

**National Aeronautics and Space Administration
Washington, DC**

NASA ADVISORY COUNCIL

December 11-12, 2013

**NASA Kennedy Space Center
Florida**

MEETING MINUTES



**P. Diane Rausch
Executive Director**



**Steven W. Squyres
Chair**

NASA ADVISORY COUNCIL

**NASA Kennedy Space Center
Florida**

PUBLIC MEETING

December 11-12, 2013

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Wednesday, December 11, 2013

Call to Order and Announcements

Ms. Diane Rausch, Director, Advisory Committee Management Division, NASA Headquarters, and Executive Director, NASA Advisory Council (NAC or Council), called the meeting to order and welcomed the NAC members and attendees to NASA's Kennedy Space Center (KSC) in Florida. She stated that the NAC is a Federal advisory committee established under the Federal Advisory Committee Act (FACA). The meeting today and tomorrow is open to the public. A dial-in teleconference capability is available for members of the public to listen to the meeting. WebEx is also available for members of the public to see the NAC PowerPoint presentations in real-time. Meeting minutes will be taken by Mr. David Frankel and will be posted to the NAC website soon after the meeting: www.nasa.gov/offices/nac. Each NAC member has been appointed by the NASA Administrator, Mr. Charles F. Bolden, Jr., based on the member's individual subject matter expertise. Each member is a Special Government Employee, subject to ethics regulations, and must recuse himself or herself from discussions on any topic in which there could be a potential conflict of interest. Any Council member with an ethics question should notify Ms. Rausch, and she will put that person in contact with NASA's Office of General Counsel. Time has been set aside on the meeting's second day for public input.

Opening Remarks by Council Chair

Ms. Rausch introduced Dr. Steven Squyres, Chair, NASA Advisory Council. He described how wonderful it was for him to be back at KSC. The last time he was at KSC, NASA's *Spirit* rover was being launched on a mission to Mars. Dr. Squyres thanked Mr. Robert Cabana, KSC's Director, for his hospitality and for making an outstanding Center tour available to the Council members. Council members were reminded to push their microphone buttons to the "on" position in order to enable the public to hear what was being said.

Welcome to NASA Kennedy Space Center

Dr. Squyres invited Mr. Cabana to address the Council. Mr. Cabana welcomed everyone to the meeting and briefly described the Center. KSC is being transformed into the world's preeminent launch complex for government and commercial space access. It is engaged on NASA's three top priorities: the Space Launch System (SLS) and Orion Multi-Purpose Crew Vehicle (MPCV or Orion), the International Space Station (ISS), and the James Webb Space Telescope (JWST). In addition, it has a significant role in NASA's most important programs and projects: the Ground Systems Development and Operations (GSDO) program, the Launch Services Program, the Commercial Crew Program (CCP), the ISS Ground Processing and Research Office, Space Technology, and Advanced Exploration Systems (AES). KSC will have an important role in the future Asteroid Mission. Slides were presented showing plans for the Crawler Transporter, the new Mobile Launcher, Pad 39B, and the Vehicle Assembly Building (VAB). Mr. Cabana explained that the changes being made now at KSC will support NASA for the next 30 years and will enable NASA to get humans to Mars. The Center is striving to divest itself from excess infrastructure that is too expensive to maintain. The plan is to leverage KSC's capabilities with commercial and international partners and

make KSC a multi-user spaceport. Mr. Cabana expressed confidence that the Center is on the right path to making that transition.

Dr. Squyres thanked Mr. Cabana for his comments and noted how impressed he was with Mr. Cabana's team.

Remarks by NASA Administrator

Dr. Squyres introduced Mr. Charles Bolden, NASA Administrator.

Mr. Bolden welcomed the Council members and noted it was a pleasure for him to be with them at KSC. He remarked that the tour with them around KSC in the morning had been excellent, and he observed "there is nothing like looking at hardware." What is even more valuable, he declared, is having an opportunity to ask the workforce how things are going and what they need. As Mr. Cabana stated in his remarks, KSC is in the midst of a major transformation. It is coming from a 30-year legacy of technological achievement with the Space Shuttle and is transitioning from that program into the future.

Mr. Bolden noted that this meeting is the third NAC meeting this year and the last under its current organizational structure. The NAC will be restructured to make it more efficient and effective. He explained that prior to his arrival as NASA Administrator in 2009, the NAC used to have over 40 members because every member in each NAC committee was also a Council member. In 2009, he made the controversial decision to restructure the NAC to have it become a small council, comprised of only the committee chairs, where he could talk to everyone one-on-one. Now in 2013, it is time for another restructuring, to make the NAC even more streamlined and effective. The current restructuring will take place over the next several months and should be completed by April 2014. Three committees are being decommissioned in order to streamline the NAC: Audit, Finance and Analysis Committee; Education and Public Outreach Committee, and Commercial Space Committee. Specifically, the function of the Commercial Space Committee is being merged into the Human Exploration and Operations (HEO) Committee. This merger of functions in the current NAC restructuring is consistent with the prior reorganization at NASA where the Agency merged Commercial Space into the Human Exploration and Operations Mission Directorate (HEOMD) at the Shuttle's conclusion, so that all human space flight activities would be conducted under one organization. The merger also reflects the strides that have been made in making commercial space an integral part of how NASA does business. Ten years from now, NASA will probably purchase most of its services from commercial providers.

Mr. Bolden described a new NAC committee, the Institutional Committee, which is being formed to provide advice on the Agency's workforce, infrastructure, and Information Technology (IT). He explained that NASA needs innovative ways to be more productive than ever before. In addition, two new Ad Hoc NAC Task Forces are being formed: the Task Force on Science, Technology, Engineering and Mathematics (STEM) Education; and the Task Force on Big Data. These task forces are for a specific purpose and will have limited durations and high impact to address their respective issues.

The existing NAC committees that will continue in the future are: Science Committee; Aeronautics Committee, Technology and Innovation Committee (with Engineering being added); and Human Exploration and Operations Committee. The Council itself will include in the future several "at-large" members who will provide advice and expertise looking strategically across the Agency at crosscutting issues. Four or five new "at-large" members are anticipated.

Mr. Bolden thanked the NAC members for their service and explained that the NAC's recommendations are taken very seriously by him and the Agency leadership. He noted that the Agency has carefully considered and responded back to the NAC on each and every recommendation during 2013, and that he looks forward to its continued support under the new structure.

NASA's accomplishments in 2013 were described. Major strides were made in commercial space and in the development of the Orion capsule for human development into deep space, notwithstanding the recent U.S. Government shutdown, no budget, and the sequester.

In January, NASA participated in the Inaugural Parade with full size models of the *Curiosity* Mars rover and the Orion capsule. NASA also launched the Tracking and Data Relay Satellite (TDRS) K, part of a network of communications satellites. In February, *Curiosity* completed its first full year of service on Mars and used its drill, marking the first time any robot has drilled into a rock to collect samples on Mars. NASA's Van Allen Probes Mission discovered a previously unknown third radiation belt around Earth.

In March, the second successful SpaceX commercial space mission was flown to the International Space Station (ISS) on March 26. The James Webb Space Telescope (JWST) continued in its development with the assembly of the support structure's wings. Three new crew members were launched to the ISS on an unprecedented four orbit fast track for rendezvous. *Curiosity* analyzed rock samples collected by its rover. The samples were found to contain sulfur, hydrogen, oxygen and phosphorus. This showed that Mars could have supported microbial life. NASA studied the effects of alternative biofuel.

