

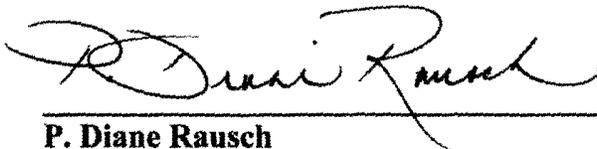
**National Aeronautics and Space Administration
Washington, DC**

NASA ADVISORY COUNCIL

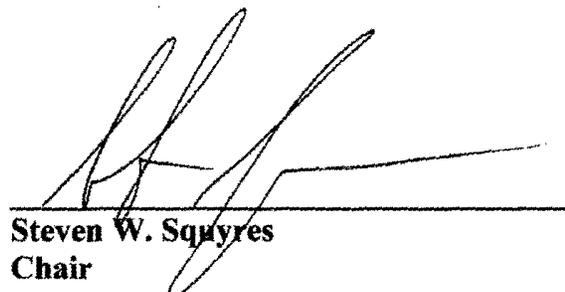
July 31 – August 1, 2013

**NASA Headquarters
Washington, DC**

MEETING MINUTES



**P. Diane Rausch
Executive Director**



**Steven W. Squyres
Chair**

NASA ADVISORY COUNCIL

**NASA Headquarters
Washington, DC**

PUBLIC MEETING

July 31 – August 1, 2013

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*Meeting Report prepared by
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NASA ADVISORY COUNCIL

**NASA Headquarters
Washington, DC**

PUBLIC MEETING

July 31 – August 1, 2013

Wednesday, July 31, 2013

Call to Order; 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 Council members to NASA Headquarters in Washington, D.C. She stated that the Council is a Federal advisory committee established under the Federal Advisory Committee Act (FACA). The meeting is open to the public. A dial-in capability is available for members of the public to listen to the meeting via teleconference, and WebEx is also available for viewing the NAC presentations online. Meeting minutes will be taken by Mr. David Frankel and will be posted to the NAC website, www.nasa.gov/offices/nac, after the meeting. 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 oneself from discussions on any topic in which there could be a potential conflict of interest. Time has been set aside at 11:45 am on the meeting's second day for public input.

Opening Remarks by Council Chair

Ms. Rausch introduced Dr. Steven Squyres, Chair, NASA Advisory Council. Dr. Squyres welcomed Council members to the second NAC meeting of 2013. He noted that the Council's original goal had been to hold this meeting at NASA's Wallops Flight Facility (WFF), however, that plan became too difficult to arrange due to logistical issues. Instead, there will be a Council day-trip and tour of WFF on Friday, August 2. The NAC's agenda for the next two days is focused on reports from the eight committees. Dr. Squyres reported that NASA Headquarters is undertaking an internal review of the NAC at the request of Administrator Bolden to take a fresh look at the Council's current structure and the way in which the Council provides advice to the Agency. The review is being conducted by NASA's Chief Scientist, Chief Engineer, and Chief Technologist.

Dr. Squyres explained that a highlight of the Council meetings is the opportunity to meet with and hear from the NASA Administrator, and then introduced Mr. Bolden. He thanked Mr. Bolden for holding the annual NAC "all hands" meeting earlier in the day with the committee members, and observed that the hard work of the NAC is done at the committee level.

Remarks by NASA Administrator

Mr. Bolden welcomed the Council members. He expressed his appreciation for the opportunity to meet with the committee members earlier in the day, and he thanked Dr. Squyres and Ms. Rausch for the tremendous work they continue to do for the NAC. Mr. Bolden explained that a highlight for him in the near future will occur on August 8,

2013, when he will welcome the eight new astronaut candidates, half of whom are women. As a Marine, he is proud that one Marine representative among the astronaut candidates is a female fighter pilot. He explained that the new astronauts will fly on commercial vehicles to the International Space Station (ISS) and will lead the way for those who go to Mars in the 2030s.

Mr. Bolden described recent events at NASA. The Space Launch System (SLS) did not pass a recent Joint Confidence Level (JCL) review due to an issue with reserves. A complicated test demonstrated that Orion can land safely even if one of its parachutes fails to open properly. A spacesuit water leak that occurred during a spacewalk on July 16, 2013, continues to be investigated. The Space Shuttle Atlantis is now on public exhibit at the Kennedy Space Center (KSC) and, in his opinion, is the most dynamic display of all the Space Shuttles. He recommends that people go through the Atlantis Pavilion to get a feel for what it is like to fly on the Shuttle. NASA continues to explore a broad array of projects in the Space Technology Mission Directorate (STMD) and the Science Mission Directorate (SMD). He noted that the facilities at the WFF have been greatly improved. A Request for Information (RFI) and a Grand Challenge have been issued for a mission to identify and capture an asteroid. The mission will help advance Exploration. It compliments and aligns with ongoing work and will help NASA meet the President's goal to land on Mars in the 2030s. A workshop for the asteroid mission will be held in September 2013. A draft Request for Proposal (RFP) has been issued for the next phase in the Commercial Crew Program (CCP) strategy. He explained that the process for certifying a new crew vehicle is complex. Comments are being sought to assure that the public-private partnership model for the certification process is safe. In aeronautics, the X-48C Hybrid Wing Body aircraft is being developed jointly by NASA and the Department of Defense (DoD), with the primary contractor being the Boeing Company. NASA is working with commercial airline companies to demonstrate fuel efficiencies. Agreements are being developed to expand work on air traffic management. The automatic dependent surveillance-broadcast (ADS-B) system was described. It is a surveillance technology for tracking aircraft as part of the Next Generation Air Transportation System (NextGen). Mr. Bolden noted that getting full funding for this from Congress is a challenge. The Aeronautics Research Mission Directorate (ARMD) will be reorganized to make it more efficient. An internal decision has been made to keep funding for ARMD level, no matter what happens to the budget for other areas. Rotary wing research is being restored, and NASA is working with the Office of Management and Budget (OMB) on how to fund the low sonic boom initiative.

Mr. Bolden emphasized that it is important to work with Congress while the House and Senate continue to work on appropriation bills. He noted that this is the first time that votes on NASA's budget have fallen on a partisan basis. The House draft appropriation bills for NASA are significantly below the President's request, while the Senate draft appropriation bills are significantly higher. The House side includes no funds for NASA's Asteroid Initiative, prohibits using any funds for the Asteroid Retrieval Mission (ARM), and cuts funds for new space technology. That legislation would challenge NASA's preeminence in space and jeopardize the success of the CCP. The Senate side provides strong support for NASA and funds the ongoing activities for an asteroid mission. Senator Kay Bailey Hutchison, recently retired, will be missed because the term "compromise" was a term she well understood, and it is uncertain whether that term is well understood by today's congressional staffs.

Mr. Bolden then requested that he be joined at the front of the room by Mr. Richard Kohrs, Chair, Human Exploration and Operations Committee (HEO) Committee. He presented Mr. Kohrs with one of NASA's highest awards, the NASA Exceptional Public Service Medal. Mr. Bolden noted that he had worked with Mr. Kohrs on the Space Shuttle Program, and that Mr. Kohrs will be leaving the Council after having served with distinction since 2010, having chaired the HEO Committee since 2011. He added that Mr. Kohrs had been a constant voice of wisdom and able to recommend alternatives when necessary. In receiving the NASA Medal and accompanying plaque, Mr. Kohrs thanked Mr. Bolden for the honor and expressed appreciation for the support given to him by Dr. Squyres, Ms. Rausch, his HEO Committee members, and the Committee's Executive Secretary, Dr. Bette Siegel. He noted that he had started his career with NASA during the Apollo era at the Manned Space Center (original name for NASA Johnson Space Center) in 1963.

Mr. Bolden invited questions from the Council. Ms. Patti Grace Smith, Chair, Commercial Space Committee, asked for his comments on excess launch pad capacity at KSC. Mr. Bolden explained that Pad 39B has been renovated to serve as a multi-use pad. When the Shuttle transition began in 2004, it was realized that Pad 39A was not going to be needed in the future. An Announcement of Opportunity was issued to determine whether there was any commercial interest in Pad 39A. Several companies have expressed an interest, and NASA Headquarters will soon determine who will be given a long-term lease. Mrs. Smith asked whether Pad 39B is being designed as a clean pad approach, and Mr. Bolden responded that no one has taken NASA up on that offer. Ms. Smith noted that there is a growing interest for multiple purposes in Florida, to the extent that exclusivity should not be an option.

Dr. David McComas, Chair, Science Committee, observed that the Science Committee and its Subcommittees must deal with the uncertain and constrained funding environment for NASA. They have heard discussion on what would be stopped or given up, but they have not heard about what can be done more efficiently. He asked whether any thought has been given to reviewing the requirements imposed on missions, which cause costs to increase. Mr. Bolden responded that NASA is already trying to do things in a different manner. He described how the Science Mission Directorate is flying Earth science missions on the International Space Station. In human spaceflight, the requirements have been modified and streamlined. Orion is being built much differently than it would have been in the past. In CCP, there are human rating standards to be met. Beginning four years ago, NASA began giving its human rating standards to industry and asked them what could be modified to safely streamline the work.

