NASA AEROSPACE SAFETY ADVISORY PANEL
National Aeronautics and Space Administration
Washington, DC 20546
VADM Joseph W. Dyer USN (Ret.), Chair

May 5, 2014

Mr. Charles F. Bolden, Jr.
Administrator
National Aeronautics and Space Administration
Washington, DC 20546

Dear Mr. Bolden:

The Aerospace Safety Advisory Panel (ASAP) held its 2014 Second Quarterly Meeting at Kennedy Space Center, Cape Canaveral, Florida, on April 21-23, 2014. We greatly appreciate the participation and support that was received from the subject matter experts and support staff.

The Panel submits the enclosed Minutes and Recommendations resulting from this meeting for your consideration.

Sincerely,

VADM Joseph W. Dyer, USN (Ret.)
Chair

Enclosure

AEROSPACE SAFETY ADVISORY PANEL
Public Meeting
April 23, 2014
Kennedy Space Center (KSC)
Cape Canaveral, Florida

2014 Second Quarterly Meeting Report

Aerospace Safety Advisory Panel (ASAP) Attendees
VADM (Ret.) Joseph Dyer (Chair)
Dr. Patricia Sanders (via telecon)
The Hon. Claude Bolton
CAPT (Ret.) Robert Conway
Mr. John Frost
Mr. Bryan O'Connor
Dr. George Nield
Dr. Donald McErlean

ASAP Staff and Support Personnel Attendees
Ms. Harmony Myers, ASAP Executive Director
Ms. Marian Norris, ASAP Administrative Officer
Ms. Paula Burnett Frankel, Technical Writer/Editor

NASA Attendees:

Barry Braden	NASA/KSC
Emillo Cruz	NASA/KSC
Al Diaz	NASA/KSC
Alan Dumont	NASA/KSC
Linda Euell	NASA/KSC
Al Feinberg	NASA/KSC
Mark Gordon	NASA/KSC
Jayleen Guttromson	NASA/HQ
Bill Higgins	NASA/KSC
Laura Maier	NASA/KSC
Dawn Martin	NASA/KSC
Dave Rainer	NASA/KSC
Gerry Schumann	NASA HQ

Other Attendees:

Jason Burton	Air Force
Emanuel Chatters	Air Force
James Dean	*Florida Today*
Brian Gloade	APT Research
Brant Grimes	Air Force
James Munroe	Air Force

Attendees via Telecon:

Michael Bell	NASA/KSC
Charles Bolden	NASA HQ
Paul Campbell	Lockheed Martin
Stephen Clark	*Spaceflight Now*
Crystal Jones	NASA/KSC
Diane Rausch	NASA HQ

Opening Remarks
The ASAP Chair, VADM Joseph Dyer, called the meeting to order at 11:00 a.m. He indicated that Dr. Patricia Sanders was attending the public meeting via telecon. Dr. James Bagian had been in attendance at all of the earlier fact-finding sessions, but had to depart before the public meeting convened. Before proceeding with the meeting, VADM Dyer noted that there was a "sweep up" action that was necessary to meet the requirements of the Federal Advisory Committee Act (FACA). The FACA has been interpreted to require a public and verbal address of the recommendations that were published in the ASAP's 2013 Annual Report. To accomplish this objective, VADM Dyer asked the Executive Director, Ms. Harmony Myers, to read the recommendations. He noted that if there were any discussion or amplifications of these recommendations, the Panel would take that up after all of the recommendations were read.

Ms. Myers read the seven recommendations from the 2013 Annual Report:

1. ***NASA should clearly define missions, objectives, and requirements – for both performance and certification – in a timely manner. Once they are defined, NASA should resist continually changing these elements because of the deleterious impact on cost, schedule, performance, and safety.***

2. ***NASA should rigorously identify the risks that it is accepting and the rationale for accepting them—i.e., the value expected that justifies accepting a safety risk—and transparently communicate this information to NASA's stakeholders and the public.***

3. ***In a fixed-price environment, NASA should maintain competition in the CCP until there is confidence that the acceptable level of safety will be achieved.***

4. ***NASA should strive for realism in cost and schedule.***

5. ***NASA should consistently provide formal versus ad hoc processes for managing risk with clear accountability.***

6. ***NASA should revisit its Agency-level commercial cargo risk policy.***

7. ***NASA should continue to foster a robust safety culture.***

VADM Dyer noted that the Panel had published an extensive dialogue associated with these recommendations in the Annual Report. He opened the floor for dialogue again, and no amplifications or changes were offered. With the concurrence of Panel, VADM Dyer submitted these recommendations as published to NASA and requested NASA's response.

