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NASA ADVISORY COUNCIL

April 17, 2008

MEETING MINUTES



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**NASA ADVISORY COUNCIL
Le Pavillon Hotel
New Orleans, LA
April 17, 2008**

**Meeting Report
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Opening Remarks

Sen. Harrison Schmitt, the Council Chairman, called the quarterly NASA Advisory Council meeting to order at 8:35 a.m. and welcomed members and attendees. He noted that the Council had a productive and interesting set of fact-finding sessions at the Stennis Space Center (SSC) on April 16. He extended thanks to the SSC Director, Robert Cabana and his staff for making the visit and tour a success. Sen. Schmitt reminded everyone that the meeting was open to the public in accordance with the Federal Advisory Committee Act. Minutes of the last Council meeting in February meeting are available for distribution. In addition, NASA's responses to the recommendations from the Tempe Conference are now available. The delay in providing the document resulted from NASA management taking due time to ensure that they were clear on the substance of the responses. At the next Council meeting in July, the Science Committee will provide its analysis of the recommendations and responses.

Aeronautics Committee Report and Discussion

Gen. Lester Lyles, Committee Chairman, reported on the Aeronautics Committee and led the group's discussion. The Committee members have had frequent dialogue among themselves as well as with the Aeronautics Research Mission Directorate (ARMD) since the last meeting. In addition, the Committee had a very productive fact-finding meeting the previous day. Gen. Lyles covered three areas that were the focus of the meeting: (1) the feedback from the National Academy of Sciences (NAS)/Aeronautics and Space Engineering Board (ASEB) Workshop on the Next Generation (Next-Gen) Research and Development (R&D) Plan, an area where NASA is the key focal point for almost all of the R&D; (2) a continuing involvement and review of the Thermal Protection System (TPS) Program and how it supports the Exploration Mission activity as well as Aeronautics; and (3) the discussion the Committee had with the ARMD on candidate systems-level research projects relative to discussions at the previous Council meeting. At the last meeting, there was some concern about the implementation of one of the Committee's suggested recommendations. Continuing dialogue among the Committee members has culminated in an updated recommendation that Gen. Lyles presented later in his briefing.

Gen. Lyles reported that he personally attended the Workshop on the Next-Gen R&D Plan. The Workshop was structured to advise the Joint Planning and Development Office (JPDO), which is doing all of the planning for the next generation air transportation system. He reviewed the various R&D Plans to look for gaps in technology and research, to learn who will be working on the R&D activities, and to make some broad recommendations back to the JPDO. There will be no formal report from Workshop activity, only a briefing to the JPDO that will take place in May. The Committee will get feedback on the briefing at its next meeting in July.

There was one major issue that was most relevant to NASA and the Committee: the issue of technology transition. The JPDO is not structured to adequately manage the development activities, and this must change. This issue was identified the first day and raised a major flag. At this point, it is not clear how the issue will be worked, and the Workshop briefing will not give any specific recommendations on how it should be addressed. One of the Committee concerns is whether or not there is something that the Council should do, in light of concerns raised by Dr. Griffin. At present, the Committee is not sure it has the authority to make recommendations that might imply changing national policy or what it could do in that regard. It will look at the results

of the briefing at the next meeting to discuss further possible action. Gen. Condon raised a question regarding who would make the decision to shift responsibility—the Federal Aviation Administration (FAA), Congress, or some other authority? Gen. Lyles indicated that this is the heart of the issue with JPDO. The action may have to go back to Congress to establish some entity that will manage this broad systems-level effort. In response to a question from Sen. Schmitt, Gen. Lyles indicated that the Committee is still not sure what recommendation to present to the Administrator. Perhaps getting more information on the specific details from the Workshop will help the Committee in this respect. In the short term, this does not affect the ARMD. However, as the R&D activities mature, some of the technology will be ready for transition, and an appropriate body is needed for program management in that transition. In response to questions from Sen. Schmitt, Gen. Lyles indicated that more information on the Workshop could be obtained from the raconteur. The Workshop had a restrictive charter to look at the R&D Plans, and it did not get into the topic of competition. However, there were many references to the European program by the various groups, but the Workshop did not go into the subject in detail. There is concern that R&D in Europe is ahead of the U.S. Gen. Lyles took an action to find out more about the European endeavor and if it already has a program management entity. He added that one of the concerns is to consider whether a recommendation is necessary and how to word it.

Gen. Lyles continued with a discussion of the ARMD Thermal Protection System (TPS) technology development program. This has been examined over a series of meetings with the Directorate and some elements of the Air Force. The Committee looked at the various TPS taxonomy areas in NASA and in other partners. High Mass Mars Entry Systems, single use of a TPS (designed for a single mission with expendable materials) includes ablators (> 3000 °F), composite materials (< 3500 °F), and deployable TPS (< 1000 °F). This research is being done in conjunction with other mission directorates within NASA. Highly Reliable Reusable Launch Systems, multiple use of a TPS (designed for several missions without loss in performance) includes metals (< 2000 °F), ceramic composites (< 3000 °F), and general (< 2000 °F). Some of this research is being worked with the Air Force Research Laboratory. The Committee was satisfied that the various research areas are being addressed.

Dr. John Sullivan commented that in the single use areas (e.g., the Lunar Return mission), the Avco material would be used. For the Mars Science Laboratory (MSL), the new Apeka material will be used. The Mars human mission is still being examined and no systems have yet been selected. There is a program in place to look at new materials and approaches as well as programs in place across the entire spectrum to build up the foundational base so that the fundamental physics will be available to make a decision. Stardust used the Apeka system, but the spacecraft was fairly small and the system could be made in one piece. For MSL or the crew vehicle, the system cannot be made in one piece, and this is where the risk lies with Apeka.

Gen. Lyles noted that the Committee was given a chart that provided information about the taxonomy of all of the systems that are being examined. In response to a question from Dr. Thomas Jones, Gen. Lyles indicated that there is not a problem with a manufacturing source. Dr. Sullivan added that Boeing has “rediscovered” the formula for the “out-coat” used in the Apollo days, and test pieces have been made. Sen. Schmitt noted that new approaches will need to be developed for anything larger than about 4 metric tons. Most of the estimates for human spacecraft for Mars are around 40 metric tons.

One of the programs is looking at a graded phenolic to get the mass down. This is the largest NASA Research Announcement (NRA) in the Directorate. In response to a question from Col.

Collins regarding feedback from testing, Dr. Sullivan indicated that this is an issue. Some of the concepts say use a sounding rocket for Earth atmospheric testing. At some point, vehicles must be put together to perform this type of testing. Sen. Schmitt noted that one of the big issues is modeling the Martian atmosphere, which is highly variable by season. To design an entry system, one must know the conditions for any given entry. Gen. Lyles suggested getting a more detailed briefing to the Aeronautics Committee, along with the Space Operations and Exploration Committees.

There is a need to establish some sort of consortium to bring in good ideas from industry and other agencies. There is now a National TPS Working Group that is working toward establishing a national investment plan for TPS development

Third area of discussion was on candidate systems-level research projects. At the last meeting, there was a comment/observation that while the Aeronautics Program was conducting high quality research, it was insufficient in scope to achieve the leadership objectives in the President's Aeronautical R&D Policy. There was discussion about whether recommending more funds would be appropriate. The Committee looked at the hierarchy of the research being conducted in the ARMD—systems-level, multi-disciplinary, disciplinary, and foundational. There is a need for systems-level integration and test. However, this systems-level need cannot be done within the current ARMD structure. Gen. Lyles showed some of the foundational activities currently underway: individual blade control, Quiet Spike (a Gulfstream Aerospace/NASA collaboration), ultra-high bypass ratio turbofan, and blended wing body. Out of these foundational programs comes the need for a systems-level integration and test program.