Ms. Marion Blakey, Chair, Aeronautics Committee, requested elaboration on the ARM. Mr. Bolden responded that the ARM should not be characterized as a major science mission, and it will not contribute much to planetary science. Solar electric propulsion (SEP) is needed for deep space exploration and would be developed for the ARM. There are three segments to the mission. First, asteroids must be identified and characterized. That segment has been mandated by Congress and must be executed. The second segment is to divert, move, or relocate an asteroid to lunar orbit. That sort of capability could someday save the planet, and if we can accomplish it we will have done humanity a huge favor. The third segment would be to send astronauts to the asteroid using Orion and the SLS. Dr. Squyres advised that it makes sense to use Orion and SLS for that purpose. A member of the public in the audience expressed concern over whether the only asteroids that were to be identified were those asteroids that were the size that could be relocated. Mr. Bolden explained that NASA has identified 98 percent of all asteroids over one kilometer that can threaten Earth and that Congress has now tasked NASA with identifying asteroids in the 140 meter to one kilometer range. The audience member asserted that asteroids 100 meters and larger are extremely dangerous.

Mr. Bolden thanked the Council for the recommendations given in the past, and asked the Council to continue making recommendations.

Dr. Squyres thanked Mr. Bolden for his comments.

Asteroid Initiative: An Update

Dr. Squyres introduced Mr. William Gerstenmaier, Associate Administrator, Human Exploration and Operations Mission Directorate (HEOMD) and Dr. Michele Gates, Senior Technical Advisor, HEOMD. Dr. Gates briefed the Council on NASA's Asteroid Initiative. It will include the ARM, which has three elements: first, detection and characterization of candidate asteroids; second, a mission to capture and redirect a near Earth asteroid to Earth-Moon space; and third, a follow-on human exploration and sampling mission. These missions will demonstrate technologies for deep space exploration and will advance efforts in planetary defense. In addition, as another part of the Asteroid Initiative, NASA's Office of the Chief Technologist (OCT) will lead a "Grand Challenge," issued by the Office of Space and Technology Policy (OSTP), to find all asteroid threats to human populations and learn how

to mitigate the threats. The Grand Challenge will leverage NASA's activities in potentially hazardous asteroid (PHA) observation and game changing technology development for mitigating PHAs. The OCT will endeavor to meet the Grand Challenge through crowdsourcing, prizes, citizen science and participatory engagement, and public-private partnerships. A graph was presented to show how the activities for the ARM and the Grand Challenge overlap. Dr. Gates reviewed a chart showing the tentative schedule for the ARM's three segments. A target selection is indicated for 2016, and an uncrewed Orion test to cis-lunar space, Exploration Mission (EM)-1, is scheduled for 2017. A RFI for the Asteroid Initiative received 402 responses. The most highly rated responses will be explored at an ideas synthesis meeting to be held on September 30, 2013. The Near Earth Orbit (NEO) Search Program was described. Precision orbital analysis is performed by the NEO Program Office at NASA's Jet Propulsion Laboratory (JPL). The ARM will serve as a technology demonstration for a high-power SEP system. Its objectives also include the following: asteroid identification and characterization for target selection; capturing and controlling a non-cooperative target; demonstrating techniques relevant to future planetary defense efforts; and Orion and SLS operations beyond low Earth orbit (LEO). Some risk will be accepted for accomplishing capture due to anticipated uncertainties in target characteristics.

In response to a question from Dr. Squyres, Mr. Gerstenmaier explained that dividing the mission into three segments allows separable risks and allows the robotic mission to have higher risk than the crewed segment. Dr. Squyres noted that NASA has already completed a mission involving the use of robotic operations to land on a small, spinning, uncooperative object. Dr. Charles (Matt) Mountain counseled that a capture mechanism has no extensible value for a mission to Mars. Dr. Gates described a possible alternative robotic mission that would capture a boulder from a larger asteroid. A proposed asteroid docking mechanism was described. She reviewed a chart showing the basic elements necessary for a series of missions ranging from the ARM to a long-term visit to Martian surface by humans. Dr. Squyres emphasized the chart's importance and noted that it does not require an asteroid to be redirected into NEO. Mr. Kohrs observed that a year ago NASA had a plan to go to Mars, but did not have a budget; that has not changed. Dr. Gates explained that the potential benefits from the Asteroid Initiative include exercises in collaboration between human and robotic exploration missions; advanced SEP; asteroid sample return; and the opportunity to test deflection techniques for planetary defense.

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

Human Exploration and Operations Committee Report

Dr. Squyres introduced Mr. Richard Kohrs, Chair, HEO Committee. Mr. Kohrs reviewed the Committee's agenda from its last meeting. He reported on a briefing the Committee received from Mr. Gerstenmaier on the status of the HEOMD. A chart showing the organizational structure for HEOMD was presented. Mr. Kohrs noted that Mr. Gerstenmaier is responsible for approximately \$5 billion of NASA's budget. Charts were presented showing recent accomplishments in the Advanced Exploration Systems Program. The Program is responsible for rapid development and testing of prototype systems and validation of operational concepts to reduce risk and cost of future exploration missions. A summary schedule chart for the Exploration Systems Development (ESD) Division was presented. The chart shows plans through the second quarter of FY 2018 for SLS, Orion, and the Ground Systems Development and Operations (GSDO) Program. Recent accomplishments in Orion, SLS, and GSDO were discussed. A chart showing the ISS Flight Plan was presented. Mr. Kohrs discussed the internal water leakage that occurred during a recent Extra Vehicular Activity (EVA). A large amount of water was found inside astronaut Luca Parmitano's helmet. Mr. Gerstenmaier has convened a Mishap Investigation Board to investigate the root cause and recommend remediation and correction activities.

Mr. Kohrs reported on the briefing the Committee received from Mr. Philip McAlister on the status of the CCP. Prematurely eliminating competition was described as one of the primary risks to NASA satisfying the Program's goals and objectives. Competition among more than one industry partner during the development phase is important

to safety and cost-effectiveness. A competitive environment provides strong incentive for companies to meet and exceed NASA's safety certification requirements. Competition prevents NASA from becoming dependent on a sole provider. Competition also supports cost-sharing by industry.

Mr. Kohrs presented a proposed recommendation to add commercial expertise to the HEO Committee's Research Subcommittee's membership. Subject to possible revision following the Commercial Space Committee report, the Council approved the recommendation, which reads as follows:

NASA should add commercial expertise to the already impressive membership of the Research Subcommittee of the Human Exploration and Operations (HEO) Committee. Specifically, the committee should receive input from research, development and commercialization leaders in one or more of the relevant industries (e.g., pharmaceutical, biological, materials science, etc.) that have experience in applied research.

Mr. Kohrs presented a proposed recommendation to establish a milestones schedule for Commercial Crew development. The recommendation is as follows:

NASA should elevate priority of the Commercial Crew development and vigorously protect its funding, and establish a schedule with payable milestones and target date for the first crewed mission in 2017. These NASA actions are needed to avoid undesired growth in Commercial Crew development time and risky increased reliance on a single provider, Soyuz.

Mr. Kohrs explained that a Soyuz failure would preclude transportation to the ISS for two to three years. Dr. Squyres noted that this topic has been discussed in Congressional hearings. He counseled on the need to exercise care when specifying dates so as not to over-constrain the schedule and adversely affect crew safety. At his request, Mr. Kohrs agreed to add language to provide that any target dates must be compatible with the safety certification process. Dr. Ballhaus counseled that care must be exercised when setting dates for Commercial Crew because when cost, schedule, and performance are fixed, the risk rises geometrically. Where there has to be a variable, it should be cost, rather than risk. Dr. Squyres concurred and advised that even when language is used to expressly cap risk, there is concern that fixed dates can lead to schedule pressure that could adversely affect safety. Mr. Kohrs cautioned that unless a schedule is imposed, Commercial Crew will not be ready before the ISS is decommissioned. Mr. Robert Hanisee, Chair, Audit, Finance and Analysis (AFA) Committee, observed that there is cognitive dissonance on the part of Congress because it wants Commercial Crew done safely and does not want to fund it. Ms. Smith clarified that the House and Senate have different views, and that the Senate has shown support for going forward with the program. She advised that the Commercial Space Committee is not opposed to fixed dates, as long as they do not impact safety or lead to a down-selection among the competitors, which that committee believes would be premature at this time. Dr. John Klineberg counseled that when he was president of Loral Space & Communications, the company would never negotiate a schedule; just a delivery date, with penalties. At Dr. Squyres' suggestion, the proposed recommendation was tabled in order to give the two committees (HEO Committee and Commercial Space Committee) an opportunity to develop mutually acceptable language. The final language for this recommendation that was developed and approved by the Council is as follows:

Timely establishment of a commercial capability to deliver U.S. astronauts to low earth orbit is essential to reduce undesirable reliance on a single non-U.S. provider, Soyuz. The Council is concerned that projected funding levels for commercial crew development may be insufficient to provide a safe and robust capability by the target date of 2017. NASA should develop and clearly articulate a plan for the establishment of this capability that requires a demonstrated critical look at safety, and that addresses realistic funding levels, the contractor downselect process, and traceable milestones and target dates for initial operating capability. We request a briefing on this topic at the next NASA Advisory Council meeting.

Mr. Kohrs presented a proposed finding to commend the Systems Engineering and Integration Management team. The Council approved the finding, to read as follows:

The NAC Human Exploration and Operations (HEO) Committee was briefed on the Exploration Systems Directorate status and schedule. The Council commends the Systems Engineering and Integration Management team's progress in the schedule, cost and management of the Integrated Task. Future reviews on this subject by the HEO Committee should continue. Major program issues that are currently being evaluated by the Integration Team should be updated and reviewed by the HEO Committee.

