

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

April 19, 2013

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 2013 Second Quarterly Meeting at Goddard Space Flight Center, Greenbelt, Maryland, on April 2-3, 2013. 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 Recommendation Update resulting from this meeting for your consideration. I especially invite your attention to the section on Technical Authority.

Sincerely,

A handwritten signature in black ink, appearing to read "J W Dyer". The signature is fluid and cursive, with a long, sweeping underline that extends to the left.

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

Enclosure

**AEROSPACE SAFETY ADVISORY PANEL
Public Meeting
April 3, 2013
Goddard Space Flight Center (GSFC)
Greenbelt, MD**

**2013 Second Quarterly Meeting
Report**

Aerospace Safety Advisory Panel (ASAP) Attendees

VADM (Ret.) Joseph Dyer (Chair)
Dr. James Bagian
The Hon. Mr. Claude Bolton (via telecom)
Capt. Robert Conway
Mr. John Frost
Dr. Donald McErlean
Mr. Bryan O'Connor
Dr. Patricia Sanders
Dr. George Nield

ASAP Staff and Support Personnel Attendees

Ms. Harmony Myers, ASAP Executive Director
Ms. Susan Burch, ASAP Administrative Officer
Ms. Paula Burnett Frankel, Technical Writer/Editor

NASA Attendees

Patrick Hancock
Mark Hess
Deirdre Healey
Michael Braukus
Judy Bruner

Other Attendees

Daniel Leone, *Space News*

OPENING REMARKS

VADM Joseph Dyer called the ASAP's Second Quarterly Public Meeting of 2013 to order at 11:05 am. All members were in attendance. A subset of the Panel conducted several insight meetings since the last quarterly. This includes the recent visit to Orbital Sciences at Dulles, Virginia, and Wallops Flight Facility (WFF). Good progress is being made by Orbital, both in terms of the ability to support cargo flights as well as the upcoming launch at WFF. The Panel had not been to WFF for over two years. It is a markedly different place in terms of the infrastructure as well as the work underway. Large rockets are being assembled and there is a substantial contractor presence as part of the commercial space undertaking. The ASAP was impressed with the cooperation between NASA and the contractor team at WFF. A subset of the Panel also traveled to West Virginia and spent time with NASA's software Independent Verification and Validation (IV&V) facility. They are adding value while operating with budget constraints. It is the 10th anniversary of the Columbia Accident Investigation Board (CAIB), and the Panel has been engaged in two activities: the George Washington University Symposium on "Columbia +10 Lessons Learned and Unlearned" (available on CSPAN), and an ASAP CAIB "benchmarking" session earlier this week. The Symposium was a very good event and well-attended. A subset of the ASAP met on Monday, accompanied by speakers and subject matter experts from NASA's retired community and academia, to discuss important aspects that were recognized by the CAIB and are important for the future.

VADM Dyer shared some of the "take-aways" from the CAIB benchmarking meeting. First, the strategic objectives, policy, budget, and public communications (including congressional relationships) could be in better harmony. One of the issues at the time of Columbia and one that continues to persist is the risky consequence of operating too close to fiscal limits. In other words, is NASA still trying to do too much with too little? One of the focus points at ASAP quarterly meetings has been Technical Authority. This was a prime finding from the CAIB. Independent Technical Authority is important to sustain checks and balances within the Agency. One cannot simply rely upon good people; good systems must be in place as well. A discussion that provided greater appreciation to the ASAP was the topic of "in-family." Mr. Bryan O'Connor explained what is meant by this term. The issue with Columbia as

well as Challenger was when the system was operated out of spec but in a manner consistent with previous experience, or “in family.” The rationale for flying out of spec became “this is something we have seen before and we didn’t have anything bad happen.” This is what was characterized by Dianne Vaughan as “normalization of deviance.” It was a big issue post-Columbia, and the Agency looked at other areas where this was being applied. **It would be a good idea to look into the existing programs to see if the “in family” practice has crept back into use.** Other things that were discussed in the follow-up to CAIB +10 included the importance of determining design requirements early in the program because it is hard and expensive to change things later, especially when a program is nearing end of life.

