

RETURN TO FLIGHT

National Aeronautics and Space Administration
Washington, DC

**RETURN TO FLIGHT
TASK GROUP**

December 16, 2004

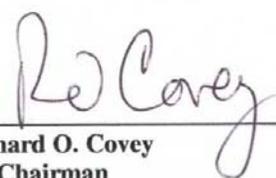
Marshall Institute
Marshall Space Flight Center
Huntsville, Alabama

PUBLIC MEETING MINUTES

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Vincent D. Watkins
Executive Secretary



Richard O. Covey
Co-Chairman

History, Report Progress &
Implementation 12-16-04

RETURN TO FLIGHT (RTF) TASK GROUP
Marshall Institute, Huntsville, Alabama
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PUBLIC MEETING MINUTES
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Return to Flight (RTF) Task Group
Marshall Institute, Huntsville, Alabama
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Introductory Remarks

Mr. Vincent Watkins, Executive Secretary of the Return to Flight Task Group (RTF TG) made introductory announcements and introduced the members present at the meeting: Mr. Richard Covey (Co-Chairman), Dr. Daniel Crippen (Chairman of the Management Panel), Mr. Gary Geyer, Dr. Walter Broadnax, Mr. Thomas Tate, Mr. William Wegner, Mr. Joseph Cuzzupoli (Chairman of the Technical Panel), Dr. Charles Daniel, Mr. Sy Rubenstein, Mr. Benjamin Cosgrove, Mr. Richard Kohrs, Col. James Adamson (Chairman of the Operations Panel), Mr. Robert Sieck, Lt. Gen. Forrest McCartney, Dr. Amy Donahue, Col. Susan Helms, Dr. Kathryn Thornton, Dr. Rosemary O’Leary, and Dr. Kathryn Clark.

Mr. Covey welcomed visitors and thanked the Marshall Space Flight Center (MSFC) for hosting the RTF TG at the Marshall Institute. He reviewed the charter of the RTF TG, emphasizing that it is not an investigative board. It is an advisory board, chartered to provide an assessment to the NASA Administrator on whether or not the Agency has met the intent of the fifteen return to flight recommendations made by the Columbia Accident Investigation Board (CAIB). The RTF TG slightly expanded its charter to include one of the “raising-the-bar” activities taken on by NASA—using International Space Station (ISS) as a Contingency Shuttle Crew Support (CSCS). The RTF TG divided into Panels—Operations, Technical, and Management—and the recommendations were divided amongst these Panels. The Panels complete their fact finding based upon closure packages prepared by NASA that show those things done or planned in response to the CAIB recommendations. The closure packages provide a complete documentation trail. These packages are taken through a process within NASA, culminating at the Space Flight Leadership Council (SFLC), which is a governing council appointed by the Administrator to ensure all things being done for RTF are reviewed, acknowledged, and accepted at the NASA Headquarters level. Closure packages come to the RTF TG only after going through the SFLC. The RTF TG sometimes requires additional information, and the closure packages are updated. The RTF TG has received closure packages for all of the return to flight recommendations. However, the Panels have not yet completed assessment of all of the packages. The purpose of this meeting is for the RTF TG to bring closure to those recommendations we can. Mr. Covey noted some of the recommendations have been conditionally closed; some require additional status prior to completion of assessment, and some will be fully closed at this meeting.

Management Panel Status

Dr. Crippen addressed the seven recommendations that were assigned to the Management Panel. The Panel recommended full closure of R6.3-2—NASA/National Imagery and Mapping Agency Memorandum of Understanding—that was conditionally closed at a prior meeting. Mr. Geyer reviewed this recommendation and he noted the necessary agreements have been executed and are in place. The tasking and information flow has been demonstrated to the proper decision makers. Mr. Covey asked the record reflect

NASA has met the intent of the CAIB recommendation and based upon the recommendation of the Management Panel, the RTF TG accepts full closure of this recommendation.

Dr. Crippen addressed R6.2-1—Scheduling and Resources. He noted this is a continuing observation and ongoing task and should pass to any follow-on group. There have been some important recent developments—Congress approved the Fiscal Year 2005 budget at the requested level and NASA is reallocating funds to the Shuttle. The President supports NASA in its RTF activities. NASA has assured the RTF TG it will provide sufficient funds to RTF. There have been some recent press reports on work reductions, etc. These reductions-in-force and retirement packages should not affect RTF, but the Panel would like to follow up on recent announcements and do further assessment on workforce schedule pressure. Mr. Covey summarized the Panel does not have an outstanding concern at this point, but believes additional analysis is required before bringing this recommendation forward for closure. Col. Adamson noted he has not personally seen any evidence of problems with resources. Dr. Crippen added his Panel visited NASA and talked to people on the floor and no undue pressure was expressed.

CAIB Recommendation 6.3-1—Mission Management Team (MMT) Improvements. Called for a plan for, and training of, the MMT. The MMT is there to react to and develop policy for things that are not planned. NASA has developed a training plan and has conducted nine full simulations (sims) to date. There will be a full, end-to-end sim the first week in March. The Management Panel wants to continue to monitor sims, particularly this last one. Some of the conditional closure of other recommendations will be closed after the last sim, and it is appropriate to keep this recommendation open. Mr. Covey noted this recommendation is one that will not be brought forward for closure until after the last sim. The Panel has asked NASA to exercise some things in the last sim and has given the Agency a list of those items. Dr. Crippen indicated he does not see any impediments to closing this recommendation after the last sim.