Center Director Overview/KSC Technical Authority Implementation

The Panel spent considerable time with the professionals at KSC, led by Mr. Robert Cabana, KSC Center Director. There are about 2000 civil servants and about 5900 contractors. This number is markedly reduced from the days of high Shuttle activity. The reduction was accomplished in a very professional manner with admirable morale on behalf of the KSC team. There is increasing activity related to commercial space. VADM Dyer noted that the future is both different and similar--different in that support for commercial space is on the rise; similar in that both the Orion Program and the Space Launch System (SLS) Program are taking shape in a more classic NASA approach.

On the commercial front, there has been a noticeable change in activity. One of the significant recent events was the lease of Pad 39A to SpaceX. Other ongoing activities include high-tempo activities between the U.S. Air Force (USAF) and the Federal Aviation Administration (FAA) related to things like range safety and licensing. On the Orion front, there will be a launch later this year—the Orion capsule on a Delta IV Heavy rocket, licensed by FAA, launched by United Launch Alliance (ULA), and returned (again under FAA license) by Lockheed Martin. There has been considerable discussion within the Panel about the interface among multiple government agencies and private activities. There have been some questions about accident reporting and responsibilities. The ASAP is in dialogue with NASA's leadership, and there are many things that need to be understood in calm times (rather than in active times) to provide as much clarity and certainty as possible to operations. The Panel looks forward to discussing this area further at its next quarterly meeting.

There was some discussion about Technical Authority. Technical Authority is the check and balance between functional expertise and program execution. On the functional side (medical, engineering, contracting, etc.), there are processes by which the Agency does work, including knowledge capture and retention--the history of what works and what doesn't work. On the program side, there are responsibilities for cost, schedule, and performance. The ASAP believes that the check and balance is critically important. One of the key requirements identified by the Columbia Accident Investigation Board (CAIB) and amplified by the Panel is that these Technical Authority activities should be independently funded and not funded by the program where there would be the potential for conflict of interest or the perception of conflict of interest. The Panel notes that the independent funding has been very well accomplished. However, there is still a need for additional clarity on how Technical Authority is executed on the day-to-day level. The Panel looks forward to some upcoming directive changes and will continue to work on this topic.

KSC Center Planning and Development

The Panel also met with Mr. Scott Colloredo, KSC Director for Center Planning and Development. He had an interesting way of drawing a verbal picture of the future at KSC. It is one that will conduct both horizontal as well as vertical launches, both human and robotic launches, and both government and commercial launches. The commercial side includes Blue Origin, Sierra Nevada, Boeing, SpaceX, Bigelow, and others who will have FAA-licensed activities at KSC. Much of what the ASAP heard in terms of planning activity at KSC could be describing by the word "zoning"— what activities take place at which locales. KSC is heading in the direction of a multi-use spaceport. These activities are laudable in many ways, but there is a lot of work left to be done—accident reporting, OSHA vis-à-vis NASA responsibilities, interagency communications and interface, etc.

There are a lot of older facilities and property at KSC and all the Centers. Being able to "divest without diminishing capability" is a phrase that the ASAP thinks describes the ongoing activity, and the Panel believes that it is being well accomplished.

Dr. George Nield added that one of the areas that Mr. Colloredo talked about in terms of Center planning includes not only the activities that are underway and expected in the near future, but also disposition of excess or underutilized facilities. Potential users are being identified and negotiations are underway to make sure that developers and operators can take advantage of the great facilities that KSC has, even though the government will not be using them in the near future.

Knowledge Capture

CAPT Robert Conway summarized the ASAP dialogue with Dr. Michael Bell, KSC's Chief Knowledge Officer. Overall, Dr. Bell's report was very impressive. The ASAP recently received an answer to a formal recommendation on this subject, but the discussion at this meeting focused on KSC. KSC is a knowledge-sharing facility with multiple sharing methods, including a lessons learned information system, forums, project requirements—all in all, about 50 tools to capture data and put it into useful format. Much of this is online, but there is a fair amount of face-to-face and classroom methods. There is a lessons learned knowledge-sharing committee that does a good job of addressing the adequate sources required to create a robust database and management system. Its charter says they actively solicit material, review significant events, validate and evaluate lessons learned, coordinate transfer, and promote use of the lessons learned and knowledge sharing.

With respect to identifying critical knowledge, some things are face-to-face, and there didn't seem to be a defined process from which lessons learned could be taken from that method. CAPT Conway indicated that he would like to see a more defined process that includes procedures and steps to take once the knowledge is captured, i.e., what they do with it and how it is disposed of.

After Shuttle, KSC deliberately captured 114 lessons learned from that program. Lessons learned are also captured from off-Center sources. There appears to be a link between the standards system and the lessons learned database. The ASAP would like to find out more about how they do that. When asked how KSC system compares with other organizations, the ASAP was told that the America Productivity and Quality Council has given KSC an award for its system. When asked how the NASA employees look at this knowledge capture activity, Dr. Bell noted that some look at it as a benefit, but admitted that some consider it a "time sink." He mentioned that it was important for the committee to inculcate this into the culture—that is the key to making this work. CAPT Conway stated that he would like to learn more about how they are doing this. With capturing lessons learned, it is important to capture the names of the people that go with them so that future generations know who to go to if that person is still available. This is being done, but it should be expanded upon.

