

**National Aeronautics and Space Administration
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NASA ADVISORY COUNCIL

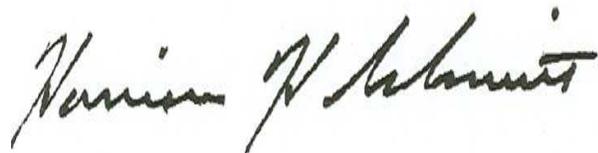
July 10, 2008

**Radisson Hotel Cleveland Airport
Cleveland, Ohio**

MEETING MINUTES



Paul A. Iademarco
Executive Director



Harrison H. Schmitt
Chair

**NASA ADVISORY COUNCIL
Radisson Hotel Cleveland Airport
Cleveland, Ohio
July 10, 2008**

**Meeting Report
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*Meeting Report Prepared By:
Paula Burnett Frankel*

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Opening Remarks

Sen. Harrison Schmitt, the Council Chairman, called the quarterly NASA Advisory Council meeting to order at 8:10 a.m. and welcomed members and attendees. He noted that the Council had a busy and productive fact-finding activities during the past two days at the Glenn Research Center (GRC) on July 8 and 9. He extended thanks to Director Woodrow Whitlow and his staff for making the GRC 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 (FACA). He asked that the public not interrupt the Council members during or after the presentations. Minutes of the last Council meeting in April are available for distribution and are also posted on the Council Web site.

Since the last meeting, Dr. Paul Robinson has resigned from the Council due to the press of other obligations, and Mr. Jay Greene has joined the Council. Dr. Robinson provided important leadership to the Council's Space Operations Committee and he deserves the thanks of all. Mr. Greene spent most of his career in flight operations at JSC and will serve on the Space Operations Committee. The Administrator has asked Col. Eileen Collins to assume the Chair of that Committee. Sen. Schmitt also welcomed Dr. Charles Kennel back to the Council as the new ex-officio member. He is Chair of the National Research Council's (NRC) Space Studies Board (SSB). Dr. Lennard Fisk served in this capacity for the last several years. Dr. Kennel noted that the SSB has been a partner with NASA for its entire existence and expects the excellent relationship to continue into the future.

Aeronautics Committee Report and Discussion

Gen. Lester Lyles led the Aeronautics Committee report. He noted that members that were absent from the Committee's fact-finding session had provided input for the discussions. It was helpful that GRC is one of the Aeronautics-focused Centers. Gen. Lyles reviewed the areas of interest explored at the current meeting: core competencies and personnel available to NASA for executing the Aeronautics mission; the Fundamental Aeronautics Program (FAP) and a specific action given to the Directorate by the Aeronautics Committee; the role of the Committee in meeting the technology developments for NextGen; Research Transition Teams; two major NASA Research Announcements (NRA's) that integrated various concepts and studies; discussion with Dr. Mike Heil and the role of Ohio Aerospace Institute (OAI) with GRC and the Air Force.

The Aeronautics Committee also reviewed the Aeronautics Research Mission Directorate's (ARMD's) obligation and costing status. ARMD does not have a linear plan because of the way that its contracts are structured. The Committee felt more positive after hearing about the status and will continue to track this topic.

The Committee identified some key questions relative to core competencies. There was a robust discussion among the Aeronautics community at the meeting. ARMD has experienced noticeable shortages of skilled personnel in the following areas: guidance, navigation and controls; multi-disciplinary design, analysis and optimization; aero-servo-elasticity; acoustics; airframe/propulsion integration; systems analysis; human factors; and wind tunnel management and operations. These same sorts of skills are also needed in other mission directorates and

present an issue across the Agency and industry. Sen. Schmitt asked for some examples of areas where the situation is not as dire. Gen. Lyles cited pure aerodynamics as an example and he indicated he would provide others. He highlighted some current management practices that will address the skill shortfalls, e.g., acquiring skills from the external community, focusing skills across projects, re-training, hiring, and coordinating with other agencies. The Committee was satisfied with how ARMD is addressing the topic.

Dr. John Sullivan commented on the Green Aircraft Initiative. One of the groups within ARMD, the FAP, has come back to the Committee with specific candidates for systems-level research projects. These are projects with discrete start and end dates and should be considered in addition to and as an augmentation of the existing funded effort. The first of these comes under the Green Aircraft Initiative. A system level research project is one that comes out of fundamental research and has reached the right level of maturity with high impact indicated from Multi-Disciplinary Analysis and Optimization (MDAO). In response to a question from Sen. Schmitt, Dr. Sullivan indicated that other agencies and the Air Force can be involved in these projects, in addition to industry and academia. Dr. Sullivan presented Chevrons research hierarchy as an example and a success story that is leading to new products. The Chevron research hierarchy includes a four-tiered modal, with foundational physics and modeling as the base, discipline level capabilities and multi-discipline capabilities, respectively, as the middle two tiers, and system design as the top tier. Some candidate systems level research projects include the following: laminar flow control; large geared turbofan; multi-objective wing with advanced features such as adaptive structures and active flow control; lightweight structures for blended wing body; and sonic boom flight test aircraft. This is not an all inclusive list, and ARMD is looking at additional projects.

The Committee reviewed the NextGen Research Transition Teams (RTT's) and the role that NASA would play in the transition of technologies. The purpose of the RTT's is to ensure that the R&D needed for NextGen implementation is identified, conducted, and effectively transitioned to the implementing agency. It provides a structured forum for researchers and implementers such as the Federal Aviation Administration (FAA) to constructively work together on a continual basis. This is still a work-in-progress. NASA and FAA are presently focusing in the following four areas, with the objective to expand the RTT's downstream: trajectory based operations; surface management; multi-sector planning; and dynamic airspace configuration. Gen. Lyles indicated that the Committee was satisfied with the approach, but made a suggestion to expand the RTT's downstream to include the Air Force.