Mr. Kohrs presented a proposed recommendation on articulating benefits from the Asteroid Initiative. It was approved by the Council as finding rather than a recommendation, subject to language refinements to be made by Mr. Kohrs and Mr. Lars Perkins, Chair, Education and Public Outreach (EPO) Committee. The final text of the approved finding is as follows:

During the last Council meeting, the Council recommended that NASA clearly demonstrate and articulate a strategy for the Agency's new Asteroid Initiative and highlight associated benefits to the public. NASA responded by sending the Council a summary of the Asteroid Initiative. The Council acknowledges and appreciates the response to our recommendation. We wish to extend the recommendation to add that NASA should work to reflect current priorities and planning for the Asteroid Initiative via internal and external communications. In particular, NASA should immediately update the NASA Website to reflect current planning (including the necessary steps to progress from current capabilities to those needed for successful human Mars exploration), priorities and technical plans and accomplishments such as those summarized by the Space Technology Mission Directorate.

Dr. Squyres thanked Mr. Kohrs for his presentation.

Science Committee Report

Dr. Squyres introduced Dr. David McComas, Chair, Science Committee. Dr. McComas presented slides showing recent science and programmatic results. NASA-funded scientists using interferometric SAR (inSAR) satellite data have discovered that Antarctic ice shelves lose more mass from melting than from calving. The Airborne Snow Observatory has helped improve water flow estimates that are used for water management in California reservoir operations. Heliophysics' Interstellar Boundary Explorer (IBEX) has provided the first view of the heliosphere's tail, which is shaped like a four-leaf clover. Voyager 1, now more than 11 billion miles from the Sun, is closer to becoming the first human-made object to reach the heliopause or boundary with interstellar space. Scientists are waiting to see evidence that there has been an abrupt change in the direction of the magnetic field, which would indicate the presence of the interstellar magnetic field. The Cassini spacecraft has revealed an enormous hurricane-like storm at Saturn's North Pole. Cassini scientists have discovered that Saturn's rings act as a seismograph that records large-scale oscillations from the planet. NASA has launched its newest solar observatory, the Interface Region Imaging Spectrograph (IRIS).

Dr. McComas discussed a chart on the 2013 Heliophysics Senior Review. The biannual review examines the value of continuing observations and science for extended missions. A chart was presented on the status of the Near Earth Object (NEO) Survey Program. Comet ISON will make its closest approach to Earth on December 26, 2013, if it survives its encounter with the Sun. It is a pristine comet, having never visited the Sun before. A chart was presented showing how NASA space assets will be used to observe the comet. The Lunar Atmosphere and Dust Environment Explorer (LADEE) will launch from the WFF on September 6, 2013. It will measure lofted lunar dust and investigate the composition of the lunar atmosphere. The Mars Atmosphere and Volatile Evolution (MAVEN) Mission will launch from NASA Kennedy Space Center in November 2013. It will be used to determine the structure and composition of the Martian upper atmosphere.

Dr. McComas presented a proposed finding on the NASA 2014 Strategic Plan development. The Council approved the finding, which reads as follows:

The Government Performance and Results Act Modernization Act (GPRAMA) of 2010 introduced new requirements that are driving the 2014 planning process. Based on a highly informative briefing from J. Pollitt, the Council finds that the planned reporting strategy is problematic. Each of the four Science Mission Directorate (SMD) science objectives spans multiple Agency goals, and should not have to be attributed to a single goal. If an objective must be attributed to a single goal, it should be attributed to the goal that best represents the majority of the work in that area. A troubling example is the developing plan to attribute the Heliophysics science objective to the Agency “of Earth” goal while the bulk of the Heliospheric strategic elements is aligned with the Agency “of Science” goal, just as it is for Astrophysics and Planetary Science.

Dr. McComas presented a proposed finding on the high value of extended science missions. The Council approved the finding, which reads as follows:

In a constrained budget environment, one option discussed for budget reduction is to terminate operating missions. The Council finds that many of the missions currently in extended phase provide some of the best science per cost in the Science Mission Directorate (SMD). While the successful planning, building, launching and commissioning of spacecraft constitutes a remarkable technical feat, the motivation for and end goal of these eyes, ears and hands in space is the science that results from data collected by these missions. Level 1 science requirements are developed during the period of formulation and implementation consistent with goals of Decadal Surveys and SMD Mission Roadmaps. Level 1 science requirements are the set that a mission must satisfy in order to achieve its pre-launch objectives. By nature, missions are conservative in their science goals and engineering limits as proposed, yet the history of NASA SMD missions shows over and over that extended mission data collection leads to science advances equaling or exceeding that of the primary mission. It is imperative that active spacecraft returning high quality data be funded into extended missions consistent with evaluation of NASA senior reviews. This strategy capitalizes on investments in mission hardware at affordable costs that result in new science, workforce development, and engaging and inspiring the next generation of explorers.

Dr. McComas presented a proposed recommendation on evaluating best practices for science education and public outreach. Mr. Perkins asserted that the President’s Budget Request for FY 2014 decimates public outreach, and that any recommendation in conflict with that budget will not have an impact; however, he supported the recommendation. At Dr. Squyres’ suggestion, past education and outreach efforts were eliminated from the scope of the recommendation. The Council approved the recommendation, which reads as follows:

The Council recommends that NASA analyze the relative effectiveness of science education and outreach efforts at NASA, measuring against Agency goals and objectives and correlating with key variables (e.g., cost, expertise, science input, and target audience). Where there are clear successes, identify a set of best practices, and use less successful efforts to indicate lessons learned; disseminate these results for the benefit of any Federal organization engaged in education and public outreach (EPO) activities.

Dr. McComas presented a proposed recommendation calling for the NASA Planetary Protection Officer to participate in mission planning and design. Dr. Mountain opined that this is an obvious thing that NASA should be doing. In response to a query from Dr. Squyres, Dr. McComas clarified that “active participation,” means “having a seat at the table.” Dr. Squyres explained that the NASA Planetary Protection staff is concerned about being disruptive if their requirements show up late in the process. He advised that the language be revised to make clear that the intent is to prevent disruption from late-arriving planetary protection requirements, and that missions must

be designed consistent with NASA policy. Subject to the revision suggested by Dr. Squyres, the Council approved the recommendation, which reads as follows:

Planning and design of missions requiring implementation of planetary protection measures should be informed at the outset and through all mission stages by appropriate participation of the Planetary Protection Officer (i.e., a "seat at the table").

Dr. Squyres thanked Dr. McComas for his presentation.

Audit, Finance and Analysis Committee Report

Dr. Squyres introduced Mr. Robert Hanisee, Chair, Audit, Finance and Analysis Committee. Mr. Hanisee reviewed the agenda from the Committee's last meeting. He reported that NASA will be losing its Chief Financial Officer (CFO), Dr. Beth Robinson, who has been nominated to serve as Undersecretary at the Department of Energy. Mr. Andrew Hunter, will serve as Acting CFO. Ms. Beverly Veit will serve as the new Director, Financial and Budget Systems Management Division. She has extensive experience with the SAP financial management software that is used by NASA. The 2013 NASA financial statement audit is underway and no serious problems are expected. Estimating the cost for asbestos remediation remains a problem. The eInvoicing pilot is underway to demonstrate electronic processing of NASA invoices using the Department of Defense Wide Area Workflow (WAWF) solution. The initiative began in August 2011, and implementation is targeted for January 2013. Mr. Hanisee reported that the era of FedTraveler at NASA is coming to an end in the near future. It has been replaced with a contract for the next generation of E-Gov Travel Service (ETS2) competitively awarded to Concur Technologies, Inc. The NASA Inspector General has issued a report containing several recommendations on conferences. Two of the recommendations address limiting the risk of inappropriate augmentation of appropriated funds.

Mr. Hanisee described the status of FY 2014 appropriation and authorization bills pending before the House and Senate. The House appropriations bill funds NASA at \$16.598 billion, a reduction of \$1.117 billion from the President's Budget Request. The Senate appropriations bill funds NASA at \$18.010 billion, an increase of \$294.9 million above the President's Budget Request. The Senate authorization bill for NASA remains flat at slightly over \$18 billion through FY 2016. Mr. Hanisee explained how sequestration will work this year. There are separate defense and non-defense caps. FY 2014 includes a 7.3 percent reduction to non-defense spending. Without a waiver by three-fifths of its members, Congress cannot pass an appropriations bill exceeding the caps in the absence of a larger agreement. Accordingly, Mr. Hanisee recommends that NASA should begin to adjust to a \$16.1 billion spending level starting on October 1, 2013. Mr. Hanisee described new mandates from the Office of Management and Budget (OMB). OMB Directive M-13-03, Improving Financial Systems Through Shared Services, directs all Executive Branch agencies to use a shared service solution for future modernizations of core accounting. This is expected to free up agency resources to focus on mission-based programs and make it easier to adopt new government-wide requirements. Charts were presented on the timing of the audit by NASA's outside auditors and on the status of audits by the NASA Office of Inspector General.