During the ASAP’s time at GSFC, the Panel met with the Center Director, Mr. Chris Scolese, who is a strong leader with keen management ability and a deep respect for good technical conscience. One of the topics he highlighted involved competition among the Centers for technology research and development (R&D) and science missions. On one end of a continuum is an approach (used in the Department of Defense) to try to “purify” undertakings at distributed Centers so that there is no overlap. That is often not wise, because this robs from good system engineering opportunities (not enough people with broad enough knowledge to operate efficiently), but financial people often like this approach. On the other end of the continuum is letting Centers compete for business. Taken to the extreme, this is not wise either, because it robs from good teaming ability across the enterprise and builds the perceived (and perhaps real) requirement for duplicate capabilities. There is probably a “sweet spot” somewhere in the middle, but today’s NASA, at least for technology R&D and science programs, appears to be swinging more in the direction of competition. This was a topic of keen interest by the Panel.

Dr. Donald McErlean added that the duplication question runs counter to the view that competition always results in lower cost. When there is a large market, duplication makes some sense, but NASA’s projects are often highly specialized with no open market. If each Center is forced to replicate capabilities at other Centers, that duplication could erode or negatively impact any savings that might be gained from competition. In addition, NASA’s projects are usually at the very leading edge of science and technology, and there is not a vast workforce that understands these sorts of phenomena. To be competitive, each Center must try to find a specific expertise that may not exist except in very small numbers. A lot of that activity takes away from the perceived cost benefit when there is a product line that is as specialized and as advanced as NASA’s. This issue must be addressed carefully so that the downside doesn’t overbalance the upside.

VADM Dyer posed the question: Does competition play a role in safety? If so, what?

Mr. John Frost noted that if one is competing on cost, which is the norm, the way to reduce cost is to cut corners and this often impacts safety. If one looks at mergers, they typically occur to eliminate duplication of effort, and the new organization is usually more efficient than the old one. Dr. James Bagian added that with competition, there is often a reticence to share experience, e.g., the Centers may be unwilling to share because that may undercut their ability to compete for future work. This has a corrosive effect that isn’t obvious prospectively. Capt. Robert Conway observed that with the leading-edge nature of work, competing rules out areas of expertise that could be needed; that could reduce cost in the long run. VADM Dyer noted that this could also present potential conflicts of interest, particularly in the “soft” Technical Authority areas that the Panel has discussed. The Center Directors are in the chain for good technical conscience, but they are also in the chain to produce winning proposals.

JAMES WEBB SPACE TELESCOPE (JWST) [reported by Panel member Dr. Donald McErlean]

Mr. Geoff Yoder, Program Director on JWST, provided a good overview of the Program. JWST is an amazing endeavor, beyond the leading edge of technology. The Program went through some difficult times, but they have re-planned and are supported by both the political and NASA leadership. Budget and schedule have both been re-formulated, and they are on track with the re-plan. The program management office, because of its size (\$8 billion over 30 years) and considerable international content, is at NASA Headquarters. The project office for the execution of most of the effort is at GSFC. Mr. Yoder reports directly to Mr. Robert Lightfoot, NASA’s Associate Administrator, and Dr. John Grunsfeld, the Associate Administrator for the Science Mission Directorate. The Deputy Program Manager is also the Program Scientist, and there is a Deputy Project Scientist from the

Astrophysics Division which, after launch, will be the recipient and operator. Mr. Yoder spent time discussing the communication chains and efforts that the Program is making to keep all of the stakeholders fully involved and aware of Program status. This is essential because of the size and importance of the Program. It is now an Agency priority. NASA wants to ensure that everyone in the Program chain has the same view of exactly where they are on the work. The Deputy Program Manager oversees the communication paths to ensure that all stakeholders are getting the correct and factual information about the Program. It was impressive how they are striving for openness and transparency. Focus areas include: open communication; execution (know where you are now and know where you will be in the future); and education (to let external parties understand the incredible science and information that will come from this device). They have an interesting and innovative use of Earned Value Management (EVM) for the cost area. Although EVM is common for contractors, it is less common for in-house portions of a program.