The Aeronautics Committee has had extensive discussions on the cross-program NRA for the Integration of Advanced Concepts and Vehicles into the NextGen. Announcements were made earlier this year, and two contracts are about to be awarded. There will be a formal kick-off on July 24 where the awardees will describe their approaches. Workshops will inform the community of initial progress about three months after award.

At the Committee's meeting, Dr. Mike Heil, president of the OAI and formerly the head of the Air Force Research Laboratory (AFRL) at Wright Patterson Air Force Base, discussed the role of the OAI with GRC and the AFRL. Notwithstanding GRC's role as the aeronautics center for NASA, it is migrating to more space activities and the aeronautics research is less dominant than in the past. For example, turbine engine research has migrated to the AFRL, and the Committee is concerned about where this puts the aeronautics regime for NASA. This is an area that the Committee may want to examine in the future. The relationship between OAI and GRC is analogous to the one between the National Aerospace Institute and Langley Research Center (LaRC). Gen. Lyles offered to take a personal action to talk to the leadership at AFRL to promote a stronger working relationship with GRC. Sen. Schmitt indicated that he and the

Administrator feel that if there are overriding issues that are important to the Transition Team for the next Administration, the Council should point out those issues. The “sea change” in enthusiasm and managerial progress in NASA over the past two years has been remarkable. The Council’s input is an important effort and each Committee should draft some items for transmission to the Administrator.

Gen. Lyles noted that there have been several iterations of discussions about the transition. The Aeronautics Committee offered three “messages” to the Council. The first builds upon an action discussed at an earlier meeting.

The Aeronautics Program, while currently conducting high quality research, is insufficient in scope to achieve the U.S. leadership objectives implicit in the President’s Aeronautical R&D Policy.

This is a major item for the Transition Team. Gen. Lyles emphasized that the bottom line is that the program is underfunded. Dr. Pat Condon suggested replacing “scope” with “breadth and depth.” Dr. Eugene Covert added that the Europeans have a very aggressive program underway with the explicit objective to top the U.S. leadership in aeronautics. Sen. Schmitt indicated that the Committee should consider adding a reference to the Space Act to the message statement.

Gen. Lyles indicated that the second message was

NASA should maintain a robust foundational research program and ARMD should plan, develop, and implement system level research projects of highest priority.

The third message is

Some ARMD research and development is also critical to the needs of the Agency’s Science and Exploration missions.

The NRC is trying to align more closely the work of the SSB and the Aeronautics and Space Engineering Board (ASEB), particularly with regard to the third message. The Committee will take the Council’s comments into consideration and go forward with the three messages. Sen. Schmitt suggested identifying the generic areas where the ARMD is particularly critical to the Science and Exploration missions.

The Aeronautics Committee plans to request a presentation on the National Science and Technology Council (NSTC) Aeronautics S&T Subcommittee draft appendix to the National Aeronautics R&D Plan, i.e., on gap analysis. At subsequent meetings, the Committee will make a point to have a dialogue with the Center ARMD point of contact and the younger workforce.

Audit and Finance Committee Report and Discussion

Mr. Robert Hanisee reported on the Committee meeting and recent activities. He noted that Mr. Michael Montelongo participated in yesterday’s fact-finding meeting by telecom. The Audit and Finance Committee had a presentation from Ms. Debra Watson, Chief Financial Officer (CFO) of the GRC, an update from Mr. Terry Bowie (NASA CFO) on the still outstanding items discussed at previous meetings, a presentation from Ms. Leslie Hyland on the Continuous Monitoring Program, a status report on the Financial Statement Audit from Mr. Thomas Green, and an update on the NASA Shared Services Center (NSSC) transition from Ms. Joyce Short.

The GRC CFO is linked to all of the activities emanating from the Headquarters CFO. Other members of the GRC CFO’s office were in attendance at the meeting. Mr. Hanisee highlighted the responsibilities of the Center CFO’s organization. There have been many significant changes at GRC since 2006. The Center focus has been moved from principally Aeronautics to a roughly equal split between Aeronautics and Exploration. The demands on the financial staff have been heavy. The GRC accounts payable work was transferred to the NSSC in May. This reduced the staff by eight full time equivalents (FTE’s). The organization is stable and has a positive budget

outlook. There were minimal concerns coming from the financial audit reviews conducted in May and June.

Mr. Ted McPherson discussed the Comprehensive Compliance Strategy. It includes internal control procedures, external audit, corrective action plans, and the Continuous Monitoring Program (CMP), which is the overall framework to assess and evaluate internal controls and compliance with Generally Accepted Accounting Principles (GAAP). Each month, the monitoring program determines the health of accounting and control transactions and reports these activities for each Center. In February, twenty-four percent of the activities were “exceptions,” or not satisfactory. Since then, the total percent of exceptions has fallen to seventeen percent. Some accounting activities in need of attention are prepaid expenses/advances/intra-NASA transactions and monthly variance analysis. The business benefits of the CMP are real. It is the foundation for auditable financial statements and management reporting. The next steps are to encourage transaction “clean-up” during each month, increase investment in training, and continue to implement front-end edits and reduce re-work. Mr. Hanisee added two years ago, most of the CFO activity was spent putting out “fires.” The Committee is very pleased to see the institutionalization of the controls that will lead NASA to be a first class financial organization.