Gen. Lyles noted that the Committee's observation statement as presented at the February meeting has not changed, but the recommendation has been modified to read as follows:

ARMD should plan and develop candidate systems-level research projects of highest priority that should be evaluated and considered by NASA for augmentation in the FY 2010 (and out years) budget request. These projects should be consistent with the objectives and themes of the National Aeronautical R&D Policy and Implementation Plan, leverage NASA's unique expertise and competences, and reflect the priorities of the National Research Council's Decadal Survey for Aeronautics.

Yesterday, the Committee saw the first blush of some of the candidate projects for systems-level integration. Dr. John Sullivan commented on how R&D programs should be structured. The diagrammatic "research triangle", with "mission" at the apex, lets researchers see where their activities fit into the whole. Sen. Schmitt added that there is a "winnowing" process from bottom to top of this triangle, but, if one considers the funding necessary to accomplish the research, we really have an upside down triangle. Funding levels required to do the mission (top) level are significantly higher, and this is what is missing. Gen. Lyles added a caveat—when looking at supporting the mission for Next-Gen, one must recognize that it is far broader than just air traffic control.

The Council approved the recommendation. Background material will be developed and the recommendation will move forward.

Audit and Finance Committee Report and Discussion

Mr. Robert Hanisee, Committee Chairman, gave the reported on the Audit and Finance Committee. Sen. Schmitt noted that this Committee has had a tremendous impact on NASA and the Administrator greatly appreciates its efforts. Mr. Hanisee commented that the Committee is

very complimentary of the Deputy Chief Financial Officer (CFO), Mr. Terry Bowie. The new CFO, Mr. Ron Spoechel, who has only been on-board about five months, is a tremendous addition. The Committee is noting the difference between a true CFO and a budgetary/accounting person. He is going after the big picture and bringing the agency into the modern world of financial management.

Mr. Hanisee reviewed the agenda and reported that all members of the Committee were present for its deliberations the previous day. There were many participants from the NASA Headquarters staff as well as from the SSC financial office. The Committee received an update from Mr. Bowie and a presentation from the SSC CFO, Mr. James Bevis, to see how they are fitting into the overall NASA financial program and implementing the recommendations of the auditors. At the last Council meeting, the Committee had just digested the year-end Ernst & Young audit report. Although the auditors were again not able to give an unqualified opinion, the report, more so than in the past, had a high degree of granularity and made specific recommendations.

The entire compliance framework, discussed previously, has now been implemented across all Centers. "Environmental Liabilities" has popped up again as an area for improvement. A plan is in process to record estimated environmental liabilities at the time an asset is acquired. In response to a question from Sen. Schmitt, Mr. Hanisee indicated that this requirement will feed into the contractors as well. With respect to government property on contractor property, Mr. Hanisee noted that he would check this and get back to the Council.

Another issue was unclosed grants. There is a big initiative to close out these items on a more timely basis.

The second item cited by the auditors was the difficulty in tracking Property, Plant, and Equipment (PP&E). The issue can be divided into two pieces: (1) all of the legacy assets, and (2) all of the new projects. NASA did implement a new asset management module that provides better asset accounting, including depreciation procedures. However, the revised asset tracking policy is not retroactive and does not address legacy assets. Mr. Hanisee reviewed the legacy asset issue. At the end of FY06, there were \$33.2B assets on the books. Included in this number were assets that had gone into space, called "theme assets." NASA pleaded a case for write-off treatment of these theme assets, and the Agency finally received approval to do this. Of the PP&E left (\$20.6 B), the vast majority is Shuttle and International Space Station (ISS) legacy assets. It was understood that NASA would never get an unqualified audit opinion until the legacy assets issue is resolved.

The Committee reviewed several paths to resolution: await "run-out" or the cross over point, which would be 2010 for Shuttle and, nominally, 2016 for ISS. The next alternative path would be to recreate balances using the manifests. The cost of doing this would be prohibitive, e.g., around \$10M, and is not acceptable to the Office of the Inspector General (OIG) or the Committee. The next path is to treat the ISS as an "R&D asset." NASA is approaching the relevant agencies to see if they would treat the entire ISS as R&D and write it off. OMB is somewhat sympathetic to this path. The fourth path is to work with the Federal Accounting Standards Advisory Board (FASAB) toward a goal of a "Fresh Start." NASA met with the FASAB and Ernst & Young on this subject, and the FASAB has developed a task force to study this approach. The FASAB would prefer an omnibus solution that would permit all agencies to write off legacy assets. Perhaps by next year, the Committee might see something positive on this issue. In response to a question from Gen. Lyles regarding the feasibility of getting a waiver, Mr. Ted McPherson noted that individual "pockets" of government agencies have gotten waivers

in the past. Dr. Paul Robinson commented that his Sandia Laboratory had gotten an unfavorable report on computer equipment, and the answer was to price it at “street value.” This was done and the Lab was able to carry the government historic costs as well as the current value costs on the books. Dr. Logsdon noted that the ISS is not yet finished. In itself, it is not R&D—it is an R&D laboratory and is intended to be used for a number of years, almost certainly beyond 2016. In response to his query about how Europe or Japan handles similar issues for their assets, Mr. Hanisee indicated that he did not know. Col. Collins posed additional related questions: What do private contractors do? What does the Department of Defense do? Does it have an external auditor? Mr. Hanisee noted that the DoD has not been amenable to external auditors, although Sen. Schmitt observed that it could be done. There are twenty-four federal agencies that do have external auditors, and that function is owed by the Office of Inspector General (OIG) in those agencies. Mr. Bowie has gotten the NASA OIG to agree to let the Office of the CFO to sit in on the selection of the auditors for the next round of audits, and this is a major step forward.

The Committee got a financial briefing from Mr. Bevis on the SSC. SSC has thirty different residents on site who are paying rent for the facilities. The Center received a \$163.4M supplemental from Congress for Katrina clean up, and the facility is now in great shape. The total on-site employee base is around 5000, with NASA civil servant base at 273 and contractor base at 818; however, the civil servant base is going to drop to 25%. SSC is going “live” on the new asset management module in May of this year. The Center was cited for a few things on the year-end audit, but has a corrective action plan in place and it is well underway.

Mr. McPherson discussed the NASA Phasing Plan process. The objective of this plan is to avoid “carry-over” of significant amounts of unobligated balances that are exposed to being taken away by Congress. At the end of 2007, NASA had accumulated \$2B of unobligated funds that had not yet been obligated within their remaining life. This situation implies (incorrectly) that the Agency doesn’t need the money. In addition, NASA had accumulated \$7B of obligated funds that had not yet been spent, or “costed,” by contractors. In response to a question from Dr. Lennard Fisk, Mr. Hanisee indicated that he did not know how much of this had been accumulated by universities. The solution is similar to the management of cash that would be performed by a treasurer in industry. The CFO is focusing on obligations for FY08 with the goal of reducing NASA’s unobligated carryover balance below \$1B. He has set and communicated targets to the Control Account Managers. Today, there is capability to use actual reporting by lines of business (Directorates), by programs, and by field Centers. The Committee has seen NASA executives start to use good, timely information. Mr. Hanisee showed an example of a mission-level graph that depicted this data.

Mr. Donald Fraser observed that mischief can come into play from changing the budget line. Mr. Hanisee explained that the system allows for a new “forecast” (not a change in the budget) on a quarterly basis.