Mr. Hanisee presented a proposed recommendation for NASA to coordinate a government-wide effort to create a common asbestos cost estimate. Dr. Squyres opined that it would be great for NASA to lead this effort. The Council approved the recommendation, which reads as follows:

The Council recommends that NASA, through the Chief Financial Officer (CFO) Council, coordinate a government-wide, collaborative effort to create common estimates and benchmarks by structure type that can then be used as a baseline for each agency as they create their own estimates for asbestos remediation (such benchmarks are lacking today). Such a government-wide collaborative effort should result in significant cost savings for the Agency (and for

the government) and should lead to a satisfactory audit trail for NASA's external auditors. The participation of the Agency's Inspector General (IG) Office through the IG Council should be encouraged by the Administration.

Dr. Squyres thanked Mr. Hanisee for his presentation.

Adjournment

Dr. Squyres adjourned the meeting for the day at 5:12 pm.

Thursday, August 1, 2013

Call to Order and Announcements

Ms. Rausch called the meeting to order and welcomed everyone to the second day of the meeting. She stated that the NAC is a Federal advisory committee established under the FACA. The meeting is open to the public. A dial-in capability is available for members of the public to listen to the meeting, and WebEx is also available. Meeting minutes will be posted to the NAC website, www.nasa.gov/offices/nac, after the meeting. All presentations and deliberations will become part of the public record. Time has been set aside during the meeting at 11:45 am for public input.

Remarks by Council Chair

Ms. Rausch introduced Dr. Squyres. He noted that the Council has a full agenda and needs to stay on schedule. He reminded everyone to use their microphones when speaking because the meeting is open to the public and is being available via dial-in teleconference and WebEx.

Commercial Space Committee Report

Dr. Squyres introduced Ms. Patti Grace Smith, Chair, Commercial Space Committee. Ms. Smith noted that her Committee has two new members: Mr. Joseph Boyle and Mr. Hoyt Davidson. She briefed the Council on topics covered at the Committee's recent meetings. In the Commercial Cargo Program, Orbital Sciences has completed 26 of 29 milestones, for payments totaling \$280.5 million out of \$288 million. The SpaceX Commercial Orbital Transportation System (COTS) Space Act Agreement (SAA) was amended in May 2011 with additional risk reduction milestones. Several key lessons have been learned in the Commercial Cargo Program: government seed money was highly leveraged; fixed-price milestone payments maximized incentive to control costs and minimize schedule delays; having multiple partners with different capabilities assured a balanced approach to technical and business risks; commercial-friendly intellectual property and data rights encourage private capital; and NASA should not expect companies to raise funds unless there is a commitment by NASA to purchase operational services. Ms. Smith reported on other commercial developments. The Commercial Crew Program is continuing to advance Commercial Crew Transportation System Designs. Certification Products Contracts (CPCs) are being used for the delivery, technical interchange, and NASA's early life cycle certification products. Commercial Crew transportation Capability (CCtCAP) contracts will cover all aspects of final development and certification of a crew transportation system, including design, manufacturing, testing, qualification, production, and operation. A draft Request for Proposals (RFP) for CCtCAP was released for comment on July 19, 2013, and awards are planned for next summer, 2014.

ISS Commercial Utilization is being managed by the Center for the Advancement of Science in Space (CASIS), a nonprofit organization charged with bringing non-traditional users to the International Space Station (ISS). NanoRacks is the only company to own hardware and sell services on the ISS. Most commercial technology proposals to date have requested or have required NASA cost-sharing. NASA has enabled some of these proposals through milestone completion-based contracts. Impediments to commercial research and investment on ISS were discussed. These impediments include the absence of a special exemption for intellectual property rights for non-NASA entities, uncertainty over the ISS life extension, the time it takes to get from selection to flight, and the cost for meeting NASA requirements.

The Commercial Space Committee received an update on NASA's Aeronautics Research Mission Directorate (ARMD) from Mr. Robert Pearce, who discussed ARMD's relationship to the NASA Strategic Space Technology Investment Plan (SSTIP), promising areas of collaboration with STMD, and lessons learned applicable to commercial space. Ms. Smith reported on the Public-Private Partnerships for Space Capability Development study. The study is intended to provide economic intelligence on public-private partnership areas for space capability development that could meet NASA's mission objectives. The study focuses on 10 areas: satellite servicing, interplanetary small satellites, robotic mining, cargo transportation beyond LEO, crew transportation beyond LEO, microgravity research for biomedical applications, liquid rocket engines, wireless power, space communications, and Earth observation data visualization.

Ms. Smith presented a proposed finding on COTS. It was approved by the Council as follows:

NASA's Commercial Orbital Transportation Services (COTS) yielded significant benefits for both NASA and the nation.

- *It developed two lower cost launch systems and spacecraft for about an \$800M investment for both International Space Station (ISS) cargo and other medium payload launch capabilities.*
- *COTS/Commercial Resupply Services (CRS) provides the potential to revitalize the commercial launch industry and recapture the U.S. share of commercial launches,*
- *Including well defined scope of potential service contracts up front creates confidence and provides risk reduction for investors.*
- *Based on positive COTS experience to date, NASA should decide whether to employ follow-on contracts after 2015.*
- *Resist requirements creep during operations phase to maintain the low-cost characteristic of the systems.*

Ms. Smith presented a proposed finding on extending ISS beyond 2020. Dr. Squyres explained that extending the ISS beyond 2020 has serious implications that could lead to dire consequences for the rest of NASA's programs in a declining budget environment. After further discussion, it was agreed that Ms. Smith would revise the finding, so as to indicate barriers and impediments that will need to be addressed if the ISS is to be extended beyond 2020. The revised finding was approved as follows:

The Council supports the extension of the International Space Station (ISS) for critical research in areas of materials processing, space environment and medicine, particularly to exploit the outreach to pharmaceutical companies. In order for the ISS to be fully utilized for projects requiring longer lead time, NASA must provide sufficient opportunity for research and commercial activity. Ample time is required to support return on investment (ROI) for closing the business case.

Ms. Smith presented a proposed finding on budgeting for larger prizes. The Council approved the finding, which states as follows:

The Council applauds NASA's smart and aggressive approach in the use of prizes and crowdsourcing. NASA should look for ways to budget at least one larger prize over the next three years. Breakthrough results from prize competition often result from larger prize values. NASA has been effectively using prizes for a number of years but has yet to budget to the level required for large, "game changing" results."

Ms. Smith presented a proposed finding on the commercial market study validation (public/private partnerships study). The Council approved the finding, which states as follows:

The Council supports the great work done by the internal NASA group that conducted the "Commercial Market Study" and finds that the product will benefit from validation by an independent private sector review.

- *The collection and presentation of data shows significant market opportunities across areas important to NASA.*
- *As this was an internal effort, it could benefit from external validation.*

Ms. Smith presented a proposed recommendation calling for continued Commercial Crew competition as follows:

The Council recommends continuing the current level of competition for Commercial Crew. Competition among more than one industry partner during the development phase is important to safety, schedule, performance and cost.

Dr. Squyres noted that this recommendation conflicted with an earlier recommendation proposed by the HEO Committee. At Dr. Squyres' suggestion, the proposed recommendation was deferred in order to give the two committees an opportunity to review and/or combine the two recommendations for future Council consideration.

Ms. Smith presented a recommendation on an ISS exemption for intellectual property rights: The consensus among the Council was to approve the recommendation, with the caveat that Dr. Squyres would work with Ms. Smith, Dr. Ballhaus, and Mr. Hanisee to craft language that avoids obvious legal hurdles. The Council approved the final language of the recommendation as follows:

The Council recommends that NASA explore reduction of barriers to ISS utilization, including Intellectual Property (IP) rights.

Ms. Smith presented a proposed recommendation for NASA's Aeronautics Research Mission Directorate (ARMD) to reach out to the commercial space tourism industry as follows:

NASA/ARMD should reach out to the commercial space tourism industry to explore possible technology development.

After discussion, it was agreed to defer action on this recommendation in order to give the Aeronautics Committee time to consider it, and perhaps produce a joint recommendation with the Commercial Space Committee for Council consideration at the next Council meeting.

Dr. Squyres thanked Ms. Smith for her presentation.

Education and Public Outreach Committee Report

Dr. Squyres introduced Mr. Lars Perkins, Chair, Education and Public Outreach (EPO) Committee. Mr. Perkins described the Committee's membership and announced that it has a new member: Mr. William Nye. Mr. Perkins reported that NASA's Education budget has been decimated, and he presented several slides showing the extent to which the budget had been cut. He announced that what he formerly had been referring to as the "taxi driver problem", is now going to be referred to as the "ambulance driver problem". Mr. Perkins asserted that "we are now in dire straits in saving the EPO mission." He noted that there are important programs that need to be preserved, and he suggested that Council members use their individual influence to preserve them.

Mr. Perkins discussed the Administration's plans for reorganizing and consolidating the Science, Technology, Engineering, and Mathematics (STEM) education program. The National Science and Technology Council (NSTC) Committee on STEM Education (CoSTEM) was established pursuant to the requirements of Section 101 of the America COMPETES Reauthorization Act of 2010. Federal STEM investments have proliferated over the years to include more than 220 programs across 13 different agencies. This fragmented approach to investing in STEM education has made it difficult to ensure that Federal efforts are coherent, strategic, and leveraged for greatest impact. The Agency's education efforts will be restructured into a consolidated education program coordinated through the Education Coordinating Council (ECC) to support the Administration's FY 2014 STEM Education plan. CoSTEM is reviewing STEM education throughout Federal agencies to ensure effectiveness, and will develop and implement through the participating agencies a five-year STEM education strategic plan, to be updated every five years. The Agency will align its STEM education investments in accordance with the five-year plan. The intent is to support a cohesive national strategy that reaches more students and more teachers more effectively. The STEM Education Reorganization Initiative preserves NASA's Space Grants and several other programs at NASA and refocuses \$27 million to facilitate the wider application of NASA's best education assets. Mr. Perkins stressed that the original CoSTEM report did not recommend consolidating STEM activity into three agencies.