In April, the rollout of the President's FY2014 Budget Request gave NASA \$17.7 billion and included \$150 million for the Asteroid Redirect Mission (ARM). This budget ensures that the U.S. will remain the leader in space discovery in the years to come. NASA is constantly seeking innovative proposals from U.S. universities to further guarantee that the U.S. will remain the leader in space. This is supported through the Space Technology Grant solicitation. The mission to sample an asteroid is moving ahead in preparation for a 2026 launch. NASA's Gravity Recovery and Interior Laboratory (GRAIL) mission uncovered the origin of massive invisible regions that make the moon's gravity uneven. This incredibly well-planned and executed mission will help spacecraft on missions to other planets in the future. In June, the Interface Region Imaging Spectrograph (IRIS) solar observatory was launched. It will observe how solar material moves, gains energy, and heats up in the interface region of the solar atmosphere.

In June, NASA selected a new group of eight potential astronauts. This comes from the second largest number of applicants NASA has ever seen. Half of the selectees were women, the highest percentage that NASA has ever had. There was no target for a specific number of women. The Cassini spacecraft took a picture of Earth in July while on its journey to Saturn. Also in July, internal studies and alternatives were reviewed for the mission to find and capture a near-Earth asteroid (NEA), redirect its orbit, and send humans to study it. The Hubble Space Telescope (HST) found a new moon circling Neptune. The Space Technology Mission Directorate (STMD) tested a large composite tank for holding cryogenic fuel.

In August, a major milestone in building the next major heavy-lift launch vehicle was achieved when engineers from the SLS completed the critical design review (CDR) for the heavy-lift rocket's design plans. This rocket will have flexible capabilities in order to launch crew or cargo to an asteroid or Mars. Additional milestones were added to NASA's Commercial Crew integrated Capability (CCiCap) Space Act Agreements (SAA's).

After many years, the Kepler mission ended after confirming 167 exoplanets and finding many more candidates, including Earth-sized planets in the habitable zones of stars. He noted that the Spitzer Space Telescope, the fourth of NASA's great observatories, continues to explore the cosmos in the infrared, and one of its tasks is to identify candidate asteroids for redirection. In Aeronautics, research efforts are directed towards quieter, greener, and more fuel-efficient aircraft. In September, the Voyager spacecraft became the first human-made object to enter deep space. NASA launched the Lunar Atmosphere and Dust Environment Explorer (LADEE), a robotic mission to orbit the moon and gain information about the lunar atmosphere and surface conditions. NASA has identified four landing sites for the next mission to Mars. The next Mars mission is scheduled to launch in March 2015. The Aeronautics

Research Mission Directorate (ARMD) unveiled a new strategic vision for continuing nearly a century of aeronautics research to maintain U.S. leadership in the commercial aircraft arena. At KSC, the Orion Multi-Purpose Crew Vehicle was powered on for the first time. NASA's Lunar Laser Communications Demonstration (LLCD) made history by transmitting data quickly between the Moon and Earth. November saw the successful closeout of the Commercial Orbital Transportation Services (COTS) program, NASA's first commercial partnership for cargo resupply of the ISS. The Mars Atmosphere and Volatile Evolution (MAVEN) mission was launched to examine the loss of atmosphere on Mars.

At the conclusion of his remarks, Mr. Bolden introduced and thanked three Council members who were rotating off the Council after this meeting – Mr. Robert Hanisee, Dr. Larry Smarr, and Mr. Lars Perkins – for their incredible service on the NAC. He noted that they are nationally and internationally recognized experts, and he awarded each of them the NASA Exceptional Public Service Medal, one of the highest honors the Agency bestows on a private citizen for their outstanding contributions to the U.S. space program. Mr. Bolden noted that these three individuals and the NAC committees they chaired (Audit, Finance and Analysis Committee, IT Infrastructure Committee, and Education and Public Outreach Committee, respectively) have been an invaluable source of wise counsel to the Agency over the past years. He explained that audit and finance issues would continue to be addressed within the new Institutional Committee being established, and that Big Data and STEM education issues would continue to be addressed by the two new Ad Hoc Task Forces being established.

Dr. Squyres thanked Mr. Bolden for his remarks, and added his own deep appreciation to Mr. Hanisee, Dr. Smarr and Mr. Perkins for their excellent contributions. He noted that working with and learning from these three exceptional people has been extremely rewarding.

Asteroid Initiative Update

Dr. Squyres introduced Mr. Gregory Williams, Deputy Associate Administrator, and Mr. William Gerstenmaier (*via telecon*), Associate Administrator, Human Exploration and Operations Mission Directorate, NASA Headquarters.

Mr. Williams described in detail the Asteroid Initiative that had previously been referred to by Mr. Bolden. There are three segments to the proposed Asteroid Redirect Mission (ARM): asteroid identification, asteroid redirection, and crewed sampling and return. To accomplish this mission, NASA is leveraging key ongoing activities in NASA's three space-related Mission Directorates: the Human Exploration and Operations Mission Directorate (HEOMD), the Science Mission Directorate (SMD), and the Space Technology Mission Directorate (STMD).

A chart showing the timeline for the mission was presented. Dr. Squyres inquired about the latest date to identify a target asteroid. Mr. Williams responded that if Exploration Mission-2 (EM-2) is going to be the vehicle, then the target asteroid would need to be identified by 2017 in order to enable launch in 2018; therefore, there are three years to find a suitable target. Mr. Hanisee asked whether the grappling would be accomplished robotically or would require an extravehicular activity (EVA). Mr. Bolden advised that the asteroid "capture" would require riding along with the asteroid for one to two years while slowly changing its course. Mr. Gerstenmaier explained that there are many variables that would affect the 2018 launch date for the redirect mission. Dr. Squyres observed that the schedule would be challenging because the target would not have been identified within five years prior to the launch. Mr. Gerstenmaier asserted that would be mitigated because there were many well-understood aspects that have enabled them to begin designing the spacecraft before identifying the target. Mr. Bolden explained that a cultural change to accomplish this mission is underway at the Agency: failure is an option. He has instructed the team that this is not a mission requiring perfection. A precursor will not be flown. There are three independent segments, and if any one of them is successful, NASA can declare victory. Mars remains the ultimate destination; however, much work remains in the Earth-to-lunar area.

Mr. Williams discussed the objectives for the ARM. The primary objectives are to gain operational experience beyond low-Earth orbit (LEO), demonstrate advanced solar electric propulsion, and identify NEAs for planetary defense. Secondary objectives are to demonstrate asteroid deflection, develop science, and develop partnership opportunities, both international and commercial. He acknowledged that for some it is difficult to accept that science is only a secondary objective. Dr. Squyres asked where within the Agency the redirect spacecraft is being developed. Mr. Williams responded that a determination on that has not yet been made. A robotic mission concept study on redirecting and deflecting a small asteroid will be led by the Jet Propulsion Laboratory (JPL). An alternate robotic mission concept study on redirecting and deflecting a small mass from a larger asteroid will be led by the Langley Research Center (LaRC). A crew rendezvous and sampling study for either concept will be led by the Johnson Space Center (JSC). An Ideas Synthesis Workshop was recently conducted to explore new ideas to help inform NASA's planning activities for the ARM.

The NEA population was discussed. NASA's Near Earth Object (NEO) Observation Program at JPL, where precision orbital analysis is performed, has led the international NEO discovery and characterization effort. There are over 10,000 known NEAs. Ninety-five percent of one-kilometer and larger NEAs have been found. The completion percentage for smaller asteroids is much lower because the population increases exponentially as the size decreases, and smaller asteroids are harder to detect. Charts were presented on solar power technology development and electric propulsion technology development. The asteroid capture mechanism concept status was discussed.