The strides made in lessons learned and knowledge sharing at KSC is significant, beneficial, and well worth the investment. Inculcation into the culture is the key to making the system more robust. Paragraph 7 of the NPD that was released states "establish metrics to assess the Agency's effectiveness and periodically evaluate those metrics to ensure that they are providing meaningful assessment." CAPT Conway stated that he would like to receive a follow-on briefing on what these metrics are for the Agency as well as for the Centers and, specifically, how they relate to affecting standards and modifications.

Mr. Claude Bolton added that the database is user friendly and analytical tools are being developed. The question is: How do we incentivize people to input to the database as well as extract from it? A point was made by other members that not only should lessons learned be captured, but also where those lessons originated. CAPT Conway noted that the metrics should describe that, and he will be looking to see if that is being done.

Dr. Donald McErlean noted that the ASAP has been tracking this topic for a couple of years. One of the positive forcing functions is that there is now a knowledge management leader at every Center. This is a very big improvement and a strong step forward. Mr. John Frost added that this was a recommendation of the ASAP, and the Agency has moved out on that recommendation and responded positively with a Chief Knowledge Officer at NASA Headquarters. The ASAP was impressed with what is being done at each Center. One of the most important missions at NASA is to develop the procedures, techniques, and tools for future generations. Capturing all the lessons learned is of tremendous value, and there are a number of ways to capture them. Historically, within the engineering field, one of the most long-lived is capturing them in standards, handbooks, or check lists that will live on. For some time, the ASAP has been pressing on how to systematically codify the lessons learned. The Panel heard one interesting comment--one of the reasons that this is not done more often is that it somewhat difficult to modify standards. This would be worthwhile for the Panel to watch and pursue in the future.

VADM Dyer added that his faith in NASA capturing lessons learned is strong. However, an important question for the ASAP to continue to pursue is: Are they doing as good a job at capturing those things that have gone right as well as those things that have gone wrong?

International Space Station

Mr. Frost noted that this topic is on the agenda at every meeting because it is very important. It is the world's Space Station and is a huge national asset. NASA pays a lot of attention to it and so does the ASAP. Mr. Dan Hartman, ISS Deputy Program Manager, led the ASAP through a good discussion on the status. They have a busy schedule coming up. They just had a very successful SpaceX docking on Easter Sunday. That visit brought 150 experiments and a considerable amount of food to orbit. The Panel has watched very carefully the use of the commercial resupply tool to get cargo to Station. This activity uses a different contracting technique than has been used in the past, including different oversight and insight. The ASAP has wanted to ensure that things weren't being risked unnecessarily if more risk was involved. Early in the program, NASA limited the type of cargo placed on those launches. There was a good discussion regarding where NASA is on the continuum of gaining confidence. There is a little more forward work for the ASAP to do to understand what NASA's policies are for the types of cargo that will be transported. NASA is in the process of getting the ASAP more information on this subject.

Upcoming events include a Soyuz mission on May 14 and the last Automated Transfer Vehicle (ATV)-5 mission on July 26. A review of the consumables showed that they are in good shape. The limiting factor now is food, and those supplies are good through August 10, thanks to the SpaceX arrival on April 20. The Panel had a good discussion on the incident that could have been very serious—the ExtraVehicular Activity (EVA) incident with water in the spacesuit. More information has become available, and it is clear now what the direct cause was—silica contamination of the drain holes in the pump separator. The indirect cause was contaminated water on the ground. NASA is now working on the root cause—how that was allowed to happen and what procedures need to be modified so that it cannot happen again. There have been a number of steps to clear up all the water on orbit. New exchange beds have been sent up and there are more to come. They have flushed the airlock water multiple times, and they are solving the problem on orbit. They have committed to not performing any planned EVAs until all the issues are resolved; however, steps are in place to provide for emergency EVAs if they are needed.

The ASAP reviewed the program risks, and the number one risk remains lack of assured access to Station, which relates to problem of when NASA stops buying rides from Russia and starts buying them from the commercial partners. Everyone that the ASAP spoke to reported continuing excellent relationship with the Russian partners with regard to crew transport. Despite what everyone is hearing in the news regarding the political situation, there has been no impact to Station, communication channels are open, and things are working well.

The program has made significant progress on planning for the safe deorbit of Station at end-of-life (EOL). The ASAP was pleased to see a signed protocol between the Russian representatives and the U.S. representatives on how they are going to proceed to formally develop the procedures, software, and hardware that will be required. This is a big step forward. The ASAP would like to see the timeline of when those steps will occur, and they are working on those.