Mr. Perkins reviewed how the NASA story is being communicated in social media. There are over 450 NASA social media accounts throughout the Agency. @NASA has been ranked as number four of the top ten brands on Twitter. The NASA page on Facebook has received more "likes" than any Federal government agency other than the U.S. Marine Corps. The NASA page on Google+ is in more circles than any Federal government agency other than the White House. NASA is the number one Federal government agency on Foursquare. NASA's web page, NASA.gov has been overhauled and is now utilizing an open-source content-management system. External searches are provided by USA Search, which is the General Services Administration's (GSA) implementation of the Bing search engine. Videos are now consolidated on YouTube (www.youtube.com/nasa). Mr. Perkins commended NASA's social media achievements.

Mr. Perkins reported that due to sequestration, NASA's Chief of Staff and Chief Financial Officer issued guidance suspending all EPO activities pending further review and established a waiver process for activities for the remainder of FY 2013. The guidance covers any activity intended to reach out to external and internal stakeholders and the public concerning NASA. Pursuant to the waiver process, Mission Directorates and Centers submitted 834 waiver requests for communications activities scheduled during the period March 23 to September 30, 2013. Only 126 have been denied. On the positive side, the waiver process has given the Communications Coordinating Council (CCC) at NASA HQ oversight over these activities for the first time, has facilitated dialogue between the CCC and the EPO community at large regarding value and return on investment of planned activities, and has accelerated CCC efforts to assemble an Agency-wide communications portfolio.

Mr. Perkins presented a proposed recommendation on coordination of education and public outreach activities. Ms. Blakey asserted that this is an effective way to approach what has been an intractable problem. Dr. McComas expressed concern over disempowering the SMD community and establishing a complicated approval process. Dr.

Squyres requested that Mr. Perkins and Dr. McComas work together to develop mutually acceptable language. After discussion, the Council approved the recommendation as follows:

NASA should learn from the approval process begun during sequestration and develop a new process for dispositioning requests to conduct Education and Public Outreach (EPO) activities that efficiently coordinates with missions, aligns EPO programs with NASA goals, and is cost effective.

Mr. Perkins presented a proposed recommendation concerning use of Mission Directorate EPO resources. Dr. Mountain notified the Council that he had a conflict of interest with respect to this subject. Dr. McComas counseled that this recommendation would “chill” the EPO resources that SMD has developed. Ms. Blakey noted that there is a large cottage industry involved, and that people prefer using their own resources. She advised that coordination should imply being cost efficient. Dr. McComas asserted that the determination should be based on an actual measurement of the efficacies of different providers, and that it should not be presumed that NASA can do this best internally. Dr. Squyres requested that Mr. Perkins and Dr. McComas again work together to develop mutually acceptable language. After discussion, the Council approved the recommendation as follows:

To the extent that missions have funding for Education and Public Outreach (EPO) activities, they should coordinate with the Mission Directorates’ EPO and utilize the most cost effective resources to accomplish such activities, be they inside NASA or out.

Mr. Perkins presented a proposed finding on the coordination and rationalization of digital media products among the Mission Directorates. The Council approved the finding, which reads as follows:

NASA’s digital multimedia products are not well coordinated among the Mission Directorates, organized consistently for public access, and consistent in supporting NASA’s overall strategic vision. The Communications Coordinating Council (CCC) Digital Media Subgroup is on the right path and should work closely with the new Chief Information Officer (CIO) to develop a digital media strategy which produces media products that are coordinated, necessary to support NASA’s overall vision, and secure. As an example, NASA runs over 1,800 websites (by some estimates ~60% of all websites run by the government). They are not all integrated into the NASA.GOV infrastructure, and some are insecure (security breaches have occurred). There is little or no coordination of these sites at the Headquarters level, and maybe obsolete and therefore incur an unnecessary operation cost burden. They also perpetuate public confusion about NASA’s overall mission.

Dr. Squyres requested that Mr. Perkins develop language for a finding to acknowledge the good work that was done in redesigning NASA’s web site. The proposed language for this finding was approved by the Council as follows:

The Council finds that the Office of Communications’ recent redesign of the NASA.GOV website, while not complete, addresses many concerns that Council has had regarding usability and information organization. We believe the Office of Communications should be recognized for the excellent progress it has made, and we look forward to the continuing improvement of NASA’s web presence. Despite its popularity, the prior version of NASA.GOV did not utilize evolving best practices in web design. Proprietary video formats, inability to search social media sources and other relevant content not hosted on the site, scattering of videos across many different sites and accounts, confusing information organization and a dated color palette detracted from the overall quality of the web experience.

Dr. Squyres noted that he had observed at the NAC “all hands” meeting with the NASA Administrator the previous day a sense of outrage among the NAC committee members over what seems to be a misguided STEM restructuring proposed to begin in FY 2014. He acknowledged that NASA had responded to a prior Council recommendation on this subject with a “non-concur,” and that the Administration’s posture on the subject has not changed. Nevertheless,

there have been other developments elsewhere on this matter and, therefore, it would be appropriate for the Council to reassert its recommendation, particularly since it is something about which the Council feels deeply. Dr. McComas concurred. Ms. Blakey suggested avoiding the term “education,” and instead using the term “citizen participation.” Dr. Larry Smarr, Chair, Information Technology Infrastructure Committee, cautioned that the White House was leading the restructuring. He advised that for the Council to disagree effectively the recommendation should be crafted to provide ammunition that would be helpful. Ms. Smith advised that the Council should indicate how wide-spread the concern is and request the Administrator to appeal to the White House. Dr. Klineberg concurred with Dr. Smarr and Ms. Smith. At Dr. Squyres request, the citizen engagement recommendation was prepared by Mr. Perkins and Ms. Blakey, and was approved by the Council as follows:

NASA plays a unique role in the inspiration and education of the public about programs in space, and has a stellar track record in this area. While the Council acknowledges that efficiencies may be gain through consolidation, the Council remains concerned with the proposed transfer of responsibility for outreach associated with NASA space missions to agencies and organizations with no spaceflight experience. NASA should ensure that funding remains in place for public outreach associated with NASA’s missions.

Dr. Squyres thanked Mr. Perkins for his presentation.

Technology and Innovation Committee Report

Dr. Squyres introduced Dr. Charles (Matt) Mountain, Technology and Innovation (T&I) Committee. Dr. Mountain reminded the Council that the Committee’s scope covers all NASA programs that could benefit from technology, research, or innovation. The Committee’s agenda from its last meeting was reviewed. A slide was presented showing the reasons for investing in space technology: it enables a new class of NASA missions beyond Low Earth Orbit (LEO); it delivers innovative solutions that improve technological capabilities; it makes NASA’s missions more affordable and more reliable; and it creates new markets. The technology challenges being focused on for deep space exploration cover communication, navigation, radiation mitigation, propulsion, logistics, power generation and storage, manufacturing in space, and entry, descent and landing (EDL). A chart showing the nine NASA Space Technology Mission Directorate (STMD) programs was displayed. The Green Propellant Infusion Mission (GPIM) in the Technology Demonstration Mission (TDM) portfolio was discussed. The mission will be a space flight demonstrating a complete propulsion system for spacecraft attitude control and primary propulsion using the “Green Propellant,” AF-M315E, developed by the Air Force Research Laboratory (AFRL) as a substitute to hydrazine. The propellant is an ionic salt blend of HAN (Hydroxylammonium Nitrate) solid oxidizer with water and a compatible fuel. It is less toxic than caffeine and provides a greater than 50 percent improvement in volumetric performance over hydrazine.

Dr. Mountain described the Low Density Supersonic Decelerator (LDSD). It is intended to enable a new class of planetary entry vehicles with improvements over the Mars Surface Laboratory (MSL) by allowing a one metric ton increase in landed mass, a 25 percent increase in elevation, and a three times reduction in the landing ellipse. A chart was presented showing the plans for a LDSD flight test to be conducted soon in Hawaii. The development of high powered SEP was discussed. Its potential applications include satellite servicing, payload delivery, space science missions, commercial space applications, deep space human exploration, and orbital debris removal. A chart was presented showing how technology development for the ARM integrates with sending humans to the Mars surface.

Dr. Mountain presented a proposed recommendation on sustaining the NASA space technology programs. He explained that the budget for space technology had been disproportionately decreased because it was included in funding for small business programs, which have mandatory funding. Dr. Squyres noted that in the past there had been similar disproportionate cuts to the planetary program. The Council approved the recommendation, which reads as follows:

The Council recommends that NASA continue its commitment to sustain and grow the Agency's space technology programs to enable future NASA missions and to maintain U.S. technical leadership in space.