Mr. Williams presented a chart showing six key strategic principles for a sustainable program. Missions need to be selected that extend capabilities. He described how the ARM crewed mission leverages ongoing work. The docking system for Orion and robotic spacecraft will be developed from the International Docking System Standard used on the ISS. He discussed charts showing how the ARM provides the first steps to Mars and other destinations. The Target NEO 2 Open Community Workshop held in July 2013 was described. Its final report is available at <http://targetneo.jhuapl.edu/>. A chart comparing findings from the workshop to current ARM planning was discussed.

Mr. Williams noted that NASA's Associate Administrator, Mr. Robert M. Lightfoot Jr., had responsibility for coordinating, guiding, and prioritizing the mission. In response to a question from Dr. Smarr, Mr. Williams explained that the biggest risks that have been identified are the Orion heat shield and life support systems development. Dr. Squyres noted that EM-2 will travel beyond Earth's radiation belt, and he asked whether NASA's analysis covered potential radiation health threats from a significant solar event. Mr. Gerstenmaier responded that radiation mitigation is being studied, and the biggest concern is galactic background radiation exposure. The 21-day mission duration is not expected to present a problem, and NASA is studying how much natural shielding will be provided by the Orion capsule. Mr. Bolden described the Exploration Design Challenge. This is a STEM program conducted by NASA in partnership with Lockheed Martin. Students in high school and college have been given an opportunity to develop designs that mitigate radiation. There have been over 30,000 entries. Lockheed Martin will bring the five top teams to KSC for the Exploration Flight Test-1 (EFT-1) launch. The presentation was concluded with a slide showing the slogan: "A Deeper Vision, A Bolder Mission, One Step at a Time. Step One: 2014."

Dr. Squyres thanked Mr. Williams and Mr. Gerstenmaier for their presentation.

NASA Commercial Space Update

Mr. Williams and Mr. Gerstenmaier next briefed the Council on the status of NASA's Commercial Space Program (CCP). Dr. Squyres noted that this presentation had been expressly requested by the Council because two Council committees had presented different down-select recommendations for the CCP at the last Council meeting.

Mr. Williams explained that commercial space has two components: commercial cargo and commercial crew. These commercial capabilities are sought in order to free NASA to explore deep space. He described the

commercial cargo accomplishments. It has produced two new low-cost U.S. launch vehicles; two new autonomous cargo spacecraft able to carry cargo to and from the ISS; and two new privately-developed large facilities at Cape Canaveral, Florida, and Wallops Island, Virginia. This provides NASA Science missions with two medium-class launch vehicle options and is helping to recapture U.S. market share for commercial launches. This was developed for about \$800 million in NASA funding. A chart showing the roadmap for the CCP was presented. There are several elements in the program: Commercial Crew Development (CCDev); Commercial Crew Development Round 2 (CCDev2); CCiCAP; and NASA Crew Certification, with two phases: phase 1 - Certified Products Contract (CPC) and phase 2 - Commercial Crew Transportation Capability (CCtCAP). Under CCiCAP, there are funded SAAs with three companies – Boeing Company, Sierra Nevada, and SpaceX – and an unfunded SAA with a fourth company, Blue Origin. Milestones achieved under these agreements were reviewed.

Mr. Williams explained that the primary objective of CPC is the delivery, technical interchange, and NASA disposition of early lifecycle certification. He provided an overview of CCtCAP. It is a process acquisition using competitive down-selection procedures, and allows for a full and open competition. It will result in firm-fixed-price, performance-based contracts with a fixed-price Indefinite Delivery/Indefinite Quantity (IDIQ) element. The base period for the contracts awarded will be August 2014 through September 31, 2017. The Request for Proposal (RFP) is centered on how well the contractor shows compliance to core CCP and ISS requirements. He noted that crew safety is the foundation of the program. Mr. Bolden explained that there is a thing called “the riddle.” It relates to how the proposals are evaluated. Cost accounts for 50 percent; therefore, safety and mission assurance seem to be secondary to cost. However, if NASA is not satisfied on mission assurance and safety, the bidder will not be selected. Mr. Gerstenmaier elaborated that safety is included within mission suitability and past performance. He asserted that safety is protected even though it is not called out in the selection statement. In response to a question from Dr. Smarr, Mr. Gerstenmaier explained that no one will be precluded from bidding on a contract as long as they are able to demonstrate sufficient maturity.

A chart on the budget situation was presented. Mr. Williams explained that FY2014 is a key year for CCP, and to stay on track the program needs an appropriation that is as close as possible to the President’s Budget Request. Mr. Bolden described the first time he brought the President’s Budget for this program to Congress. He explained to Congress that \$1 billion was needed to bring commercial crew into being by 2015. There was incredible opposition. Only around \$425 million was appropriated, and NASA was put under tremendous pressure to down-select to one contractor. That would have been unwise because the program was too immature at the time for a down-selection. Boeing had not yet become a participant, but eventually became a viable participant years after everyone else. The following year, NASA requested \$850 billion and received only around \$500 million. Congress has been cautioned that the gap cannot be closed, that a 2015 target cannot be met, and that the target date now is 2017. The FY2014 President’s Budget Request is \$821 million, which is a modest amount to fly crew by 2017. Down-selection will depend, therefore, on what Congress does.

Dr. Squyres expressed the Council’s appreciation for this presentation.

Human Exploration and Operations Committee Report

Dr. Squyres introduced Mr. Kenneth Bowersox, Chair, NAC Human Exploration and Operations (HEO) Committee.

Mr. Bowersox described the Committee membership and presented a chart showing how HEOMD at NASA Headquarters is organized. He reviewed the agenda from the Committee’s last meeting and summarized the areas discussed by the Committee. The Committee discussed ways to develop support for human exploration ; the integration of HEO programs across directorates, missions, vehicles, and systems; managing programs with constantly uncertain funding; and the importance of setting an official target date for ending NASA’s support to the ISS.

The NAC HEO Committee was briefed by Mr. Jason Crusan, Director, Advanced Exploration Systems (AES) Division, HEOMD. A chart from that briefing, entitled "Capability Driven Framework," was presented. The Committee will help AES communicate its overall mission by helping it to revise that chart. Mr. Bowersox discussed a summary schedule chart from the HEOMD Exploration Systems Development (ESD) Division. He expressed concern over the long gap between flights shown on the schedule.

The ISS program status was reviewed in a briefing to the NAC HEO Committee by Mr. Sam Scimemi, Director, ISS. The ISS is essential to meeting the Nation's goals in space and in laying the foundation for long-duration spaceflight beyond LEO. It is on the critical path for the Mars mission. Mr. Bowersox observed, as a former astronaut, that the life support systems on the ISS, while state-of-the-art, are not developed to the point where he would feel comfortable taking them to Mars. The ISS is the best place for testing those systems. The longer we have the ISS, the more we learn. NASA budget support for the ISS is currently scheduled to end in 2020.

