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

May 27, 2015

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 2015 Second Quarterly Meeting at NASA Headquarters, Washington, DC, on May 12-13, 2015. We greatly appreciate the participation and support that was received from the subject matter experts and support staff.

The Panel submits the enclosed Minutes resulting from the public meeting for your consideration.

Sincerely,

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

Enclosure

AEROSPACE SAFETY ADVISORY PANEL
Public Meeting
May 13, 2015
NASA Headquarters
Washington, DC

2015 Second Quarterly Meeting Report

Aerospace Safety Advisory Panel (ASAP) Attendees
VADM (Ret.) Joseph Dyer (Chair)
Dr. Patricia Sanders
Dr. James Bagian
The Hon. Claude Bolton (telecom)
CAPT (Ret.) Robert Conway
Mr. John Frost
CAPT (Ret.) Brent Jett
Dr. George Nield
Dr. Donald McErlean (telecom)

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

NASA Attendees:
Grey Hautaluoma
Lynne Loewy
Rick Irving
Deirdre Healey
Frank Groen
Russ DeLoach

Other Attendees:
Linda Karanian, Aerojet Rocketdyne
John Berk, SpaceX

Telecon Attendees:
Susan Bachle, NASA OIG
Mike Beims, NASA
Paul Campbell, NASA/JSC
Stephen Clark, SpaceFlightNow.com
James Dean, Florida Today
Bill Harwood, CBS News
Frank Morring, Aviation Week
Stephanie Schierholz, NASA
Karen Vansant, NASA OIG
Dan Vergano, Buzz Feed News
Dan Leone, Space News

Opening Remarks

The Aerospace Safety Advisory Panel (ASAP) Chair, VADM Joseph Dyer, called the public meeting to order at 4:00 p.m. and welcomed attendees. He announced that The Honorable Claude Bolton has a new grandchild and would be participating in the meeting via telecom. The ASAP spent most of the previous day looking at many of the aspects of the Commercial Crew Program (CCP). Gaining the kind of insight that the ASAP has needed to assess the safety status of commercial crew has been a challenge. Late last year, the NASA Administrator committed to ensuring a "sea change" in attitude and sharing, and that has been accomplished. The Panel had an excellent meeting looking at many aspects of the Program. VADM Dyer noted that he and the members would share with the public that which they could, but much of the information is restricted and labelled as "sensitive but unclassified" (SBU). The Panel will be working with the CCP and NASA to be more liberal in publicly sharing information as time goes on. They believe that openness is in the best interests of the program, but it is complicated. There are two commercial contractors producing designs that are their property. They are in competition and sensitive to sharing information with competitors. The Panel also looked into the Space Launch System (SLS) and a number of administrative activities related to safety at NASA. The Associate Administrator,

Human Exploration and Operations Mission Directorate (HEOMD), Mr. William Gerstenmaier, discussed several topics of interest to the Panel including exploration and commercial space. VADM Dyer referred to him as "America's rocket scientist" and opined that he is perhaps the world's most knowledgeable manager of space systems, a genuine expert, and a great American. Mr. Gerstenmaier began a dialog on a topic that was addressed in the ASAP 2014 Annual Report – constancy of purpose—which can be plainly expressed as "let's not restart the program with every Administration;" rather let us maintain course and speed to deliver on the promise of America's mission in space.

Mr. Gerstenmaier's strategy in maintaining constancy of purpose centers on being specific with regard to programs in a five-year horizon, communicating a common vision or objectives in the five-to-ten year horizon, and keeping Mars as an ultimate horizon mission. The two nearer horizons include SLS, Orion, commercial cargo, and commercial crew. There was also discussion about extending the International Space Station (ISS), the business case associated with that, activities to foster commercial space, sufficiency of funding, and NASA being able to do all those things that they are tasked to do. Without sufficient funding, NASA is always stressed to do everything "on its plate." The Panel hopes that the markup on Hill will be very supportive of that which is necessary. The Russians had a Progress mission that ran into some difficulty a few weeks ago, and the Panel was able to obtain some good insight into that. The status will be included in this report.