Dr. Lennard Fisk commented that another significant way to attack the problem lies with the number of people available to process the paper that will accomplish the obligations. For example, last year in the Sciences Mission Directorate (SMD), there was only one person at NASA Headquarters to process around 1600 grants. This is a serious potential logjam. The Committee should ask the following question at the Directorate levels: Have the cutbacks in staff over the last decade or so produced a system that cannot respond to direction by the CFO to perform the needed tasks? There also is a bottleneck that occurs earlier in the system at NASA Headquarters because some management transaction must take place between review of the grant and the start of the processing. Mr. Hanisee agreed that this is probably the case. He noted that

grant accounting is shifting to the National Shared Services Center (NSSC); however, the changeover to the new accounting module has been delayed to the beginning of next fiscal year.

Gen. Lyles noted that several years ago, the number one DoD program that had unobligated expenditures was Titan IV. The number one root cause was what Dr. Fisk highlighted—only a few people available to process thousands of invoices. The number two cause was that some projects had thousands of line items that had to be addressed. To help address these problems, the Titan Program was restructured to significantly reduce the number of line items. NASA has to be sure that it looks at the root causes. Mr. Hanisee asked Dr. Fisk to discuss this subject with him further offline, and he would get response from the Office of the CFO. In response to a question, Mr. Hanisee clarified that all grants, but not all contracts, will be administered at the NSSC.

In summary, the Committee found that valuable anticipatory insight into the financial management of NASA projects, programs, and missions is now available at NASA as a result of all of the progress previously reported by the Committee. The Committee recommended that the NASA CFO be provided the opportunity to brief the full Council at its next meeting in July at the Glenn Research Center (GRC). Sen. Schmitt agreed that this would be put on the agenda. Mr. McPherson noted that in a few years, NASA should be well ahead of other civilian agencies in the area of financial management.

Mr. Michael Montelongo discussed the Comprehensive Compliance Strategy, which is a framework of management controls that ensures General Accepted Accounting Principles (GAAP) and regulatory compliance. The NSSC is on track to complete Accounts Payable and Accounts Receivable transition in 2008. Three Centers are in place, three more will be incorporated in May, and the remainder will be added in August. The new estimated savings has increased to \$12M-\$15M. However, these savings are contingent on building up to the requisite volume of transactions and that the Centers redeploy the “saved” labor assets. The NSSC is moving to substantially reduce costs per transaction. Mr. Hanisee added that one of the things the Council saw on Tuesday's tour was the application of technology to ensure accurate capture of data. The grants activity is now scheduled to transition in November 2008.

With respect to financial staff personnel, 94 are currently on-board against 103 authorized. In response to a question, Mr. Hanisee indicated that there is some movement of staff among Centers and between Headquarters and Centers. Mr. Spoehel is encouraging this. Mr. Montelongo noted some of the key initiatives that the CFO has put in place, for example, phasing plans and performance reporting.

In conclusion, the Committee finds that substantial and substantive progress continues in order to institutionalize transparent and integrated, cross-domain process, systems, and tools that have real prospect of improving NASA's financial profiles through more robust management and control. In response to a question from Mr. Fraser regarding the lack of audit personnel, Mr. Hanisee noted that there was a very serious problem three or four months ago, and the Committee was about ready to make a formal recommendation; however, the new CFO had just come on board and asked for some time to address this issue. The problem is now moving toward resolution, and the Committee is watching this very carefully. Mr. Hanisee stated that there is an overall shortage of skilled accounting people in the country, and the DC area is particularly critical. Here in Mississippi, they are fully staffed. Sen. Schmitt observed that from Dr. Fisk's remarks, it appears that the understaffing of related positions, such as in grant and invoice processing, still exists within the Agency.

Exploration Committee Report and Discussion

Gen. James Abrahamson, Committee Chairman, introduced the Exploration Committee's Report and Capt. Rick Hauck reviewed the agenda of items that would be discussed with the Council: Human System Standards, the Thrust Oscillation Focus Team (TOFT) Progress Report, and the Small Pressurized Rover (SPR).

Dr. David Longnecker discussed the briefing, received from Dr. Jeff Davis, Director of Space Life Sciences at Johnson Space Center (JSC), on standards for crew habitability and environmental health. Since 1987, NASA-STD-3000 has been the NASA human engineering standard. This standard is now being updated and is going through final evaluation and approval. Standards were established to drive vehicle design and operational requirements. Dr. Longnecker described the approach that NASA is using is to develop Space Flight Human System Standards at the Agency level. It consists of creating two volumes related to standards: (1) a Crew Health volume and (2) a Habitability and Environmental Health volume. The first volume has been in place for a year or so and the standards are well embedded. Dr. Longnecker focused his report on the second volume. A key portion of it is the Human Integration Design Handbook, a repository of NASA's knowledge base and lessons learned. The timeline for completing this volume is by October 2008. Dr. Longnecker gave an example of how the standards flow from Volume to Handbook to program requirements for vehicle design and performance. Sen. Schmitt added that the present effort is for the establishment of quantitative standards, but do not specify how the standard should be met from an engineering standpoint. He inquired whether there is a process in place in the system to modify the standard if there is a significant cost impact to meeting it. Capt. Hauck indicated that Dr. Davis had assured the Committee that there is a process and the astronaut constituency would be part of that process.

The Committee had several conclusions and observations. The Standards to Requirements approach is necessary and appropriate to assure proper consideration of Human Factors in the design process for new exploration-class vehicles. The development of the Human Integration Design Handbook includes input from a wide variety of stakeholders (including the Astronaut Office) and external subject experts, including such organizations with significant data-bases as NASCAR (with respect to protection from high-impact, high-g incidents, etc.). The process is appropriate for achieving the desired results. Dr. Paul Robinson added that the key to the NASCAR result is the mitigation technology; there is no substitute for data with those kinds of g-forces. Restraints, as well as a wide variety of airbags, have saved lives. In response to a question from Dr. Owen Garriott, Dr. Longnecker indicated that the angle of Earth-return landing for Orion was mentioned and discussed.

Mr. McPherson noted that there had been some concern about partners and building interfaces. The Committee understood that while it is clearly a NASA-led effort, the organization has good plans and is prepared to move out in ways to socialize these standards with other international and commercial partners. Capt. Hauck added that one example of that is the "guest traveler" under the Soyuz project. This may be a good stepping-stone to facilitating commercial entities. Dr. Longnecker noted that one of the challenges on international standards is Volume 1 (Crew Health). The U.S. policies differ from those in Russia, e.g., thyroid function in term of fitness for flying. There is a lot of work underway to try to come to common standards.

Dr. Longnecker discussed where the Biomedical Committee should be going downstream. Two areas need forward work. The first area is a follow up briefing from NASA's Advanced Capabilities Division regarding the linkages with the developing the Lunar Sciences Institute (LSI) at Ames Research Center. The Committee will be working with NASA to see where the Agency has moved on this topic. Sen. Schmitt observed that there will be a conference at the LSI

in July. Dr. Bradley Jolliff added that at this conference, there will be an opportunity for life sciences to present papers. He also indicated that the NRA for additional nodes for the LSI should be out in May, and life sciences is one of the themes. Dr. Longnecker noted that this is a good example of how the Council can be very helpful to the process.