Mr. Bowersox submitted a proposed Council recommendation that NASA act immediately to officially extend NASA's support to the ISS beyond 2020. He explained that it is difficult to justify commercial transportation to the ISS if it will only be supported by NASA until 2020. In addition, extending the date will help international partners line up support from their governments. In response to a question from Mr. John Borghese, Mr. Bowersox explained that the 2020 date is derived from the fact that the NASA's official ISS budgeting date stops at 2020. The time length for any extension will need to be based on actual equipment lifespan engineering analysis. The HEO Committee did not reach a consensus on how far beyond 2020 the ISS should be extended and was concerned about taking funds for the extension from other programs. He believes that an analysis from the program managers is needed. Dr. Charles Kennel counseled that the most significant aspect to the recommendation is its indefinite duration, which he believes would be helpful to the international partners. Dr. Squyres concurred that it is wise to not implicate a specific date. Dr. Squyres suggested that the recommendation be modified to include having NASA generate a plan consistent with the existing budget to show how an extension would be funded. He expressed concern over potential safety implications because the more money spent on ISS means less funding would be available for a more robust flight rate. After further Council discussion, Mr. Bowersox determined that it would be best to withdraw the recommendation in order to give the HEO Committee an opportunity to query NASA on its plans for an extension to the ISS.

Dr. Squyres thanked Mr. Bowersox for his presentation.

Science Committee Report

Dr. Squyres introduced Dr. Eugene Levy, substituting for Dr. David McComas, Chair, Science Committee.

Dr. Levy described the Science Committee's membership and discussed recent science results. Firefighting has been aided by the Studies of Emissions, Atmospheric Composition, Clouds and Climate Coupling by Regional Surveys (SEAC⁴RS). NASA data provided to the Disaster Response Coordinator at the United States Geological Survey (USGS), and made publicly available through the Hazards Data Distribution System, helped in the disaster response to Typhoon Haiyan that struck the Philippines. A slide showing Comet ISON being a "slingshot" around the Sun was presented. Recent major accomplishments in Heliophysics were described. Voyager 1 became the first human-made object to venture into interstellar space. Using the Helioseismic and Magnetic Imager on NASA's Solar Dynamics Observatory, scientists have mapped the flow of material inside the sun. Two teams of scientists, using NASA's Hubble Space Telescope, have found water signatures in the atmosphere of five distant planets.

Results from the second Kepler Science Conference were described. Dr. Levy noted that the Kepler mission has identified 104 exoplanet candidates and has led to a landmark change in the ability to identify planets around stars.

He presented a chart showing Kepler candidates in the habitable zone. A graph showing the altitude and range capability for NASA's airborne science aircraft was presented. Dr. Levy discussed NASA's airborne campaigns from 2005 through 2013. The Heliophysics System Observatory was described. It is a fleet of spacecraft to understand the Sun and its interactions with the Solar System. Heliophysics has 18 operating missions and 6 missions in development. NASA has a \$5.5 billion investment in Heliophysics space assets (excluding launch costs) and a \$68 million annual operating budget (1.2 percent per year). The LADEE lunar mission was described. Its objective is to measure lunar dust and to ascertain the composition of the thin lunar atmosphere. The LLCD was described. Lessons learned from the Mars Science Laboratory (MSL) were discussed.

Dr. Levy discussed Mars 2020 mission and the Mars Exploration Program (MEP). He presented the Mars 2020/MEP recommendations and explained that they are extremely important to sustaining NASA's Mars Program. Pursuant to those recommendations, the SMD should fill the MEP Program Director position immediately and constrain non-SMD add-ons to those not impacting MSL heritage.

Dr. Levy discussed planetary protection policy and requirements needed to control interplanetary transfer of viable bio-organisms or spores from one planet to another. This means back to Earth from another planet, or forward from Earth to protect the biological integrity of other planetary environments. The policies and requirements are governed by active international agreements. One concern is that public perception about back contamination risks could present an existential threat to interplanetary-return missions, whether acquiring rocks or returning people. Dr. Levy noted that terrestrial life occurs in a broader variety and thrives in a wider range of environments than once believed. The Martian surface does not appear to be conducive to life and seems to be a self-sterilizing environment. The Martian subsurface may have more water than previously believed. He described the planetary protection framework. NASA follows Committee on Space Research (COSPAR) planetary protection policy, in accordance with agreement among the parties to the United Nations Outer Space Treaty. The NASA Planetary Protection Officer (PPO) interprets the rules set by international agreement, and recommends measures to comply with international agreement.

Dr. Levy submitted a proposed recommendation for NASA to reconsider its interpretation of external guidance on travel restrictions for scientific meetings. In response to a question from Dr. Squyres, Dr. Levy advised that the interpretation affects principal investigators as well as NASA employees. Dr. Squyres counseled that the proposed recommendation should be revised to be more actionable and to be clear that it extends beyond the science community. Dr. William Ballhaus and Dr. Levy agreed to work together to revise the recommendation and bring it back to the Council for further consideration.

Dr. Levy submitted a proposed recommendation for NASA to restore the original Education and Public Outreach funding to all SMD programs. Council consideration on this recommendation was deferred until after Mr. Lars Perkins presented his report on the activities of the NAC Education and Public Outreach Committee.

Dr. Levy submitted a proposed recommendation that the PPO not be housed within any NASA Mission Directorate and that it be located with a reporting line that would assure its independence and freedom from conflict of interest. In response to a question from Dr. Kennel, Dr. Levy advised that the PPO should report to either NASA's Chief Scientist or Chief Engineer. Dr. Kennel concurred. Dr. Squyres agree that independence and avoiding even the perception of a conflict of interest is very important. He advised that, in addition to addressing forward and backward planetary protection, there is a need to address flight system cleanliness in order to prevent false positives. Dr. Levy argued that planetary protection decisions are based in science and, therefore, the PPO should not be severed from science. At Dr. Squyres request, Dr. Levy agreed to revise the recommendation to make it clear that the decisions would be informed by science and that responsibility for maintaining good practices would remain within the SMD's purview.

Dr. Squyres thanked Dr. Levy for his presentation.

Adjournment

Dr. Squyres announced that the Council dinner previously scheduled for that evening had been canceled. He then adjourned the meeting for the day at 5:30 p.m.

Thursday, December 12, 2013

Call to Order and Announcements

Ms. Rausch welcomed the Council members back to the second day of the public meeting. She reminded the Council members that all comments will be part of the public record, and that meeting minutes will be posted and available on NASA's website

Remarks by Council Chair

Dr. Squyres welcomed everyone back to the meeting. He observed that they had a full agenda, and there was a need to stay on schedule. He reminded everyone to use their microphones because the meeting is open to the public and he noted that there would be an opportunity later in the meeting for public input. Dr. Squyres explained that in keeping with NAC tradition, an early-career scientist at KSC was being given an opportunity to address the Council at this meeting. The NAC has had fantastic presentations in the past from other early-career NASA scientists and engineers around the country, and he was looking forward to today's presentation.

Aeronautics Committee Report

Dr. Squyres introduced Mr. John Borghese, substituting for Ms. Marion Blakey, Chair, Aeronautics Committee.

Mr. Borghese described the Committee's membership. He noted that half the members come from universities and half come from industry. This, he asserted, provides interaction for innovation. He reported that the Committee explored four areas at its most recent meeting: NASA Langley Research Center (LaRC); the Rotary Wing Project; Advanced Composites Project Planning; and the National Research Council (NRC) Autonomy Study. He described LaRC and its major facilities. It was founded in 1917 as the first research center of the National Advisory Committee for Aeronautics (NACA), the precursor to NASA, and is very important for flight testing. Over the next 20 years, 1.2 million square feet of facilities will be taken out of service at LaRC; this will lead to significant cost savings. A Hybrid Wing Body Community Noise Experiment that was conducted in LaRC's 14 by 22 foot subsonic wind tunnel was described. The test employed 96 sensors that enabled scientists to listen to sound in the wind tunnel and evaluate noise.