Commercial Crew Program Update

Mr. George Nield reported on the presentation by Ms. Kathy Lueders. Most of the discussion focused on the Commercial Crew Transportation Capabilities (CCtCap) contracts with Boeing and SpaceX. NASA still has some remaining milestones as part of the previous effort—the Commercial Crew Development 2 Space Act Agreements (SAAs). Blue Origin, Sierra Nevada, and Space X have all negotiated extensions to their SAAs to complete the remaining milestones. NASA appreciates and supports the involvement of the non-selected companies with SAAs. All have been pleased that they are able to maintain dialog. Most of Ms. Lueder's discussion concerned details on the status of Boeing and SpaceX. She covered a schedule overview, a list of accomplishments to date, milestone status, risk status (NASA is using the classic 5-by-5 matrix with red, yellow, and green codes for consequence and likelihood for each risk), and a series of special topics for each of the companies. The particular details are in the SBU category. In summary, Ms. Lueders reported that both providers are meeting their contractual milestones and maturing their designs. Both are providing increased insight opportunities for NASA, and both have moved past the "paper products" stage and are actually building and testing hardware. In spite of all that good news, it was acknowledged that both the companies and NASA still have a great deal of work ahead of them.

Commercial Crew Program Certification

The Honorable Claude Bolton reported on the CCP certification briefing by Mr. Edward Burns, CCP Systems Engineering and Integration Manager. Mr. Burns provided the ASAP with an informative overview and update of the certification process, which the ASAP has been following very closely. The overview covered the CCP certification philosophy/strategy; CCP certification components, including requirements, verification and validation (V&V), and phased safety reviews; certification status for Boeing and SpaceX; and some concluding remarks. He described the philosophy/strategy by comparing and contrasting the Commercial Crew Integrated Capabilities (CCiCap) program with CCP and showed how CCP certification builds upon requirements levied on the CCtCap contract. For CCtCap, a commercial provider develops a Commercial Transportation System (CTS) and asserts that it meets NASA's safety, crew, and technical requirements, and that it is managed to an acceptable level of risk for transporting crew. The CCP substantiates the commercial provider's assertion. This results in NASA approval of a number of important items, including certification plans, V&V plans, specifications and standards, design certification reviews, hazard reports, variances, operations plans, management plans, certification data plans, etc. In addition, the interim certification milestones that were used in CCtCap are also

used in CCP. These are the Certification Baseline Review (CBR), ISS Design Certification Review (DCR), Flight Test Readiness Review (FTRR), Operations Readiness Review (ORR) and Certification Review (CR). Mr. Burns highlighted the CCP certification components: requirements, V&V, and phased safety reviews. With regard to the requirements component, Mr. Burns stated that the Agency, the HEOMD, and the Program retain key accountability for NASA human spaceflight safety and mission success requirements, which are allocated from NPR 8705.2B within an overall NASA/industry shared accountability framework. NPR 8705.2B was used as a basis for developing the HEOMD-10001 document, with applicable requirements flowed down to CCP requirements documents that were levied in the CCtCap contract. Several charts were shown illustrating the NPR8705.2B flow down of human-rating requirements and mapping into CCP documents, including the 1100 series documents and the CCT-REQ-1130 requirements.

With regard to the V&V certification component, Mr. Burns stated that the CCP had developed verification strategies based upon the CCT-REQ-1130 requirement, that SSP 50808 has established verification/expectation for the requirement set, and that successful verification closure of requirements and validation of the system sets will provide grounds for CCP certification approval. In essence, the V&V Plan will address all of the verification requirements and, additionally, some aspects of a test plan based on stakeholder evaluation of risk. Regarding the third certification component, Mr. Burns stated that the NASA phased safety review process is levied through CCT-PLN-1120, various SSP documents, and the CCtCap contract. There are three phases: Phase I occurs around Preliminary Design Review (PDR), Phase II occurs around Critical Design Review (CDR), and Phase III occurs around DCR. Phase II is currently in work. It has been a very detailed, tough, and candid review thus far, but it is resulting in the contractors understanding what NASA expects in order to certify that a vehicle meets NASA's fault-tolerant requirements. Hazard reports are also part of the review certification component. Non-traditional review of the hazard reports was conducted during the Certification Products Contract (CPC) against Phase I criteria, while hazards affecting ISS were reviewed jointly. Although CCP certification status for the two CCP contractors was provided to the ASAP, that status cannot be shared publicly because of the proprietary nature of the information. Mr. Burns concluded his presentation to the ASAP by using the classic systems engineering "V" to describe the CCP certification process. In the upper left corner of the "V" are the Agency requirements, going down to the bottom of the V—the partner-specific baseline—then up through a number of partner certification processes, to eventually reach NASA (at the upper right corner of the "V") for Agency certification approval. Mr. Burns' presentation was thorough and informative. It clearly showed the ASAP where NASA is, where the companies are, and the detail and thought that have gone into the plans for certification of the vehicles.