Mr. Lloyd commented on the previous recommendation on resources (6.2-1). He noted there have been requests for buy-outs at five field Centers. Recently, the Administrator requested authority to provide buy-outs so additional competencies can be brought in to support the exploration vision. The Agency is trying to construct a workforce to move forward with the exploration strategy. However, one of the requests was a certification that no resources would be taken away from any safety-oriented process or any process related to RTF.

Dr. Crippen noted of the nine sims, the Management Panel staff has attended seven. Dr. Crippen encouraged Mr. Cuzzupoli and Col. Adamson to also have representation from their Panels at the last sim in March.

Recommendation 9.1-1—Organization. Is being treated as a single recommendation even though it consists of a detailed plan to accomplish three sub-parts. It will be closed as a single recommendation. At this point, the closure pack is still in need of some documentation and work. Most of what is necessary is just that. The Panel has seen

much of what NASA intends to do and feels it would meet the intent of the CAIB recommendation. This recommendation is moving well toward closure and the Panel anticipates closure of this in March. There has been progress on all three sub-parts.

Dr. Crippen reviewed the three other CAIB recommendations associated with 9.1-1: 7.5-1—Independent Technical Engineering Authority; 7.5-2—Safety and Mission Assurance; and 7.5-3—Space Shuttle Integration Office Reorganization. A few weeks ago, NASA reorganized their Independent Technical Authority (ITA). As of now, the current plan will fulfill the CAIB objectives. There has been a fair amount of public attention and concern on this subject. The Panel wants to see a few more details on the integration and how it will work. The ITA will own the technical requirements and have the authority to waive them. There is a formal mechanism to delegate authority from the Chief Engineer through a set of warrants and the first set of warrants was issued yesterday. The Panel believes the proposed organization will meet the CAIB recommendation. The Panel has discussed the possible limitation of removing technical authority from the Program Director. Some people have been concerned that separation of technical authority from the Program may produce some disadvantages. Although, NASA has complied with the intent of the CAIB recommendation, the Panel needs further review on the details of how the ITA will work with the safety organization. Mr. Covey summarized progress has been made and NASA's response meets the intent of the CAIB. The documentation needs some additional work. Dr. Crippen agreed and noted the NASA Engineering and Safety Center (NESC) has been formally moved from the safety side of the organization to the Chief Engineer. This change of organization has not been reflected throughout all of the documentation and this recent change needs to be clarified. Since the process has just been derived in the last few months, some of the details need to be worked out. Mr. Cuzzupoli noted the NESC seems to be coming along very well and the Technical Panel has been seeing some good reports from it. Dr. Crippen clarified the Chief Engineer gives the raises to the people in the NESC. Mr. Kohrs noted the ITA and the NESC are Agency-wide, not just Shuttle Program. Dr. Crippen commented the Panel expects many of the people in NESC will be warrant holders. In response to a question from Mr. Sieck, Dr. Crippen indicated he was more confident of resources now that NESC has been moved under the Chief Engineer. The Chief Engineer is running full steam at implementing the ITA. Mr. Geyer added he has visited NESC and is impressed with the speed of implementation. Mr. Crippen noted the Panel has not completed its full assessment of the implementation of the warrant authority. The RTF TG agreed to keep this recommendation open.

With respect to 7.5-2, Dr. Crippen noted Mr. Bryan O'Connor has proposed the Safety and Mission Assurance (SMA) personnel would come under his purview for review and hiring. However, the SMA Directors at the field Centers would still report to the Center Directors. Although the proposal does not exactly do what the CAIB recommendation specified, Dr. Crippen noted Mr. O'Connor has convinced the Panel his proposal meets the intent of the CAIB recommendation and will work. Since the plan is developed but still evolving, this recommendation will remain open.

The Panel is assessing how well the System Engineering and Integration Office (SEIO) is working in RTF and can report it is working very well. The only consideration to closing involves documentation. The Panel is looking for a statement of roles and responsibilities, noting there is some possibility of confusion if there is not a clear statement. In the main, NASA has met the CAIB intent on Recommendation 7.5-3, but it should stay open until the documentation is completed. Mr. Cuzzupoli noted the Technical Panel has been involved with the SEIO and feels comfortable with the integration group.

Mr. Covey stated the RTF TG was pleased with the progress on each of these recommendations. NASA is moving in a direction that appears to meet the intent of the CAIB, and the documentation is the primary reason the Panel is not bringing these forward for closure at this time. Dr. Crippen added there are few details in ITA to be worked out, but there should be no impediment to resolving those.

This completed the Management Panel report.

Operations Panel Status

Col. Adamson addressed the Operations Panel report. He provided a quick review of the Operations Panel activities and summarized where they are relative to the total body of work. The Operations Panel has engaged in seven activities—six of those are specific RTF, and one is the raise the bar activity NASA imposed on itself (SSP-3). Two recommendations have been presented at prior meetings; two more will be presented today. The Panel is not prepared to present two others as it just recently received the closure packages. There is one more recommendation the Panel is attaching to the work being done under another recommendation.

