National Aeronautics and Space Administration

International Space Station Advisory Committee

September 3, 2013
NASA Headquarters
Washington, DC

OPEN MEETING REPORT

Gregory A. Mann
Executive Secretary

Thomas P. Stafford
Lt. Gen. USAF, (Ret.)
Chairman

NASA INTERNATIONAL SPACE STATION ADVISORY COMMITTEE

September 3, 2013
NASA Headquarters
Washington, DC

TABLE OF CONTENTS

NASA INTERNATIONAL SPACE STATION ADVISORY COMMITTEE

September 3, 2013
NASA Headquarters
Washington, DC

MEETING REPORT

Mr. Greg Mann, Executive Secretary of the NASA International Space Station (ISS) Advisory Committee (AC), welcomed the participants, called roll and then gave the floor to Lt. Gen. Thomas P. Stafford, USAF (Ret.), Chairman of the NASA ISS Advisory Committee:

General Stafford: *Good afternoon and thank you for participating in this open meeting of the NASA International Space Station Advisory Committee. Before we get started, I'd like to take a moment to express my gratitude to one of our Committee members, Percy Baynes, who recently stepped down from the Committee after more than 14 years of service. Percy served NASA for more than two decades, including several years as the Director of the Orbiter Division of the Space Shuttle Program at NASA Headquarters, and we will miss his support and insight on the Advisory Committee.*

For our meeting today, the Advisory Committee will be discussing findings from the fact-finding meeting held in Moscow in mid-July, where we met with the Russian Advisory Expert Council. I will summarize each of the main areas we reviewed in Moscow and then allow the Committee members to ask questions and discuss each topic.

ISS Program Overview

General Stafford: *The Joint Commission's (JC) ISS overview briefing covered the current flight plan for visiting vehicles and crew changeover, Expedition 36 objectives, crew utilization for science, and ISS system status. U.S. and Russian representatives covered their respective segments and support systems. Based on the current flight planning, consumables on board ISS are in good shape and the resupply plan is sound.*

In the presentation from the ISS Program Office, the status of Commercial Resupply was covered in some detail as well as international partner missions of ATV-4 and HTV-4. The JC was also briefed on the SpaceX-2 (Spx-2) Dragon Draco Thruster Check Valve failure and the HTV-3 down mode to abort during undocking.

Orbital Demo (Orb D), and Orbital 1 mission status was presented and the JC was shown the current cargo manifests planned for delivery to ISS during those missions. Cargo manifested on Orb D is not mission critical to ISS so a delay of launch or abort will not impact ISS operations.

The SpaceX-3 (SpX-3) mission will launch on the new Falcon 9 version 1.1, which is currently undergoing qualification testing. The new launcher will give SpaceX the ability to increase payload to ISS from 800 kg to 1580 kg of cargo. The Dragon vehicle will also be utilizing powered mid-deck lockers for the first time.

ISSP presented the JC with a summary of the Dragon Draco Thruster Check Valve failure during SpX-2's launch. The anomaly was overcome real-time prior to berthing and the check valves were recovered and operated nominally during unberthing. SpaceX identified the root cause and a design modification will be incorporated for future missions.

The HTV-3 down mode to abort during release and departure from the ISS was caused by an interaction between the grapple fixture cam arms on the vehicle and the initial motion of the SSRMS during back away from HTV-3. This interaction created rates on the HTV vehicle that gave the on-board guidance an indication the vehicle would leave its designed departure corridor and thus it initiated an abort per joint safety requirements. NASA is assessing a number of options to eliminate this interaction on future vehicles and will implement a modified SSRMS release procedure to incorporate a delay in the start of initial SSRMS back away. NASA has assessed other free flyer vehicles (Dragon and Cygnus) and has implemented a corresponding approach to mitigate the concern.

Both programs highlighted the fact that during November the ISS will have a 9-person crew for a short time and that it will be a particularly busy time period. The planned EVA schedule will impact science utilization during that time as well.

General Stafford asked if there were any questions regarding the ISS Program Overview. There were no questions or discussion.