Mr. Howard Stanislawski reported on the status of the FY 2008 Financial Statement Audit by Ernst and Young (E&Y). The FY 2008 audit process is moving forward positively. It began in January with the lessons-learned meeting, and the Audit was kicked-off in March. There were Center “walk-throughs” in March and April. Internal control testing at the Centers was underway in June. There will be subsequent testing in August and September. Field work will be completed in October, and an opinion rendered by November 14, 2008. The Audit process is about fifty percent complete. All data sought by the auditors has been delivered on time. To date, there appear to be no significant “show stoppers.” Mr. Hanisee added that last year, the Committee had hoped to get a full audit from E&Y, rather than a disclaimer, but NASA did not achieve this. E&Y appears to be doing significantly more detail work this year, but whether it will be a qualified or unqualified audit will depend on resolution of certain issues. However, the Committee is still optimistic.

Mr. Hanisee provided an update on the NSSC. Since February, accounts payable and accounts receivable have been transitioned, in waves, from Dryden Flight Research Center (DFRC), Marshall Space Flight Center (MSFC), Stennis Space Center (SSC), GRC, Kennedy Space Center (KSC), LaRC, Ames Research Center (ARC), and Johnson Space Center (JSC). The final large wave will come in August with the transition of Goddard Space Flight Center (GSFC), the NASA Management Office (NMO) at Jet Propulsion Laboratory (JPL), and Headquarters. Payment of grants will move over in January 2009, dependent on a new SAP (Systems, Applications, and Products) release. Mr. Hanisee showed the “score card” on invoice payments made on time. By July, the NSSC hit the benchmark (98% made on time) and was under the benchmark on interest payments. Mr. Stanislawski added that there is a statute (the Prompt Payments Act) that sets the interest payment and interest. Mr. Hanisee showed the distribution of late payments by number of days late. About thirty percent of late payments are within two days. Authenticating and verifying invoices is a significant part of the mechanics of the delays. The Committee was encouraged by the progress that has been made. A successful Wave III operational readiness review for ARC and JSC transition was made on June 26 and the NSSC went “live” with those Centers on July 1. There is an issue with staffing, but the Committee feels that this is a transitional problem that will be overcome.

The major problem continues to be with Property, Plant and Equipment (PP&E). As noted in the previous meeting, there was a major activity with Federal Accounting Standards Advisory Board (FASAB) to get the space assets classified as R&D. In FY 2007, \$13.3B of legacy assets were reclassified as R&D. The remaining problem assets are Space Station (\$13.2B) and Space Shuttle (\$1.0B). E&Y has stated that NASA will have no chance for a clean opinion until this issue is resolved. NASA could recreate an auditable trail, but the Office of Inspector General (OIG) opined that the cost to re-create an auditable trail is too high to justify. The CFO staff has appealed to both E&Y and FASAB to permit reclassification of Space Station and Shuttle as R&D. Mr. Bowie's team is putting together a formal white paper outlining the options and specifically recommending the option to reclassify the assets as R&D. This is the most reasonable thing to do, and the Committee is optimistic. In response to a question from Dr. Edward David, Mr. Bowie indicated that the Space Station could be interpreted as R&D under the definition. There is no point in penalizing the Agency for the next seven or eight years because of this issue. In response to a question from Gen. Lyles, Mr. Hanisee noted that FASEB wants a ruling that will apply to all government entities, and that is part of the reason for the caution. In response to a question from Dr. Kennel, Mr. Hanisee explained that this is strictly bookkeeping and there are no implications to the operations or the International Partners on the Space Station. Mr. McPherson noted that in 2001, only one federal agency out of twenty-four had a clean audit. Today, all but four of them have clean audits. The Committee encourages a more aggressive approach because PP&E has been resolved elsewhere in much greater amounts, and everyone should deal with it and move on. Mr. Hanisee noted that treating an asset in a particular way could have legal implications, but at the present, there is nothing specific out there that should give cause for concern. In any event, the Committee does not consider future legal implications within its charter. The Integrated Asset Management (IAM) tool was implemented in May, and this tool will help the Agency track new assets from now on.

There have been active discussions about the shortage of personnel in the Office of the CFO (OCFO) at NASA Headquarters. The authorized FTE level is about 103; the current FTE's plus the new hires is at 98, an improvement of five FTE's since April. Hopefully, the remaining vacancies will be filled in the near future. The Committee has been on the verge of making a recommendation to move the OCFO out of the DC area, but this recommendation is still being held in abeyance.

Mr. Hanisee reviewed other old business: grant accounting (the roll-out is on schedule), and deficiencies in the FY 2007 audit. One of the deficiencies was Environmental Liabilities, and the OCFO is putting together an environmental group which expects to have estimates completed by year end. Open contracts, another deficiency, is making progress. The grants portion will be resolved by the new Grant Accounting Software.

The audit contract is up for re-bid for 2009. The Audit and Finance Committee should have more insight on this by the next meeting.

Enormous progress has been made in the financial and accounting area across the Agency. If the asset issue can be resolved, there is a chance for a real audit this year and a good chance for a clean audit opinion. The Committee had no specific recommendations at this time, but the Committee's message has been transmitted to the OCFO. The Bowie and Spoehel team is working very well. In response to a question from Sen. Schmitt, Mr. Hanisee indicated that the Committee would address the issue of insufficient personnel in the grants processing area.

Exploration Committee Report and Discussion

Gen. James Abrahamson introduced the report from the Exploration Committee. The Committee had a very busy meeting and has been closely involved with the Space Operations Committee and the Science Committee. Gen. Abrahamson discussed the award of the Constellation Space Suit System and Orion "Human-in-the-Loop" test plans.

The suit has been under development for about a year. The award is still keeping a single spacesuit system, but it will have two configurations which share many components. Gen. Abrahamson showed the two configurations: the launch/entry/abort and microgravity extravehicular activity (EVA) suit; and the Lunar Surface EVA suit. A wide range of companies participated in the competition. Several of the team members of the proposers had already been working with NASA on components. The winning Oceaneering team has pioneering experience with underwater activity and off shore oil rig issues.