The ASAP was very impressed by the technical aspects associated with the JWST deployment in space. For example, the sunshield is five membranes, each of which is about the size of a tennis court, half the thickness of a piece of paper, and in total sustains a 500 degree K difference between the outer layer and the instrument package. Incredible technology is being developed. The ultra-sensitive detectors are so sensitive that they could see a single candle on the moon from 1 million km away. The temperature difference for the sunshield membrane would give an equivalent SPF of about 1.2 million. Mr. Yoder also discussed the launch vehicle (Ariane 5), which is being contributed by an international partner. The instrument packages, which are being developed by the European Space Agency (ESA), U.S. contractors, and GSFC, are on schedule. Dr. McErlean stated that it is truly an amazing program and spacecraft.

The Hon. Claude Bolton added that the in-house earned value system is admirable and is unusual among other government agencies. In 2007, the Technology Readiness Level (TRL) was TRL 6 and has continued to mature; this speaks to the maturity of the technology and lets NASA move on to the Integration Readiness Levels (IRLs). The Program is in good shape from a technology and integration standpoint. It appears to be very well-managed and its prospects are high.

Mr. Frost noted that JWST is a hugely complex project, and the Panel has discussed the importance of public understanding in this regard. Everybody knew the complexity of the Curiosity landing on Mars. However, where it had 100 critical functions that had to operate properly, JWST has 300. **It is very important that the public be well-informed of the complexity of JWST and the odds of success. Mr. Yoder told the ASAP that the Program has already started working with the Curiosity managers to develop a plan to do that, and the ASAP encourages this effort to continue. VADM Dyer added that a great video (a la Curiosity's "Seven Minutes of Terror") would be worthwhile.**

TECHNICAL AUTHORITY [reported by Panel Member Mr. John Frost]

The Panel had a spirited discussion with NASA's Chief Engineer, Mr. Michael Ryschewitsch, on Technical Authority (TA). This subject was one of the key findings from the CAIB investigation—the importance of moving the engineering, the safety, and the medical personnel and groups from an “advisory” role to actually having authority and an impact on the safety-critical decisions that are part of the processes. NASA has worked hard in the past on how they would implement that. The ASAP has followed the status at each Center. It was difficult to get that program to “lie flat,” but eventually the entire Agency seemed to understand the authority levels of the “TAs.” One of the CAIB-member briefers mentioned that this concept comes from the Navy submarine program, and its intent is to establish a “belly-button” for the critical thoughts and decisions and give that person the responsibility and authority to have an effect on outcome. There are several elements to TA. Mr. Frost addressed the “authority” part. As this was built into the Agency after Columbia, it was the authority to concur or non-concur in safety-critical decisions. If the Technical Authority non-concurred, the decision could not be accepted at that level, and it had to go up to the next level for a broader look. The ASAP thought that this was a good implementation. Over the past couple of years, it appears to be slipping from what has been dubbed the “capital” TA to “small letter” TA, moving back towards an advisory role. In a couple of meetings, there has been the discussion that if the TA non-concurs in a decision, the Project/Program can still accept the risk and approve the decision. The system then relies on that Technical Authority to use the available channels to go to the next level to bring his or her thoughts to bear. This