The second area is a follow up briefing from the NASA Human Research Program and other subject experts regarding hazards, risks, and exposure limits for lunar habitation. One particular area is extended extravehicular activity (EVA) and radiation exposure. Dr. Jones was asked to briefly discuss his participation in a meeting related to this subject. He noted that the Space Operations Committee is very interested in the operational scenarios planned for the Moon (e.g., living in a habitat for 6 months, performing geological field work with extended traverses on rovers, etc). However, the Committee has more questions than answers. He raised the following questions: what we don't know is if the current state of knowledge in radiation exposure for crew members will permit these kinds of scenarios in becoming a reality? Through the cosmic ray exposure and solar proton events one is exposed to, is there a limit on how much surface activity one can actually conduct on the moon? The Space Operations Committee would like to get briefings from both the NASA experts and the experts outside of NASA on what is the current state of knowledge on what the space radiation environment means to lunar operations and deep space operations (e.g., possibly to the earth asteroids and then eventually to Mars). Capt. Rick Hauck made reference to a recent study by the National Research Council (NRC); he felt would be worthwhile reading on this subject and would forward a link to those interested. The study is titled "Managing Space Radiation Risk in the New Era of Space Exploration".

Dr. Kulcinski then asked several questions of Dr. Jones: is it the issue that we don't know the radiation environment? Or is it we don't know the shielding capability we are going to have? Or is it just that we don't know the limits at which we want to expose the crew? Dr. Jones replied that it is safe to say he does not know the answers to those questions. Dr. Jack Burns added that there was another study led by Dr. Dan Baker, at the University of Colorado, which was also an NRC report, similarly looking at the cosmic ray environment; and is different than the report mentioned by Capt. Hauck, but equally as relevant and worthwhile reading. Dr. Jones summarized that the Council now has some preliminary reading and hopefully by the next meeting a briefing can be scheduled on this topic for further discussion. Dr. Mark Robinson made one last comment, that there is an instrument being flown on LRO called "Crater", which is specifically designed to investigate the lunar radiation environment in terms of human presence on the Moon. He noted he would be glad to forward information on this to those interested.

Dr. Fisk raised the following questions: What is the state of our knowledge in being able to predict solar flares in sufficient advance warning to seek a higher level of shielding? What are the consequences for people? This is a field of research that is very active in the Science Mission Directorate (SMD). Dr. Garriott added that equally important is the mitigation potential from pharmacology. Hopefully, the briefing will include both components (engineering and pharmacological). Mr. Doug Cooke of ESMD indicated that someone from the research program could give a report on the effects of radiation, which is an on-going effort. Sen. Schmitt agreed that this should be part of the briefing. Dr. Longnecker noted that another thing that needs some consideration is the exposure limits, which some people think are too conservative. The question is: Are they appropriate for exploration?

Dr. Paul Robinson indicated that the Space Operations Committee is keyed onto the fundamental limits to missions that can be attempted. For solar flares, it is not only mitigation, but how the spacecraft is built. Sen. Schmitt noted that radiation probes inserted into the lunar regolith during lunar missions have been analyzed by the geoscience community. One was deployed on Apollo

17. Dr. Longnecker observed that the breadth of topics suggested by the Council discussion indicates that the Committee may want to go beyond a briefing at a Council meeting—perhaps a one-day conference would be more appropriate. Another approach would be to take it in “pieces.” Sen. Schmitt commented that what we really need is the data that defines the hazard, both particle and x-ray, and then determine the risks from that hazard and possible mitigation or elimination of those risks. Dr. Garriott reiterated that some time should also be spent looking at pharmacological mitigating factors, and Sen. Schmitt acknowledged that there have been new “alleged” pharmacological solutions to radiation exposure. Dr. Longnecker stated that part of the focus is to have these biological limits keyed up as the operational processes and technologies are developed.

Dr. Donald Fraser discussed the thrust oscillation issue. He noted that this is a work in progress. The oscillation is vertical, created by various phenomena in the solid rocket motor. Various studies are underway to understand the root cause or origin of the oscillations. It can affect anything in the launch vehicle stack and is a potentially serious issue. Dr. Fraser showed the organization of the Thrust Oscillation Focus Team (TOFT) approach. Participants are both internal and external to NASA. The Team is roughly on schedule, and by summer there should be some resolution of these issues. Six potential solutions have been identified, and they fall into two categories: (1) modifications to the motor, and (2) isolating the stack from the motor oscillation. Most possible solutions are in the latter category.

The Committee finds that there is a high likelihood that one or more of the identified solutions will work. The Team has addressed this issue in a very professional manner and is utilizing the full depth of NASA’s capabilities across the board, including advanced Computational Fluid Dynamics (CFD) tools and the Ames supercomputing center to model the dynamics inside the motor. In addition to enhancing the understanding of this issue, there has been an overall advance in large solid rocket motor design tools. Instrumentation that will measure the oscillation and obtain additional data will be on the Shuttle launch in October. Gen. Abrahamson emphasized that the design teams and the programs underway need to look forward to acceptable and mostly non-intrusive types of solutions. Nearly every solid rocket motor has had some kind of oscillation issue, and we should have some really effective design tools for the future. In response to a question from Col. Collins, Mr. Cooke clarified that the “pogo” problem is an oscillation phenomenon in liquid rockets; the thrust oscillation issue is a problem in the solid rocket. Dr. Sullivan noted that the Committee saw the test setup at the Marshall Space Flight Center (MSFC), and was curious about the status of that. Mr. Cooke indicated that he would find out the status and get back with Dr. Sullivan.

Before the next briefing was presented on the Small Pressurized Rover (SPR) concept, Dr. Kenneth Ford recused himself from this topic as a precautionary measure. Dr. Abrahamson reviewed the concept that was briefed to the Committee by Mr. Mike Gerhardt. The concept is multi-wheeled, with wheels able to rotate in all directions. The intent of these small rovers is to be able to provide a habitat that can be a safe haven with life support of at least 72 hours, a place to live, a way to extend the exploration range, and a means to limit dust and other problems for people living on the surface. Dr. Abrahamson showed a chart that depicted the design features. One of the key features is the suits—they are carried outside, and the structure inside is such that the astronaut potentially can get into the suit easily and quickly with minimal air loss. The rover is a simple chassis with SUV-size living accommodation on top—a VW bus-type of concept. The SPR is not much bigger than the unpressurized Apollo rover except for the height of the pressurized volume. Water in an enclosing envelope provides radiation protection. There is a very small dome window on the top as well as a large window on the front. It is sized for crew of two, although it can accommodate four in an emergency situation. Dr. Abrahamson showed

some of the interior concepts for exercise, privacy, and sleeping. The chassis exists as a functional proto-type, and some tests are currently being performed. By October, there will be a more extensive test regimen, including a several day sortie, simulation of a solar particle event, simulation of a suit malfunction, and evaluation of incapacitated crewmember recovery. Sen. Schmitt emphasized the importance of testing on some real geological problems. He indicated that initially, he was a skeptic of this concept for a number of programmatic as well as operational reasons. However, one of the things learned from Mr. Gerhardt's briefing is that the SPR on early missions could be operated as an unpressurized rover by using just the chassis with the pressurized module added subsequently when longer exploration traverses are desired. The program is moving forward very well. Initial, rough cost estimates are about \$23M per copy.

Dr. Edward David noted that the Science Committee was briefed on the SPR as well. One thing that was impressive was that Mr. Gerhardt has had an extended industrial career in deep sea (oil rig) diving, and there is relevance with respect to man/rover teams and how they can be integrated as well as to seal design.

Dr. Abrahamson presented the Committee's recommendation on this topic, including a background statement and rationale:

Background: The presentation of the Small Pressurized Rover (SPR) by astronaut and project manager Michael Gerhardt was very impressive in terms of the innovative thinking that has been associated with the development of the SPR concept. The Committee recognizes that the SPR concept is one of the options being examined to provide surface mobility in the initial stages of lunar exploration. Whatever option is pursued, it will be a central and very visible feature of the earliest lunar missions. It is the Committee's judgment that this capability should be provided by the U.S.