The first three recommendations relate to imagery: 3.4-1—Ground-Based Imagery; 3.4-2—High-Resolution Imagery of the External Tank (ET); and 3.4-3—High-Resolution Imagery of the Orbiter. Col. Adamson reviewed the CAIB recommendations. To date, NASA has done about 70 percent of all of the work for the Operations Panel activities. The work that remains to be done is well defined, and with one minor exception, it has been scheduled and is in progress. In many cases, NASA has gone above and beyond the CAIB recommendations and embraced them energetically.

Mr. Sieck discussed 3.4-1—Ground-Based Imagery. The CAIB requested the Program upgrade the ground system imagery, make the requirements crisper, and look at using other assets. The CAIB suggested NASA treat the Shuttle as a developmental vehicle and collect as much technical information as practical. NASA moved out quickly on this recommendation and started implementing more short, medium, and long-range cameras to optimize views of the vehicle. However, there is a caveat—the resolution of these assets will not definitively establish whether there is a “hit” on the vehicle. While the systems will be required, they are not a launch constraint from a safety standpoint. It should be noted the Operations Panel assessment did not go beyond the capture of information. The analysis of the information is part of another recommendation. Mr. Sieck showed slides of some of the assets. While the assets are not “high tech,” they

are complex and must be set up and maintained properly. In addition to these ground assets, NASA is looking at leasing two WB-57's as airborne platforms. This will be particularly useful whenever there is cloud cover during launch. The status of the assets will now be part of the launch decision process. The Panel made a number of trips to the Kennedy Space Center (KSC). Significant progress has been made. NASA has doubled the number of camera sites. Requirements are still being updated and NASA is converging on a set of requirements. All of the safety documentation and the documentation associated with the cameras themselves should be completed this spring. Mr. Sieck summarized what is still open: the program requirements, including the minimum assets required for launch; and how the accountability for the assets and the reporting is part of the launch decision process. Once final documentation is received, the Panel will be ready to close this recommendation. In response to a question, Mr. Sieck indicated the assets have been re-positioned to optimize collection of information. Col. Adamson commented the array of imaging assets recommended by the CAIB is rather bewildering. These assets are not meant to capture or map specific damage sites to the vehicle—they are meant to give some information about how a piece of debris would fly during ascent. Mr. Covey agreed information from these assets falls into the category of “engineering test data.” Dr. Clark added this is part of a suite of information that will be in hand to help make critical decisions. Mr. Covey stated the RTF TG believes NASA has met the intent of the CAIB, subject to documentation being completed. The RTF TG agreed to close this recommendation conditionally.

Lt. Gen. McCartney discussed 3.4-2—High-Resolution Imagery of ET. There is a requirement to get the data down without depending on retrieval of film. Columbia had the standard array of imaging devices. In addition, the crew used the hand-held camera. Two digital cameras will now cover the ET separation and data from these cameras will be downlinked. The crew-held camera will still be used, but the Program has optimized the Orbiter maneuvering so it will be in a better position to obtain images. In addition, NASA has replaced the 35 mm camera in the right hand umbilical well with a digital camera. It will provide a series of snapshots with the same quality of data as the 35 mm, which was excellent. The information will be downlinked on Flight Day 1.

Lt. Gen. McCartney showed slides of the camera views. He noted the Panel conducted fact finding at KSC. The assessment of the Panel is the appropriate cameras have been selected. NASA has gone a step further by accelerating installation of the umbilical well camera. All of the work has been completed or scheduled. No further action is needed on the crew hand-held camera. The umbilical well camera is undergoing final qualification and testing and this activity rolls out into the March timeframe.

Lt. Gen. McCartney noted this is standard procedure for all types of hardware. The Operations Panel felt that contingent upon successful completion of this work, NASA has met the intent of the CAIB recommendation. If there is a problem, the Panel members expect NASA will notify them. Checkout will be reported at the Flight Readiness Review. Mr. Covey summarized that based upon the Operations Panel recommendation, the RTF TG accepts the closure of 3.4-2 pending completion of planned work.

Lt. Gen. McCartney reviewed 4.2-5—KSC Foreign Object Debris (FOD), which was previously closed conditionally. The CAIB recommended KSC standardize the definition of FOD. KSC did several things: they changed the definition to one that is now consistent with industry and the rest of NASA; they implemented a training program to ensure the workforce understood the definition of FOD; and they followed the training program with an audit. The audit was completed in October. The report generated good data and corrective actions are being taken. The Panel believes NASA has met the intent of the CAIB recommendation and recommends full closure. In response to a question, Lt. Gen. McCartney noted KSC will continue to audit and will continue training. Also, FOD inspections will be a matter of record. Mr. Covey summarized the RTF TG finds NASA has met the intent of the CAIB recommendation and accepts NASA's request for closure on this item.

Mr. Sieck discussed 10.3-2—Orbiter Digitize Closeout Photography, which was previously closed conditionally. The CAIB recommended the photograph system be digitized so images are immediately available for on-orbit troubleshooting. This recommendation was conditionally closed in July. NASA has completed the purchase of all of the cameras for closeout photography, has completed training of all of the people certified to use the cameras, and has worked this in simulation. The Panel feels NASA has met the intent of the CAIB recommendation. Lt. Gen. McCartney noted previously, the requirements for closeout imagery were not as crisp as they could have been. NASA re-verified the requirements and corrected this problem. Cataloging and indexing is also much improved. It is now a user-friendly system. Mr. Covey noted based upon the previous closure package and the Operations Panel recommendation, the RTF TG accepts NASA's request to close this recommendation.