requires, in some cases, courage or heroism to face the battle that might ensue. This is different than ASAP's understanding of the requirement to have a concurrence or non-concurrence. After discussing this subject with Mr. Ryschkewitsch, it appeared that the TA authority still exists if top-level or "black and white" Agency requirements or "shall-statement" standards are being violated, but it becomes more of an "advisory" role if it is not a black and white requirement. Unfortunately, most of NASA's past accidents (and most accidents Mr. Frost is familiar with) have not been clear violation of requirements; they have been "in family" issues and subtle issues, like the foam was on Columbia and the O-ring was on Challenger. If the TA non-concurs, that is a red flag that needs to be raised to the next level and examined carefully. **NPD 1000.0A still says "decisions relating to technical and operational matters involving safety and mission success require formal concurrence by the cognizant TA." The ASAP is not sure that this is the way it is being implemented. This issue needs to remain on the table as the ASAP visits the Centers and looks at how it is actually being implemented. NASA needs to "re-crystallize" the TA authority so that it doesn't slip from capital TA to "TA-lite."** Other issues pertain to knowing who the knowledgeable person is within the Agency (the "belly-button") and who is responsible for growing that authority and building the standards and the infrastructure that supports it. The whole concept of TA is very broad.

VADM Dyer stated that it is his personal opinion that of all the findings of the CAIB, the one that is most important to preserve and carry forward is the concept of TA. The CAIB found fault with NASA's technical authority, in that there was a requirement for "too much courage" to speak up. It was easy to be intimidated and silenced. Too much power was invested in the side that could both intimidate and elect to not listen. TA was viewed as the fix for that. Those members of the Panel who have served for some time thought that TA was in good repair; however, it is not "standing as tall" as it once did and should. Dr. Bagian noted that one of the things Mr. Ryschkewitsch talked about was the way projects and programs are separated from the TA chain at the Centers. In many cases, the TA final decision is the Center Director's. The question was raised regarding potential conflict of interest. Mr. Ryschkewitsch acknowledged that in some cases, projects also report to a Center Director. In that case, there is the situation where the person who is going to approve of the safety-critical decision (the Center Director) also has the budget and schedule performance responsibility for the project, thereby creating a potential conflict of interest. This situation is exacerbated by the current atmosphere of competition, which could inadvertently put Centers in a position of disadvantage. **The TA description in 7120.5E states that it is located at the Centers; it was not previously stated like that. Mr. Ryschkewitsch noted that he has weekly telecons with the program Chief Engineers, which is a good thing; however, this is a rather informal activity. Also, rotating engineers around gets people exposure to a variety of functions, but this practice is inconsistent across the Agency. It appears to be recognized that this rotation practice is advantageous, but some Centers do it and some don't. Perhaps this area should be considered a "best practice" and be addressed in a more formal way.**

CYBER SECURITY [reported by Panel member Dr. Patricia Sanders]

In response to an earlier ASAP request, the Panel received a presentation from Mr. Dana Mellerio of NASA's Office of the Chief Information Officer (OCIO) on the challenges of cyber security and the actions being taken to meet these challenges. Mr. Mellerio particularly focused his presentation on the efforts with respect to administrative software, but also noted the requirements for equivalent attention to mission software development. The ASAP was pleased to note NASA's recognition of this critical issue and the concerted attention being paid to it. The Panel expects to follow up with a look at some of the specific approaches being applied to NASA's key development efforts and mission systems.

EXECUTIVE SESSION WITH MS. LORI GARVER [reported by Panel Chair VADM Dyer]

VADM Dyer noted that the ASAP had an opportunity for an executive session with NASA's Deputy Administrator, Ms. Lori Garver. The Panel was impressed with her interest and energy in space, up to and including a strong personal desire for space travel. She is confident in the policy direction of NASA, which she believes flows strongly and directly from the President. She is also a keen supporter of space industry economic development and has a great respect for the International Space Station (ISS) and the role that it plays in furthering human space travel. The ASAP enjoyed having Ms. Garver for an executive session and hopes to repeat this in the future.