The DoD philosophy of "spiral development" is being employed in the suit development. Nearly all of the exploration systems will have to not only survive and work in the lunar and Mars environment, but they will have to work for decades. Sen. Schmitt noted that the recreation of the internal engineering capability has enabled "tapping" of more than one viewpoint, not just the contractor's. The positive tension between teams can be very advantageous.

Gen. Abrahamson discussed the Orion testing philosophy. Orion is planning a comprehensive test program which is critical to the success of the certification and qualification of Orion. Orion has adopted a "test like you fly" approach." It will have humans involved in testing at multiple levels. Gen. Abrahamson noted that there are real issues in terms of the test facilities and what can be done in nearly every aspect of going back to the moon. Dr. Condon added that the "test like you fly" approach makes a lot of sense, but there is a big difference between testing like you might have to fly and testing like you plan to fly. The risk must be balanced in the test environment. The test philosophy should be one that takes into account testing how we might have to fly. The new generation of testers should not base a test philosophy on what we have been forced into on programs like Shuttle. Some of the testing on that program was driven by funding constraints rather than on what NASA would have liked to do. Gen. Abrahamson agreed that the Committee would go back to the written test philosophies and examine them. Sen. Schmitt noted that overall, the crew is more risk averse on the testing side, and it is worth understanding that position as it can drive the testing approach. Capt. Rick Hauck agreed that the Committee should pursue the understanding of the crew's perspective. Col. Eileen Collins felt that NASA is on the right track, but offered to follow-up with her contacts informally. Gen. Abrahamson commented that there are a lot of synergies that come out of testing which can be seen at the integrated level, for example, testing the suit and spacecraft ECS loops together.

The Exploration Committee continues to see highly maturing architecture planning that is making major contributions to project management. These plans are flowing into acquisition and test in a highly commendable way. There is superb team development across multiple Centers and disciplines.

Capt. Hauk discussed the Lunar Capabilities Concept Review (LCCR). He attended this review at JSC on June 18-20. The LCCR was conducted to define an integrated Point of Departure (POD) transportation architecture for the Constellation Program lunar capabilities to deliver and return to the surface of the moon for short durations, and to support a range of lunar exploration scenarios and possible surface system architecture, including establishment of a lunar outpost. He emphasized that what resulted was a POD, not a final design. The attendees included the Constellation Program senior management and the standing review board. Dr. Clive Neal, a member of one of the Council Subcommittees and chair of the Lunar Exploration Analysis

Group, represented the science community. The review satisfied Mission Concept Review (MCR) criteria for Ares V and Altair (crewed and cargo). The consensus opinion was that NASA is ready to proceed toward the Human Lunar Return (HLR) System Readiness Review (SRR). The Constellation Architecture Team (CAT) has made extraordinary progress on the lunar transportation architecture and the lunar surface architecture and campaign strategies over the last two years. Capt. Hauck showed a depiction of the lunar sortie design reference mission. Col. Collins commented on the decision for launching the crew first. The rationale is that if there is a problem with Ares V and it cannot be launched, the crew can be brought back. If the cargo is launched first, and Ares V cannot be launched, the cargo cannot be brought back. Ares V would be carrying a highly valuable asset. Dr. Doug Cooke, clarified the rationale behind the decision. However, NASA is holding open the option to reverse the order.

No decisions were made at this juncture on surface system capabilities. The lunar transportation figures of merit include performance, affordability, risk, and operations/extensibility. In terms of performance for lunar transportation, the program will be looking at up-mass. Altair will take a crew of four to and from the surface for seven days on the surface, or lunar outpost crew rotation. It will have global access capability, anytime return to Earth, the capability to land fourteen to seventeen metric tons of dedicated cargo, and an airlock for surface activities. The descent stage will be liquid oxygen/liquid hydrogen propulsion. The ascent stage will be hypergolic propellants or liquid oxygen/methane.

Capt. Hauck showed the Ares V trade space. The recommended new Ares V POD is the 51.0.48 vehicle. The access to all lunar landing sites (global access) requires a combination of additional lunar orbit insertion (LOI) delta-V, pre-descent low lunar orbit (LLO) loiter, and post-ascent LLO loiter.

In summary, the LCCR identified a POD transportation architecture sufficient to proceed with Ares V and Altair project formulations. The MCR criteria were satisfied for Ares V and Altair. Groundwork was laid for development of Lunar Surface System concepts. The LCCR Board was very enthusiastic about the work that has been done as well as the team itself. In response to a question from Dr. Bradley Jolliff about critical elements or things to watch carefully, Capt. Hauck indicated that cost is always something to watch. Mr. Cooke added that another thing to watch is vehicle performance requirements. Capt. Hauck stated that there is an absolute need for the end user (i.e., the surface user) to be maintained in the lines of communications. The people on the development side are very receptive to that communication.

In terms of the recent architecture studies, surface systems have been maturing, and the POD has been informed by these architecture studies. Capt. Hauck corrected a note on the chart. The loiter skirt does not give the loiter capability in LLO; it gives loiter capability in low Earth orbit.

Human Capital Committee Report and Discussion

Dr. Gerald Kulcinski gave the Human Capital Committee report. He noted that at its fact-finding meeting, Mr. Mike Cabbage gave a presentation on NASA TV, and Dr. Toni Dawsey provided an update on the NASA workforce.

As a result of discussions at its last meeting at SSC, the Committee made a recommendation that an outside organization should be contracted to do an evaluation of NASA TV. Unfortunately, at the April meeting, the Committee was not aware of or presented with the results of a recent internal analysis on NASA TV that was published on July 31, 2007. That report was done by senior people at NASA HQ who knew a lot about the subject. It is a very good report and addresses most of the things the Committee was concerned about. NASA TV is actually a

conglomerate of four channels: the mission operations channel (live), the education channel, the media services channel, and the public channel. The latter is not quite 24/7, but is close to it.