Dr. Mountain described key technology challenges from SMD for active remote-sensing technologies, large deployable structures, intelligent distributed systems, and knowledge capture. He described a briefing the Committee received on Commercial Cargo and Crew. They were informed that Commercial Crew industry partners are deliberately not pursuing advanced technologies. The industry partners are using cost-effective approaches and sound engineering practices; however, they have not wanted to overly rely on advanced technology to meet the safety, reliability, and cost-effective “nibbles” of the program. A chart entitled “Genesis of Collaborations Synopsis” was presented. It states that the U.S. National Space Policy 2010 goals were to energize competitive domestic industries and to actively explore the use of inventive, non-traditional arrangements. The chart indicates that Commercial Crew partners have requested over 1,000 existing NASA documents, data, and test results. It also asserts that NASA needs a better understanding of commercial space capabilities to inform NASA'S deep space architecture.

Dr. Mountain presented a proposed finding on industry's pursuit of advanced technology in its Commercial Crew programs. After discussion and revision, the Council approved the finding as follows:

Industry may not be pursuing advanced technology in its Commercial Crew programs, however, NASA and industry are using innovative partnering and contracting models (Space Act Agreements and streamlined requirements from NASA). NASA would benefit by further exploring this acquisition approach to streamlining requirements in active dialogue with industry.

Dr. Mountain described how NASA technology is being used aboard commercial fixed-wing aircraft. He presented a proposed finding recognizing the severe budget pressures of the NASA Aeronautics program and the need for ARMD to invest in traditional research and technology. Ms. Marion Blakey, Chair, Aeronautics Committee concurred with the finding, and it was approved by the Council as follows:

For more than a decade, the NASA Aeronautics program has been under severe budget pressures, shrinking from over \$1B to roughly \$560M annually. U.S. aviation leadership is vital to our nation's economic future. NASA has historically played a leading role in preserving U.S. aviation leadership. It appears that NASA Aeronautics is no longer significantly investing in several traditional research and technology areas, such as supersonics, hypersonics, flight research and general aviation.

Dr. Mountain reported that the T&I Committee had met with NASA's Chief Technologist, Dr. Mason Peck, who explained that the asteroid Grand Challenge is to “find all asteroid threats to human populations and know what to do about them.” The Grand Challenge has five segments: detect, characterize, track, communicate, and mitigate. Dr. Peck, together with NASA's Chief Scientist and Chief Engineer, are developing a new basic research program for engineering science. Dr. Mountain presented a proposed recommendation that NASA establish a basic research program in engineering science. Action on the proposal was suspended pending retrieval of NASA's response to a prior recommendation on the same subject. After retrieval and further discussion, Council approved the following finding:

The Council reasserts its previous recommendation on the importance of fundamental aerospace engineering science. We look forward to hearing an update from the Agency on the recommendation.

Dr. Mountain explained that staff support for the T & I Committee was moving from STMD to the Office of the Chief Technologist (OCT), and that Ms. Kathleen Gallagher of OCT would be replacing Mr. Michael Green of

STMD as the Committee's Executive Secretary. Dr. Mountain presented a proposed finding to thank the STMD staff for its support of the T & I Committee. The Council approved the finding as follows:

The NAC Technology and Innovation Committee management is moving from the cognizance of the Space Technology Mission Directorate (STMD) to that of the Office of Chief Technologist (OC) beginning at its next meeting. Katie Gallagher (OCT) will provide support in future. The Committee would like to thank Mike Green, Executive Secretary the past three years, and Anyah Dembling, Executive Assistant, for all their help and efforts at managing the Committee activities, including our meetings. Also, the Committee wishes to thank STMD Associate Administrator Mike Gazarik for STMD's support as well.

Dr. Squyres thanked Dr. Mountain for his presentation.

Public Input

Dr. Squyres invited comments from the public. There were none.

2013 International Space Apps Challenge

Dr. Squyres introduced Mr. Nicholas Skytland, Open Innovation Program Manager, NASA Johnson Space Center (JSC) and Ms. Ali Llewellyn, International Space Apps Challenge Manager, JSC. Also introduced by Ms. Deborah Diaz, NASA Deputy Chief Information Officer, were their supervisor, Dr. Sasi Pillay, Chief Technical Officer, NASA Glenn Research Center (GRC), and Mr. Sam Wilkinson, a 17-year-old scientist from Oxford, England, who was a winner at last year's International Space Apps Challenge. The International Space Apps Challenge is a two-day "hackathon" where teams of technologists, scientists, designers, artists, educators, entrepreneurs, developers, and students collaborate across the globe, using publicly available data to design innovative solutions for global challenges in software development, citizen science, hardware, and data visualization. For the 2013 event, more than 9,000 people in 44 countries and 83 cities engaged in the largest hackathon "in the galaxy." Approximately 2,000 participants participated virtually. They were responding to 58 highly-curated challenges, half of which came from NASA. There were 474 partners, including five international space agencies and six U.S. Government agencies. The participants submitted 770 solutions. New York City had 387 participants and 33 projects. San Diego, Chile had 368 participants and 28 projects. In New York City, half the developers were female. The London event met at the Google campus there. The average team size was 3.9. One hundred thirty-four projects were globally recognized. There were 35 finalists and six winners.

Several winning projects were described. *Sol* is the world's first interplanetary weather app. It integrates weather data from the Curiosity Rover on Mars with weather data from Earth. *Aurora Localization via Starfields* provides a method for localizing aurora in images taken from the ISS to a location over the Earth. *Sync* concentrates open-source projects stored in different ways into one location, creating an intuitive project directory. *EarthKam Explorer* provides web-based 3-D visual exploration of satellite images taken by middle school students through the ISS EarthKam program. *T-10* is a prototype mobile application for use on the ISS. Astronauts can program in specific points of interest they wish to photograph, and T-10 will alert them shortly before the Station is set to fly over that location if the current weather permits photography. T-10 can also notify people on the ground when they might be included in the photograph.

The International Space Apps Challenge cost to NASA was \$265,000. The value of the top 134 apps developed is estimated to be \$4.6 million. This represents a return on investment (ROI) to NASA of 1,635 percent. In response to a question from Dr. Squyres over whether the approach is sustainable, Ms. Llewellyn explained that it takes a long time to develop the challenges and that the program is careful not to "over tap" the community. In response to a question from Dr. McComas, Ms. Llewellyn explained that the challenges are published 30 days in advance and

that, from anecdotal evidence, approximately 15 percent of the participants start early. Some partners fund proposed solutions and not just NASA benefits. A video was shown about a remotely operated vehicle (ROV) used on the NASA Extreme Environment Mission Operations (NEEMO-16) expedition. The ROV had been developed in response to a challenge to operate an ROV underwater from another continent. Dr. Squyres noted that he had been a member of the NEEMO-16 crew and was underwater at the time. In response to a question from Dr. McComas about how they handled intellectual property, Mrs. Llewellyn explained that they only worked with public data, and that all solutions had to be submitted under an open-source license agreement. They intentionally avoided situations that might implicate the International Traffic in Arms Regulations (ITAR). Participants appreciated the fact that NASA is not asserting any claims on their work. She added that NASA's lawyers in the Office of General Counsel, Intellectual Property Division, had been very helpful. Mr. Perkins thanked the presenters for their energy, passion, and creativity. Dr. Mountain asked the presenters what the Council could do to help future efforts. Mr. Skytland responded that when it comes time for investment decisions to be made, NASA should not ignore programs like this.

Dr. Squyres thanked Mr. Skytland and Ms. Llewellyn for their presentation. He noted that presentations like this were one of the best things about NAC meetings. He thanked Ms. Rausch for finding the program and bringing it to the NAC. The Council applauded the presenters.

Information Technology Infrastructure Committee Report

Dr. Squyres introduced Dr. Larry Smarr, Chair, Information Technology Infrastructure (ITI) Committee. Dr. Smarr noted that the Committee was now up to full strength and he thanked Dr. Squyres and Ms. Rausch for their assistance in making that happen.

Dr. Smarr presented a proposed finding on three new Federal open data directives. He explained that on February 22, 2013, an Executive Order was issued to require Federal agencies investing in research and development to have clear and coordinated policies for increasing access to the research and scientific data. The second directive, the White House Big Data Initiative, was released on March 29, 2013. The third order was issued on May 9, 2013, and requires agencies to collect or create data in a way that supports downstream information processing and dissemination activities. The Council approved the finding, which provides as follows:

The U.S. Government has issued several new directives and guidance on open data:

- *Office of Science and Technology, February 22, 2013: Increasing Access to the Results of Federally Funded Scientific Research*
- *Office of Science and Technology Policy, March 29, 2013: Big Data is a Big Deal*
- *Presidential Executive Order, May 9, 2013: Open Data Policy – Managing Information as an Asset*

Dr. Smarr notified the Council that he had briefed the NAC's four Science Subcommittees on the review conducted by NASA on the existing national cyber-infrastructure supporting access to data repositories for NASA SMD missions.

A joint proposal was presented from the ITI Committee and Science Committee for a Council recommendation that the two committees explore the NASA cyber-infrastructure that supports access to data repositories for NASA SMD missions. Dr. Squyres observed that this was advice to the NAC rather than advice to the Agency. Mr. Kohrs requested that the data from the ISS be included. At Dr. Squyres' request, Dr. Smarr agreed to formulate and present at the next NAC meeting a proposed Council finding indicating that this would be an important undertaking.