Improving Communications/Review of Decision Making Process

General Stafford: *The ISS Program Office (ISSPO) representative did an excellent job of initiating the discussion on "How can we communicate better, particularly during integrated operations". However, the Russian Committee members clearly misinterpreted NASA's intention for this discussion topic and instead responded with a defense of the Russian decision-making process and the actions taken during the 51P Progress approach and docking incident. While the Russians conceded that the ISS Mission Management Team voted against a "go" for docking, their position remains that this was a Russian vehicle docking to a Russian port, and since their analysis showed there would be no issues, they had the authority to make the final decision. They also made the point that NASA has made similar unilateral decisions for issues on the U.S orbital segment.*

The ISSPO representative was able to steer the discussion back to a worthwhile discussion on the intended topic of improving the communication process for the IMMT. Although the Russian delegation agreed that we should find ways to improve the communication process, they continued to maintain that existing station governance documents and the decision-making process do not need any improvement. They did also, note that during real-time situations like these it can be very important to have senior management communicating as was done during this event.

On day two of the meeting, the Joint Commission finally ended up having the "how can we improve communications" discussion initially intended for day one. It ended up being a fruitful discussion and both sides agreed that work could be done to better clarify roles and responsibilities and lines of communications during off-nominal situations on the ISS.

General Stafford asked if there were any questions regarding the Improved Communication / Decision-Making Process. There were no questions or discussion.

KURS Antenna Deploy Anomaly

General Stafford: *The Advisory Committee noted that the Russian delegation were very forthcoming in providing extensive technical documentation in support of the KURS antenna discussion, and even arranged for one of their technical experts to come for a second day of more detailed questioning.*

Progress 51P launched on 24 April 2013. After reaching orbital insertion, all appendages deployed nominally with the exception of the KURS AC2 short-range antenna (one of two KURS Antenna systems). Data indicated the antenna was still in the fully stowed position. Subsequent attempts to deploy the antenna were unsuccessful, and during approach and docking the antenna was visually confirmed to be in the stowed position. MCC-M had previously developed a software patch and uplinked this patch to the 51P vehicle, which allowed the automated rendezvous using only one deployed antenna and extended the final approach time from 11 to 20 minutes. Both US and Russian analysis and modeling indicated potential contact of the KURS antenna with the SM Passive Docking Assembly interface surface and with the ATV Multi Retro Reflector (MRR) elements. However, no unusual sounds or noises were observed during the docking and probe retraction. All Progress systems operated nominally with the exception of the KURS АСФ2 antenna, which had still not deployed.

Shortly after undocking, the antenna released and extended to the fully deployed position. A Russian State Commission was formed to review the failure for cause, impacts and actions/recommendations to preclude future failures. The cause was determined to be due to excess resin migrating to a location that locked the mechanism latch pins in the capture position. Some of the mechanisms from the same batch were inspected, tested and verified to have the same failure mode and cause. The mechanisms for subsequent Soyuz and Progress vehicles have been replaced with verified operational units. The fiberglass caps have been replaced with metal caps and resin is no longer used for their retention.

General Stafford asked if there were any questions regarding the KURS antenna issue. There were no questions or discussion.

Soyuz 32S Premature Seat Strut Retraction

General Stafford: *The Joint Commission agreed that the premature seat strut retraction topic had been fully discussed already in other forums, but the Advisory Committee wanted to get a briefing on the resolution of the issue, address some specific questions, and understand the recommendations that had been taken to ensure that this did not happen again.*

The Soyuz 32S landing took place on 15/16 March 2013. Landing impact loads for the crewmembers on Soyuz crew vehicles are attenuated by 3 main systems:

1. *Main Parachute (a smaller reserve parachute is deployed if needed).*

2. *Individual seat struts that are actuated (cocked) after chute deploy and act like shock absorbers at touchdown.*
3. *Landing rockets that are fired just prior to landing impact for "soft landing".*

During the landing sequence, the FE2 "Kazbek" Seat Shock Absorber experienced a failure. The main landing parachute sequence was successfully begun at an altitude of approximately 10.5 km. After main chute deployment, the pyrotechnic cocking charge of all 3 crew seats operated properly and extended the struts. About 5 minutes after cocking, the FE2 seat shock absorber collapsed and the seat sank to the lower (launch) position. The "soft landing rockets" operated nominally. At landing, the other 2 seat shock absorbers stroked, operating correctly. While initial NASA reports indicated that the FE2 seat accelerometer registered 21g (vs. 5-6 for CDR and FE1), the Russians claim that the actual g load was much lower and offered to provide NASA with accelerometer data to corroborate this measurement.