Commercial Crew Program Waivers and Deviations

Dr. James Bagian reported on Mr. Burns' discussion on waivers and deviations. He talked about waivers and deviations that can be thought of under the general category of variances and how variances are handled in these programs. A number of elements in the presentation dealt with SBU-type information. Dr. Bagian did not discuss those elements, but reported on the overall process. When the processes were developed, NASA ensured that they involved the principal stakeholders in CCP and ISS as well as various stakeholders in Safety and Mission Assurance (SMA) and the contractors. The stakeholders are part of the process for clarity of methodology and responsiveness to achieve goals. There is an understanding that in the commercial world, there may be other ways to attain the goals, and NASA wanted to keep lines open as much as possible to achieve the ultimate safety goals. Although the requirements are there, in some cases there is the opportunity to look at alternatives or exceptions. There are a number of internal boards that can review requests. There is a fairly orderly way of requesting variance and providing rationale. There are a number of ways a variance can go. An exception is a permanent relief from a requirement, e.g., recognition of an alternative standard. A deviation is a temporary relief granted in advance while still more information and experience is being gained and which will hopefully result in a permanent resolution. A waiver is a temporary relief from a requirement after a

baseline system has been approved. There are a number of ways the variances can be worked off: redesign, mitigation of risk, alternative standard, approved as is, and obtaining additional required data. In some cases, the variance can be deferred because the process or experience base it is too immature to accept. The rest of the presentation dealt with specific examples in the programs that could not be discussed in this public meeting.

Commercial Crew Program Loss of Crew/Loss of Mission

Mr. John Frost reported on the beefing by Mr. Justin Kerr, Manager of the Spacecraft Office in the CCP. Loss of Crew (LOC)/Loss of Mission (LOM) has been a topic of great interest to the ASAP for years. The LOC is loss of crew probability—how likely there will be loss of crew on a given mission. It is a top level metric that tells how safe the system is overall. It is a theoretical number, evaluated by a probabilistic risk assessment. The Panel is interested in ensuring that the bar is set high enough to drive designers and engineers to provide the safest vehicle possible.