Dr. McErlean noted that one of the things that was mentioned as a new event was the launching of several "cubesats" from the Station. These tend to be university student projects that support the national Science, Technology, Engineering, and Mathematics (STEM) objectives for education and for maintaining a high interest for space exploration activities among the student population. This was a very encouraging development.

Mr. Bolton added that he was again impressed with the amount of work going on and the number of countries participating in the Station and how well they work together—not with only routine things, but on problems. Those people who are doing the work up there should be recognized. Mr. Frost noted that he had heard that there is an effort underway to nominate the Station for the Nobel Peace Prize.

VADM Dyer agreed that this is a great example of effective program management and cooperation. The ASAP saw a new experiment in KSC's "Swamp Works" that will be going up to Station—growing plants by using the proper light frequency to accelerate growth so that produce can be generated in a couple of weeks. They are also looking at closing the loop on oxygen generation and carbon dioxide absorption with living plants. The idea of long-term living in space by using natural products to do the same kinds of processes that they do on Earth (in addition to having a renewable food source) is very innovative and imaginative. Also, studies indicate that being around living plant life has a positive psychological benefit.

Launch Services Program

Mr. Bryan O'Connor reported on the Panel's discussion with Ms. Amanda Mitskevich, Manager, Launch Services Program (LSP). He noted that the ASAP has spent considerable time looking at the human spaceflight and industrial safety activities, but not as much time with the robotic science missions. This is because the history of the safety panel comes from a human spaceflight accident many years ago. However, over the last two to three years, the Panel has been studying how NASA becomes confident enough to put people on the new launch vehicles. Gaining enough confidence to do important missions on high-risk launch vehicles is not new to NASA. The LSP has been doing this for about 15 years, and the ASAP felt it would be very useful to look at that Program.

In addition to Ms. Mitskevish, the Panel talked with Mr. Jim Norman, who is the NASA Headquarters executive on launch services; Ms. Mitskevech's deputy, Mr. Chuck Dovale; her chief engineer, Mr. James Wood; Mr. Rick Boutin, the Chief Safety and Mission Assurance Officer; Mr. Darren Bedell, the Systems Integration Manager; and several others. This program derived from people who had been at Goddard Space Flight Center (GSFC) and Glenn Research Center (GRC) managing the NASA launch vehicle programs (the Deltas and Atlases) at those two places. They came together at KSC and established a program offering two different types of rockets plus the ground support and the range safety services needed at KSC. In the 15 years that they have been together as a program, they have bought services from commercial operators for over 75 launches. Their key strategy is to provide access to space. To do that, they certify and procure domestic space transport. Their customers are the robotic science missions and the space and civil sector missions, e.g., the communications and weather satellites. They use fixed-price contracts, but have some flexibility that is not normally used with those types of contracts. Some of this learning is being shared with the commercial crew and commercial cargo people. The LSP people are very nimble with the contract—they are able to set up task orders to do things that were not anticipated in the fixed-price contract without bringing the entire program to a halt while making changes. They have been flying about four flights per year under the NASA Launch Services II (NLS II) contract for the last few years. Currently, four vehicles are certified under that contract: Pegasus XL, Minotaur C (formerly Taurus XL), Atlas V, and Delta II. Four more are on the queue for certification: Antares, Athena Ic, Athena IIc, and Falcon 9 v1.1.

The ASAP discussed the mission life cycle and how that starts—somewhere between four and ten years before launch—to get these vehicles on the path to certification and launch. Their certification program is not what one

normally thinks of as certification, where NASA lays down standards and requirements documents and verifies compliance. It is more of a risk-based approach to certification, where NASA looks at how the contractor is validating its own requirements and verifying compliance with its requirements. NASA is there observing how that is done and becomes comfortable with the process. If the NASA people don't like what they see, then they are involved in the engineering boards and make recommendations. In the end, if NASA does not feel comfortable, NASA has a "no go" for launch as well as payments. NASA oversight is in the form of approval for the design for public safety, along with the Air Force Range, and they have a go-no go for launch at the end. It is very much a NASA operation in that respect. Even though the Agency is buying a commercial service, these launches are considered to be "NASA missions" for purposes of range safety and mishap investigation and reporting.

The Panel discussed how the LSP coordinates with other activities (e.g., commercial cargo) that are in the new business of buying launch services from commercial entities. The Program "loans" them some of their people and shares information that it learns from its own missions and certification efforts. Because there are several different types of approaches to buying these services, there are obvious barriers to communications that must be negotiated. The ASAP was very interested in how the Program deals with this, because the Panel supports and encourages the maximum exchange of information between these programs. It would be unfortunate if NASA learned something about a launch vehicle in one of these programs and did not communicate appropriately with another NASA organization. NASA knows that there are some limitations on proprietary data, but the organization is doing the best they can to ensure they have a good information exchange. If the Panel senses that there may be a problem, it will follow up with questions. Overall, the ASAP obtained a good understanding of how the LSP operates.