EXPLORATION SYSTEMS DEVELOPMENT (ESD) [reported by Panel member Dr. Bagian]

Mr. Dan Dumbacher, ESD Deputy Associate Administrator, and Mr. Paul McConnaughey, ESD Chief Engineer, spoke to the ASAP about the work in ESD. The Orion Heat Shield has been completed and is now at Textron in Boston for future work. Exploration Flight Test (EFT)-1 (the first launch, scheduled for September 2014) is proceeding well. Qualification Motor (QM) 1, which was discussed with the Panel at the last meeting, had some voids in it that were discovered during inspection. The project has decided not to use this QM for flight test, but is keeping it for use in an aging study. They are re-pouring the QM, which will delay the hot firing until later in the fall.

The Program is using a Cross Program Systems Integration Team (CPIT), which brings together systems safety, systems engineering, integrated design, system integration, and mission management. This group is co-chaired by Mr. McConnaughey. Mr. McConnaughey discussed the risk that they have identified with Exploration Mission (EM)-2, currently scheduled for 2021. This circumlunar mission will be the first crewed mission, and a concern was raised by the crew office that this would be the first time there would be a fully-configured Orion module that would have the Environmental Control and Life Support System (ECLSS), communication, displays, etc. That plan raised the question: Is the risk low enough to have a first flight of those systems, with crew, as a circumlunar mission? They are currently looking at what could be done in EM-1, which is a lunar fly-by to test high-energy re-entry. Should that be tested with hardware on board? Should that be crewed? The big constraint is budget—they are very tight on budget all along the Program. It is not clear what the answer will be after the trades are done.

Another area that was discussed (and was questioned by ASAP in the past) was the Program's risk acceptance chart ("Exploration Systems Development Hazard Matrix"). Mr. Dumbacher's presentation at the last ASAP quarterly indicated that developers could buy off on risks at the lower-likelihood levels without NASA input. At this meeting, he explained that they had not described this correctly or clearly. Those risks would be handled by the Center safety and health programs. Mr. Dumbacher stated that the ESD Deputy Associate Administrator has final approval for critical (mission loss) or catastrophic (life loss) hazards. However, the revised risk matrix showed that organizations or boards are the deciding authority. There was still concern expressed by ASAP. The Panel believes that a person or a position should be identified as the final acceptance authority for residual risk, not an organization or board. Critical or catastrophic risks of low or very low probability were shown as being accepted at the Joint Program Control Board (JPCB) or PCB level. Some ASAP members felt that all hazards rated as critical or catastrophic (mission or life loss), regardless of probability, should require ESD Program-level approval. **There is no official policy on where to draw the line for the project's ability to make the call on residual risk acceptance versus the program's.** VADM Dyer asked that this issue be put on the agenda for the next meeting, and Mr. Terry Wilcutt (Chief of NASA's Office of Safety and Mission Assurance), Mr. Ryschkewitsch, and Mr. Dumbacher agreed to take the action to do this.

Overall, everything is moving along.

Ms. Julie Kramer provided a follow-up on the Orion pressure vessel crack activity. She stated that the repair was successful, but acknowledged that they were surprised to find that the crack was substantially deeper than they had originally thought. [Subsequent to the public meeting, Dr. McErlean suggested that the ASAP withhold comment on the success of the repair until further testing and analysis are carried out to confirm that the problem has been solved. The ASAP will continue follow this issue.]

Mr. Frost observed that the conservative process for these flights would be to fly flight hardware uncrewed, then crewed in low Earth orbit (LEO) before flying crewed to lunar. However, this would require one more flight than is currently budgeted. **The ASAP would like to see the rationale for flying first-time crewed to lunar rather than LEO; it would also like to see the rationale for not flying flight-configuration before flying crew. On the ESD Hazard Matrix (the risk acceptance chart), the ASAP would like to see individuals or positions (not boards) listed for all the levels, from minor to catastrophic consequences and from very low to very high likelihood.** Mr. Frost asked that these be action items.