Dr. Smarr discussed the Chief Information Officer (CIO) evolving role in IT governance models. He described several major directives or guidance: the Clinger Cohen Act of 1996; the Bush E-Government and President's Management Agenda, E-Gov Act of 2002; the Federal Information Security Management Act (2002); the Obama 25 Point Plan; the Digital Government Strategy (May 23, 2012); the PortfolioStat Guidance (OMB M-13-09); CIO Authorities (OMB M-11-29); and the Federal IT Acquisition Reform Act (FITARA), as passed by the U.S. House of Representatives in June 2013. A graphic was presented showing how CIO governance issues are becoming more complex as the highly customized client service era ends. Dr. Smarr opined that NASA's new CIO, Mr. Larry Sweet, and NASA's Deputy CIO, Ms. Deborah Diaz, are well able to handle these changes.

Dr. Smarr presented a proposed recommendation for NASA to produce an IT governance document and to articulate the CIO's duties. Dr. McComas observed that these were two separate recommendations. Research by Ms. Rausch indicated that the CIO's responsibilities have already been formally articulated as part of NASA Policy Directive (NPD) 1000.3D/The NASA Organization. Dr. Mountain opined that Center Directors would not find an IT governance document to be important. He expressed concern that it would lead to a bureaucracy. Dr. Squyres requested clarification on the meaning of the phrase "governance methods," as used in the proposed recommendation. With the caveat that the meaning of that phrase be clarified, the Council approved the first part of the recommendation, which reads as follows:

NASA should produce a clear and concise Information Technology (IT) governance document, including documented processes, policies, and organization roles and responsibilities. The framework should incorporate leading IT governance methods.

A graphic was presented on NASA's optical communication technology strategy. The Lunar Laser Communication Demonstration was described. Dr. Smarr discussed a slide entitled "Human DNA Cascades into Omics." He briefed the Council on the role played by microbe cells in the human body. He explained that 99 percent of the genetic information carried by DNA in the human body resides in microbe cells, not in human cells, and that the human body contains 10 times as many microbe cells as human cells. He asserted that inclusion of the microbiome will radically change medicine. Dr. Smarr described a planned mission for one astronaut, Scott Kelly, and one cosmonaut, Mikhail Kornienko, to spend one year on the ISS. They will launch in spring 2015, and return to earth in spring 2016. This is an excellent opportunity to perform astro-omics on twins because former astronaut Mark Kelly is the twin brother of astronaut Scott Kelly. Dr. Smarr concluded his presentation with a slide stating that "Germs sent to space return three times as deadly," and that "relatively little was known about microbial changes to infectious disease risk in response to spaceflight."

Dr. Squyres thanked Dr. Smarr for his presentation.

Aeronautics Committee Report

Dr. Squyres introduced Ms. Marion Blakey, Chair, Aeronautics Committee. Ms. Blakey presented a list of her Committee's members and reviewed the subjects explored at its last meeting. A chart was presented on the NASA Aeronautics FY 2014 Budget Request. Ms. Blakey noted that the budget has been flat for some time and is at rock-bottom. She reviewed the budget highlights. NASA Aeronautics research is focused on the following: safe, efficient growth in global aircraft operations; innovative composites research; integration of Unmanned Aerial Vehicles (UAV) into the National Airspace System (NAS); ultra-efficient commercial transports; transition to low-carbon propulsion; and real-time system-wide safety assurance. The Integrated Systems Research program adds funding for the Advanced Composites Project, which will focus on reducing the time for development and certification of innovative composite materials and structures. Funding has been reduced to reflect the Administration's STEM consolidation initiative to centralize all STEM education activities across the Federal government. Funding has been added to explore options for the future of rotary wing research.

Ms. Blakey presented a proposed finding to express support for rotary wing research. The Council approved the finding, which states as follows:

Other countries, notably the European nations, Russia, China, and Korea, are funding advanced rotorcraft research. Europe in particular has made a strong effort to dominate this market, and they have succeeded with European companies ranking #1 and #2 in the civil rotorcraft market, while the top U.S. company is #3 in the civil market. Specifically, Europe is leading with the development of the first civil tilt-rotor vehicle, and more generally, they have made a strong push to improve helicopter performance (e.g., speed, range and payload) and environmental performance (noise in particular). As other countries continue to invest strongly in rotary wing research, it is anticipated that U.S. market share will continue to decline in both the civil and military markets. The Council fully supports the Aeronautics Research Mission Directorate (ARMD) continued investment in rotary wing research and efforts to align their research with those technologies deemed crucial to regaining U.S. leadership in this area of aeronautics.

Ms. Blakey presented a proposed finding to express support for hypersonics research. The Council approved the finding, which states as follows:

The Council fully supports the Aeronautics Research Mission Directorate (ARMD) continued investment in hypersonics research and efforts to align their research with those technologies deemed crucial to sustaining U.S. leadership in this area of aeronautics. NASA's investment in hypersonics should be strategically coordinated/ aligned with the Department of Defense's, given the potentially expensive nature of the research and the limited resource environment for the foreseeable future.

Ms. Blakey provided details on the Advanced Composites Project. She explained that it currently takes 20 years to certify new composites and that the project's goal is to reduce that to five years. This will be a new project in the Integrated Systems Research Program. Charts were presented to illustrate the difficulties in composites research and the challenges in accelerating composites development and certification.

A graphic was presented showing three "flavors" of flight research. One is where a modified aircraft carries the flight experiment. The second is where the aircraft configuration itself is the flight experiment. The third is where existing aircraft are used to execute flight experiments. The Alternative Fuel Effects on Contrails and Cruise Emissions (ACCESS) flight experiment was described. During the test, emissions from the Dryden Flight Research Center (DFRC) DC-8 were measured in flight by an instrumented Falcon aircraft from Langley Research Center (LaRC) that had been modified for use in atmospheric sampling and as a remote-sensor test-bed.

Ms. Blakey discussed the areas recently explored by the Unmanned Aircraft Systems (UAS) Subcommittee, which had been established to assess NASA's efforts to reduce technical barriers to enabling UAS access to the NAS. Technical focus areas in the NAS project include the following: certification and safety; human systems integration; command and control performance standards; integrated test and evaluation; sense and avoid performance standards; and air-traffic systems integration.

Ms. Blakey presented a proposed finding to support the next phase of the UAS in the National Airspace System (NAS) project. The Council approved the finding, which reads as follows:

The Council strongly supports the Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) project and proceeding with the next phase of the project. We believe that the project has evolved to consider key stakeholder concerns, including those put forward by the UAS Subcommittee. The Council endorses the work of the

Subcommittee in prioritizing the project Technical Work Packages that are key to success, and which might be slightly de-emphasized as program planning evolves.

Ms. Blakey presented a proposed finding on expanding ARMD efforts in small unmanned aircraft systems. The Council approved the finding, which reads as follows:

The Council believes it is important that future Aeronautics Research Mission Directorate (ARMD) efforts in unmanned systems include technologies and operational performance standards that have the broadest applicability to all classes of Unmanned Aircraft Systems (UAS). The Council feels that the current UAS in the National Airspace Systems (NAS) project largely excludes certain classes such as “small UAS” (typically defined as less than 55 pounds), a segment that may have the largest near-term economic impact. Examples of technology specifically applicable to small UAS include those that will enable beyond-line-of-sight and other non-visual flight rules (VFR) operations.

Ms. Blakey discussed the Integrated Strategy for Autonomy Research. It entails three elements. The first is sponsoring a National Research Council (NRC) study to develop a national research agenda for autonomy in civil aviation. She provided charts to show the NRC study committee membership and an overview from its first meeting. The second element is to assemble a NASA inter-center autonomy study team to develop a top-level framework for ARMD research. The third element is to build upon ongoing related research and planning.

Ms. Blakey presented a proposed finding on supporting ARMD initiatives in automation and autonomy. The Council approved the finding, which reads as follows:

The Council strongly encourages that the Aeronautics Research Mission Directorate (ARMD) continue and expand its broad involvement in Unmanned Aircraft Systems (UAS) technologies and programs, toward the goal of ARMD, NASA and the U.S. being the world leader in this field. The Council further supports ARMD planned initiatives in the broader areas of automation and autonomy. These underlie the future evolution of all aspects of aviation and the adaptations of these technologies that increase aviation safety and enable new aeronautical capabilities.

Dr. Squyres thanked Ms. Blakey for her presentation.

Council Discussion: Wrap-up: Final Acknowledgments

Dr. Squyres noted that the HEO Committee and Commercial Space Committee have presented different recommendations on establishing milestones to be used for down-selecting Commercial Crew competition. The Commercial Space Committee does not want to downselect and does not want any dates to be specified. HEO Committee says that downselect dates are needed. Dr. Squyres recommended that the issues be highlighted and presented to the Agency for its solution. The Council concurred.

Dr. Squyres noted that the HEO Committee’s proposed recommendation to add commercial expertise to the membership of HEO Committee’s Research Subcommittee stands as approved.

Dr. Squyres noted that HEO Committee’s proposed recommendation on the Asteroid Initiative was approved as a finding. He and Ms. Rausch will clarify the language.

Dr. Squyres noted that the Science Committee’s revised language for its proposed recommendation calling for the Planetary Protection Officer to participate in mission planning stands as approved. It now clarifies “appropriate participation” by inserting “(i.e. a seat at the table)”, and now adds “consistent with NASA procedural requirements.”