Recommendation: NASA should amend its list of U.S.-provided lunar architecture elements to include initial surface mobility, since such surface mobility is an extension of the transportation elements that the U.S. has already indicated its intent to provide. This is consistent with the extant policy of providing U.S. Space Transportation for Exploration of the Moon.

Rationale: The U.S. has communicated to potential international partners that it will develop the transportation system to bring crew and cargo to the surface of the Moon. It would seem incomplete to transport crews to the lunar surface without also providing the mobility necessary to identify suitable locations for outpost build-up and otherwise conduct initial exploratory activities. Without this initial mobility element, the space transportation capabilities are truncated. In addition, the surface mobility systems will be a focus of intense public attention and global visibility. It is in the U.S. interest that they be clearly identified as U.S.-provided elements of the lunar architecture to be delivered on a schedule that is compatible with the first U.S. missions. This ensures that fully successful round-trip missions can be successfully accomplished but does not necessarily imply that the U.S. would object to parallel development by international partners of complementary capabilities.

Sen. Schmitt indicated that the Council may want to reference this to some of the recommendations from the Tempe Conference, i.e., that mobility should be a primary element of the architecture. He acknowledged that this recommendation would not preclude a U.S. commercial partner from providing the capability. Gen. Abrahamson emphasized that the SPR will be the focus of intense public attention when we get back to the Moon.

On a related matter, Sen. Schmitt noted that the Committee will be briefed prior to or at the next Council meeting on the process that led to a Request for Proposal (RFP) for the new suit of which the Council was unaware. The Committee needs to integrate that information with the SPR concept and assure consistency. In response to a question from Gen. Lyles, Gen. Abrahamson noted that there will be budgetary impacts (\$300M over several years), and the trade-offs need to be carefully examined. Through inclusion of partners, there may be a way to minimize the impact.

The Council agreed to take the proposed recommendation forward.

Human Capital Committee Report and Discussion

Dr. Gerald Kulcinski, Committee Chairman, reported on the Human Capital Committee meeting. Current issues for the Committee include: workforce transitions; the Office of Education (OE), the Office of Strategic Communications (OSC), Small Business, and the Office of Diversity. At this meeting, the Committee primarily focused on the Office of Strategic Communications, workforce transitions, and the Office of Education.

The Committee received fact-finding presentations on NASA Strategic Communications, an update on Shuttle Human Capital, a “Next Generation” presentation from young NASA engineers, and a briefing on NASA’s Elementary and Secondary Education Program Review and Critique. Topics from the OSC included an update on the 50th anniversary events, current NASA strategic initiatives, and the NASA Presentation Tool. After review of the current plans for the 50th anniversary, the Committee was pleased to report that there are many cross-country, high-profile events for particular audiences. The only mild concern was that there should be more avenues for participation by the general public. Dr. Kulcinski reviewed some of the high-profile events. NASA will have a big role in the Folklife Festival on the DC Mall this summer, which gets a million plus visitors every year. There will be a 50th anniversary celebration gala at the National Air and Space Museum, Steven F. Udvar-Hazy Center on September 24, 2008. Sen. Schmitt indicated that Council members would be receiving invitations to this event and strongly encouraged them to attend. Discovery Communications has put together a 6-part documentary series, “When We Left the Earth,” which starts in June.

Some of the current NASA strategic initiatives include an upgrade to the website, www.nasa.gov, several National Air and Space Museum exhibits, making NASA Educational TV available to every school in the country through Web access, and a conference at the Aspen Institute in June to explore the “Space Economy.” Dr. Kulcinski noted that selected media (PowerPoint presentations, small videos, imagery, etc.) will be available on the NASA Website in the May timeframe. In response to a question, he noted that this will also be an information resource for NASA employees. Educational videos will be available on “You Tube.” At the last meeting, NASA TV evoked a lot of discussion. Currently, NASA TV costs about \$14M per year, most of it outsourced. Because of the retirement of the Shuttle (one of the initiating events for NASA TV) and the emergence of internet-based delivery, the rationale to continue NASA TV needs to be reexamined.

The Committee presented a recommendation on this topic:

An outside organization should be contracted to do an evaluation of the current effectiveness and viewer-ship of NASA TV and to recommend a clear rationale and set of themes for its continuance.

Partly the reason for the recommendation is the budget for the OSC. The overall budget for this Office is insufficient to carry out its goals and it looks as though future budget cuts are in store for the next five years. Mr. Montelongo inquired about the percentage of the budgets of other agencies that go to public affairs. Dr. Kulcinski indicated that OMB claims that the budget for NASA's public relations is among one of the largest. Sen. Schmitt noted that starting this year, there will be significant testing in the Constellation Program, and this would be an opportunity for public outreach events.

Dr. Kulcinski stated that the Committee felt that there should be a much closer relationship between the OE and the OSC to achieve their joint goals of outreach and Science, Technology, Engineering, and Mathematics (STEM) pipeline support. The Committee is concerned about the OE not being seamlessly incorporated into the OSC. The integration of OE into the OSC framework requires further refinement. The OSC should work with the OE to better align the OE portfolio of programs with NASA's mission.

Dr. Kulcinski reviewed the chart on the average age of the NASA civilian workforce. The Committee has been told that contractors have the same profile. Some of the younger NASA analysts and engineers were present to give their perspectives on the workforce issue. Available data shows that NASA (and the aerospace industry) is "old" by comparison with other "hi-tech" industries. Gen. Lyles noted that the last time he looked at DoD, it was comparable to NASA. NASA is hiring older employees to get projects off and running, a tactical decision rather than a strategic plan. The average age of a full time permanent hire is almost 40. NASA's current average age is close to 50. In NASA, there is a lower percentage of employees younger than 35 than in all other U.S. science and technology industries (excluding aerospace). Continuing the trend of hiring midlevel scientists and engineers (S&E) could result in a critical dearth of qualified S&E employees in 10 to 15 years. The current accounting system is contributing to this problem by not differentiating costs between grade levels. Dr. James Milgram added that this is only one of a number of factors.

Dr. Kulcinski presented the Committee's preliminary observation on this topic: To ensure an adequate amount of innovation and vitality so that NASA can remain globally competitive, the hiring of entry level S&E needs to be emphasized.

Dr. Garriott added that NASA gets younger people primarily through co-op hires. Gen. Lyles related some of his anecdotal experience. He has attended several career fairs, attended by a variety of technical and engineering industries and agencies. One of the least impressive booths for attracting people has been the NASA booth. Mr. Montelongo added that it is difficult for young individuals to navigate the current Office of Personnel Management (OPM) rules and processes for an agency like NASA. About the only entry pipeline to NASA is through the co-op and Presidential Management Intern (PMI) programs. Dr. Ford noted that in addition to the age problem, there is the related issue of how good are the people that NASA is hiring. Under the co-op program, the hires are usually local to the hiring Center. The issue of having very good people is what is at stake. There has to be something to "light the fire" so that good people will want to come to work at NASA. Dr. Kulcinski noted that the Committee is trying to steer the OE more into hiring "best and brightest." Dr. Paul Robinson indicated that Sandia tries to recruit the best for its staff positions. Deans from some of the engineering schools are invited to Sandia. They then become "recruiters" for the Lab. Some of Sandia's strategies could be useful to NASA. Dr. Sullivan noted that the identical thing happens with contractors. It appears that in NASA, there is a structural issue that results in hiring who is convenient, rather than trying to hire the best. NASA should reach out to good engineering schools, not just ones locally near the field Center. Gen. Pat Condon opined that people who are involved in recruiting need to think about how to

take what NASA is doing and make that exciting to the younger generation. The Committee will follow-up on this discussion at its next meeting.