Lt. Gen. McCartney discussed 3.4-3—High-Resolution Imagery of the Orbiter. The CAIB recommended there be a capability to obtain and downlink high-resolution images of the underside of the Orbiter wing leading edge and forward section of both wings. NASA is doing this in two ways: (1) by the Orbiter Boom Sensor System (OBSS), addressed by Recommendation 6.4-1—Thermal Protection System (TPS) On-Orbit Inspection and Repair; and (2) through use of the ET camera located in the liquid oxygen feedline fairing. NASA has identified the OBSS as the primary method. The Panel recommends this specific recommendation be considered jointly with 6.4-1 since both of the recommendations focus on the OBSS. Mr. Covey noted this recommendation will be kept open and tracked with the inspection portion of 6.4-1.

Col. Adamson noted the Panel just recently received a closure package on SSP-3 and is not ready to close on that item. Col. Helms provided a status on this activity. NASA has worked on the feasibility study for some time. The Space Station Program has done a lot of excellent work on the limits of the feasibility. NASA does intend to utilize the Station if necessary. They will pre-plan a rescue Shuttle (STS-300) for the first two RTF missions. There is a methodology on how long they can wait. For the first two flights, NASA has said there will be no gap between keeping the Station crew alive and the ability to launch STS-300. This is the metric for feasibility of SSP-3. The Panel feels NASA's estimation analysis is extremely good and is above and beyond what the Panel

expected to see. In addition, NASA has recognized the need to recompute the duration as the Station status changes. The duration is a living number and it is tracked as a dynamic variable. The closure package was late in coming to the Panel, but based upon preliminary review, good progress is being made. The Panel is looking for more detail on how the variable is taken into account in the launch decision process. The panel agrees with NASA's approach that this is not certified—it is an emergency approach only. The Panel has asked that CSCS be part of the March MMT sim. Col. Adamson commented NASA has gone beyond the CAIB individual recommendations and is assessing the safety of the vehicle based upon integration of all of the recommendations. As part of overall risk reduction, NASA felt this raise the bar activity was necessary to reduce the risk of RTF. The safe haven concept is one of the concepts NASA has proffered to give an additional level of comfort in flying while it evaluates the work that was done on the tank. Mr. Covey noted the RTF TG may have to look at the compendium of the responses to recommendations in addition to assessing them individually. This action should be brought to closure at the next plenary, which will be after the full-up MMT sim.

In closing the Operations Panel report, Col. Adamson recognized the contributions of Dr. Clark and Col. Helms on 6.4-1, which will be discussed by the Technical Panel. Mr. Covey thanked the Operations Panel in making significant progress.

Technical Panel Status

Mr. Cuzzupoli introduced the recommendations handled by the Technical Panel. He noted NASA is planning to move the ET by the end of this month. The Panel recognizes the tremendous amount of progress made. There has been a lot of work and redesign on the Orbiter and the milestones NASA established for RTF are happening. He noted there would be a lot of detail in his charts. The Panel is reporting on six recommendations—it proposes fully closing two, with a status report on the other four. The Panel hopes to have 3.3-1—Reinforced Carbon-Carbon (RCC) Structural Integrity, closed by January.

Dr. Daniels discussed 4.2-1—Solid Rocket Booster Bolt Catchers. The problem with the bolt catcher was not part of the accident, but was surfaced during the course of the CAIB investigation. NASA fully embraced the CAIB recommendation and has completely redesigned the bolt catchers. Dr. Daniel reviewed the design changes: stronger material; a single piece forged design; machined cork for TPS; bolts doubled in size and material; increased size and strength of inserts; impact absorption material; and a different type of O-ring. In addition, delegations of inspection points were re-established. At the end of the activity, the calculated factor of safety support by test was 1.86 minimum. Dr. Daniel showed slides of the bolt catcher assembly and the NASA Standard Initiator pressure cartridge, which was also redesigned. He described the NASA verification process, which included development tests and qualification testing. The Panel has been involved in the process from the inception of the original Design Certification Review (DCR) through development and qualification testing. It feels NASA has fully met the intent of the CAIB recommendation and recommends acceptance for full closure. Mr. Cuzzupoli commented the Panel has pushed back on a lot of the design and plans. Dr. Daniel has been working closely with MSFC and the Center appreciates his hard work. Mr. Covey

noted by the time the Panels bring their reports to the plenary meetings of the RTF TG, many of the concerns has been resolved by the Panel fact-finding. He noted based upon the closure package and the Technical Panel presentation, the RTF TG concludes NASA has met the intent of the CAIB recommendation and accepts NASA's request for closure.

Mr. Cuzzupoli discussed 4.2-3—Two-Person Closeout. Yesterday, the RTF TG viewed a video of one of the closeout areas and there were more than two people involved. Detailed procedures have been modified to meet the two-person closeout requirement. Procedures have been implemented, as witnessed by Panel members at Michoud and KSC. The audit of all elements is complete and documentation has been received. There are no open Requests for Information (RFI's), and the Panel recommended full closure. Mr. Covey noted the RTF TG accepted this for closure based upon the full closure package and the Panel recommendation.