Exploration Systems Development

Dr. McErlean reported that the ASAP discussed this topic extensively with Mr. Daniel Dumbacher, Associate Administrator for Exploration Systems Development in the Human Exploration Mission Directorate at NASA Headquarters. Exploration Flight Test (EFT)-1 is on schedule. The previous schedule showed an October launch date; Mr. Dumbacher told the Panel that they are still working to that timeline internally and would probably be ready to go at that time, but they have agreed with the Air Force to postpone the launch date to early December to allow the Air Force to launch an important national payload in October. EFT-1 will fly on a Delta IV Heavy as an uncrewed test flight. The Space Launch System (SLS) core stage is scheduled to start testing and is beginning assembly at the Michoud Assembly Facility (MAF). They expect a Critical Design Review (CDR) on the core stage this summer and are beginning structural testing this month. On one of the tours, the ASAP saw Orion in its buildup—much progress from about a year ago when Orion was just a bare shell. Most of the wiring and instrumentation is installed, external systems are in place, the heat shield has been delivered, and it will be installed in a couple of months. The service module is underway. It is being built up for assembly and completion later this year. They expect to do a power-on test on the command module on May 21. This is an important milestone in the buildup. This June, the test article is scheduled to be ready for initiation of ground processing and ground testing, and in September/October it will be on-site and ready for launch.

Exploration Mission (EM)-1, the first launch on the SLS core rocket, will occur in late 2017 or early FY18, and there is a lot of activity around that element. The Environmental Control and Life Support System (ECLSS) is being built up and will soon undergo testing, including some testing on the International Space Station (ISS). All of these activities are pointing toward a crewed test; the earliest date would be in August 2020 or early FY21. The decision on a crewed test on EM-2 has tentatively been made, but the crewed flight could slip to EM-3. Mr. Dumbacher emphasized that NASA will not fly crew in the spacecraft until all systems are fully tested and ready to go.

On one of the tours at KSC, the ASAP was able to see the thermal insulating tiles on the crew module, the heat shield in the protective dome, and the service module. The Program has had successful separation tests and has done some underway recovery testing. In the next month, they will fit the heat shield to the command module. In early June, they plan to mate the crew module and service module and will be ready for ground operations around July. Dr. McErlean stated that we are getting close to seeing the first experimental launch of the new system that will take us beyond low Earth orbit (LEO), back into outer space.

Mr. Frost noted that the process of deciding whether the first crew would be on EM-2 or not is an interesting exercise. In discussion with the LSP, the Panel learned that they have strict rules on how many flights must be successfully accomplished before a high-value payload is launched. They can require as little as 3 successful launches in addition to requiring extensive insight before launching a high-value cargo, or 14 or more successful flights if the level of insight is less. Due to the greater government launch vehicle involvement, NASA has a different approach for human spaceflight. These differing flight test philosophies should be considered in planning the first crewed, SLS-launched mission.

Ground Systems Development and Operations

VADM Dyer noted that the ASAP had an opportunity to spend some time with the ground system operations people, who are essential and perform high-quality work, but often do not get as much public appreciation as those in the flight segments. However, they are absolutely necessary--preparing the facilities, transporting launch vehicles, providing much of the infrastructure necessary to prepare for a full system support for both NASA as well as commercial launches. There is a lot of work that must get done "behind the scenes" that can be on the critical path if it is not accomplished properly. VADM Dyer noted that these folks are so good they seldom get on the critical path. The ASAP sent high compliments to the ground operations teams.

Mr. O'Connor added that everyone talks about Shuttle mishaps and loss of crew, but NASA has lost people on the ground also. Ground systems operations can be very dangerous, and there are a lot of hazardous operations. One of the things that the ASAP regularly asks is: "How is that coming? Are the things we learned from the Shuttle Program being applied to keeping high-risk ground operations (e.g., high energy activities, heights, etc.) safer?" If not done right, they can hurt people badly.

Safety and Mission Assurance

Mr. Claude Bolton reported on the ASAP discussions with Mr. Russ Deloach, Acting Director (as well as Deputy Director), KSC Safety and Mission Assurance (SMA), who addressed the ASAP on the KSC SMA in several key areas including: overview of the SMA Directorate; program/project support for LSP and the Commercial Crew Program (CCP) collaboration and the Ground Systems Development and Operations (GSDO) Program; SMA support to KSC partnerships, including KSC range safety planning for FAA-licensed launch activity; KSC institutional safety, including culture and metrics; workforce status; anticipated challenges; and an update on KSC's certification for Capability Maturity Model Integration Maturity Level 3 (CMMI ML3).