Mr. Frost provided some background on the topic. The Panel had understood at an earlier meeting that the LOC requirement was being reduced fairly significantly. There was a lot of detailed information provided by Mr. Kerr, and the "change" in requirement is not as bad as the Panel originally thought. The Space Shuttle at end-of-life had LOC of about 1 in 90. The follow on Constellation (that was originally envisioned to replace Shuttle) had a goal of 10 times better (1 in 1000), based on a 2005 study, which at that time was thought possible and was consistent with the request from the Astronaut Office. As the Constellation system design began and the program started looking at hazards and threats, in particular the very significant Micrometeoroid and Orbital Debris (MMOD) threat, they found that 1 in 1000 was going to be an impossible number to meet. The Agency decided toward the end of that program to reduce the LOC number to 1 in 270 (or 3 times better than Shuttle at end-of-life). The Panel had a concern with that LOC number at prior meetings and asked NASA to relook at it. They did and felt it was the best that could be done. When the CCP came along, the HEOMD chose that same number to keep an even playing field (commercial crew should be as safe as Constellation would have been), and the requirement of 1 in 270 was set for commercial crew. Most felt that the contract was clear that the requirement was to be met without any inspection on orbit. As the contractors started producing their designs and analyses started coming in, NASA learned that both commercial providers were relying on inspection on orbit, which was not intended by the Program. That triggered more studies and analyses, which finally led the CCP to conclude that even the 1 in 270 couldn't be met, primarily because of MMOD hazard. The CCP wanted to focus the contractors' attention on the things that they could do. The approach that NASA took was to take the requirement, reduce it slightly to what was believed to be the most safety that could be attained without operational mitigations (1 in 200), and clearly made the contractors understand that no inspection could be counted on—they had to meet that number on their own. It is now clear that coupled with that, NASA has a made commitment to find other operational control mechanisms that will make up the gap between 1 in 200 and 1 in 270. The kinds of things that can be done on orbit include: inspection by ExtraVehicular Activity (EVA) or robotic arm, docking procedures and location of docking port, and reducing time on orbit. All of these will be examined. The CCP has committed to studies to determine which of those make the most sense and to implement them. Mr. Frost cautioned that some of those operational constraints, such as EVA inspection, carry their own risk. NASA needs to be careful as it picks what the controls will be and to be smart about how to make up the gap. Bottom line, there is still a 1 in 270 requirement; some of that has been allocated to the contractors and some to the Program. The Panel believes NASA is moving forward in an orderly and well-thought-through process.

Commercial Crew Mishap Process/Plan

Dr. George Nield reported on the mishap process topic that was discussed by Mr. Rick Gavin, Federal Aviation Administration (FAA) Liaison/Range Safety in the CCP. One of the key interests on program is: What happens in event of a mishap? Efforts have been devoted to focusing on this topic. One of most interesting parts of the

presentation was review of current law. In the NASA Authorization Act of 2005, there is requirement, put in place by Congress, that if there is any incident that results in loss of ISS or its operational viability, loss of any U.S. space vehicle carrying humans that is owned by the Federal government or that is being used under government contract, or loss of a crew member or passenger in any of those types of space vehicles, then a Presidential Commission must be formed to investigate the incident. This is very significant for everyone to recognize. This law affects both the ISS and commercial crew flights being conducted under contract to the Federal Government. Recognizing that and considering all of the other responsibilities surrounding a potential mishap, NASA is working with other stakeholders, including FAA, to put together a plan to deal with it. A document entitled "Mishap Preparedness and Contingency Plan for the Commercial Crew Program" is being prepared. There are a couple of key matrices in that document that are of particular interest. One spells out who has search and recovery responsibilities by mission phase—whether it is the contractor, NASA, Department of Defense (DoD), FAA, or the National Transportation Safety Board (NTSB) during pre-launch, ascent, on orbit, descent, and landing. Another matrix being prepared as part of the plan identifies the lead investigator organization—the contractor, NASA, the Presidential Commission, FAA, or NTSB. Various scenarios were identified; for example, injury or damage to contractor personnel or property, injury or damage to NASA personnel or property, loss of vehicle with flight crew recovered, loss of vehicle with loss of flight crew, damage to vehicle with crew recovered, damage to vehicle with loss of crew, and loss of life or damage to public property. Those are the possible cases that are being examined. A draft of the document is nearing completion. NASA hopes to have the entire document complete and baselined by the end of May.

Dr. Bagian noted that during the briefing, it was heartening to see that they are looking forward to being prepared. However, they are still early in the planning stages, and there are a number of situations that need to be "fleshed out" to fill some voids. The ASAP will continue to observe these to ensure that they have a thorough plan. Dr. Nield added that although some people have an idea on what is intended or what should be in the plan, there are many complex situations, such as a mixed crew (some NASA astronauts and some non-NASA crew) that could affect the assignments.

CCP Software and Wrap Up/Forward Work

Dr. Patricia Sanders reported on the presentation on CCP software by Mr. Chris Gerace, Manager of the CCP Integrated Performance Office, and on Ms. Lueders comments on CCP forward work.