Dr. Kulcinski noted that there is some public concern about the workforce transition, citing a recent *SPACE News* headline. The focus appears to be on Florida and Louisiana. Some of the transition number, e.g. the workforce for Constellation, was not included in the data set that was given to the Committee, so the situation is not as bad as the Committee originally thought. The total resources available for Shuttle/Constellation are roughly constant at \$6B. The Committee needs to continue to work this issue.

An employee survey was sent to over 200 civil service employees at Kennedy Space Center (KSC), JSC, MSFC, and SSC. One of the results was the respondents' intent and influences to stay with the program. In most places, two-thirds to three-quarters of the personnel indicated that they intend to stay with the program.

The National Research Council (NRC) report on NASA's Elementary and Secondary Education Program Review and Critique was carefully thought out. There were 22 recommendations or observations. One concern was that insufficient metrics were used to judge the effectiveness of the OE programs. The OE is taking this very seriously and is working hard to develop metrics to address the effectiveness of programs. Another concern was for the overall organization of the OE portfolio. One consequence of this report was that OE delayed solicitation of new Explorer Schools until they can secure better ways to evaluate the effectiveness of these schools and until budgetary conditions improve.

In response to a question about salaries, Ms. Debbie Denton-Misfeldt (Executive Secretary of the Human Capital Committee) indicated that civil servant salary is about \$50,000 to \$60,000 for a fresh-out Bachelor's. This is comparable to what the private sector is paying. Sen. Schmitt indicated that in his interactions with the educational system, he has not seen any diminution in interest. Most of the problem seems to be internal to NASA, i.e., how to reach these people. Dr. Kulcinski agreed that the problem appears to be more structural than he originally thought. Dr. David added that NASA staff must go to the universities and talk to both the professors and the students. Dr. Kulcinski agreed that this approach works, as evidenced by Sandia's success in recruiting the higher quality people. Mr. McPherson noted that all of the 24 agencies are required to have a Chief Human Capital Officer. The Council needs to hear from this executive on what actions are underway. Dr. Ioannis Miaoulis noted that NASA has missed some major opportunities—the message that NASA puts out should be consistent with who does the work. There is a general public perception that NASA is mostly scientists, rather than engineers. Dr. Jolliff challenged this observation with respect to the Mars rovers. He noted that the message is out there (about who does what) and it is a good one. Gen. Abrahamson commented that “best and brightest” may be someone who knows a lot about testing rocket engines. We should not be totally critical of NASA's recruitment approach for that kind of job. He agreed that there is a balance that needs to be struck.

Science Committee Report and Discussion

Dr. Edward David, the Committee Chairman, reported on the Science Committee meeting. Overall, the Committee was delighted with what it heard. A lot of progress has been made in carrying programs forward as well as getting programs started. There have been budget increases in 2008 and 2009 for Research and Analysis (R&A) programs in Astrobiology and in Lunar Science. R&A budgets have been strong across the board in the other sciences. The James Webb Science Telescope (JWST) passed its Preliminary Design Review (PDR) with no major issues identified. The Mars Phoenix Scout mission is en route to Mars and scheduled to land on May

25. MESSENGER is on its way to a second encounter with Mercury on October 6. In terms of program changes, there have been some significant actions. In Earth Science, \$600M is available over the next five years for new Decadal missions. The Joint Dark Energy Mission (JDEM) will launch in 2014 and the Heliophysics Solar Probe Plus will launch in 2015. Planetary's Outer Planets Flagship will launch in 2016 or 2017 and the Lunar science orbiter and LADEE will launch in 2010 or 2011. These changes represent good use of efficiencies, out-year mission operations savings, and re-phrasings for several missions. Sen. Schmitt indicated that he has heard that LADEE has insufficient funding. Dr. Jolliff agreed that there is some concern that those wedges may be insufficient. The Committee will need to look hard at the resources allocated for those missions. The cost analysis is at a very preliminary phase and the Committee expects to hear more at the next meeting.

At this meeting, the Committee primarily focused on NASA's Planetary Science portfolio. Briefings were made by Dr. James Green (Planetary Science Division Director), Dr. Doug McCuistion (Mars Exploration Program Director), and Dr. Chuck Gay (the new Deputy Associate Administrator of SMD). They were very informative. Other briefings (with the Space Operations and Exploration Committees) included a strategic review of expendable launch vehicle options by Mr. Bill Wroebel, and Lunar Rover trades and status by Mr. Mike Gerhardt. The Planetary Science portfolio is well balanced along some key dimensions. There is a good mix of small, medium, and large missions as well as a good mix of strategic and competed, Principal Investigator (PI)-led missions. Mars is the focus of a sustained campaign of scientific exploration. There is a continued need to ensure that Mars is integrated intellectually with the rest of the Planetary Science Program. The next NRC decadal survey will help. Mars Sample Return (MSR) remains a goal of the Mars program. It promises the largest leap in understanding after MSL. Dr. Jolliff added that the cost issues are being worked very hard by the Program. There are a number of options that allow components over several missions, obtaining good science along the way. The Mars mission must have international participation. With respect to cost, the Committee is hearing something along the lines of \$3.5B for the U.S. element. Dr. Jolliff noted that the Mars budget took a significant reduction in the FY09 request vis-à-vis the FY08 request as on-going mission development costs pass their peak funding. This remains a concern to the community. Dr. Mark Robinson added that over the next year, the Program will look at getting realistic costs over four scenarios. The Program seems to be heading toward three missions, spread over several years, rather than one flagship mission.

The Lunar Science "Full Moon" Program complements the Lunar Exploration Architecture. SMD has initiated plans to implement a NASA Lunar Science Institute (administered through the Ames Research Center), with distributed nodes to be established through a competitive proposal process. Themes include exploration as well as science. Sen. Schmitt noted that he is working with Dr. Clive Neal to get a result on the integration of the Lunar Architecture and the Tempe Recommendations sometime this year, rather than waiting until next year. The Program that is laid out lasts until FY15. This is a sign of vigor, which is heartening. There is a Planetary portfolio challenge: both Outer Planets Flagship and MSR as new programs. The out-year profile makes it highly unlikely that both can be done at the same time. NASA needs to work this over the next few budget cycles. Both missions require and will benefit greatly from international collaboration.

Dr. David reviewed the characteristics of the Outer Planets Flagship Mission. It consists of focused sub-missions, not like Cassini or Galileo. The Europa Jupiter System Mission will consist of a NASA Europa Orbiter, an ESA Jupiter Planetary Orbiter, and a JAXA Magnetospheric Orbiter. The Titan Saturn System Mission will consist of a NASA Titan Orbiter and ESA *in situ* vehicles (lander and balloon). The NASA cost cap is \$2.1B. Dr. Jolliff added

that all of these missions are interesting, but only one will be selected. Work on the Mars Exploration Architecture is focused on optimizing the mix and timing of missions to meet the highest priorities of the scientific community. The planetary science community supports MSR as a goal, and supports plans to enable the launch of a MSR mission or missions in the 2018-2020 timeframe as long as it can be done capably and cost effectively. Ongoing planning, including budgetary and cost considerations, of the Mars Exploration Architecture for MSR is proceeding well. As noted earlier, because of cost and scope, international partnerships are necessary for MSR. Dr. Jolliff reported that the Mars Architecture Tiger Team met briefly in February. The Mars Exploration Program Analysis Group (MEPAG) also met in February. Both are looking at how to do the mission, when it needs to be done, etc. The Tiger Team concluded, however, that the FY09 budget does not have a sufficient wedge. There are focused efforts to make and incorporate realistic estimates of costs and risks into architecture planning.

