in Bremen attracted more than 3000 participants. Finding facilities capable of hosting plenary events and 30-plus parallel sessions, each with 100 or more participants, is a challenge. But, is that challenge changing the nature of COSPAR? Have the assemblies become so big that only the major space-faring nations possess the large, modern conference facilities needed to host COSPAR? More importantly, is COSPAR sliding into a two-tier structure of member nations that can and cannot host a scientific assembly?

These potential concerns led to the drafting of a proposal for a new type of meeting focusing on education and the affairs of emerging space powers. This new activity, dubbed the COSPAR Symposium, was discussed by the COSPAR Bureau and Council in Bremen and remanded to an ad hoc group for additional discussion (with input from both member organizations and associates). Proponents of symposia argue that they are designed to achieve the following:

- Assist COSPAR to offer opportunities to countries with small- to medium-size space programs to hold space research-related events;
- Promote the continuing expansion of space programs worldwide, with a particularly dynamic trend in emerging and developing countries; and,
- Direct a portion of COSPAR cash reserves into new initiatives in favor of the development of space research.

(Continued on page 9)



As currently conceived, the COSPAR Symposium would have the following characteristics:

- Differ clearly from the scientific assemblies and minimize perceived competition with them;
- Be held in odd years, with the first being held as early in 2013;
- Have a clear thematic focus and a distinctly multidisciplinary/interdisciplinary character;
- Avoid scheduling conflicts with other events organized by other relevant International Council for Science groups and partner organizations; and
- Be organized in a manner that does not give added work to the leadership of COSPAR's Scientific Commissions and, thus, not impact preparations for the scientific assemblies.

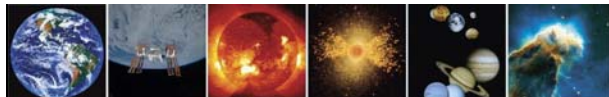
The intent is that the COSPAR Symposium will differ from the scientific assemblies in the following areas:

- Convene in countries without a large space infrastructure;
- Aim to attract between 500 and 1,000 participants, perhaps with a regional focus;
- Focus on a small number of interdisciplinary events and/or sessions featuring the latest results from new missions;
- Feature training, educational, capacity-building, and outreach events specifically oriented toward the needs of teachers, students, young professionals, and the general public;
- Last no more than 4 days; and
- Require registration fees approximately one-third of that for a scientific assembly.

Needless to say, the proposal has received a mixed reception. Nevertheless, responses to survey forms distributed by the COSPAR Secretariat and discussions at the most recent meeting of the COSPAR Scientific Advisory Committee and Bureau generally supported the proposal. However, there were significant comments to the effect that there were already too many meetings and that the symposia could dilute the importance of the assemblies. U.S. Representative Robert Lin offered qualified support for the proposal. But, he cautioned that the advisability of an off-year symposium is a strong function of the detailed format of and scientific program for the event. He made the following points in his response to the COSPAR survey:

- Two extreme types of events can be envisaged: a scaled-down version of the current assemblies or a scaled-up version of a capacity-building workshop. Neither is a good model. Finding the middle ground between these two extremes is key. While an appropriate middle ground can probably be achieved, Lin worries about the process by which it is found. A potential danger is a bifurcation of COSPAR into factions that routinely participate in symposia to the exclusion of assemblies and vice versa.
- A thematic focus for the symposia is appropriate. But, how broadly or narrowly focused will it be? The theme needs to be sufficiently broad as to be potentially relevant to all of the COSPAR scientific commissions and panels participating in the symposium. This seems to be a tall order! Is it necessary, practicable, or even desirable to engage all commissions and panels? More importantly, who decides the theme? Is this proposed by the host as part of the bidding process?
- A multidisciplinary character is also appropriate. But again, can all of COSPAR or even major subcomponents be engaged? Somebody needs to decide which scientific commissions, sub-commissions, and panels are in and which are out. How is this decided? Do the chairs of all commissions and panels have the option to become involved with a particular symposium?
- Four working days is an appropriate duration.
- It is not clear what is meant by the "regional focus" of the participants. Does it mean that the symposium will showcase results from researchers in a specific region? Does it mean that the participants will be drawn primarily from a specific region? Or does it mean something else? The success of a symposium will depend on drawing the correct balance of "regional" and "non-regional" participants. What this balance is and how it is achieved is not clear.
- Aiming for 500 to 1,000 participants appears reasonable.
- Holding the symposium in the odd years is essential. But, nothing has been said about the timing within the year. There are already a lot of major meetings and clashing with one of them would be disastrous.