The Russian State Commission formed to investigate the incident concluded that:

1. *The seat stroke shock absorber deployed properly with its pyrotechnic charge, but the seat latch mechanism which holds the seat in the upper (cocked or deployed) position did not engage and the seat descended to the lower (non-shock-absorbing) position prior to landing.*
2. *Inspection and multiple testing of FE2's seat did not reveal any system anomalies or operational failures. (The seat latched every time and never failed after proper latching).*
3. *The Commission finding was that the most likely cause was failure of the latch to engage due to interference from (incorrect packing of) FDF and/or crew clothing.*
4. *Corrective Action: Special stowage instructions for the crew and MCC-M approval of configuration via on-orbit closeout photos before Soyuz departure from ISS.*

General Stafford asked if there were any questions regarding the premature seat strut retraction. Mr. Joe Cuzzupoli asked if the Russians had previous incidents where the strut did not act properly. General Joe Engle stated that this was the first known anomaly of this kind with the latching. General Stafford added that any other failure of this type has never been brought to his attention.

P6 Channel NH3 Leak

General Stafford: *At the request of the Advisory Committee, the ISSPO presented on the history and current status of the P6 channel NH3 leak. The Program had been watching a slow NH3 leak for the past several years and it had remained constant at about 1.5 pounds per year. Last summer (June, 2012) the leak began to accelerate to between 3.5 to 5 pounds per year and by spring of 2013 to 5 pounds per day.*

At this point the crystals of escaping NH3 were visible to the crew and the decision was made to do an unplanned EVA to replace the Pump Flow Control Subsystem (PFCS) to restore full functionality and attempt to determine the exact leak source. The P6 Channel function was restored by the installation of the new PFCS but the leak source could not be determined. The old unit was installed to an external stowage location and connected to a data port for continued observation. Because of the concern of residual NH3 in the PFCS, there is no current plan to return the faulty PFCS for examination or repair.

During this discussion the Russians made it clear that they had issues with NASA conducting an EVA so close to the Soyuz departure, but ultimately they acknowledged that they understood the NASA position and were satisfied that they got their concerns expressed.

General Stafford asked if there were any questions regarding the NH3 leak. There were no questions or discussion.

4-Orbit Rendezvous

General Stafford: *Following the second, successful 4-orbit rendezvous with the Soyuz and three prior successful 4-orbit rendezvous for the Progress, the Joint Committee discussed the pros and cons for base-lining the 4-Orbit Soyuz rendezvous. The ISSPO had identified three issues they wanted the JC to explore:*

1. *Crew rest: the first time 4-orbit rendezvous, we implemented a two-week crew time shift in Baikunor to prepare. That was deemed too long, so the next time they did a slam shift the night before launch, with a small nap. Seeking a final recommendation on the crew rest / time shift issue.*
2. *Space adaptation syndrome*
3. *Ability of the Soyuz crew to move out of their seats to use restroom or get a small snack*

I reminded them (the Russian AEC) *that I did the first ever 4-orbit rendezvous in space with Wally Schirra and it wasn't a big deal. We later did a 3-orbit and a 1-orbit.*

The Russians agreed that the medical communities on both sides should work together and resolve all these questions before baselining 4-orbit rendezvous flight.

Previous Soyuz missions to the ISS have all docked to the station two days after launch. Docking to the ISS after 4 orbits is advantageous in that spending two days in the cramped interior of the Soyuz along with two other crewmates is known to be a stressful and uncomfortable time for astronauts and cosmonauts, many of whom have suffered from symptoms of space sickness at the same time. A fast rendezvous requires extremely precise orbital adjustments from the ISS, and extremely precise orbital insertion by the Soyuz-FG booster, which was only deemed possible following a study conducted last year, which showed that such accuracy was achievable with the existing Soyuz-FG booster and modernized Soyuz TMA-M series spacecraft.