Mr. Rubenstein discussed 3.3-2—Orbiter Hardening. The recommendation contained two parts: (1) to increase the Orbiter's ability to sustain minor debris; and (2) to determine the impact resistance of the Orbiter to debris. NASA initiated a program to increase the Orbiter's ability to sustain minor damage, consisting of near-term changes for RTF, mid-term changes, and long-term changes. In parallel with the hardware activity, NASA developed a detailed test, modeling, and analysis program. Some of the testing showed some other areas for improvement. The effort started with the System Integration Team defining critical debris. The ET Project made significant changes to reduce critical debris. The Orbiter Damage Impact Assessment Team activity is underway. The testing program on the tile is essentially complete and the RCC testing will be complete in February 2005. Damage assessment is in progress. As this activity moves forward, it generates requirements for what has to be repaired. The Program selected 15 hardening improvements, in three phased groups. The first group will be implemented for RTF. Mr. Rubenstein described the four Phase I redesigns and discussed the status of each: wing spar protection for RCC panels 5-13; elimination of void in the main landing gear door corner; elimination of bonded stud from the forward Reaction Control System carrier panel; and thicker side window thermal panes. Phase II work has been approved and is underway: front spar protection for RCC panels 1-4 and 14-22; and enhanced thermal barrier modification for the main landing gear door. Developments for the Phase III projects (advanced RCC and tiles) have been initiated, but final implementation plans for these projects have yet to be made. The Panel has been working in line with NASA, witnessing the tests. Excellent progress has been made. The Panel concurs with the selected Orbiter hardware projects. The test and analysis process is coming to its final stages, but the Panel has not seen the details of how the models will be combined with flight history and how they will be assessed. Because of the number and types of tests and the newness of the mathematical techniques, the panel recommends keeping this recommendation open. Mr. Covey requested when this is brought back for closure, it be covered at a high level focusing on the part that was not complete at this meeting. Mr. Cuzzupoli noted the Program has presented a closure package. The Panel understands what is needed for closure and the Program will update the package accordingly.

Mr. Kohrs discussed 3.2-1—ET Debris Shedding. The CAIB recommended elimination of all sources of critical debris. The Program has included more than thermal protection debris in its action. Mr. Kohrs showed the ET activities. The project has addressed the following: TPS re-certification; intertank/LH2 flange; bipod fitting ramp; ET camera system; TPS non-destructive inspection (NDI); and LO2 feedline bellows ice. He discussed the status of each of these activities. The ET Project broke the recommendation into three phases: (1) elimination of critical debris for RTF; (2) further reduction of debris (beyond first return to flight); and (3) long term activities. The third phase has been deferred. The project has re-certified all TPS applications in critical debris zones. The bellows ice problem does not yet have a final analysis. Depending on weather conditions, the drip lip eliminates 40 to 75 percent of the ice build-up. Whether this is sufficient is still being analyzed. As a backup, the project is looking at a heater system and this is open work. The Panel needs to see the final hardware fix or analysis. The Phase II work includes redesign or elimination of LO2 and LH2 PAL ramps and enhancement of Non-Destructive Inspection (NDI) technology as an acceptance tool. The ET Project is employing a lead tank/trail tank approach for RTF. ET 120 will be shipped prior to final certification of the ET design. There will be two DCR's. The first is occurring this week; the second DCR will deal with the TPS and is scheduled for January, but the Board will not culminate until mid-March. The trail tank will not be shipped until final design certification/re-certification. The ET Project feels they have certified the materials and applications; some additional testing is on-going for DCR 2. There have been a series of Panel meetings, and the Panel has visited Michoud a number of times. The Panel applauds the ET Project for a tremendous amount of work over the past year and a half. The Project has developed an aggressive plan to eliminate debris. The Panel recommends keeping this open to look at the results of DCR 2.

Dr. Crippen expressed concern with the use of some of the mathematical models. He noted they will not be used for real time, in-flight analysis. Dr. Daniel commented the operations people do not intend to use models to make real-time flight decisions. They will use the transport model to decide where to go to look for damage. He agreed the extent to which they should be used before flight is open for debate. There are a series of models—liberation models, transport models, kinetic energy models, and structural models. These are being developed by different people, and have to be connected in order to understand how things happen. All of these models were developed to be deterministic models. Subsequent to the last four months, the project has stepped into simulation and probabilistic models. Dr. Daniel noted several members of the RTF TG share the concern expressed by Dr. Crippen. There is no doubt more is known about debris, how it flies, and how it impacts than was known before. Dr. Crippen observed output is only as good as assumptions. Dr. Daniel noted the assumptions and ground rules are dynamic in nature. There has been an evolution in these as well as the tools themselves. There is ongoing discussion on the degree to which these models can be used for certification of the vehicle. In January, there will be discussion on how these models will be combined. The models are very complicated; in many cases, these are new models to the people who are using them. Col. Adamson commented these are tools used in an operational scenario along with another anchor point. Dr. Daniel noted the operations people have indicated they will use the models in that regard, e.g., where to go

look. They would not eliminate anything based solely upon a model. Dr. Clark added NASA is looking at the models in the right frame of mind. Mr. Cuzzupoli noted the CAIB recommendation was NASA needed to do more modeling and we are certainly getting that. The Program Office has to come to grips with what the models can be used for and when there is enough. Dr. Crippen added the RTF TG's concern is NASA would read more into the results or overly rely upon them. Point estimates come from serially linked models cannot be relied upon. In response to a question from Mr. Covey, Dr. Daniel indicated the Panel has heard NASA is using the models inconsistently, but it has not heard NASA is using the models inappropriately. The end use of the model is indeterminate at this time. The models allow us to better understand the physical environment under which the vehicle is operating; however, there should not be an over reliance on the complex answers provided by models.