In summary, Lin's view is that COSPAR should undertake to hold one symposium on a trial basis and then decide, based on practical experience, whether or not to attempt any more. This is basically what the COSPAR Bureau decided to do when it discussed the issue during its March 2011 meeting. The tentative plan is to try and organize one in 2013. Where it will be held, how it will be organized, and all other details remain to be determined. Stay tuned for new developments.



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 39th COSPAR Scientific Assembly, to be held in Mysore, India, on July 14-22, 2012.

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

COSPAR Space Science Award honors a scientist who has made outstanding contributions to space science. Recent recipients include: G. Hasinger (2010), S.W. Squyres (2010), G. Gloeckler (2008), K. Pounds (2008), A. Nishida (2006), E. T. Gruen (2006), J.E. Blamont (2004), V.I. Moroz (2004), S.M. Krimigis (2002), C.T. Russell (2002), R. M. Bonnet (2000) and D. Hunten (2000).

COSPAR 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: L.-L. Fu and Y. Ménard (2010), M.A. Geller (2008), R. A. Greenwald (2006), S.S. Holt (2004), A. Brack (2002) and J.H. Carver (2000).

COSPAR William Nordberg Medal is presented to a scientist who has made a distinguished contribution to the application of space science. Recent recipients include: K.-N. Liou (2010), J. Waters (2008), J. P. Burrows (2006), L.J. Lanzerotti (2004), M. Chahine (2002) and K. Ijiri (2000).

COSPAR 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: H. Tananbaum (2010), G.G. Fazio (2008), C. Elachi (2006), Y. Tanaka (2004), G. Bignami (2002), J. Paul (2002) and S.C. Bower (2000).

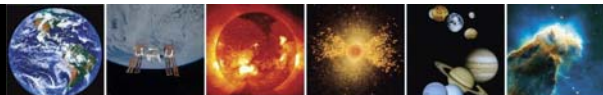
COSPAR Distinguished Service Medal serves to honor extraordinary services rendered to COSPAR over many years. Recent recipients include: M.A. Shea (2010), I. Révah (2008) and S. Grzedzielski (2001).

Vikram Sarabhai Award is awarded by 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 2006-2011. Previous recipients include: Z. Pu (2010), M.A. Abdu (2008), M. E. Machado (2006), A.P. Willmore (2004), R. Xu (2002) and Z.-X. Liu (2000).

Jeoujang Jaw Award is bestowed by 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 are C.T. Swift (2010) and J.L. Burch (2008).

Zeldovich Medal is conferred by the Russian Academy of Sciences to scientists, under 36 years of age on the last day of 2011, for excellence and achievements. Medals are presented to a scientist in each of COSPAR's Scientific Commissions. Recipients of the 2010 Zeldovich Medals are: P.I. Palmer (Scientific Commission A); A.A. Fedorova (Scientific Commission B); J. Lei (Scientific Commission C); Y. Narita (Scientific Commission D); V. Sguera (Scientific Commission E); O.A. Gusev (Scientific Commission F); J. Shiomi (Scientific Commission G) and J.W. Conklin (Scientific Commission H).

Additional details concerning the awards, together with instructions and nomination forms, can be found at <http://cosparhq.cnes.fr/Awards/awards.htm>. Completed nominations forms must be received by the COSPAR Secretariat in Paris no later than November 30, 2011. Questions can be addressed to David H. Smith, executive secretary of the U.S. National Committee for COSPAR, at dhsmith@nas.edu.