With regard to whether there should be one more flight, Dr. Bagian noted that many systems (e.g., ECLSS) do not need to have to have crew in the vehicle to test the hardware.

INTERNATIONAL SPACE STATION UPDATE [reported by Panel member Capt. Robert Conway]

Mr. Michael Suffredini, ISS Program Manager, provided a positive and thorough briefing on ISS status. There have been many accomplishments, including the second SpaceX cargo resupply flight in early March, the precedent-setting four-orbit rendezvous of the oncoming team with the ISS and the multiple benefits associated with that, as well as the H-II Transfer Vehicles (HTVs) and other port utilization vehicles being on schedule. There are several extra-vehicular activities (EVAs) coming up in the near future in preparation for the new Russian Multi-Laboratory Module (MLM), currently scheduled to arrive the end of this calendar year. Inside the ISS, there is a lot of activity. Looking for the established objective of 35 research hours per week, the U.S. Orbiting Segment (USOS) has been averaging 37 hours and above since January. With respect to consumables, everything is on track. There have been some system challenges. The Photovoltaic Thermal Control System 2B ammonia leak was previously briefed to be of concern. The leak has subsided to a manageable five pounds per year, which gives adequate time to assess and address the problem. The Ku Band Antenna Group forward link system that went down is to be replaced on an upcoming EVA. There are some software transitions in work, and based on the Panel briefing on security, there was some question regarding the security of that software. The ASAP was assured that Station software is part of an isolated system and proper safeguards are always being taken. In addition, the Panel asked if there was a person responsible for software security for ISS software. The ASAP received a resounding “Yes” to that question.

As a result of Mr. Suffredini’s briefing, the Panel gained more understanding about the SpaceX Dragon capsule problem. He discussed how SpaceX did an excellent job of handling the situation. By the time Dragon was ready to arrive at the ISS ellipsoid, all four quads were ready to go with only three of four being needed for docking and two of four for abort. **The Panel also asked if the pad abort in the first SpaceX launch had any connection with the check values that were causal in this problem. Mr. Suffredini did not know the answer to this question, but stated that he would get back to the ASAP with an answer.** An issue raised by the ASAP was concern over the manufacturer of the lithium ion batteries, which is the same manufacturer as the recent 787 Dreamliner NiH2 battery. Mr. Suffredini provided a good brief and assured the Panel that thorough procedures, safeguards, and strict vendor selection give the highest confidence on the quality of the ISS batteries.

Many system enhancements are in work. Up to this point, the bottom line is all good news. Mr. Suffredini addressed the questions that the Panel had in the past: the foreseeable and unforeseeable anomalies that would necessitate Station de-orbit, and the risk to ground personnel in the event of an unforeseeable anomaly. At first evaluation, the chance of injury on the ground from a random decay path was 1 in 10. Subsequent safeguards reduced this to 1 in 33 as reported at a previous ASAP meeting. The plan to de-orbit the ISS (both foreseeable and unforeseeable) exists but is being refined. If it was necessary to de-orbit the ISS today, NASA could get it done. However, formalization of the de-orbit plan in conjunction with the Russians is ongoing. Software development and enhancement is in work and the formally agreed upon de-orbit plan is expected by the end of the summer. **With respect to the ASAP’s formal recommendation on this subject, the Panel would like to extend the recommendation and receive another update at the next quarterly meeting in June.** In summary, ISS is a “good news” story, as there have been many successes with a low number of negative issues and problems existing in the realm of the Station capabilities and ground crews to solve quickly.

VADM Dyer introduced the next topic—Commercial Crew. The update was addressed in two parts—programmatics and certification.