Dr. Kulcinski relayed a few comments from the Working Group report on NASA TV: NASA is distribution rich and content poor; and the production facilities, staff expertise, and funding at NASA are inadequate to produce quality television products on a regular basis. In addition, there are OMB and Congressional restrictions. Sen. Schmitt noted that these restrictions appear to be inconsistent with the Space Act. Dr. Kulcinski agreed but noted that that is a separate issue that the Committee did not address. As a result of the information in the internal report, the present OMB restrictions, and the current financial situation in the Office of Strategic Communications (OSC), the Committee suggested a revised recommendation. The Committee's view is that NASA should significantly upgrade the content of the NASA education channel and the NASA TV channel or phase them out.

The Committee continues to support the original recommendation with the caveat that the "outside contractor" should take into account the July 2007 internal review.

At the Committee meeting, Dr. Dawsey reviewed the status of Human Capital activities at NASA Headquarters. The workforce has been divided into three areas: Baby Boom population (born before 1961); Generation X population (born between 1961 and 1975), and Generation Y population (born after 1975). Between forty and sixty percent of the NASA workforce, across the agency, is Baby Boom population. Generation Y population varies significantly from Center to Center. The largest amount of hires over the past five years has been from Generation Y population, but there is still a relatively large percentage hired from the Baby Boom generation. Consequently, it will take some time for the average age at NASA to change. In two years, the people eligible for retirement will double, and NASA will start to see a significant turnover and change in the skill set. There are not a lot of people in NASA that have the capability of running large projects.

Dr. Kulcinski presented some observations on NASA co-ops. In March, the total number of co-ops was 407, representing 129 schools from across the country. Most of the co-ops are in engineering, which is not surprising; however, there were only two co-ops in the science area. Dr. Jack Burns commented that it is not usual for science students to be co-ops. Ms. Deborah Denton-Misfeldt, Executive Secretary for the Human Capital Committee, added that schools are selected based on their programs, and students selected have academic requirements. There are many more applicants than are selected. The highest number of co-ops per Center is at JSC; the lowest is at Headquarters (zero). The "Tier 1" universities are greatly underrepresented in the NASA co-op program. For example, Dr. James Milgram noted that Massachusetts Institute of Technology (MIT) has only three. There is a tendency for the higher numbers to come from schools in close proximity to the field Centers. Co-ops are currently the major source of Generation Y hires. The Committee does not know the reason for underrepresentation of the Tier 1 schools. Dr. Kulcinski noted that young scientists are attracted by programs. Where NASA has a star affiliation with a University, e.g., the University of Maryland Earth Sciences department, there is a good match for the co-ops.

The Committee felt that the Office of Human Capital is now in good shape to handle major changes in the workforce needs across the Agency, thanks to the Workforce Planning Data Base developed over the past few years. The Office is to be commended in putting this together. One issue they continue to grapple with is the length of time it takes Constellation, as a new program, to assign work to new employees.

Mr. McPherson noted that at other high performing agencies in Washington, performance compensation systems have been revamped; others have made big investments in training. In a tactical way, what are the top two or three results for the employees? Dr. Kulcinski indicated that the progress that the Office of Human Capital has achieved is the ability to understand the workforce and the skill mix. There is no longer any “uncovered” workforce, so there is more stability. There is more confidence that the Office can fit employees into the organization, across the Agency. Ms. Denton-Misfeldt noted some other changes include different types of appointments and changes in the bonus structure. Some of these changes have required special authorizations, which have been requested by NASA.

Science Committee Report and Discussion

Dr. David introduced the report from the Science Committee meeting. He noted that it has been a very active group. Dr. David showed some recent mission highlights, including a photo of the Phoenix Lander overflying a meteor crater on Mars. Dr. Jolliff added that a recent press release shows the separation of the heat shield. Another image showed ice dug up by the Mars Lander, later disappearing through evaporation. This may imply the prior presence of water. The Gamma-ray Large Area Space Telescope (GLAST) successfully launched aboard a Delta II rocket on June 11. Jason 2, a mission to chart sea level change, was launched on June 20. Dr. Kennel noted that this is the only reliable measurement of sea level. NASA’s Science Mission Directorate (SMD) faces a challenging eighteen months ahead, with sixteen launches planned over this period. SMD is reassessing the costs and schedules of key missions initiated in the FY 2009 budget request. .

Planning is underway to formulate the aggressive lunar program featured in the FY 2009 request, including the NASA Lunar Science Institute (LSI), the Lunar Atmosphere and Dust Environment Explorer (LADEE), and the International Lunar Network. Dr. Jolliff noted that five to seven off site nodes for the LSI will be selected. Good progress has been made recently in management of Research and Analysis (R&A), reducing time from proposal receipt to selection and funding. Dr. Jolliff commented that a lot of the science capability of NASA resides in academia, which is not very responsive to sharp changes in budget. Therefore, stability in funding is essential for science productivity. Dr. David showed the Lunar Exploration Architecture milestones. The focus on the LCCR surface systems will occur in the next year.

As noted earlier, the LCCR was briefed by Dr. Cooke in joint session with the Exploration Committee and the Space Operations Committee. The Science Committee is impressed with the results of the reference architecture. The responses to the Tempe Recommendations and the ongoing evaluation of science planning process were briefed by Dr. Marguerite Broadwell. The Science Committee emphasized the following unresolved issues: the return mass of sample material (a recommended capability of 300 kg); an Apollo-like (or more capable) rover needed for early outpost or sortie missions; continued emphasis on surface scenario planning and training, including astronaut participation; a deployment mechanism for “drop-off” satellites from the Orion SIM bay; and trade studies for design reference outpost sites other than polar sites, including resources to accommodate high-priority science activities.