Mr. Covey summarized the RTF TG cautions NASA to be careful in the reliance on models in the absence of ways to adequately validate the assumptions and the performance of the models, particularly when looking at the results of models that have been linked together. Mr. Cuzzupoli agreed the real issue is what the models are going to be used for. This must be clear. Mr. Lloyd noted the CAIB said modeling had been used inappropriately (outside of validation) prior to the accident. The CAIB's caution was to make sure models are validated and are used within the constraints of their intended use. Mr. Lloyd suggested the RTF TG recommend NASA fully detail the validation of the models and when they should be used. Mr. Covey summarized relative to the status of 3.2-1, the open issues concern resolution of the bellows ice problem. Mr. Kohrs added there is also open work on final design certification the Panel needs to look at. Mr. Cuzzupoli noted this was a reason to have the next plenary meeting sometime after DCR 2. The tile and RCC repair report, as well as the final MMT sim, fits under that timeframe as well.

Mr. Cuzzupoli discussed the status of 3.3-1—RCC Structural Integrity. The RCC panels were sent back for Non-Destructive Evaluation (NDE). The Panel needs to look at the closure of all Material Report/Problem Report's from the detailed RCC NDE inspection, and needs to close the RFI on RCC impact test data. It also needs the report on the RCC nose cap and the impact to OV-103 and OV-104. The Program Office is scheduling a meeting for the Panel to look at this. The Panel is approaching full closure and should be ready to do that in January or at the March meeting. Mr. Covey summarized some of the open conditions have been closed, but some are still open. The RTF TG conclusion is to leave this recommendation conditionally closed.

Dr. Daniel discussed 6.4-1—TPS On-Orbit Inspection and Repair. He noted this is the most integrated of the CAIB findings. It addresses how to inspect for and repair RCC and tile damage. This is an ongoing activity. It has had some success stories and some situations have been very difficult. It is driven by assets the Program has for imagery and the impact testing characterization on the TPS. Currently, it is a work in progress. The OBSS has proved to be much more robust than anticipated. Overall, the situation on what we can see and how we can see it is more robust. However, the lower bound (non-critical impact event) has not been established. The testing is ongoing. There is an

activity to understand and characterize all of this. Testing is coming together in December and information is expected in January. The operations people are looking at using all of these assets to determine damage. The issue of repair has turned out to be somewhat more difficult. Tile repair is still a work in progress. It involves human thermal vacuum testing. In addition, access is critical. Repair is currently an open item. By STS-114, there will not be a comprehensive repair capability for tile and RCC. There is a potential for a limited capability for both, but we do not know what that is at present. On January 7, 2005, there will be a down-select and the Panel will be part of that activity. The question will be how much these repair techniques can be implemented. Dr. Clark noted a lot of work is being done on the flight timelines and they are well thought out. Crew training is in progress. NASA is working many actions in parallel, and operations are moving as fast as it can. In response to a question, Dr. Daniel indicated the latest chamber runs were just yesterday. Progress is being made.

Mr. Covey noted the toughest technical challenges have been involved with eliminating debris from the tank and development of repair capabilities for RCC and tile. The Agency embarked on a program to do everything possible to find capabilities prior to RTF. The RTF TG will continue to watch this evolving situation. It will take the progress and success (or lack thereof) in the context of the overall CAIB recommendations regarding capabilities prior to flight. The RTF TG challenge will be to bring this under an umbrella approach and complete its work. Col. Adamson added it is important to consider what NASA has done to date, what it could do with two more years' work, and what is practicable. There will be some repair capability, although limited. In the end, this may land in the "gray" area. Dr. Daniel noted the proof of this will be a detailed test objective. We will know a lot more after STS-114 than we know today. Mr. Covey noted, to a large degree, the debris actions are in the same category. The RTF TG agreed to keep this recommendation open. Mr. Cuzzupoli noted there is an RTF TG tag up every week and he and Dr. Daniel would provide a progress report at those tag ups. Mr. Covey noted the RTF TG would look at all the recommendations that flow into this.

Integrated Vehicle Assessment (IVA) Sub-Panel Fact-Finding Status

The last agenda item was a report from the IVA Sub-Panel. Lt. Gen. McCartney gave the report in the absence of the Panel Chair, Ms. Fox. This topic deals with the STS-114 Operations Integration Plan (OIP) for TPS assessment. The Plan has evolved over the last year and the November 15 Plan has an Annex on the damage assessment process. The Plan as it exists now is over 100 pages, and it will be Program Requirements Control Board (PRCB) baselined, i.e., everyone involved in the PRCB will accept ownership and will sign up to the Plan. There have been a series of paper sims to validate and help the developers understand the Plan and they have gone very well. The Plan will be used for more comprehensive and aggressive simulations and will be there for the final dress rehearsal in March. The Sub-Panel was pleased to see senior NASA management accepts and supports the OIP. The OIP represents a significant and successful development effort and it could serve as a model for other information assessment processes required to support complex decision-making. The Sub-Panel will continue to monitor OIP development and training efforts. Lt. Gen. McCartney noted this is not an activity that

requires closure. Mr. Covey stated this falls into the category of observations the RTF TG can make. Dr. Clark applauded Ms. Terry Murphy in her work in pulling this together and making it successful.