Following liftoff at 8:43 PM GMT and successful orbital insertion shortly thereafter, 34S immediately performed its first two engine burns on its first orbit of the Earth, which were pre-programmed into the Soyuz's on-board computer prior to launch. On the second orbit, actual orbital parameters were uplinked from a Russian Ground Site (RGS), which allowed for a further eight rendezvous burns to be performed more precisely over the next five hours of flight.

During this time, the Soyuz crew unstrapped from the Kazbek couches and entered the Orbital Module (BO) to stretch their legs and use the bathroom facilities. However, due to the extremely tight schedule and high workload, they did not have time to take off their Sokol launch and entry suits, although they were able to take off their suit gloves and open their helmets.

Docking to the ISS at the Mini Research Module-2 (MRM-2) port was slightly ahead of schedule at 2:28 AM GMT on March 29. Based on the results from the 34S 4-orbit rendezvous, discussions are underway to baseline the 4-Orbit Soyuz rendezvous. Which I think is wonderful.

The Joint Commission noted their support for the work being done on the 4-orbit rendezvous, but as there were no experts from the medical community present for either side, recommended that the medical experts assess this topic at their Multilateral Medical Operations Panel (MMOP) meeting in September.

General Stafford asked if there were any questions regarding the 4-orbit rendezvous. There were no questions or discussion. General Stafford reiterated that he did the first 4-orbit rendezvous in 1965 and there were no problems.

Certification Status Update of ISS to 2020

General Stafford: *At the request of the Roscosmos Advisory Expert Council (AEC), the ISSPO and RSC-Energia both presented on the current status of efforts to certify the ISS to 2020. The Russians questioned when the ISS partners would be able to see the Certification Documents, and were provide those documents by the ISSPO representative before the JC meetings concluded.*

The Russians also questioned the delivery of spares to the ISS and how to deal with components that are no longer being manufactured. The ISSPO responded that the first question was to verify if replacement parts were still available. The U.S. side is currently limited to the SpaceX Dragon capsule and the Japanese HTV for bringing up large items, and noted that items such as the U.S. solar arrays are too large to get to station anymore (without the Shuttle), so these larger items would have to be able to be certified to 2028. The ISSPO also explained that NASA does have concerns about some manufacturers no longer being in business, and noted the Agency is working to address these situations continually in the certification process. Most importantly, the ISSPO noted that there are not yet any components that have proven unable to be certified until 2020.

During his presentation, the RSC-Energia representative addressed concerns that some components in the FGB and Service Module are getting old (beyond their intended life time), and that the original manufacturers are not still in business. In the final presentation, the ISS Program Manager for the Khrunichev Space Center noted that the Russians have completed their analysis for extension of major systems through 2020. By December 2013, they expect to have certification completed for all Russian systems and hardware through 2028. He concluded that the Russians do not expect or foresee any technical issues at this time.

General Stafford asked if there were any questions regarding the certification status of the ISS to 2020. Mr. Cuzzupoli asked if there are any other items that we can't carry up by SpaceX or Orbital Sciences, besides the solar arrays. Dr. Charles Daniel stated that radiator booms cannot be carried up, but all spares are on-orbit. He explained that the largest ORU that can be carried up is the CMG via the ATV, but he believes that all of the CMGs are on-orbit as well. He added that the solar arrays could only be carried up in the Shuttle bay, but stated that those vendors have been out of business for decades anyway.

EOL Updates from Russian side

General Stafford: *Although the Joint Commission had previously agreed to address the end-of-life topic at the fall meeting at NASA's Johnson Space Center, some members of the Roscosmos Advisory Expert Council had some points they wanted to identify at this meeting to ensure they were addressed at the fall meeting:*

- *Their concern was not with the "nominal" (pressurized with crew onboard) configuration, but with the emergency/depressurized configuration.*
- *With normal solar activity, current controlled de-orbit templates require about 1 year. If a rapid depressurization (bad MMOD hit) happens, the Russian avionics are probably only good for 6 months. This topic is actively being investigated by the ISSPO.*

The Joint Commission concluded that it would be useful to have more detailed presentations on this topic at the next JC meeting.

General Stafford asked if there were any questions regarding the contingency de-orbit plans. General Stafford asked Dr. Daniel if he had been involved in any of the contingency plans and he said he had not. General Stafford said this issue would be revisited during the JC meetings in the fall.