Mr. Gerace reviewed the software requirements for the CCP and the partners' software architectures and their current status. The CCP is levying on the partners compliance with NPR 7150.2A, which spells out NASA's Software Engineering Requirements including software management, life cycle engineering, configuration management, documentation, and independent verification and validation (IV&V) among other aspects of software engineering. In some areas, the partners have proposed alternate standards which are being assessed by the Program office. The ASAP focused some of its attention specifically on the requirement that human-rated software be acquired, developed, and maintained by an organization with a non-expired Capability Maturity Model Integration for Development (CMMI-DEV) rating at Level 3 or higher and the providers' plans for IV&V. With respect to overall software architectures, the Panel observed that each provider took a significantly different approach to the architecture, which has been noted throughout the Program and is typical of the diverse nature of the two providers.

Ms. Lueders provided a wrap-up following the excellent in-depth and candid discussions on the CCP. Essentially, both partners are advancing their design concepts and are actively building and testing hardware to inform their designs, but they have important design challenges remaining. NASA is engaging meaningfully with the providers on these challenges and also on evolving the processes for certification, including disposition of waivers and deviations. Ms. Lueders stated that NASA remains committed to supporting the SAA partners as

they advance their concepts. They added three unfunded milestones with Blue Origin within scope of the original agreement, and signed an amendment with Sierra Nevada Corporation extending the CCiCap SAA and adding an unfunded milestone for a design analysis cycle on the Dream Chaser.

In addition to being exceptionally pleased with the thoroughness and candor of the CCP discussions, there are two key "takeaways" from the day's engagement. First, the discussions reinforced the Panel's belief in the value of maintaining competition in the Program. Each provider brings very different approaches, philosophies, advantages, and risks to developing and building crew transportation. Having the two "bookends" of diverse approaches is critical to managing the risks in this highly challenging endeavor. It also continues to provide leverage in ensuring as safe as possible human spaceflight in the fixed-price environment. Second, it remains clear how challenging it is to maintain the appropriate balance between insight and oversight with the commercial partners. The ASAP noted in its 2014 Annual Report that the CCP was caught between the acquisition strategies of managing a development program and buying a commercial transportation service. The Program office continues to work the delicate balance between ensuring NASA's responsibility for crew safety and permitting the commercial providers to further their solutions for mission success without over-constraining those solutions. This will remain a significant and crucial challenge for the Program office as they evolve a new way of doing business.

VADM Dyer noted that one topic that came up in the sessions with Mr. Gerstenmaier and Mr. Robert Lightfoot, and which has been the focus of the Panel, was the importance of competition. The ASAP has long been on record that competition is an important part of the commercial space program. In prior meetings and in the Annual Report, the Panel noted that it is a diversified portfolio—there are two competitors: Boeing, who has a hundred year legacy, and SpaceX, a new company in the space business. Challenges for Boeing are finding new ways of doing business, reducing cost, and increasing speed. Challenges on SpaceX are bringing innovations and a new way of doing business in a safe and efficient manner. This wide portfolio is a blessing and will provide NASA with an important outcome. There are some, who for reasons of funding challenges, would like to see a downselect earlier on. The thinking there is: If you need a house, why would you want to build two houses? Why not select one? VADM opined that the CTS is a "very complicated house." It is being pursued with a fixed-price contract, and the ASAP believes that competition brings the best of both providers to the fore. It also allows NASA to watch these two approaches and companies mature before making a downselect. The Panel stands foursquare in support of competition, as does NASA.

Dr. Nield commented that one of the other items emphasized in the last several annual reports is the discrepancy between the requested budgets for the Program and what has been appropriated. This has been a concern. Now that the companies are under fixed-price contracts, it is important for all to recognize that if NASA does not receive the appropriations that it is counting on, it will have a very significant impact on schedule, and we will end up relying on the Russians beyond the 2017 target.