Mr. Covey asked the RTF TG members for any further comments. Mr. Kohrs noted the 3.2-1 closeout package was received last Friday. Mr. Cuzzupoli stated the Shuttle Program Office has been very cooperative in providing support needed by the Panel. Mr. Tate commented on the 9.1-1 change—it is commendable. It will be difficult to implement, but it will have a profound effect on NASA's mission. He commended the players on their work. Dr. Broadnax observed that over the past 16 month period, a great deal has been accomplished. We are beginning to see the fruits of the labor invested and it is very gratifying. He complemented everyone who has given his or her time to get to this point. Dr. Crippen thanked the professionals who supported the RTF TG in putting the meeting together and making it work. As an ex-officio NASA participant on the Task Group, Mr. Lloyd thanked the RTF TG for persevering and sticking with a very arduous task. Col. Adamson noted the Administrator has taken a personal interest as NASA has approached the milestones in RTF. As we go down the path, we are not passing any milestones we need to turn around from. The Administrator wanted to know if there are any "long poles." The RTF TG has now received packages on everything. A tremendous amount of work has been done in the last few months and everything is on the table. Mr. Sieck echoed Dr. Broadnax's comment about productivity and accomplishment, particularly since the last plenary. Dr. O'Leary commented no one on the Panel wants to manage NASA—the RTF TG is an advisory committee. Although this has been a very positive experience, the Task Group is looking forward to coming to conclusion on its activity. NASA is an impressive organization and the staff is to be commended.

Action Items/Closing Remarks

Mr. Watkins reviewed the action items: Dr. Crippen to inform NASA of the RTF TG concerns with how modeling data will be used. The Technical Panel will provide periodic status of 6.4-1 development and issues.

Mr. Covey made some concluding remarks. He noted the RTF TG is about to complete its work in support of the launch window. Its job is to assess the CAIB recommendations, not state whether NASA is ready to fly. The RTF TG is milestone driven—it must have a final report one month before launch. The Task Group has been very demanding and has required a lot from the Program from a documentation standpoint. The Program has responded exceptionally well. The pressure will continue to mount to bring the RTF TG assessments to conclusion. In following its charter to assess NASA's response to the CAIB recommendations, it will have played a role in the Administrator's determination of whether NASA is ready to fly. Mr. Covey thanked the staff and the MSFC people. He noted progress has been substantial and the remaining work is not daunting. The RTF TG will start working schedules at its tag-up next week. Although the last meeting was planned for KSC, the Task Group thought it might be better served to keep the last meeting at its facility in Houston.

The meeting was adjourned at 1135.

Return to Flight Task Group (RTF TG)
Public Meeting
December 16, 2004
Marshall Institute, Marshall Space Flight Center

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|---------------|-----------------------------------------------------------------|------------------------------|
| 7:30 – 7:35 | Administrative Remarks | Mr. Watkins |
| 7:35 – 7:40 | Public Meeting Opening Remarks | Mr. Covey |
| 7:40 – 7:45 | Opening Remarks from Management Panel | Dr. Crippen |
| 7:45 – 7:50 | NASA/NIMA MOU | Mr. Geyer |
| 7:50 – 7:55 | Task Group Discussion/Questions/Deliberation | Mr. Covey/TG |
| 7:55 – 8:10 | Status Update – Implementation Plan/Report to Congress (R9.1-1) | Dr. Crippen |
| | * Independent Technical Engineering Authority (R7.5-1) | |
| | * Safety and Mission Assurance Organization (R7.5-2) | |
| | * Space Shuttle Integration Office Reorganization (R7.5-3) | |
| 8:10 – 8:15 | Status Update – Scheduling and Resources (R6.2-1) | Dr. Crippen |
| 8:15 – 8:25 | Status Update – MMT Improvements (R6.3-1) | Dr. Crippen |
| 8:25 – 8:30 | Opening Remarks from Operations Panel | Col. Adamson |
| 8:30 – 8:45 | Ground-Based Imagery (R3.4-1) | Mr. Sieck |
| 8:45 – 8:50 | Task Group Discussion/Questions/Deliberation | Mr. Covey/TG |
| 8:50 – 9:05 | Hi-Resolution Imagery of ET (R3.4-2) | Gen. McCartney |
| 9:05 – 9:10 | Task Group Discussion/Questions/Deliberation | Mr. Covey/TG |
| 9:10 – 9:15 | KSC Foreign Object Debris (R4.2-5) | Gen. McCartney |
| 9:15 – 9:20 | Task Group Discussion/Questions/Deliberation | Mr. Covey/TG |
| 9:20 – 9:25 | Orbiter Digitize Closeout Photography (R10.3-1) | Mr. Sieck |
| 9:25 – 9:30 | Task Group Discussion/Questions/Deliberation | Mr. Covey/TG |
| 9:30 – 9:35 | Status Update – Hi-Resolution of Orbiter (R3.4-3) | Gen. McCartney/ Mr. Sieck |
| 9:35 – 9:50 | Status Update—CSCS (SSP-3) | Col. Helms/ Dr. Donahue |
| 9:50 – 9:55 | Opening Remarks from Technical Panel | Mr. Cuzzupoli |
| 9:55 – 10:10 | Solid Rocket Booster Bolt Catcher (R4.2-1) | Dr. Daniel |
| 10:10 – 10:15 | Task Group Discussion/Questions/Deliberation | Mr. Covey/TG |
| 10:15 – 10:20 | Two-Person Closeout (R4.2-3) | Mr. Cuzzupoli |
| 10:20 – 10:25 | Task Group Discussion/Questions/Deliberation | Mr. Covey/TG |
| 10:25 – 10:45 | Status Update – Orbiter Hardening (R3.3-2) | Mr. Rubenstein |
| 10:45 – 11:00 | Status Update – External Tank Debris Shedding (R3.2-1) | Mr. Kohrs |
| 11:00 – 11:05 | Status Update – RCC Structural Integrity (R3.3-1) | Mr. Cuzzupoli |
| 11:05 – 11:20 | Status Update – TPS On-Orbit Inspection and Repair (R6.4-1) | Dr. Daniel/ Dr. Clark |
| 11:20 – 11:30 | IVA Sub-Panel Fact Finding Status | Gen. McCartney |
| 11:30 – 11:40 | Action Items/Closing Remarks | Mr. Covey |
| 11:40 – 11:45 | Closing Administrative Remarks | Mr. Watkins |