Sen. Schmitt noted for the members who are looking at the lunar surface scenario, there is potential in the pressurized rover concept to have an unpressurized rover. The results of a workshop relative to surface scenario planning will be coming out shortly. Dr. Jolliff added that one of the things at Tempe was a field trip to look at the kinds of things an astronaut on the surface of the moon would be interested in doing. One of the recommendations was to have the astronaut corps involved as early as possible and formulate the training requirements.

NASA needs a unified and well-crafted statement of rationale for the human return to the moon. Many people still do not understand why we are planning a return to the moon. The science portion of this rationale can be derived from the Tempe Workshop. Sen. Schmitt noted that there is an excellent summary of the Workshop by Dr. Kulcinski's team. The powerpoint presentation is available and is hosted on the Lunar Planetary Institute (LPI) Web site. Sen. Schmitt noted that the Lunar Science Workshop presentations are linked to the Council's website by taking you to the LPI website, but it is rather tedious to sort through all the presentations to find the PowerPoint summary and should be made easier to access. Col. Collins stated that using the moon's resources is another important reason for returning to the moon. Dr. Jolliff noted that the entire Council needs a complete set of the rationale.

Another issue is space communications. Planetary Science and Lunar Exploration programs will need higher bandwidth and spatial distribution for space communications in the future. The Committee supported the SMD/Exploration Systems Mission Directorate (ESMD) idea to conduct a demonstration of optical communications on the LADEE mission. It proposed a joint session with the Space Operations Committee at the October meeting on the future of space communications and the future of the Deep Space Network (DSN). Dr. Burns noted that this is a critical issue for both the manned and unmanned missions, and both Ka-band and optical need consideration. Dr. Kennel added that eventually, optical communications systems will transform the science missions. Col. Collins will act as the point of contact to get briefings, etc., put together for the Science and Exploration Committees.

Another item of concern to the Committee was the availability of medium-class launch vehicles. The Committee endorsed SMD's continued discussion with the DoD on the potential use of launch capabilities such as Minotaur. The Committee will explore this further at the October meeting.

The Science Committee presented one proposed recommendation:

Features of a Venture-Class Mission Line in Earth Science. The Earth Science Division should issue yearly calls for Venture-class missions as recommended by the NRC decadal survey. The Venture-class mission line should incorporate an optimal mix of space-based and suborbital missions. Opportunities for space-based missions should place no restriction on possible overlaps with decadal survey strategic missions. NASA should review its plans for implementing the Venture class mission line with the Science Committee during its October meeting.

In response to a question from Sen. Schmitt, Dr. Byron Tapley noted that the Venture class is a small-class, rapid response mission (around \$150-\$200 M). The terminology comes from the Decadal Survey. Mr. Greg Williams, Executive Chair of the Science Committee, noted that SMD has already accepted the recommendation to do this type of mission. The Council agreed to fill out the background material and take the recommendation on Venture-class mission forward.

With respect to Mars Sample Return (MSR) launches, Dr. Jolliff noted that a number of things are coming to fruition in the 2018 to 2020 timeframe. The MSR mission is an opportunity for international partnership. The other large mission during this timeframe is an Outer Planets Flagship, the next one after Cassini. There is clearly a feed-forward from the Mars Science Laboratory (MSL).

Dr. Kennel briefly described the history of "Mission to Planet Earth," which consisted of three large spacecraft containing very large instruments. The bill for this mission grew to \$60B, which

was not sustainable. What came out of this was the idea that the Earth should be measured in a system of smaller satellites. NASA promised Congress a delivery of twenty-four measurements on the Earth system. The twenty-four measurements were provided by twenty-three different spacecraft. The strategy was to spread the requirement over a smaller number of cheaper satellites with less risk to the system. The "Mission to Planet Earth" concept was much the same as the current National Polar-orbiting Operational Environmental Satellite (NPOES) concept. Dr. Kennel offered to provide a more detailed presentation at the next meeting.

Space Operations Committee Report and Discussion

Col. Collins reported on the Space Operations Committee meeting. Activities since the last meeting include a visit to Orbital Sciences by Dr. Thomas Jones, a visit to JSC to see the Chariot Lunar Rover, and a visit to the reconfigurable operational cockpit facility.

Dr. Jones discussed his visit to Orbital Sciences, one of the two competitors for the Commercial Orbital Transportation System (COTS). The other competitor is Space-X, which the Committee has already visited. The Committee now has a good comparison to the Space-X proposal. Orbital Sciences is planning to launch cargo to Space Station in an unpressurized module. The demo mission launch is planned for December 2010 from the Wallops Flight Facility. Return cargo is a future capability. The proposed launcher is the Taurus II (about the size of a Delta II). This particular rocket has not flown before, but it is based on prior experience with smaller launchers. Orbital Sciences has Wallops experience and a good launch plan. A liquid fuel second stage is possible.

Orbital Sciences is also the lead subcontractor for the Orion Launch Abort System (LAS). It is the largest application of reverse flow nozzle technology. The full-scale abort test is scheduled for March 2009. In response to a question from Dr. Owen Garriott, Dr. Jones indicated that this is a much bigger launch abort system than Apollo. The Orion mass growth has increased the LAS system requirements and cost. In response to a question about the ArianeSpace cargo module, Dr. Jones noted that because of its expense, it is not a panacea. Col. Collins added that the Automated Transfer Vehicle (ATV) is not a return vehicle. The Committee continues to follow COTS very closely.