During the overview, the ASAP noticed that three SMA Directorate positions were being filled by people in "acting" roles. The ASAP was pleased to hear that all positions are close to being filled with full-time people. The ASAP received detailed briefings on SMA's involvement and support on a number of current programs including the LSP, CCP, ISS, Orion, GSDO, Advanced Exploration Systems (AES)/ Space Technology Program (STP), and support to Center efforts to provide services to commercial endeavors.

SMA is assisting KSC partnerships in taking advantage of KSC's underutilized facilities to enable commercial access to space. These include Launch Pad 39A, Orbital Processing Facility (OPF) 3, Shuttle Landing Facility (SLF), and the Vehicle Assembly Building (VAB). SMA is integrated into the partnership process at every step. Partnership work also extends to range safety support and is exemplified by the recently released Memorandum or Agreement (MOA) between the 45th Space Wing and KSC for Eastern Range related operations.

With regard to KSC institutional safety, KSC is doing very well according to the safety metrics. There is an increased focus on construction safety and the use of the NASA "5-Factor" safety culture model: reporting culture, just culture, flexible culture, learning culture, and engaged culture. KSC SMA is reviewing safety survey reports to better evaluate the KSC safety culture, and the ASAP looks forward to receiving the results from this work.

The ASAP learned that the KSC SMA workforce appears to be adequate today. However, in the coming years, the skill mix will need to change and the numbers may need to increase as programs enter operational phases. For FY15, KSC SMA is within the proposed budget for the first time since Shuttle fly-out and the cancellation of the

Constellation Program. While that sounded good, discussions revealed that this was a result of losing people rather than a budget adjustment.

While the budget was not formally presented in the briefing, ASAP analysis of information provided previously revealed a disproportionate reduction in SMA FY14 funding versus overall NASA budget reduction percentages. The ASAP is concerned and wants to understand the impact of such disproportionate cuts on KSC and Agency-wide institutional SMA as well as whether or not those managers who are reducing institutional and OSMA funding truly realize the impact of such cuts. OSMA is not identified separately as a budget line item, but is part of a NASA-wide, cross-cutting line called "Cross-Agency Support (CAS)." The ASAP will continue to watch this area very closely and request further information and provide insights in the coming months.

The final part of the SMA presentation was on the status of the KSC CCMI ML 3 certification/appraisal process for software. "KSC Class A Software Projects" is the organizational unit identified for the CMMI ML3 appraisal. Ms. Tami Wilson from the KSC Engineering and Technology Directorate and who is the KSC software engineering Technical Authority, presented the ASAP with a status update on the appraisal process. While the progress has been steady to date, a quick-look appraisal held with the lead CMMI appraiser revealed gaps which NASA must address to meet the CMMI certification requirements. NASA's updated plan for the next readiness review and the ultimate certification/appraisal inspection will be available in May 2014. When KSC will have its CMMI certification completed is "TBD" at this time. However, the plan to close this out will be available next month. Discussions following the CMMI update addressed possible next steps, which included the applicability of System Engineering and Integration's (SE&I's) Team Software Process (TSP) to NASA's software tool set. Mr. Bolton indicated that, in his opinion, there may be even better tools.

Bottom line, the safety metrics look good, and even with budget challenges, they are doing an excellent job at KSC. This is a testament to the people in that office as well as the leadership. Mr. Bolton noted several Air Force personnel from the 45th Space Wing who were present at the meeting and commented that it was good to have them there.

Mr. O'Connor noted that he and Mr. Bolton had looked at the Office of Safety and Mission Assurance (OSMA) budget at NASA Headquarters. That group is headed by Mr. Terry Wilcutt; there are two similar groups—the Office of the Chief Engineer and the Office of the Chief Health and Medical Officer. These are the Agency's head Technical Authority offices. They handle policy, they oversee SMA and engineering activity at the Centers, and they are the "standard bearers" for the Agency's core values—safety, excellence, teamwork, and integrity. Those values are "core" because they are special, and they have been called core values in the Agency for over 20 years. The ASAP' question is: Why does NASA put these Offices' budgets into something called "cross-agency support?" There should be some way that NASA could accentuate the important things that are done under that budget line item. Mr. O'Connor suggested that NASA think about that and work with its stakeholders to ensure that the core values are not adversely affected. VADM Dyer noted that the first time he saw this line item, he thought it referred to "interagency"—he didn't realize it related to the activities that Mr. O'Connor described. He indicated that he worries that some people on the Hill may also have that same misinterpretation. He hopes that this is considered in the budget deliberations going forward.