COMMERCIAL CREW UPDATE [reported by Panel member Mr. O’Connor]

Mr. Phil McAlister provided an update on the programmatic aspects of the Program. Mr. Ed Mango discussed the certification status. The answers to a couple of ASAP questions are still outstanding, and NASA plans to provide a response soon on those. One is the formal policy document on when certification of a system is required and when it is not. This document is currently in the Administrator’s office for review and approval. The other question concerns the factor of safety for structures—how NASA plans to deal with those systems that have already been developed and flying and have lower than a 1.4 factor of safety, and how the Agency will become comfortable with that condition without having to redesign. The NASA Engineering and Safety Center (NESC) will be providing more

information on this subject. One of ASAP's topics of interest has been the optional milestones. If NASA decides to exercise these milestones, what kind of work would be done and would there be any possibility that it could include crewed flights? Mr. McAlister said that there is still no intent to do crewed flights under a Space Act Agreement (SAA). Any crewed flights would be under contract. However, the Program wants to hold out the possibility of exercising a subset of the optional milestones to keep the contractors moving forward on useful work. With regard to the contract, there will be a Procurement Strategy Meeting (PSM) in May; the Program is considering the option of doing a fixed-price contract, at least in part. The Panel has considered this issue and believes that there does not appear to be a compelling argument for a fixed-price contract for the certification portion of the contract.

VADM Dyer commented that in his personal opinion, based upon observation of many different contract types on past developmental programs, the ultimate cost to the government often is not much different between a cost type contract and a fixed-price contract. When one goes into an area where everything is not known, which is certainly the case with commercial space, there is a need to make corrections during the execution of development, and in a fixed-price environment, that is done via change orders. One often ends up in the same place in terms of cost, but there are different implications for safety. In a fixed-price contract, everything that is undertaken above and beyond the core contract either has to come from change orders or erosion from what the company would have otherwise made if they had not undertaken that which the government believes is necessary. This has implication on working relationships and it can make safety more culturally challenging.

Mr. Frost summarized that the Hon. Claude Bolton is working with NASA to bring DoD knowledge and lessons-learned together and to share some experiences that DoD has had with hybrid contract vehicles where there are both fixed price and cost type provisions covering different parts of the work. Mr. Frost stated that in his experience as a safety engineer on fixed-price contracts, it is difficult to get safety problems fixed when it is coming out of the contractor's margin.

Mr. McAlister and Mr. Mango discussed the budget. They use a 50 percent confidence level when budgeting and have gotten approval for \$488M for FY2013 (after sequestration and other cuts) as opposed to the \$830M that the President initially requested for this year. This will cut into the schedule margins; however, they are not changing the schedule at this time. They are still looking at FY 2017 for first flight. They reiterated that competition remains very important. The ASAP has asked: Will NASA go to one contractor or continue to try to keep two or three companies going, even with less money? It was obvious that they believe competition is very important and they will keep the companies going as long as they can.

VADM Dyer added that going forward with a 50 percent confidence in the understanding of the cost of the Program exacerbates the fixed-price concern that was expressed earlier.

COMMERCIAL CREW CERTIFICATION [reported by Panel member Dr. George Nield]

Mr. Mango introduced his new Deputy Program Manager, Ms. Kathy Lueders, who replaced Mr. Brent Jett. She has a very good background that will substantially contribute to the Program, having worked on ISS and having had experiences with SpaceX and Orbital Sciences on commercial resupply. Mr. Mango laid out NASA's understanding of what certifications need to be for this Program, including a framework that includes certification of the design element, the production element, and the operations element. He also talked about what NASA's role is for certification, including insight and oversight, the independent assessment that NASA plans to do, and the process for granting certification. For the design portion of certification, the fundamental elements include verification that the design meets the requirements, validity of the processes that create the design definition, validity of the processes that produce the system, and validity of the tools that verify the design control of the design definition. The production element refers to production and assembly processes, planning, process control, inspection, and product acceptance. The operations element of certification includes ensuring that such things as operational plans, processes, procedures and operational support systems are consistent with the design of the flight elements, the operations meet mission requirements, and verification and validation of capabilities of the hardware, software, and human interfaces. The operations element includes the following: assembly, integration, and test; launch preparation and launch countdown; pre-flight planning and product development; training of

flight crews and operations personnel; mission execution and operations support; and recovery support. The general subject of certification has been a topic of keen interest to the ASAP, and the Panel is starting to understand what NASA plans to do. Dr. Nield observed that NASA is providing a lot more specificity and detail.