On May 5, Col. Collins and Dr. Jones observed a "dry run" of the Chariot Lunar Rover, a testbed for pressurized or unpressurized payloads on the lunar surface. The plan is to test the chassis in the field to prove out the suspension and motors. Payloads would be up to three metric tons. It is powered by ion-lithium batteries. Col. Collins was not sure about the range, but offered to obtain this information.

On their visit later in the day, Col. Collins and Dr. Jones saw the low fidelity mockup of the pressurized rover and "drove" this rover on the simulated lunar surface. They also visited the "B-Dome" simulator which is capable of both Shuttle and lunar surface simulations. It offers excellent training opportunities for Orion approach and docking to the International Space Station (ISS) as well as lunar orbit and surface operations. They discussed the pros and cons of building an actual lunar landing trainer vs. simulator-only training. Sen. Schmitt noted that all of the Apollo lunar landing flights at DFRC were successful; the accidents were at Ellington and at least two were related to wind gusts. He cited the importance of the report from the people who did the original work.

Col. Collins highlighted the briefings that the Committee attended at GRC: results of the EVA Suit contract selection; report on the lunar capabilities concept review; Orion Human-in-the-Loop (HITL) test plan; advanced capabilities engagement with the LSI; the NRC Decadal Survey of

Life and Microgravity Sciences; and radiation hazard protection and risk mitigation strategic issues.

As noted by Gen. Abrahamson in his presentation, the Committee reviewed the Constellation suit development. From an operations point of view, suit fit is an issue. Gloves, internal bladders, and joints are a concern. For example, Configuration 2 had a metal waist ring that increased flexibility on the lunar surface, but caused pain on Earth reentry. Orion couch/palette design may also be an issue. The Committee has asked for a briefing at the next meeting. The Space Operations Committee offered an observation: NASA should consider hosting former "spacewalkers" from Apollo and Shuttle, the suit designers, the NASA suit program manager, and current astronauts for a roundtable on EVA suit issues.

The Human-in-the-Loop Test Plan was briefed to both the Space Operations Committee and the Exploration Committee. No HITL vacuum test will be conducted. The Astronaut Office is satisfied with the human/vacuum test plan. It appears sound based on the briefing, although some concerns about integrated testing were raised.

On behalf of the Ad Hoc Biomedical Committee, Dr. David Longnecker reported on biomedical/radiation briefings. The group discussed several issues. The LSI was reviewed relative to its activities that might fit with biological/medical sciences. The Congressional mandated Decadal Survey of Physical and Life Sciences was reviewed.

As of yesterday, sixty notices of intent to apply for Life and Physical Sciences Cooperative Agreements had been submitted to NASA; about thirty fit into the general area of Exploration and about ten had components in the nodes for life sciences. NASA and the Committee were very pleased that life sciences appears to be a robust component. There has been an initial planning group to help guide the development of the proposal to NRC for the Decadal Survey. The group has been prioritizing the statement of tasks. A report is expected in Summer 2010. Dr. Kennel noted that all five of the major disciplinary areas now have Decadal Surveys, and this creates a good baseline for the Agency's science.

There were four presentations in the radiation area: crew safety standards, probabilistic risk assessment, acute radiation sickness, and incorporating radiation protection in Orion design. There are both acute problems, ranging from nausea through skin problems and beyond, and chronic issues or long term effects and the development of cancers. The countermeasures fit into several categories. The big ones are shielding (protection) and mission architecture. Other approaches are pharmacologic. Forecasting solar particle events is fairly limited, at least in a way that would allow alteration of an ongoing mission. Probabilistic risk assessment is based on a lot of uncertainty, and there is a lot of work that needs to be done downstream prior to long-term missions. At the moment, the Orion radiation protection exceeds the requirements by about twenty-five percent.

The Committee concluded that progress is being made in the area of radiation safety, but major uncertainties remain for exploration-class missions, including extended lunar habitation. The biological effects of deep space radiation are not well characterized, and these uncertainties prevent appropriately precise and valid probabilistic risk assessments. Much additional work by a wider community or radiation biologists will be required to resolve these uncertainties. Funding has now come online for acute radiation sickness studies. Sen. Schmitt commented that it appears that, compared to the situation forty years ago, there is far less concern about solar particle events, which are easier to shield; there is significantly more concern about the galactic particle environment. Dr. Longnecker noted that this conclusion could certainly be drawn from

the briefing, but may not be the view of the wider biological science community. Confidence in the ability to predict solar particle events may be close to zero. One of the key factors is to get around the communication times, i.e., be able to monitor and communicate directly with the astronaut during an EVA. Sen. Schmitt noted that two meters of regolith still appears to be the requirement for galactic radiation shielding, although density would be an issue. Dr. Jones added that for the moon, if the flux of cosmic rays is above what is anticipated, the stay time can be limited. This is not an option for Mars.

Dr. Longnecker noted that some of these things become quite important when they are linked back to astronaut standards. The risk of exposure induced death (fatal cancers) is about three percent. Forecasting is directly related to astronaut experience and age. He indicated that among the biological factors, radiation could be a show-stopper if not properly addressed. Sen. Schmitt observed that radiation does not have to be a show stopper if you can afford the shielding to manage the exposure. A general briefing on radiation to the Council should include outside perspectives.

For the next meeting (October 14-16, 2008) at Ames Research Center (ARC), the Committee would like briefings on the ISS National Laboratory progress and issues, the ISS six-person crew transportation plan, and lunar communications/navigation development (in conjunction with the Science Committee). In addition, the Committee expects to conduct fact-finding on three items: the Soyuz latching issue, the transition of the KSC launch facility from Shuttle to Ares 1 and Ares 5, and the Orion fault tolerance design approach. Capt. Hauck questioned whether the Council has crosstalk with the Aerospace Safety Advisory Panel (ASAP). It might be useful to have advisory committee crosstalk. Sen. Schmitt indicated that he and Mr. Iademarco would follow up on this. A member of the ASAP board was present at a NAC meeting about two years ago, and this practice should be re-activated.