STAFF NEWS

Lloyd V. Berkner Space Policy Internship

The Lloyd V. Berkner Space Policy Internship Program selected Rachael Alexandroff (Princeton University) and Katie Daud (University of Pennsylvania) as participants in its 2011 summer program and Danielle Piskorz (Massachusetts Institute of Technology) for the 2011 fall program.

The goal of the program is to provide promising students with the opportunity to work in the area of civil space-research policy in the nation's capital, under the aegis of the SSB. Additional information on the program can be found in this newsletter and at http://sites.nationalacademies.org/SSB/ssb_052239.

Rachael Alexandroff grew up in Toronto, Canada, and is currently a rising senior at Princeton University. She is pursuing a major in astrophysics with a certificate in planets and life. On campus she is the president of the Astrobiology Club and a participant in Women in Science at Princeton focus group. She has done research in the areas of planetary statistics and active galactic nuclei, including an internship in the summer of 2010 at the Joint Institute for VLBI in Europe. Her passion for space exploration began at the age of 7, and her interest in science policy developed through classes in science journalism and environmental public policy. After graduation in spring of 2012, Rachael hopes to continue her studies by pursuing a Ph.D. in astrophysics.

Katie Daud is a senior at Bloomsburg University of Pennsylvania with a triple major in planetary science, Earth science, and political science. She serves as the president of the Astronomy Club and senator for the Community Government Association. She did research for the Smithsonian National Air and Space Museum on lunar tectonics. Katie is interested in combining both her passion for space exploration and her skills in policy to work for NASA's Office of Legislative and Intergovernmental Affairs.

Danielle Piskorz grew up on Long Island, New York, and recently graduated from the Massachusetts Institute of Technology with a degree in physics and a minor in applied international studies. She has done various research projects at L'Institut d'Astrophysique de Paris, Los Alamos National Laboratories, and the Jet Propulsion Laboratory and spent her junior year studying at the University of Cambridge. Danielle plans to begin her graduate studies in fall 2012 at the University of Chicago's Department of Geophysical Sciences. In the meantime, she intends to gain meaningful experience in science policy with the hope of making a contribution to the field in the future.



SSB interns Katie Daud and Rachael Alexandroff, seen here posing in front of a model of the Curiosity rover, attend an event at the Smithsonian Air and Space Museum celebrating 50 years of nuclear spaceflight.

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KATIE DAUD, Summer
DANIELLE PISKORZ, Fall

Christine Mirzayan Fellow
HEATHER SMITH

*Staff of other NRC boards who are shared with the SSB



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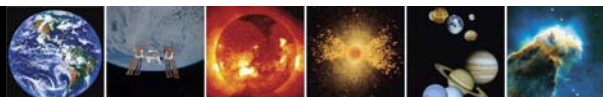
- July 6-8 *Committee on the Assessment of NASA's Earth Science Program—Seattle, WA*
- August 3-5 *Committee on the Evaluation of Space Radiation Cancer Risk Model—Washington, DC*
- August 18-19 *Space Studies Board Executive Committee—La Jolla, CA*
- August 28-31 *Decadal Survey on Solar and Space Physics (Heliophysics): Steering Committee—Irvine, CA*
- September 8-10 *Organizing Committee on the Effects of Solar Variability on Earth's Climate: A Workshop—Boulder, CO*
- September 12-14 *Committee on the Evaluation of Space Radiation Cancer Risk Model—Washington, DC*
- September 21-23 *Committee on the Assessment of NASA's Earth Science Program—Irvine, CA*

FUTURE SSB MEETINGS

November 8-10, 2011, in Irvine, CA

April 4-5, 2012, in Washington, DC (April 4 joint with ASEB)

****NEW DATE**** November 12-14, 2012, Irvine, CA ****Changed due to election day****



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