Assurance of ISS Operations into 2020

General Stafford: *Because the intent of this particular proposed topic was to discuss legal obligations of committing to extended flight duration rather than safety or mission assurance, it was determined not in the scope of the tasking of the Joint Commission.*

Conclusion

General Stafford: *Overall, the Joint Commission commends the ISS Program and the International Partners for the continued successful operation of the ISS with the attempt to maintain an international crew of six. The Joint Commission recognizes that continued vigilance is required to maintain safe and productive operations of the space station.*

The Joint Commission agreed to meet again in Houston in Fall 2013 for another fact-finding meeting on the above issues. In preparation for that meeting, the Joint Commission will request additional information on the above-mentioned topics from the appropriate ISS Program points of contact.

That concludes the current report and summarizes the work accomplished by the Working Group during the recent fact-finding meetings in Moscow. Given this report, do any Advisory Committee members have any questions? Are there any objections to the report?

There were no questions or objections to the report.

General Stafford: *Fine, then based on our fact-finding meetings, the full Advisory Committee and Joint Commission concurs with the assessment outlined here today. Thank you all again for the expertise you bring to our committee. Now, I'll turn this over to the Executive Secretary to wrap things up.*

Greg Mann: *Thanks again for all of your hard work on this fact-finding assessment. Is there any public input?*

There was no public input.

Greg Mann: *I would ask that the Special Government Employees remain on the call for your annual ethics briefing, which will be given by James Reistrup from the General Counsel's office. Special Government Employees are: Gen. Stafford, Jim Adamson, Joe Cuzzupoli, Chuck Daniel, Dan Heimerdinger, Jake Jacobson, and Ron Merrell*.

Greg Mann: *This meeting is adjourned at 1:35pm.*

Attachment A

NASA INTERNATIONAL SPACE STATION ADVISORY COMMITTEE

September 3, 2012
NASA Headquarters
Washington, DC

ADVISORY COMMITTEE MEMBERSHIP

Chairman

Lt. Gen. Thomas Stafford, USAF (Ret.)

Members

Col. James Adamson, U.S. Army (Ret.)
Mr. Joseph Cuzzupoli
Dr. Charles Daniel
Dr. Daniel Heimerdinger
Maj. Gen. Ralph Jacobson, USAF (Ret.)
Dr. Ronald Merrell
Dr. Josef Schmid
Mr. Thomas Whitmeyer
Col. Jeffrey Williams, U.S. Army (Ret.)

Technical Advisors

Maj. Gen. Joe Engle, USAF (Ret.)
Maj. Bob Maiberger, U.S. Army (Ret.)

Executive Secretary

Mr. Greg Mann

Asst. Executive Secretary

Ms. Holly Stevens

Attachment B

NASA International Space Station Advisory Committee Meeting
NASA Headquarters
Washington, DC
September 3, 2012

Members Participating *(via telecom as noted)*

NASA International Space Station Advisory Committee *(all via telecom)*

Gen. Thomas P. Stafford
Mr. Joe Cuzzupoli
Mr. Charles Daniel
Dr. Dan Heimerdinger
Gen. Ralph Jacobson
Dr. Josef F. Schmid
Col. Jeffrey N. Williams

Executive Secretary

Mr. Gregory Mann
Ms. Holly Stevens *(via telecon)*

Technical Advisers

Gen. Joe Engle *(via telecon)*
Mr. Robert Maiberger *(via telecon)*

NASA Attendees

Ms. Meredith McKay (OIIR)
Ms. Jennifer Troxell (OIIR)
Mr. Michael Braukus (PAO)
Trent Perrotto (PAO)
Rachel Kraft (PAO)

Media

James Dean *(via telecon)*
Florida Today

Dan Leone
Space News

Leonard David *(via telecon)*
Space.com

General Public

Raymon Furth
Executive Assistant of Research and Federal Relations
University of Colorado Office of Government Relations

Ted Kronmiller *(via telecon)*
Counsel
Arianespace, Inc.

Ben Roberts
ISS OMB Examiner

Matthew Bodner
Research Intern
American Foreign Policy Council (AFPC)

Michael Lapidus *(via telecon)*
Government Affairs Associate
Space Exploration Technologies (SpaceX)