Col. Collins noted two potential visits before the 2009 meetings: the ISS computer lab upgrade, and the Orion displays. Both are at JSC. Another topic that the Committee will follow is the COTS program (the first RFP) and the Commercial Resupply Program (the second RFP currently being competed).

Sen. Schmitt noted that the Committee had very well-informed fact-finding sessions at this meeting, although only one formal recommendation came out of the deliberations. He and Mr. Iademarco will continue to work the Council's 2009 meeting schedule. With respect to scheduling Council meeting locations, priority will be given to those Centers where the greatest changes have occurred. For example, most of the changes have probably occurred at JSC.

Sen. Schmitt requested that Council members put the preliminary dates in their schedules as a "hold," and feedback will be obtained from everyone on optimum dates. A schedule will be developed that tries to accommodate most of the Council members.

The meeting was adjourned at 3:30 p.m.

**NASA Advisory Council Meeting
Cleveland, Ohio
July 10, 2008**

Hotel

Radisson Hotel Cleveland Airport
Kingston Room

8:00 a.m. – 8:15 a.m.	Opening Remarks	Hon. Harrison Schmitt
8:15 a.m. – 9:15 a.m.	Aeronautics Committee	Gen. Lester Lyles
9:15 a.m. – 10:15 a.m.	Audit and Finance	Mr. Robert Hanisee
10:15 a.m. – 10:30 a.m.	<i>Break</i>	
10:30 a.m. – 11:30 p.m.	Exploration Committee	Gen. James Abrahamson
<i>11:30 p.m. – 12:30 p.m.</i>	<i>Lunch (Council Only)</i> with GRC Director & Senior Staff (Radisson Hotel, Rm. Lenox)	Dr. Woodrow Whitlow
12:30 p.m. – 1:30 p.m.	Human Capital Committee	Dr. Gerald Kulcinski
1:30 p.m. – 2:30 p.m.	Science Committee	Dr. Edward David
<i>2:30 p.m. – 2:45 p.m.</i>	<i>Break</i>	
2:45 p.m. – 3:45 p.m.	Space Operations Committee	Col. Eileen Collins
3:45 p.m.	Adjourn	

**NASA Advisory Council Members
July 10, 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. Eugene E. Covert, T. Wilson Professor of Aeronautics, Emeritus, Department of Aeronautics and Astronautics, Massachusetts Institute of Technology • 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. • Mr. Howard Stanislawski, Partner, Sidley Austin, LLP
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 C. Fraser, DRS Technologies • Capt. Rick Hauck, USN (Ret.), Astronaut (Ret.)
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. 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. Byron Tapley, Director, Center for Space Research Professor, Aerospace Engineering, University of Texas, Austin • 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> Colonel 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
Ex-Officio	<ul style="list-style-type: none"> • Dr. Charles F. Kennel, Chair, Space Studies Board, National Research Council
Not Attending	<ul style="list-style-type: none"> • Dr. Raymond S. Colladay, Chair, Aeronautics and Space Engineering Board, National Research Council • Dr. Lucy Fortson, Vice President for Research, Adler Planetarium and Astronomy Museum • Dr. Stephen I. Katz, M.D., Ph.D., Director, National Institute of Arthritis and Musculoskeletal and Skin Diseases • Dr. Ilan Kroo, Professor, Professor of Aeronautics and Astronautics, Stanford University • Dr. John Logsdon, Director, Space Policy Institute, George Washington University • Dr. Ioannis Miaoulis, President and Director of the Museum of Science, Boston • Hon. Michael Montelongo, Senior Vice President, Strategic Marketing, Sodexho, Inc. • Adm. Benjamin Montoya, CEO, SmartSystems Technologies • Dr. Mark S. Robinson, Research Associate Professor, Department of Geological Sciences, Arizona State University

**NASA ADVISORY COUNCIL
Radisson Hotel Cleveland Airport
Cleveland, Ohio
July 10, 2008**

ATTENDEES

<i>Council Members</i>	<i>NASA Attendees</i>
Abrahamson, James A.	Bowie, Terry
Burns, Jack	Denton-Misfeldt, Deborah
Collins, Eileen	Iademarco, Paul
Condon, Pat	King, Marla
Covert, Eugene	Lei, Jih-Fen
David, Edward	Ostrach, Louis
Ford, Kenneth	Parham, Jane
Fraser, Donald C.	Williams, Greg
Garriott, Owen	Wolf, Jean
Hanisee, Robert M.	
Hauck, Rick	
Jolliff, Bradley L.	
Jones, Thomas	
Kennel, Charles F.	
Kulcinski, Gerald L.	
Longnecker, David	
Lyles, Lester L.	
McPherson, Edward R.	
Milgram, R. James	
Schmitt, Harrison H.	
Stanislowski, Howard J.	
Sullivan, John	
Tapley, Byron	

Other Attendees:

Heil, Michael
Heyward, Arin
Ostdiek, Paul

Ohio Aerospace Institute
Ohio Aerospace Institute
APL

**NASA ADVISORY COUNCIL
Radisson Hotel Cleveland Airport
Cleveland, Ohio
July 10, 2008**

LIST OF PRESENTATION MATERIAL¹

- 1) Aeronautics Committee Report to the NASA Advisory Council [Lyles]
- 2) Report of Audit and Finance Committee [Hanisee]
- 3) NASA Advisory Council Exploration Committee [Abrahamson]
- 4) Lunar Capabilities Concept Review NAC Overview [Hauck]

Other documents distributed at the meeting:

- 1) NASA Advisory Council Meeting Minutes, April 17, 2008

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