Dr. Fisk noted that there has always been an on-going mission problem in general. About five years ago, the SMD put the Senior Review process into place. All on-going missions are reviewed and resources are distributed. Continuation of missions is done under peer review. This process has been working well.

Dr. David reviewed an example of a three-launch scenario for MSR. It involves several different types of rovers and vehicles as well as what to do with the sample when it is returned. Dr. Jolliff added that in the three-mission scenario, an international partner could provide a launch and an orbiter.

Cost growth in the MSL remains a concern within the Mars Exploration Program and the Planetary Science Division. The Mars Program recently investigated the consequences of a launch slip from 2009 to 2011 if required by schedule pressures. The additional cost of slipping the launch could be as high as \$350M. Given the cost of a delayed launch, it would be more efficient to solve MSL's cost growth problems in 2008 and 2009 so that the mission can remain on schedule for a 2009 launch. MSL is not only a key mission for the Mars Program, but also has priority at the Agency level. Most of the additional cost of a launch slip is the "marching army" for an additional year.

The Committee presented its recommendation on the launch of the Mars Science Laboratory in 2009:

NASA should continue to make every effort toward MSL mission success with a launch in 2009. NASA should continue to recognize MSL as an Agency-wide priority, and the Agency should assist the program in finding the resources necessary for mission success. *(Note: after re-evaluation of this recommendation by the Science Committee and the NAC Chair, it was decided this recommendation would be submitted to the Agency as an observation)*

Dr. Jolliff indicated that based upon recent comments, the Administrator is also thinking along these lines. Dr. Fisk observed that there is a cost associated with making the 2009 launch—this is simply the technical challenge to get the mission done by 2009. The point is to use the power of the Agency to accept the fact of carryover funds and other means to help SMD find the most cost-effective way to get the money. The reputation of the entire Agency is at stake and it should be considered in that sense.

The Council accepted the recommendation.

Dr. David noted another issue—long-lived power sources. For many planetary missions concepts, solar/battery power is insufficient for long-term power supply or sustainability through operation at extremely low temperatures and at night. Development of the Advanced Stirling Radioisotope Generator (ASRG) greatly increases the efficiency of usage of radioisotope fuel and is a positive step, but an adequate supply of Pu(238) is also important. Dr. David described the ASRG. It is small, it has already been developed, and it works. Dr. Burns agreed that the ASRG is worth consideration. However, the Committee did not want to limit the option solely to the ASRG. Briefly, the Committee recommendation is:

Take steps to develop or ensure the availability of long-lived power supplies for landed networks and other planetary missions.

Future work of the Committee will include a review of NASA's responses to selected Council recommendations arising from the Tempe Workshop. Education/Public Outreach (E/PO) will be on the Science Committee agenda for July and the Committee will invite the Human Capital Committee's participation.

The Council accepted the proposed recommendation. It will be worked and moved forward.

Space Operations Committee Report and Discussion

Dr. Paul Robinson, the Committee Chairman, reported on the Space Operations Committee. Some of the recommendations from the February meeting have already been completed. There is a process at JSC to capture the lessons learned from various accidents and make sure the staff understands what has happened in the past. The Committee received a briefing on the pressurized rover and EVA/suit sealing systems. It was very pleased with the progress, and will continue to monitor these activities. Unfortunately, there was no opportunity to visit the Michoud facility this month. Workforce transition is still a key issue.

The Committee was briefed on the Commercial Orbital Transportation System (COTS), and will continue to monitor it. The Committee will also continue to monitor the utilization of the ISS as a National Laboratory, along with the Exploration Committee and the Biomedical Subcommittee. Along with the Science Committee, the Space Operations Committee was briefed on the long-term availability of medium launch capabilities. The lunar outpost architecture has taken a big step forward. The Committee will be focusing on radiation exposure limits for long-duration surface stays.

With respect to U.S. commercial expendable launch vehicles (ELVs), there are options in all vehicle classes—small, medium, and heavy. The Delta II is shutting down, with re-start costs currently estimated at about \$100M and growing. There is now an overcapacity of small and large (EELV)-class launch services. Piggy-backing is an option with larger launch vehicles, but opportunities for co-manifesting may be limited and may introduce added risk. Sen. Schmitt noted that the business case for anyone providing commercial launch vehicles also includes the DOD and intelligence agencies. Dr. Robinson countered that the launch vehicle suppliers had planned on a large number of commercial customers, and that has vanished, although current demand is significant. The Administrator has requested a cohesive strategy on the launch question by the end of the summer. The Committee will review that strategy and brief the Council at future meetings.

With respect to COTS, SpaceX has completed consolidating design and production under one roof. The Space Act Agreement has been modified to reflect SpaceX's new testing and production schedule. SpaceX still plans the Demo 3 flight to ISS to take place prior to Shuttle

retirement. Adm. Benjamin Montoya visited SpaceX, and found a different approach that holds promise for future successes in the program. Orbital Science Corp. (OSC) was recently selected as a second participant in COTS Phase I. In October, the Council recommended that NASA maintain at least two COTS participants through Phase I Demonstration for ISS cargo delivery. Dr. Robinson briefly reviewed OSC's approach, called "Taurus II." The cargo demonstration (the focus of the contract) is planned for completion by March 2010. This is an exciting, competitive program with these two U.S. suppliers. COTS may be a player in medium launch, but is yet an unproven capability for science missions. There are a number of options in the medium launch category, but the primary motivation with COTS is to provide a transportation system to ISS in the time gap between Shuttle and Constellation and use the commercial sector and competition to help lower costs. COTS's biggest benefit in the short term is in delivering pressurized and unpressurized cargo to ISS. There is still uncertainty whether COTS can achieve its goals. Nevertheless, COTS cargo delivery is critical for maintaining ISS beyond 2010. Members of the Space Operations Committee will attend upcoming major design reviews. The Committee is cautiously optimistic about the COTS solution.

Dr. Robinson discussed the issue associated with the Iran, North Korea, Syria Non-Proliferation Act (INKSNA). NASA has an exemption to the INKSNA to purchase Russian crew (Soyuz seats) and cargo (Progress upmass) through December 31, 2011. NASA is not pursuing an extension to the INKSNA exemption to buy Russian cargo services after 2011 for ISS, only crew transportation and rescue services. The exemption language has been submitted to Congress.

The Space Operations Committee has participated with the Exploration Committee in the Pressurized Lunar Rover and Lunar EVA capabilities. There has been a great deal of innovative thinking. The Rover is potentially an enabler of early and extensive lunar operations. More reviews are necessary, but it is a potential game-changer. The Space Operations Committee concurs with the Exploration Committee that it is important that the U.S. maintain this kind of capability. The Space Operations Committee would like to continue its participation on this subject with the Exploration Committee.

Dr. Robinson highlighted a number of topics for forward work. He noted that a number of the issues on the list require results in the intermediate programs before the Committee can decide where to place emphasis in the future. The ISS is already a great testbed for questions on solar particle showers, but much more information and evaluation is required. This data could be very important in considering Rover shielding and environment.

The Space Operations Committee had no recommendations for the Council at this meeting.

In response to a question from Dr. Mark Robinson, Dr. Jones indicated that SpaceX will use a common berthing mechanism and will dock at one of the standard ISS docking ports. OSC plans to rely on a different interface—an unpressurized cargo carrier, snatched by the robotic arm. In response to a question from Dr. Burns, Dr. Robinson indicated that he did not have a feel for exactly how the ISS could be used as a testbed for cosmic radiation shielding. In response to a question from Sen. Schmitt, Dr. Longnecker stated that he is not presently aware of any program applications that would use the National Institutes of Health (NIH)/NASA Memorandum of Understanding (MOU). This subject will be put this on the "future work" list.