In terms of what NASA's role will be in commercial crew certification, the Program will make use of the Partner Integration Teams (PITs) for insight. They are considering having a subset of the PIT—a Joint Test Team—follow along during the services part of the Program to continue to monitor the operations environment. Mr. Mango explained to the ASAP how the Program is interpreting the oversight role, which is acceptance of the certification information that the contractor has provided as evidence of compliance to the requirements. To implement that, they will use the Program Control Board (PCB). NASA will also perform an independent verification approach for certain selected areas where there is low confidence in the verification method or in NASA's ability to assess verification by reviewing the contractor's analyses products only. In terms of granting certification itself, they will go through the Commercial Crew Program PCB, where there will be input and recommendations from the Technical Authority and the Crew Office. Ultimately, the NASA Administrator will be the individual that grants certification. The Program hopes to have commercial capability in place to fly crew by 2017 if the intervening steps are successful and if the budget is available. Mr. Mango and Mr. McAlister emphasized that 2014 will be a big year for the Program if the required funding is provided.

VADM Dyer added a couple of comments relative to commercial space that tied back to other parts of the ASAP's meeting. With regard to something that the ASAP has discussed at prior meetings—the optional milestones—there was a clear statement from Ms. Garver that NASA would undertake human spaceflight only as part of contract and not as part of a Space Act Agreement. The ASAP has focused on this issue, and this statement and intended action is in keeping with ASAP's advice to NASA. The Panel is please to see that.

With regard to the type of contract vehicle, Mr. Frost noted that the PSM is May 17, and he indicated that he would like to find a vehicle for the ASAP's collected wisdom to go to the participants at that meeting. The ASAP agreed to discuss this further offline.

VADM Dyer reported on the Panel's executive session with Mr. Lightfoot, who is currently the NASA Associate Administrator and was formerly the Center Director at Marshall Space Flight Center (MSFC). As an adjunct to that meeting, the Panel discussed two topics. The first was a report from Mr. Terry Wilcutt, Chief of NASA's Office of Safety and Mission Assurance, regarding the grounding of aircraft at NASA Dryden Flight Research Center and some issues with maintaining good configuration control that are being handled with the airplanes on the ground. Those airplanes will be coming back on line one at a time as confidence is restored. This is important to flight test safety, and the ASAP was happy to see the problem identified and progress being made. The other topic receiving focused attention at NASA is the Office of Inspector General (OIG) report regarding explosive material storage, which the ASAP would hear about later that day. The ASAP also planned to tour the GSFC laboratories and facilities in the afternoon.

In response to VADM Dyer's call for any further comments or questions, Mr. O'Connor reported that he was getting real-time input regarding completion on an action item. The question concerned the crew input on the Program Managers' Change Boards. On ISS, the Crew Office does have veto authority for things that involve residual safety risk to crew. They have a formal vote on such matters at the Program Change Board, and their vote is recorded for the record, as opposed to signing the actual change paper as is done by the TAs and program/project manager. The question was: Is that the way it works for all the human spaceflight programs? The answer is yes, that is the way it is done for commercial crew, Orion, and Mr. Dumbacher's ESDCB. That is the operating procedure and all the programs understand it.

There were no other questions or comments, and VADM Dyer adjourned the meeting at 12:15 pm.

Update to existing recommendation:

2012-01-02 **ISS De-Orbit Capability** [ASAP point of contact: Jim Bagian]

Progress continues. The ASAP would like to receive an update at its next quarterly meeting (June 2013).