Dr. Squyres noted that the Commercial Space Committee's proposed recommendation on ISS exemption for intellectual property rights stands as approved. Ms. Smith has revised the language and the title has been revised to read: "*Reduce Barriers to ISS Exemption for Intellectual Property (IP) Rights.*"

Dr. Mountain reported that the T & I Committee recommendation on the Space Technology Program was similar to a prior recommendation that had been responded to by NASA with a "concur." Accordingly, the current recommendation will be redrafted as a finding to ensure that the matter is not forgotten. Dr. Mountain and Dr. Squyres will draft the language.

Mr. Perkins presented a proposed finding on citizen engagement. Dr. Squyres recommended that the finding begin with the following sentence: "*The Council remains concerned with the proposed transfer responsibility for outreach associated with NASA space missions to organizations with no space flight experience.*" The language will be polished after the meeting. Ms. Blakey observed that NASA plays a unique role in the public's education about programs in space and has a stellar track record in that regard. Dr. Squyres advised that that should be the first sentence. Dr. McComas expressed concern that there is a lot of education that may not be included in public outreach.

Dr. Squyres noted that the EPO Committee's proposed finding on NASA's web site redesign was approved as revised.

Dr. Squyres advised that the next NAC meeting will be held at KSC on December 11-12, 2013. The NAC's next meeting after KSC was tentatively scheduled for April 16-17, 2014, at NASA Headquarters.

Dr. Squyres invited the Council members to make closing comments. Mr. Kohrs expressed concern over the Human Exploration and Operations Mission Directorate budget. Mr. Perkins expressed extreme concern over the STEM status and asserted that the STEM restriction has to be removed. Ms. Blakey advised that it was incumbent on each Council member in their various roles to explain that the STEM consolidation as it applies to NASA is ill-conceived. Dr. McComas asked whether there was any reasonable possibility that astronauts flying in space might bring back dangerously evolved microbial material. Dr. Smarr acknowledged the possibility and explained that this is barely beginning to be understood. Dr. Squyres concurred with the concerns voiced by Mr. Kohrs. He observed that NASA is being asked to do too much with too little, and that due to its many constituencies, NASA is finding it difficult to change its organization. He explained that if the budget remains flat, the Agency will need to undergo a transformation. He advised that it would be smart to plan ahead, rather than react, and that the Council needs to look at what a new NASA will look like if NASA has to change its portfolio.

Dr. Squyres thanked Dr. Klineberg for standing in for Dr. Charles Kennel and thanked Dr. Mountain for standing in for Dr. Ballhaus. He thanked Mr. Kohrs for decades of service to NASA. He thanked Ms. Diane Rausch, Ms. Marla King, the eight Committees' Executive Secretaries, and everyone on the NASA support staff for their assistance in making this NASA Advisory Council meeting highly productive and successful.

Dr. Squyres adjourned the meeting at 4:46 pm.

NASA ADVISORY COUNCIL

**NASA Headquarters
Washington, DC 20546**

PUBLIC MEETING

July 31 – August 1, 2013

Wednesday, July 31, 2013**Council Public Meeting**

NASA HQ, Program Review Center, Room 9H40 (9th floor)

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 – 2:00 pm	Remarks by NASA Administrator	Mr. Charles Bolden NASA Administrator
2:00 – 2:30 pm	Asteroid Initiative: An Update	Mr. William Gerstenmaier Associate Administrator Dr. Michele Gates Senior Technical Advisor Human Exploration and Operations Mission Directorate NASA HQ
2:30 – 3:15 pm	Human Exploration and Operations Committee Report	Mr. Richard Kohrs, Chair
3:15 – 3:30 pm	Break	
3:30 – 4:15 pm	Science Committee Report	Dr. David McComas, Chair
4:15 - 5:00 pm	Audit, Finance and Analysis Committee Report	Mr. Robert Hanisee, Chair
5:00 pm	Adjourn	

Thursday, August 1, 2013**Council Public Meeting**

NASA HQ, Program Review Center, Room 9H40 (9th floor)

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	Commercial Space Committee Report	Ms. Patti Grace Smith, Chair
10:00 – 10:45 am	Education and Public Outreach Committee Report	Mr. Lars Perkins, Chair
10:45 – 11:00 am	Break	
11:00 – 11:45 am	Technology and Innovation Committee Report	Dr. William Ballhaus, Chair
11:45 – 12:00 noon	Public Input	
12:00 noon – 1:00 pm	Lunch	
1:00 – 2:00 pm	2013 International Space Apps Challenge	Mr. Nicholas Skytland Open Innovation Program Manager Ali Llewellyn International Space Apps Challenge Manager NASA Johnson Space Center
2:00 – 2:45 pm	IT Infrastructure Committee Report	Dr. Larry Smarr, Chair
2:45 – 3:00 pm	Break	
3:00 – 3:45 pm	Aeronautics Committee Report	Ms. Marion Blakey, Chair
3:45 – 5:00 pm	Council Discussion; Wrap-up; Final Acknowledgments	All
5:00 pm	Adjourn	

NASA ADVISORY COUNCIL MEMBERS

July 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>President and 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 – Commercial Space Committee	Ms. Patti Grace Smith , <i>Patti Grace Smith Consulting, LLC</i>
Chair – Education and Public Outreach Committee	Mr. Lars Perkins , <i>Entrepreneur</i>
Chair – Human Exploration and Operations Committee	Mr. Richard Kohrs , <i>NASA (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>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>Dr. Charles F. Kennel, <i>Chair, Space Studies Board, National Academies</i></p> <p>Gen. Lester Lyles, USAF (Ret.), <i>Chair, Aeronautics and Space Engineering Board, National Academies</i></p>

NASA ADVISORY COUNCIL
NASA Headquarters
Washington, DC

July 31 – August 1, 2013

MEETING ATTENDEES

NASA Advisory Council Members:

Dr. Steven W. Squyres, <i>Chair</i>	Cornell University
Dr. William Ballhaus (<i>attending via telecon</i>)	The Aerospace Corporation
Ms. Marion C. Blakey	Aerospace Industries Association
Mr. Robert M. Hanisee	Trust Company of the West
Dr. John Klineberg (<i>for Dr. Charles Kennel</i>)	Space Studies Board, National Academy of Sciences
Mr. Richard Kohrs	NASA (Ret.)
Dr. David McComas	Southwest Research Institute
Dr. Charles (Matt) Mountain (<i>for Dr. William Ballhaus</i>)	Space Telescope Science Institute
Mr. Lars Perkins	Entrepreneur
Dr. Larry Smarr	California Institute for Telecommunications and Information Technology, University of California/San Diego
Ms. Patti Grace Smith	Patti Grace Smith Consulting, LLC
Ms. P. Diane Rausch, <i>Executive Director</i>	NASA Headquarters

NASA Attendees:

Beck, Beth	NASA Headquarters
Bolden, Charles	NASA Headquarters
Cioffi, Carla	NASA Headquarters
Dembley, Anyah	NASA Headquarters
Diaz, Deborah	NASA Headquarters
Finn, Marc	NASA Headquarters
Gates, Michele	NASA Headquarters
Gerstenmaier, William	NASA Headquarters
Green, Mike	NASA Headquarters
Herring, Angela	NASA Headquarters
Johnson, Lindley	NASA Headquarters
Jurand, Deirdre	NASA Headquarters
King, Marla	NASA Headquarters
Letchworth, Janet	NASA Headquarters
MacDonald, Alex	NASA Headquarters
Minor, Susan	NASA Headquarters
Nye, Bill	NASA Headquarters
Palmer, Jennifer	NASA Headquarters
Payne, Stefanie	NASA Headquarters
Pearce, Robert	NASA Headquarters
Pillay, Sasi Kumar	NASA Glenn Research Center
Reuther, James	NASA Headquarters
Robinson, Shawanda	NASA Headquarters
Siegel, Bette	NASA Headquarters
Skytland, Nick	NASA Johnson Space Center
Smith, Greg	NASA Headquarters
Feeley, T. Jens	NASA Headquarters
Worley, Lanven	NASA Headquarters

Other Attendees:

Bejmuk, Bo
Floyd, Mary
Frankel, David
Holmes, C.P.
Llewellyn, Ali
Lochner, James
Moloney, Michael
Odom, Jim
Richardson, Larry
Slater, Frank
Trang, Hian
Waddell, Trevor
Wilkinson, Sam

NAC HEO Committee
Zantech
P B Frankel, LLC
NAC ITI Committee
Valador
Universities Space Research Association
National Research Council
NAC HEO Committee
United Launch Alliance
Aerospace Industries Association
REI Systems
Aerospace Industries Association
Valador

**NASA ADVISORY COUNCIL
NASA Headquarters
Washington, DC
July 31 – August 1, 2012**

LIST OF PRESENTATION MATERIAL

- 1) NASA's Asteroid Initiative: An Update [Gerstenmaier & Gates]
- 2) Human Exploration and Operations Committee Report [Kohrs]
- 3) Science Committee Report [McComas]
- 4) Audit, Finance, and Analysis Committee Report [Hanisee]
- 5) Commercial Space Committee Report [Smith]
- 6) Education and Public Outreach Committee Report [Perkins]
- 7) Technology and Innovation Committee Report [Ballhaus & Mountain]
- 8) 2013 International Space Apps Challenge [Skytland & Llewellyn]
- 9) Information Technology Infrastructure Committee Report [Smarr]
- 10) Aeronautics Committee Report [Blakey]