Dr. McErlean noted that the ASAP was thrilled to have a tour of KSC's "SwampWorks." In discussion with the lab people there, they noted that they were in place because they occupied a historic building which could not be torn down. Their budget comes from whatever they can "scrounge around" and get someone to contribute to. As a long-time research and development (R&D) professional, in both the Nary and Air Force, Dr. McErlean stated that he knew what trying to get funds for an R&D lab is like. NASA is going back to space. EFT-1 will take place the end of this fiscal year, and that should thrill anyone who was part of Shuttle. Although this is a just first step, there is always a first step, even with Shuttle in the 1970s. The technologies that we need to stay in space—habitats, long-term radiation countermeasures, etc., are being worked on today in our laboratories. NASA has talked about the development of capabilities, which are different from mission-related activities. In discussing this with NASA leadership, the sense is that it would be good if there were a budget for "capability development' that did not have to be extracted out of the mission-specific lines. Industry has Independent Research and Development (IRAD) to

develop capabilities that are needed across a broad variety of programs. NASA should explore some mechanism for doing this across multiple Centers and allow some sponsorship for that. Dr. McErlean emphasized that this suggestion is not meant to take anything away from the Swampworks at KSC, which is doing a great job.

Commercial Crew

Dr. George Nield discussed Ms. Kathy Lueders' update on the CCP. The ASAP started by congratulating her on her recent formal selection as the CCP Program Manager. NASA has been working very hard to figure out how to successfully execute Commercial Crew Transportation Capability (CCtCap). There are four aspects to the plan to reduce the risk for CCtCap: maturing the designs under the Commercial Crew Integration Capability (CCiCap) Space Act Agreements, refinement and understanding of the requirements and the contractors' approaches under the Certification Products Contract (CPC), assessment of contractor's maturity and compliance, and planning for program execution under the next phase as part of the selection process currently in progress. The ASAP is seeing very good progress on CCiCap. Three funded companies are part of that activity: Boeing, Sierra Nevada, and SpaceX. Boeing has recently completed pilot-in-the-loop demonstration, spacecraft primary structures CDR, and software CDR. Upcoming in July is the CDR itself. SpaceX has recently completed a Dragon parachute helicopter drop test, a delta ground systems Preliminary Design Review (PDR), and an integrated CDR. They have some interesting activities coming up later this year—a pad abort test schedule in June and an in-flight abort test in August. Sierra Nevada has recently completed its certification plan review and its CDR incremental design review. In August, they hope to do some additional Engineering Test Article (ETA) flight testing. In addition to the three funded companies, NASA has an unfunded Space Act Agreement (SAA) with Blue Origin, and they are continuing to make progress on their milestones.

There has been a lot of great work by NASA and the companies involved under the CPC. There were over 500 deliveries of data and products to NASA. The Agency has gone through all those and has been able to disposition them before start of the "blackout" period that they are under now for a selection later this year. NASA is working with a number of other partners, including the FAA for a program management plan on how NASA will work with that agency in the post-certification era and for modification to the Commercial Space Launch Act that will add definition for a new category of person flying under these missions: "government astronaut." NASA is also collaborating with the LSP to review how CCP deliveries are taking place and how to share lessons learned from the LSP. Ms. Lueders also described the progress being made in safety reviews. Earlier this year, NASA established the Safety Technical Review Board (STRB), and that Board has now had week-long safety reviews with each of the spacecraft and launch vehicle providers. This has been very successful. NASA hopes to have one or more companies selected in the August/September timeframe under the CCtCap contract.

The final item discussed with the ASAP was in response to a question posed at an earlier meeting: How does the CCP disposition the various deliverables? Ms. Lueders stated that the Program Control Board (PCB) is the decision forum, and she provided an example on how the inputs are solicited and how the discussions take place. As the ASAP discussed that, the Panel had some questions about how that process works. For example, if a Technical Authority in a particular area does not agree with the proposal, does that issue automatically get elevated, and if so, under what circumstances? Ms. Lueders took the action to go back and really understand how the CCP is planning to implement the recently updated NASA directives on Technical Authority. This is an area that the ASAP has been working on with NASA for some time; progress is being made, but there are still some questions. Ms. Lueders indicated that she would clarify how this is handled on the CCP and any changes that she proposes going forward.

There were no further questions or comments, and VADM Dyer adjourned the meeting at 12:25 pm.

ASAP RECOMMENDATIONS, FIRST QUARTER 2014
(Recommendations from 2013 ASAP Annual Report)

2014-AR-01 Definition of Missions, Objectives, and Requirements for Performance and Certification

Finding: Unless a program's mission and objectives are clearly defined and articulated, it is impossible to determine what level of safety risk is acceptable.

Recommendation: NASA should clearly define missions, objectives, and requirements – for both performance and certification – in a timely manner. Once they are defined, NASA should resist continually changing these elements because of the deleterious impact on cost, schedule, performance, and safety.

To specifically apply this recommendation to NASA's programs, the ASAP offers the following:

1) **The ESD mission(s), objectives, and requirements, including Loss of Crew (LOC) and Loss of Mission (LOM) requirements, should be clearly and explicitly identified.**
2) **The rationale for maintaining the ISS should be clearly stated.**
3) **The CCP objectives should be further clarified and prioritized.**

Rationale: Requirements for both performance and certification need to be defined and communicated early enough in a program to be incorporated into the design from the beginning. Safety risks that could have been avoided or mitigated if addressed at the outset could become prohibitive to alleviate if identified too late in a development program.