Exploration Systems Development Update

Mr. John Frost reported on the update by Mr. Bill Hill, Associate Administrator for Exploration Systems Development (ESD), HEOMD. He noted that this is the "other" big human spaceflight program. It is the heavy lift vehicle that will take us to Mars. Most of the time when the Panel reports on ESD, it is progress, which is a good sign. The biggest progress was the flight of Exploration Flight Test (EFT)-1 in December 2014. It gave the people within the Agency confidence, and more importantly, the public and stakeholders an idea of what is to come. Another big accomplishment was the full-scale SLS booster firing. The SLS had a problem with voids that could have been significant, but the team had a very creative solution that works well. It appears that voids are a thing of the past. The next big event is test flight Exploration Mission (EM)-1, on track for 2018—a 24-day, uncrewed cis-lunar voyage that will inject a lot of energy into the Program. Mr. Frost noted that the following flight, EM-2

that will have crew, brings up an issue that deserves attention. Presently, the Program does not have the upper stage that it needs because of lack of funding. A new upper stage, called the Exploration Upper Stage (EUS), will be developed for future crewed flights. As a fall back, NASA is planning to use the Interim Cryogenic Propulsion System (ICPS) that will get the job done through the test flight, but it is not what NASA will be using eventually. This interim step will cost at least $150 million (M) to human-rate ICPS engine, which will be wasted because this design will be "tossed" in the near future. This is not within NASA's control—it requires funding. The timeline is such that NASA must have a go/no-go decision by this fall on which way to proceed. Mr. Frost strongly encouraged those that control the funds to think about the best use of that $150 M—should it be applied to the new engine (the EUS) or the old?

Within SLS, there are a couple of other interesting things. Langley Research Center has completed wind testing the 35-inch model—up to 24,000 mph, running 800 tests—and has collected very useful data. Mr. Hill went over his "worry list." Most of those are straightforward things. The ICPS is at the top of the worry list, and it has several components. Getting hazard analyses done on time has been a problem. Since NASA is not sure that they are going to use the ICPS, they have put off some of the human-rating analyses until later in the development cycle. This is a conservative use of money, but this delays the hazard analyses that normally are done as part of design. When hazard analyses are done late, they simply document the design instead of informing it. This is a classic mistake in the system safety world. The Panel hopes that NASA can do the hazard analyses early enough to affect the design. They have seen this problem of sequencing on a couple of other NASA programs, and the ASAP will keep an eye on this at future meetings.

Mr. Jett reported on the Orion Program, which was discussed by Mr. Mark Geyer, the Orion Program Manager at Johnson Space Center, who provided detailed information on the Program. At the last quarterly, the Panel reviewed the initial results of EFT-1. Since that meeting, further analysis of the data has been completed by NASA and Lockheed Martin. At this meeting, the Panel reviewed more detail on the Orion spacecraft performance during EFT-1 flight and recovery. Overall, the spacecraft performed exceptionally well. Items of interest to the Panel included: the aerothermal/Thermal Protection System (TPS) data and hardware response, which indicated a later transition from laminar to turbulent flow than predicted; the six MMOD impacts that were noted on the crew module backshell (all less than 0.25-0.30 mm), the number of which was above predictions but difficult to draw conclusions from due to the short duration of the mission; and spacecraft up-righting bag failures (three of five did not inflate). The Panel learned that these failures were the result of small tears in the bags. NASA suspects the packing and deployment conditions may be a factor, but the investigation is still ongoing. The helium pressurization system for these bags did show some leakage prior to launch and was initially suspected. That pressurization system is undergoing some design changes to hopefully eliminate those leaks. Mr. Jett noted that it is often said that in the test world, you learn more from failures than you do from successes. While that is true, you also learn from successes because it helps you validate your analysis tools and models. Mr. Geyer indicated that was definitely the case for EFT-1. He also noted that many lessons were learned from the build and the processing for the flight. A good example of that is what NASA learned from building the monolithic heat shield for EFT-1. Mr. Jett further discussed this when he talked about issues.

Mr. Geyer briefly discussed the progress to date toward EM-1 and the overall master schedule. The crew module primary structure and the service module, which is being provided by the European Space Agency (ESA), are the primary challenges for Orion with regard to making the EM-1 date.

Mr. Geyer spent a significant amount of time discussing his top issues – the things he worries about as Program Manager. Many of these are the typical program issues – supplier chain, funding uncertainty, mass control, software production and testing, etc. The Panel was very interested in the details on the heat shield redesign from Avcoat integrated with monolithic honeycomb structure to Avcoat blocks (approximately 180) that are

individually bonded to the vehicle. This new design presents some challenges with regard to verifying the bond between the blocks and the spacecraft. The Program is working through these challenges.