RTF Task Group
Membership

Co-Chairmen:

Lieutenant General Thomas Stafford USAF (Ret.), Chairman, NASA Advisory Council Task Force on International Space Station Operational Readiness (Stafford Task Force), President, Stafford, Burke & Hecker Inc., Astronaut (Gemini 6A, Gemini 9A, Apollo 10, CDR of the Apollo-Soyuz Test Project)
Mr. Richard Covey, Vice President, Support Operations, Boeing Homeland Security and Services, Astronaut (STS-51I, STS-26, STS-38, and STS-61)

Task Group Members:

Colonel James Adamson, U.S. Army (Ret.), CEO, Monarch Precision, LLC, Astronaut (STS-28 & 43)
Major General William Anders U.S. Air Force (Ret.), Retired Chair and CEO of General Dynamics Corporation, Astronaut (Apollo 8)
Dr. Walter Broadnax, President, Clark Atlanta University
Dr. Kathryn Clark, President, Docere, Consultant in science and education
Mr. Benjamin Cosgrove, Senior Vice President, Boeing Commercial Airplane Group (Retired)
Dr. Dan Crippen, Former Director of the Congressional Budget Office, Member Aerospace Safety Advisory Panel
Mr. Joseph Cuzzupoli, Vice President and K-1 Program Manager, Kistler Aerospace Corporation
Dr. Charles Daniel, Engineering Consultant, Stafford –Anfimov Task Force
Dr. Amy Donahue, Assistant Professor of Public Administration, University of Connecticut, Member Aerospace Safety Advisory Panel
General Ronald Fogleman, U.S. Air Force (Ret.), President and COO of Durango Aerospace Incorporated
Ms. Christine Fox, President, Center for Naval Analyses
Mr. Gary Geyer, Aerospace Consultant, Served for 26 years with the NRO
Colonel Susan Helms, U.S. Air Force, Vice Commander, 45th Space Wing, Patrick AFB, FL, Astronaut (STS-54, STS-64, STS-78, STS-101, and ISS 2)
Mr. Richard Kohrs, Chief Engineer, Kistler Aerospace Corporation
Mrs. Susan Livingstone, Former Under Secretary of the Navy
Mr. James Lloyd, Ex Officio Member: Deputy Associate Administrator, Office of Safety & Mission Assurance, NASA Headquarters
Lieutenant General Forrest McCartney, USAF (Ret.), Aerospace Consultant, Former Director of Kennedy Space Center
Dr. Rosemary O’Leary, Distinguished Professor of Public Administration, Syracuse University
Dr. Decatur Rogers, Dean, Tennessee State University College of Engineering, Technology and Computer Science
Mr. Sy Rubenstein, Aerospace Consultant, Former President, Rockwell International Space Systems Division
Mr. Robert Sieck, Aerospace Consultant, Former Director of Shuttle Processing, Kennedy Space Center
Mr. Thomas Tate, Retired former Vice President of Legislative Affairs for the Aerospace Industries Association
Dr. Kathryn Thornton, Professor, University of Virginia School of Engineering & Applied Science, Astronaut (STS-33, STS-49, STS-61)
Mr. William Wegner, Consultant, Former Deputy Director to Admiral Rickover in Nuclear Navy Program

Task Group Support

Executive Secretary: Vincent D. Watkins, NASA Johnson Space Center
Astronaut Representative: Colonel Michael Bloomfield, USAF

RETURN TO FLIGHT (RTF) TASK GROUP
Marshall Institute, Huntsville, Alabama
December 16, 2004

MEETING ATTENDEES

RTF Task Group Members:

Richard Covey (Co-Chairman)
James Adamson
Walter Broadnax
Benjamin Cosgrove
Kathryn Clark
Dan Crippen
Joseph Cuzzupoli
Charles Daniel
Amy Donahue
Gary Geyer
Susan Helms
Richard Kohrs
James Lloyd (Ex-Officio)
Forrest McCartney
Rosemary O'Leary
Sy Rubenstein
Robert Sieck
Thomas Tate
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William Wegner

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Other Attendees:

Mark Carreau
L. Felton
Paula Frankel
Jade McCarthy
Ken Monroe
Myron Pessin
Maria Sevier
Chris Shank
Denise Shelton
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