Mr. Borghese submitted a proposed finding to endorse the approach that LaRC has taken toward establishing a strategic effort utilizing strategic partnerships and community/stakeholder engagement to inform future facility and workforce decisions. Mr. Ballhaus expressed concern that foreign wind tunnels, rather than NASA's wind tunnels are being used for testing due to cheaper costs. Charges for using NASA's facilities have been imposed due to full-cost accounting. He recommended that this be examined further by the NAC Aeronautics Committee. Dr. Squyres concurred. The proposed finding was approved to read as follows:

The NAC endorses the approach that NASA Langley Research Center (LaRC) has taken toward establishing a strategic effort to inform future facility and workforce decisions. The NAC feels that the underlying process of utilizing strategic partnerships and community/stakeholder engagement has enabled NASA's Aeronautics Research Mission Directorate and LaRC to efficiently manage facilities and more effectively plan for future research needs.

Mr. Borghese presented a chart showing that the U.S. has lost leadership and market share in the civil rotorcraft market. He discussed rotary wing research conducted in FY2013 at NASA Ames Research Center, at NASA Glenn Research Center, and at LaRC. A chart describing rotorcraft research themes and technology challenges was discussed. Mr. Borghese described rotorcraft research roles in the U.S. He explained that industry does not typically invest in advanced experimental methods. The Department of Defense (DoD) is focused on incremental upgrades to existing platforms and has a low risk tolerance for program-of-record acquisitions. NASA's focus is typically longer-term than industry or DoD and is more risk-tolerant to explore innovation. Key partnerships and agreements were discussed.

Mr. Borghese submitted a proposed finding that supports the ARMD's continued investment in rotary wing research, and encourages ARMD to maintain its partnerships for rotary wing technology development with the DoD. Dr. Squyres noted that the Council in the past has expressed concern about erosion in the U.S. market share for rotary wing production. The proposed finding was approved as follows:

The NAC supports NASA's Aeronautics Research Mission Directorate (ARMD) continued investment in rotary wing research and encourages maintaining research efforts that provide advancements in dual use (civilian and military) capability. The NAC finds that is a great strength of the research to invest in technologies that provide benefit primarily to civil aviation, but also serve to advance military capabilities. The NAC encourages ARMD to maintain those partnerships with the DoD that will foster the development of those technologies, and enable NASA to hasten civil use of technologies developed primarily for military report. In addition, rotorcraft research is a logical place in which to make advances in NASA's autonomy agenda/initiative.

Mr. Borghese discussed a concern in composites research. He explained that the time for developing and certifying composite materials and structures for aerospace approaches 20 years. This inhibits innovation and adversely affects national competitiveness. A slide was presented showing recent activities to address the problem. These include a NRC-organized Meeting of Experts, a Defense Advanced Research Projects Agency (DARPA) Advanced Composites Workshop, and an Advanced Composites Consortium (ACC) formed by NASA. Charts describing the NRC study and the ACC were presented. Mr. Borghese noted that the NAC Aeronautics Committee is seeking additional information on how second-tier companies gain access to composite-related intellectual property. Dr. Ballhaus noted his concern over the fact that significant progress has not been made over the past 20 years in detecting composite voids and in getting composites certified.

Dr. Squyres thanked Mr. Borghese for his report.

Audit, Finance and Analysis Committee Report

Dr. Squyres introduced Mr. Robert Hanisee, Chair, NAC Audit, Finance and Analysis Committee.

Mr. Hanisee reviewed the Committee's agenda from its most recent meeting. Due to inclement weather conditions, the meeting had been conducted telephonically, which Mr. Hanisee reported was less than satisfactory. Charts showing current budget cycles and Agency budget highlights were discussed. He observed that without a budget agreement, NASA will be operating in FY2014 under a Continuing Resolution at FY2013 levels. He noted that NASA is currently at its lowest historical inflation-adjusted budget. He explained that this, while dire, is tempered by increases in productivity.

The Office of Management and Budget (OMB) FY2014 Guidance on Conference Attendance was discussed. Attendance at conferences must be core to the Agency's mission, and there must be no alternative methods for participation. The OMB Guidance limits attendance at domestic conferences to 50 attendees Agency-wide. For international conferences, attendance is similarly limited to 50 attendees, with the additional requirement that each attendee must have a substantive involvement in the conference. Waivers from these requirements may be issued by the Agency Chief Financial Officer (CFO). Conferences costing more than \$75,000 must be approved by the Agency CFO. In response to a question from Dr. Ballhaus, Mr. Hanisee responded that he did not know how these requirements were being enforced at NASA. The NASA Conference Tracking System (NCTS) and the NASA Inspector General's (IG's) recent Report on Select Conferences were described. Mr. Hanisee noted that NASA received a new IG approximately three years ago and working relationships with him were more cooperative and with less adversity than the former IG .

Mr. Hanisee discussed the status of "E-Invoice" and "E-Travel." On May 31, 2012, the General Services Administration (GSA) awarded Concur Technologies, Inc., a contract to launch the next generation of the Federal Government's web-based travel management service. Carlson Wagonlit Travel protested the award, and on September 13, 2013, was given a contract to be a second vendor. This should have no impact on NASA unless Concur Technologies elects to invoke dual pricing for transaction fees. A deployment schedule is being finalized.

Mr. Hanisee presented a slide from NASA's Office of the Chief Financial Officer (OCFO) entitled, "NASA's Top Challenges." They are:

- Considering whether to further extend the life of the ISS
- Developing the SLS and its component programs
- Securing Commercial Crew Transportation services
- Maintaining cost and schedule for the JWST
- Ensuring continued efficacy of the Space Communications Networks
- Overhauling NASA's IT governance structure
- Ensuring the security of NASA's IT systems
- Managing NASA's infrastructure and facilities

Mr. Hanisee noted that Dr. Elizabeth "Beth" Robinson is leaving NASA soon; she has been nominated to become Under Secretary at the Department Of Energy. Mr. David "Radz" Radzanowski has been nominated to become NASA's CFO. He has served as NASA's Chief Of Staff since May 2010. Prior to joining NASA, he was Branch Chief for Science and Space at the White House Office of Management and Budget (OMB). Mr. Andrew Hunter will serve as NASA's Acting CFO until Dr. Robinson's nomination is confirmed.

Mr. Hanisee reported that NASA had recently received a "clean" audit opinion for the third consecutive year from its external auditors, and is to be congratulated for this continued achievement. One beneficial change was switching external auditors from KPMG to PricewaterhouseCoopers. He noted that the NAC Audit, Finance, and Analysis Committee is being decommissioned as a result of NASA Administrator Bolden's recent decision to restructure the NAC, and that responsibility for organizational oversight in the future will lie within the new NAC Institutional Committee. Since this meeting was the final meeting for Mr. Hanisee, he presented to the Council several observations and recommendations from his committee concerning the new Institutional Committee: (1) at least one member should have a financial background and understand Generally Accepted Accounting Principles (GAAP); (2) they should meet with NASA's external auditors no less frequently than once during and once following each annual Agency external audit; and (3) they should meet with the NASA IG at least once a year.

Mr. Hanisee noted that he has served with pleasure on the NAC since 2005. He thanked the Council members for listening and he expressed his appreciation for all the hard work done by the NASA staff, by Ms. Rausch and her staff, and by his Committee members. Dr. Smarr counseled that the incredibly patient methodology utilized by Mr. Hanisee and his committee exemplifies what is critically necessary in IT governance.