Sen. Schmitt adjourned the meeting at 3:30 p.m. The next meeting will be at the Glenn Research Center (GRC) in Cleveland, Ohio, on July 8-10, 2008.

**NASA Advisory Council Meeting
Le Pavillon Hotel
833 Poydras Street
Bienville Room
New Orleans, LA 70112
(800) 535-9095**

8:30 a.m. – 8:45 a.m.	Opening Remarks	Hon. Harrison Schmitt
8:45 a.m. – 9:45 a.m.	Aeronautics Committee	Gen. Lester Lyles
9:45 a.m. – 10:00 a.m.	<i>Break</i>	
10:00 a.m. – 11:00 a.m.	Audit and Finance	Mr. Robert Hanisee
11:00 a.m. – 12:00 p.m.	Exploration Committee	Gen. James Abrahamson
12:00 p.m. – 1:00 p.m.	<i>Lunch (Council Only)</i> With Stennis Center Director & Senior Staff (Gravier Room)	Mr. Robert D. Cabana
1:00 p.m. – 2:00 p.m.	Human Capital Committee	Dr. Gerald Kulcinski
2:00 p.m. – 3:00 p.m.	Science Committee	Dr. Edward David
3:00 p.m. – 3:15 p.m.	<i>Break</i>	
3:15 p.m. – 4:15 p.m.	Space Operations Committee	Dr. Pat Condon
4:15 p.m.	Adjourn	

**NASA Advisory Council Members
April 17, 2008**

Chair	<ul style="list-style-type: none"> • Hon. Harrison H. Schmitt, Apollo 17 Astronaut and Scientist
Aeronautics Committee	<ul style="list-style-type: none"> • <i>Chair:</i> General Lester L. Lyles, USAF (Ret.), Consultant, The Lyles Group • Dr. Ilan Kroo, Professor, Professor of Aeronautics and Astronautics, Stanford University • Dr. John Sullivan, Professor of Aeronautics and Astronautics Director of the Center for Advanced Manufacturing, Purdue University
Audit and Finance Committee	<ul style="list-style-type: none"> • <i>Chair:</i> Mr. Robert M. Hanisee, Trust Company of the West • Hon. Edward R. “Ted” McPherson, Chief Executive, Intersolve Group, Inc. • Hon. Michael Montelongo, Senior Vice President, Strategic Marketing, Sodexo, Inc.
Exploration Committee	<ul style="list-style-type: none"> • <i>Chair:</i> Lieutenant General James A. Abrahamson, USAF (Ret.) • Dr. Kenneth Ford, Founder and Director, Florida Institute for Human & Machine Cognition • Dr. Donald Fraser, DRS Technologies • Capt. Rick Hauck, USN (Ret.), Astronaut (Ret.) • Dr. John M. Logsdon, Director, Space Policy Institute, George Washington University
Human Capital Committee	<ul style="list-style-type: none"> • <i>Chair:</i> Dr. Gerald L. Kulcinski, Associate Dean of Research, College of Engineering, University of Wisconsin-Madison • Dr. Ioannis Miaoulis, President and Director of the Museum of Science, Boston • Dr. R. James Milgram, Professor, Department of Mathematics, Stanford University
Science Committee	<ul style="list-style-type: none"> • <i>Chair:</i> Dr. Edward David, President, EED, Inc. • Dr. Owen Garriott, Astronaut (ret.) • Dr. Bradley L. Jolliff, Research Associate Professor, Department of Earth and Planetary Sciences, Washington University • Dr. Mark S. Robinson, Research Associate Professor, Department of Geological Sciences, Arizona State University • Dr. Jack Burns, Professor, Department of Astrophysical and Planetary Sciences, University of Colorado AND Vice President Emeritus for Academic Affairs & Research University of Colorado System
Space Operations Committee	<ul style="list-style-type: none"> • <i>Chair:</i> Dr. C. Paul Robinson, President Emeritus and former Director, Sandia National Labs (Ret.) • Col. Eileen Collins, Astronaut (ret.) • Dr. Pat Condon, Chairman of the Board, Air Force Association (ret.) • Dr. Thomas D. Jones, USAF (ret.), NASA Astronaut (ret.) • Dr. David Longnecker, Institute of Medicine, National Research Council • Adm. Benjamin Montoya, CEO, SmartSystems Technologies
Ex-Officio	<ul style="list-style-type: none"> • Dr. Lennard A. Fisk, Chair, Space Studies Board, National Research Council
Not Attending	<ul style="list-style-type: none"> • Dr. Eugene Covert, T. Wilson Professor of Aeronautics, Emeritus, Department of Aeronautics and Astronautics, Massachusetts Institute of Technology • Dr. Stephen I. Katz, M.D., Ph.D., Director, National Institute of Arthritis Musculoskeletal and Skin Diseases • Mr. Howard Stanislawski, Partner, Sidley Austin, LLP • Dr. Lucy Fortson, Vice President for Research, Adler Planetarium and Astronomy Museum • Dr. Byron Tapley, Director, Center for Space Research Professor, Aerospace Engineering, University of Texas, Austin • Dr. Raymond S. Colladay, Chair, Aeronautics and Space Engineering Board, National Research Council

**NASA ADVISORY COUNCIL
Le Pavillon Hotel
New Orleans, LA
April 17, 2008**

ATTENDEES

<i>Council Members</i>	<i>NASA Attendees</i>
Abrahamson, James A.	Iademarco, Paul
Burns, Jack	King, Marla
Collins, Eileen	Krezel, Jonathan
Condon, Pat	Ostrach, Louis
David, Edward	Parham, Jane
Fisk, Lennard A.	Williams, Greg
Ford, Kenneth	Wolf, Jean
Fraser, Donald	
Garriott, Owen	
Hanisee, Robert M.	
Hauck, Rick	
Kroo, Ilan	
Jolliff, Bradley L.	
Jones, Thomas	
Kulcinski, Gerald L.	
Logsdon, John M.	
Longnecker, David	
Lyles, Lester L.	
McPherson, Edward R.	
Miaoulis, Ioannis	
Milgram, R. James	
Montelongo, Michael	
Montoya, Benjamin	
Robinson, Mark S.	
Robinson, C. Paul	
Schmitt, Harrison H.	
<i>Sullivan, John</i>	

Other Attendees:

Reed, Cheryl

Johns Hopkins University/Applied Physics Lab

NASA ADVISORY COUNCIL
Le Pavillon Hotel
New Orleans, LA
April 17, 2008

LIST OF PRESENTATION MATERIAL¹

- 1) Aeronautics Committee Report to the NASA Advisory Council [Lyles]
- 2) Report of Audit and Finance Committee [Hanisee]
- 3) Exploration Committee [Hauck]
- 4) Human Capital Summary [Kulcinski]
- 5) Science Committee Report [David]
- 6) Space Operations Committee [Robinson]

Other material distributed at the meeting:

- 1) NASA Advisory Council February 2008 Meeting Minutes
- 2) NASA Responses to the NASA Advisory Council Recommendations from the Workshop on Science Associated with the Lunar Exploration Architecture (the “Tempe Workshop”)
- 3) NASA Response to Recommendation NAC-07-02 from the Council’s Exploration Committee Concerning the Vulnerability Assessment of Operational Cyber-Security
- 4) NASA Responses to the Recommendations Developed by the Council’s Exploration and Science Committees at the July Meeting of the NASA Advisory Council

¹ Presentation and other material distributed at the meeting are on file at NASA Headquarters, OER/ACMD, 300 E Street SW, Washington, DC 20546.