2014-AR-02 Identification and Communication of Safety Risk

Finding: For Exploration Systems Development (ESD) and its elements, the determination of acceptable risk threshold is dependent on the benefit to be gained by incurring the risk. For the International Space Station (ISS), the acceptance of risk (and cost) of extending the Space Station's life is dependent on the benefit anticipated from maintaining the ISS's capability for a longer period. For the Commercial Crew Program (CCP), accepting the risks inherent in embracing a new commercial partnership business model is dependent on the value of the approach's objectives.

Recommendation: NASA should rigorously identify the risks that it is accepting and the rationale for accepting them—i.e., the value expected that justifies accepting a safety risk—and transparently communicate this information to NASA's stakeholders and the public.

Rationale: Determination of what constitutes an acceptable safety risk is based on a value decision that balances the potential untoward outcomes against the potential gains as defined by the mission and objectives. Only through such a balancing process can the determination of "How safe is safe enough?" be made.

2014-AR-03 Competition in the Commercial Crew Program

Finding: NASA has elected to award a fixed-price contract for the certification and initial provision of commercial crew transportation. The contract award is likely to occur before certification requirements clarity has been achieved and confidence has been gained that the potential commercial partners can provide certifiably safe transport.

Recommendation: In a fixed-price environment, NASA should maintain competition in the CCP until there is confidence that the acceptable level of safety will be achieved.

While maintaining competition, the ASAP believes that it is imperative that NASA use its oversight and insight capability to ensure that competing providers do not shortchange safety in order to gain a competitive advantage in other dimensions, such as cost and schedule.

Rationale: If competition is maintained, NASA may have alternatives other than accepting a less-safe design, unnecessary higher costs, or late delivery.

2014-AR-04 Realism in Cost and Schedule

Finding: NASA may not have control over the budget amount that is appropriated for a program. Cogent and fair cost analysis will be necessary.

Recommendation: NASA should strive for realism in cost and schedule.

Rationale: Unrealistic cost or schedule expectations—or the combination of both—puts undue pressure on performance and safety.

2014-AR-05 Processes for Managing Risk with Clear Accountability

Finding: In 2013, NASA took a very positive step in documenting and clarifying the Technical Authority responsibilities. This formalization represents a practice that should be followed more generally—for example, in the informal process of validating the Safety and Mission Success budget to avoid an unfortunate budgeting structure at NASA Headquarters

Recommendation: NASA should consistently provide formal versus ad hoc processes for managing risk with clear accountability.

Rationale: Reliance on the quality and integrity of personnel to "do the right thing" makes risk management personality-dependent rather than part of a formal process.

2014-AR-06 Commercial Cargo Risk Policy

Finding: Early in the program, NASA limited the ISS Program to non-critical or "Class-D equivalent" payloads on new vehicles. The assumption was that once NASA developed confidence in the reliability of that service, it would be able to fly more important cargo. As the ISS's science and technology work expands, international vehicles are less available. As the Stations' components wear over time, the ISS Program has found it necessary to fly more and more important cargo on the new vehicles.

Recommendation: NASA should revisit its Agency-level commercial cargo risk policy.

This reassessment should be made with the intent to:

- Make clear to the programs, Agency leadership, and stakeholders what, if any, limits to ISS cargo are appropriate for the relatively unproven vehicles and the limited insight/oversight posture currently in place;
- Provide guidance on when and under what circumstances the ISS Program will be able to fly important cargo in the commercial cargo vehicles;
- Decide whether and how much to ramp up Government insight for recurring early flight activities, as well as future design and/or operational changes by the contractors; and
- To the extent that the Agency chooses to accept a higher risk posture than was indicated or assumed by past policies, update those policies in the interest of transparency.

Rationale: When asked about the earlier "Class-D equivalent" guidance, NASA managers acknowledge that it has not been formally lifted. At the very least, this gives the appearance of an inconsistent risk philosophy for ISS cargo versus other Agency activities.

2014-AR-07 Robust Safety Culture

Finding: NASA's safety culture originates at the Agency's leadership level and flows down from there.

Recommendation: NASA should continue to foster a robust safety culture.

Rationale: Leadership must take special care to communicate consistently and clearly, especially regarding decisions that challenge long held values—such as the CCP fixed-price contract for certification or the weighting of price over safety in the CCtCap Request for Proposal (RFP)—or involve violation of previously articulated policy decisions, such as CRS cargo only involving non-critical, Class D-equivalent hardware. NASA should "take the temperature" of its safety culture throughout the Agency with regular measurements, formulate and implement appropriate corrective actions where indicated, and assess the impact of the corrective actions.