Dr. Squyres thanked Mr. Hanisee for his presentation and for his service to the Council. Dr. Squyres asked Mr. Hanisee to extend his appreciation to the Committee members, and Mr. Hanisee agreed to do so.

Human Exploration and Operations Committee Report (continued)

Dr. Squyres reintroduced Mr. Bowersox. Mr. Bowersox advised the Council that a decision had been made to withdraw the recommendation on ISS extension in order to give the NAC HEO Committee an opportunity to meet with HEOMD and learn more about its plans. Mr. Hanisee asked whether the potential competitors for Commercial Crew have indicated how many flights are needed to amortize their investments. Mr. Bowersox responded that that would come out in their proposals. Mr. Bowersox noted that the European Space Agency (ESA) will be building the Service Module for Orion and will need to be assured about the U.S. commitment. He believes that the international partners' trust in the U.S. would be enhanced by showing that NASA intends to extend the ISS. A slide was presented listing human health and performance concerns. Dr. Smarr recommended that microbes be added to the list and that the NAC HEO Committee consider this as a primary reason for extended studies on the ISS. He explained that 90 percent of the cells in the human body are microbes and that most drugs consumed by humans are actually metabolized by the body's microbes. He also noted that in 2015 there will be a one-year flight that should be historic with one twin, Astronaut Scott Kelly aboard the ISS, while the other twin, former Astronaut Mark Kelly, remains on the ground. Dr. Squyres explained that while a compelling case had been presented for extending the ISS beyond 2020, the Council generally resists making recommendations calling for additional funds to be expended without showing a source for the funding. In order to give the Agency actionable advice, it is important to provide guidance on how funding would be accomplished. He concurred with the decision to bring the proposed recommendation back to the HEO Committee for additional discussions with HEOMD on what makes the most sense financially and how an extension would be funded. Alternatively, a finding could be used to communicate to the Agency, in which case resources for funding would not need to be identified.

Dr. Squyres thanked Mr. Bowersox for his additional presentation.

Science Committee Report (continued)

Dr. Levy and Dr. Ballhaus presented revised language for a recommendation on the way that NASA is interpreting external guidance on travel restrictions. The Council approved the recommendation, which reads as follows:

The Council recommends that NASA leadership reconsider the interpretation of external guidance on travel restrictions for scientific and technology meetings, conferences, and working groups to allow the optimal participation of the scientific and technology community, including NASA employees and contractors, to enhance productivity within the existing highly constrained financial resources.

Dr. Squyres thanked Dr. Levy and Dr. Ballhaus for their assistance.

NASA Through the Eyes of an Early Career Engineer: Why I Think It's Going to be a Bright Future for Kennedy Space Center

Dr. Squyres introduced Mr. Cabana, who introduced Ms. Anne Caraccio, Chemical Engineer, Materials Science Division, Engineering Directorate, NASA Kennedy Space Center (KSC).

Ms. Caraccio described her innovative projects at KSC. One project involves deep space mission trash utilization. NASA wants to use compacted trash for radiation shielding. Another project that she has been working on is a “trash to gas” project. A third project involves working with composites that are being developed in game changing technology for cryogenic tanks that will be used to store liquid fuel in space.

Ms. Caraccio described the “grass roots movement” of innovators at KSC. The Swamp Works is a lean development environment for rapid, innovative, and cost-effective exploration mission solutions for NASA and commercial space industry. The approach is to start small and build up fast. Testing is performed during early stages. Failures are allowed and drive design improvements. Innovation Expo brings people throughout the Center together and enables ideas to be cross-pollinated. Spaceport Innovators is a group that meets during lunch time and discusses topics that interest the innovation community. Launching Leaders is an early career group where people can volunteer on weekends for things like working at zoos, cleaning beaches, and providing mentoring.

The Council applauded Ms. Caraccio at the conclusion of her presentation. Mr. Borghese asked her to describe what NASA leadership has done to motivate her. She responded that she has a very good Branch Chief who has put trust in her to do the right thing. Dr. Squyres asked for her opinion on what NASA should be doing to retain its young employees. She advised that NASA should put trust in them and allow them to carry weight; give them an opportunity to lead projects and teams, and if something goes awry, of course to call them out for it, so that they may learn from the experience. Mr. Kennel asked Ms. Caraccio to describe what she thinks KSC would look like in 20 years. She replied that KSC would be a spaceport that would launch its own rockets and help commercial companies develop space-based industries.

Dr. Squyres thanked Ms. Caraccio for her presentation.

Public Input

Dr. Squyres invited members of the public, in person and via dial-in teleconference, to address the Council. No one expressed an interest in doing so during the time period set aside for this: 11:45 a.m. to 12:00 p.m.

Technology and Innovation Committee Report

Dr. Squyres introduced Dr. William Ballhaus, Chair, Technology and Innovation (T&I) Committee.

Dr. Ballhaus began his presentation by reminding the Council that the Committee’s scope includes all NASA programs that could benefit from technology, research, and innovation. He described the Committee’s makeup and the presentations that were given at the last Committee meeting. Charts were presented on the Technology Roadmap and the Strategic Space Technology Investment Plan (SSTIP). The original 14 technical areas in the Roadmap have been enhanced to include autonomous systems, avionics technology, radiation technology, space weather technology, and a 15th technical area has been added for aeronautics. A chart showing the schedule for updating the Roadmap was presented. The development of solar electric propulsion (SEP) was discussed. A chart showing the initial steps that need to be taken for an eventual Mars mission was presented.

The plan to combine the SEP Technology Demonstration Mission (TDM) with the Asteroid Redirect Mission (ARM) was discussed. The Space Technology Mission Directorate (STMD) is seeking an affordable demonstration of high-power lightweight solar arrays and high-power electric propulsion. Combining the SEP TDM with the ARM would validate high-power lightweight solar arrays, high-power SEP, and asteroid retrieval. SEP was chosen for the ARM because it reduces launch mass. A chart showing the requirements for large autonomously deployable solar

arrays, a high power processing unit, and a high power thruster for use in deep space was presented. SEP as a credible alternative for multiple future Human Exploration Mission concepts was discussed.

Dr. Ballhaus presented a proposed finding that technologies developed by STMD are critical to the ARM, and that the cadence for updating the technology roadmaps is appropriate. After discussion, the Council approved the finding, to read as follows:

- *Technologies under development by STMD have proven critical to the recently-defined Asteroid Retrieval Mission (ARM)*
 - *This proves that the road mapping and strategic investment planning processes were effective at identifying these technologies*
 - *The ARM provides a stretch goal that is important to enable focus on needed technologies*
 - *Importantly, a demonstration has been incorporated into the ARM*
- *The Council is pleased that the process for updating the NASA Technology Roadmaps and Strategic Technology Investment Plan now appears to be an established process with appropriate cadence for periodic updates.*

Dr. Ballhaus discussed a briefing that had been given to the committee on barriers to innovation. The consensus recommendation was to protect and sustain resources for innovative ideas and provide opportunities, assistance, and recognition to innovators. The top five solutions were:

- Allow some corporate time for creative thinking
- Establish innovation laboratories and creative spaces
- Provide innovation funding and project investments in innovation
- Streamline processes
- Establish skunk works strategically aligned with NASA challenges

Dr. Ballhaus noted that as a result of the recently announced NAC restructuring, engineering will be added to the NAC Technology and Innovation Committee's responsibilities. The committee will be renamed the "Technology, Innovation and Engineering Committee." They plan to speak with NASA's Chief Engineer and to look at basic engineering methods. Mr. Borghese advised that allowing people to fail is very important and that funding multiple risk paths, if it can be afforded, has proven to be very successful. Dr. Smarr suggested putting a tax on projects and using the money for innovation.