Mr. Geyer is also closely tracking the abort environment and the impact of that environment on design. Testing has shown that firing the Launch Abort System (LAS) motor results in approximately 180 db at the edge of the crew module, which is quite high. This represents a challenging environment and the team is working through the analysis of each affected component on Orion.

Overall, it was an excellent presentation. The Panel looks forward to continued interactions with the Orion Program and following the progress to EM-1 and subsequent flights.

Mr. Frost wrapped up the report on ESD with a brief update on the ground elements. NASA is making great progress on the mobile launcher, the crawler transporter, and Pad 39B. On EFT-1, there was a little difficulty in recovery of the capsule—it took longer than expected. NASA is going to take a look at alternate ways of recovery and will choose an optimum one shortly. That decision is due July 21. The "bottom line" is that while funding is needed for the EUS, America's heavy lift capability is moving along very rapidly and is very real.

International Space Station Program Update

CAPT Robert Conway reported on the update by Mr. Michael Suffredini, ISS Program Manager. He noted that the Panel once again had an excellent briefing on the Program. One of the primary topics was the reconfiguration of ISS to accommodate commercial crew and cargo vehicles. There have been three EVAs to date with ongoing maintenance, construction, and rewiring. The ISS will be ready to take vehicles on the new locations by end of calendar year 2015. Mr. Suffredini briefly discussed the 59P anomaly; the investigation is still ongoing. They are looking at a third-stage event that occurred just before third-stage shutdown and separation and may have imparted rotation on the vehicle, which spun and reentered the atmosphere. A Russian Commission is investigating, with NASA representation on it. NASA also has an Independent Review Team (IRT) looking at the data and making its own assessment. To date, there is nothing conclusive. However, as a precaution, the Soyuz 41S and its crew return flight have been delayed until June to ensure due diligence that nothing is wrong on the Soyuz. The June date is the first opportunity to land in daylight at the landing site. The Commission is due to report out this Friday.

Mr. Jett added that although the preliminary evidence points to the problem initiating in the third stage of the Soyuz rocket, they haven't completely ruled out an initiating event in the Progress itself. There is a similarity between Progress and Soyuz, and they want to convince themselves that the problem is not in the Progress before clearing the Soyuz 41S to come home.

Mr. Suffredini continued his discussion on equipment and system issues. There are no significant risks at this time. Both the total ISS and U.S. Orbiting Segment (USOS) supplies look good, except for Russian food; if nothing is done, it will go to zero in early July. There has been some rescheduling of Progress 60P, which has been accelerated from August to early July. Food sharing on Station will push out the limit to the December timeframe. In the meantime, there is no risk on resupply. Categorization of minimum on-orbit spares is defined by the impact of the risk of the equipment to ISS. This gives the Program the information they need to ensure that they can make decisions when needed to get spares on board.

Visiting vehicles were also discussed—SpaceX-6, preparations being made for SpaceX-7, and SpaceX-8, which will use a modified Falcon vehicle. Upgrades are providing a 33 percent increase in performance. The ASAP will watch the path to certification with interest. The first modified Falcon flight will be a non-ISS mission. The Cygnus/Atlas configuration (Orb-4) will go up in October, carrying about 3500 kg of up mass.

Orb-3 was also addressed. The AJ-26 engine failure caused that rocket to crash. The investigation focused on ruling out Foreign Object Debris (FOD). Information is pointing to an internal engine fault and an issue on a turbo pump, but that investigation is still ongoing. The investigation is being conducted by Orbital ATK, and the report should be coming out soon. NASA has an IRT on this as well. They are looking at what could have been done differently, and what should be done moving into the future to prevent such an incident from happening again. Overall, the ASAP had another excellent briefing from Mr. Suffredini that showed the continued demonstrated excellence in the Program.

There were no other comments from the Panel or questions/comments from the public. VADM Dyer adjourned the meeting at 5:10 pm.