Dr. Squyres thanked Dr. Ballhaus for his presentation.

Education and Public Outreach Committee Report

Dr. Squyres introduced Mr. Lars Perkins, Chair, NAC Education and Public Outreach Committee.

Mr. Perkins reprised a chart showing "The Taxi Driver Problem" whereby a typical taxi driver states, "NASA? I thought they were out of business." Mr. Perkins emphasized that effective public outreach requires a single simple message to the public. The message should be repeated relentlessly throughout NASA and everyone should know it. NASA's current mission statement is "NASA exists to reach for new heights and reveal the unknown, so that what we do and learn will benefit all humankind." This mission statement is not memorable and cannot be remembered by the NASA workforce. A much simpler and more effective statement would be something such as, "Invent. Discover. Explore." Mr. Perkins asserted that NASA may be entering an existential crisis. He presented a chart showing that Google searches for NASA terms have declined significantly over time.

Several charts were presented on NASA's expenditures on Education and Public Outreach (EPO), particularly expenditures for Science, Technology, Engineering and Mathematics (STEM) education activities. He explained that the problem with NASA's spending on education, as is the case with IT, is that it lacks governance, has no Chief Executive Officer (CEO), and is not viewed as being mission-critical. The unique and highly successful EPO approach utilized by SMD was described. SMD partners scientists and educators by embedding EPO programs and funding in its science missions and research. SMD Policy Document SPD-18 provides that "SMD missions must have an EPO program that is funded with at least 1% of the total prime mission cost, excluding launch vehicle." Several charts were presented showing how SMD missions' unique materials are used for educational purposes across the country. Charts summarizing outstanding public outreach metrics were presented for the Space Telescope Science Institute, Chandra, Spitzer, Kepler, Cassini, and IBEX.

Mr. Perkins discussed the Obama Administration's plan to consolidate STEM activity into programs within the Department of Education (K-12), the National Science Foundation (higher education), and the Smithsonian Institution (informal education). He stressed that the original interagency Committee on STEM Education (CoSTEM) report did not recommend STEM activity consolidation into those three agencies. [See http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf, 5-Year Federal Science, Technology, Engineering, and Mathematics (STEM) Education Strategic Plan, prepared by the CoSTEM of the National Science and Technology Council in response to the requirements of the America Competes Reauthorization Act of 2010]. He noted press reporting that the planned STEM consolidation effort appeared to have been developed within the White House Office of Management and Budget (OMB), and that this consolidation plan hit the U.S. scientific community as a complete surprise, with no warning and no consultation.

Mr. Perkins noted that the NAC EPO Committee is being decommissioned and that its responsibilities would be included in the NAC's new Institutional Committee. He expressed his appreciation for the opportunity to work with the NASA Advisory Council. Mr. Perkins asked, and Dr. Squyres agreed, to afford Mr. Perkins an opportunity to have a transition meeting with the person chairing of the new Institutional Committee. Mr. Perkins concluded his presentation by noting that STEM education at NASA is "at risk," and asking others who would be remaining to "carry the torch."

Mr. Bowersox thanked Mr. Perkins for providing the Council with an outstanding presentation. Dr. Smarr complimented Mr. Perkins on producing the best presentation that he has seen on science education. He remarked that he hoped the NASA Administrator and Associate Administrators would have an opportunity to hear it in the future. Mr. Perkins responded that he would be available to give such a presentation.

Dr. Squyres thanked Mr. Perkins for his presentation. He noted that the Council has been passionate about NASA's STEM education activities, and that no other issue is more important than STEM. He gave his personal assurance as Council Chair that the torch would be carried on.

Science Committee Report (continued)

Dr. Levy presented the Science Committee's recommendations on EPO funding for SMD missions. After discussion, the recommendation was approved to read as follows:

The Council recommends NASA restore the original Education and Public Outreach funding to all SMD programs.

Information Technology Infrastructure Committee Report

Dr. Squyres introduced Dr. Larry Smarr, Chair, NAC Information Technology Infrastructure Committee.

Dr. Smarr reviewed the Committee's membership and noted that its last meeting was its best attended meeting. He expressed special appreciation for the assistance he received from his Vice Chair, Mr. Charles Holmes, and his Executive Secretary, Ms. Deborah Diaz, NASA's Deputy Chief Information Officer (CIO). He noted that NASA is rapidly transforming. KSC is reinventing itself for the post-Shuttle era. Orion, SLS and ARM reflect a multi-center, flexible approach. Integrated data science is being utilized in multiple science disciplines. NASA's Commercial Cargo Program success demonstrates a new partnership model between government and private industry. NASA's financial audit has gone "from the doghouse to three clean audits in a row." NASA's EPO has developed an outstanding presence on the web and in social media.

A vision of a 21st century NASA was described. Twenty-first century high-performing organizations respond in an agile, flexible manner to challenges by quickly discovering and integrating required resources. They enable disparate and distributed groups to rapidly come together to solve problems and to develop new capabilities by using common tools implemented over a unified high-bandwidth IT architecture. NASA is evolving towards and that vision, where IT-enabled teams at multiple centers will join to rapidly solve problems. NASA's CIO, in collaboration with Centers and missions, is jointly articulating that vision and identifying the products and joint capabilities that need to be developed to enable it. Building trust across boundaries is essential, and Agency-wide IT governance is critical to this transformation. NASA's Administrator, in response to a July 2013 NAC recommendation, has stated that improving IT governance is a top priority for the Agency. A recent Government Accountability Office (GAO) trends report indicates, however, that NASA was not in compliance with the OMB's directive for IT investments. NASA has started making the transition to compliance, utilizing Control Objectives for Information and Related Technology (COBIT), a set of best practices for IT management.

Dr. Smarr described the need that SMD missions have for research infrastructure. A NASA-wide IT framework will support and enable enhanced analysis and access to existing mission databases. Integrated high-performance computing, cloud provisioning, next-generation networking, storage, and analytics for "big data" are being designed across NASA. NASA is increasingly an active participant in cross-agency big data and data access Federal initiatives. He explained that a separate network is required for big data because the shared Internet was not designed for big data. That network is starting to come into being; however, there is no current architecture for it at NASA. There is going to be a new NAC Ad Hoc Task Force on Big Data, and the new NAC Institutional Committee is the right place for the oversight to take place.

Dr. Smarr concluded his presentation by asserting that there must be a collaborative approach between the CIO and scientists. The CIO must talk with the people doing the work and the people doing the work must realize that there is an IT infrastructure.

Dr. Kennel advised that open access to data is the key to innovation, and that the historical scientific data acquired by NASA over past decades, if made publicly available, would support research for a generation. He complimented Dr. Smarr for a splendid presentation.

Dr. Squyres thanked Dr. Smarr for his presentation.

Science Committee (continued)

Dr. Levy presented a revised recommendation to remove the PPO from the jurisdiction of any organization that might create the appearance of a conflict of interest. The recommendation was approved by the Council, with the

understanding that Dr. Squyres and Dr. Levy would undertake to clarify its language after the Council meeting was concluded.

Council Discussion; Wrapup; Final Acknowledgments

Mr. Bowersox expressed his appreciation for the opportunity to attend his first meeting, and it had been a very positive experience. He stated that he was looking forward to serving on the NAC in the future, and was impressed with everyone's enthusiasm. Mr. Perkins expressed his appreciation for the opportunity to serve on the NAC, and hope that paths would cross in the future. Dr. Smarr also expressed appreciation for the opportunity to serve on the NAC and work with Dr. Squyres. He voiced special appreciation for the services provided by Ms. Rausch.

Adjournment

Dr. Squyres thanked the Council members for a very productive meeting, and expressed his appreciation to the outgoing, incoming and continuing members. He thanked KSC Center Director Robert Cabana and his staff for their outstanding support over the past week in hosting the NAC meeting. He announced that the next NAC meeting would be held in April 2014 at NASA Headquarters in Washington, DC. He adjourned the meeting at 3:15 p.m.



NASA ADVISORY COUNCIL

NASA Kennedy Space Center, Florida

Headquarters Building – Room 2201

PUBLIC MEETING

December 11-12, 2013

Wednesday, December 11, 2013

1:00 – 1:03 pm	Call to Order and Announcements	Ms. Diane Rausch Executive Director NASA Advisory Council NASA Headquarters
1:03 – 1:10 pm	Opening Remarks by Council Chair	Dr. Steven Squyres Chair, NASA Advisory Council
1:10 – 1:30 pm	Welcome to NASA Kennedy Space Center	Mr. Robert Cabana Director, Kennedy Space Center
1:30 – 2:15 pm	Remarks by NASA Administrator	Mr. Charles Bolden NASA Administrator
2:15 – 3:00 pm	Asteroid Initiative Update	Mr. Gregory Williams Deputy Associate Administrator Mr. William Gerstenmaier (<i>telecon</i>) Associate Administrator Human Exploration and Operations Mission Directorate
3:45 – 4:30 pm	Human Exploration and Operations Committee Report	Mr. Kenneth Bowersox, Chair
4:30 – 5:15 pm	Science Committee Report	Dr. Eugene Levy (<i>for Dr. David McComas, Chair</i>)
5:15 pm	Adjourn	

Thursday, December 12, 2013

9:00 – 9:01 am	Call to Order and Announcements	Ms. Diane Rausch Executive Director NASA Advisory Council NASA Headquarters
9:01 – 9:03 am	Remarks by Council Chair	Dr. Steven W. Squyres Chair, NASA Advisory Council
9:03 – 10:00 am	Aeronautics Committee Report	Mr. John Borghese <i>(for Ms. Marion Blakey, Chair)</i>
10:00 – 10:45 am	Audit, Finance and Analysis Committee Report	Mr. Robert Hanisee, Chair
10:45 – 11:00 am	Break	
11:00 – 11:45 am	<i>NASA Through the Eyes of an Early Career Engineer: Why I Think It's Going to be a Bright Future for Kennedy Space Center</i>	Ms. Anne Caraccio Chemical Engineer Materials Science Division Engineering Directorate NASA Kennedy Space Center
11:45 – 12:00 noon	Public Input	
12:00 noon – 1:00 pm	Lunch	
1:00 – 1:45 pm	Technology and Innovation Committee Report	Dr. William Ballhaus, Chair
1:45 – 2:30 pm	Education and Public Outreach Committee Report	Mr. Lars Perkins, Chair
2:30 – 3:15 pm	IT Infrastructure Committee Report	Dr. Larry Smarr, Chair
3:15 – 4:00 pm	Council Discussion on NAC Reorganization; Wrapup; Final Acknowledgments	All
4:00 pm	Adjourn	

NASA ADVISORY COUNCIL MEMBERS

December 2013

Role	Council Members
Chair – NASA Advisory Council	Dr. Steven Squyres , <i>Goldwin Smith Professor of Astronomy, Cornell University</i>
Chair – Aeronautics Committee	The Honorable Marion Blakey , <i>Chief Executive Officer, Aerospace Industries Association</i>
Chair – Audit, Finance, and Analysis Committee	Mr. Robert M. Hanisee , <i>CFA, Managing Director, Trust Company of the West</i>
Chair – Education and Public Outreach Committee	Mr. Lars Perkins , <i>Entrepreneur</i>
Chair – Human Exploration and Operations Committee	Mr. Kenneth Bowersox , <i>Former NASA astronaut and Captain, U.S. Navy (Ret.)</i>
Chair – Information Technology Infrastructure Committee	Dr. Larry Smarr , <i>Director, California Institute for Telecommunications and Information Technology, University of California, San Diego</i>
Chair – Science Committee	Dr. David J. McComas , <i>Senior Executive Director, Space Science and Engineering Division, Southwest Research Institute</i>
Chair – Technology and Innovation Committee	Dr. William F. Ballhaus Jr. , <i>President and Chief Executive Officer (Ret.), The Aerospace Corporation</i>
Ex-Officio Members	<p>Gen. Lester Lyles, <i>Chair, Aeronautics and Space Engineering Board, National Academies; USAF (Ret.)</i></p> <p>Dr. Charles F. Kennel, <i>Chair, Space Studies Board, National Academies</i></p>

NASA ADVISORY COUNCIL

**NASA Kennedy Space Center
Cape Canaveral, Florida
December 11-12, 2013**

MEETING ATTENDEES

NASA Advisory Council Members:

Dr. Steven W. Squyres, *Chair*
Dr. William Ballhaus
Mr. John Borghese (*for Ms. Marion Blakey*)
Mr. Ken Bowersox
Mr. Robert M. Hanisee
Dr. Charles Kennel
Dr. Eugene Levy (*for Dr. David McComas*)
Mr. Lars Perkins
Dr. Larry Smarr

Ms. P. Diane Rausch, *Executive Director*

Cornell University
The Aerospace Corporation
Rockwell Collins
U.S. Navy (*Ret.*)
Trust Company of the West
Space Studies Board
Rice University
Entrepreneur
California Institute for Telecommunications and
Information Technology
NASA Headquarters

NASA Attendees:

Adams, Pam
Bolden, Charles
Cabana, Robert
Caraccio, Anne
Chabot, Valerie
Feinberg, Al
Fowler, Lisa
Gerstenmaier, William
Hill, Bradley
Kennedy, Eracenia
King, Marla
Malone, Lisa
Manning, Joshua
Shiflett, Kim
Siegel, Bette
Speed, Welmon V.
Williams, Greg

NASA/Kennedy Space Center (KSC)
NASA Headquarters
NASA/KSC
NASA/KSC
NASA Headquarters
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NASA/KSC
NASA Headquarters
NASA Headquarters
NASA/KSC
NASA/KSC
NASA/KSC
NASA Headquarters
NASA/KSC
NASA Headquarters

Other Attendees:

Dean, James
Floyd, Mary
Frankel, David
Lockley, Barbara
Uhran, Bergit

Florida Today
Zantech IT
PB Frankel, LLC
[affiliation unknown]
PB Frankel, LLC

NASA ADVISORY COUNCIL

**NASA Kennedy Space Center
Cape Canaveral, Florida
December 11-12, 2013**

LIST OF PRESENTATION MATERIAL

- 1) NASA Kennedy Space Center – Pushing the Boundaries [Cabana]
- 2) Asteroid Redirect Mission and the Future of Human Spaceflight [Williams, Gerstenmaier]
- 3) NASA Commercial Space Update [Williams]
- 4) Human Exploration and Operations Committee Report [Bowersox]
- 5) Science Committee Report [Levy]
- 6) Aeronautics Committee Report [Borghese]
- 7) Audit, Finance, and Analysis Committee Report [Hanisee]
- 8) Technology and Innovation Committee Report [Ballhaus]
- 9) Education and Public Outreach Committee Report [Perkins]
- 10) Information Technology Infrastructure Committee Report [Smarr]