

b. The flow leaving the high flow condition during the data sampling intervals. The data sampling rate is only once every second. Of added interest the time delay device is attached to the junction panel, where the screwdriver incident occurred. The last instance of high O₂ flow indication, approximately 4 seconds before the fire call had a rather steep slope. In reviewing the nine instances of high O₂, only two others indicated this type of steep slope. One was at 2319 Zebra (Zebra - Zulu Mean Greenwich Mean Time) when the command pilot opened the space plate, the other was at 2323 Zebra and the voice recording did not reveal anything out of the ordinary at this second time.

Item 2. A review of all available data discloses that the C-band transponder dropout and the VHF-FM interruption at 233054.7 Zebra was caused by an AC power interruption. It cannot be concluded at this time whether AC power interruption was caused by AC power or DC power glitch (a malfunction detected over a very small period of time in the electrical or electronic systems). A playback of the MDS recorder should help to clarify this situation.

Item 3. The elapsed time indicator and capacitor for the warning systems on Spacecraft 012 was examined and found to be satisfactory yesterday. This was the same indicator that was burned on Spacecraft 014.

Item 4. The medical tape recorder will be opened late today or early tomorrow. TPS's are in preparation for removal of tape and the strip-out of data at the KSC facility. A test tape is being prepared to verify the reduction and strip-out of data at this facility. Cook Electric, the recorder manufacturer, and 3-M, the tape manufacturer, have each a tape expert enroute to inspect recorder and tape prior to removal.

Item 5. During inspection of spacecraft inverters this morning, visual inspection of inverter 2 and 3 indicated they were in good shape; however, inverter #1 looked suspicious. Systems engineers and fire board panel people have been requested to inspect this inverter immediately.

Item 6. The chromatograph connector cannot be lifted from the floor. It is stuck. Another TPS is being prepared for its removal. This is the chromatograph connector that we were suspicious about earlier in the investigation. That ends the report.

CHAIRMAN:

Thank you.

Col. Baxter, do you have any progress report in the operation of your panel?

BAXTER:

Yes, sir. Very briefly, we followed a priority along these lines. Eye-witnesses first. That is, people who actually saw flame or fire, or heard something at the command module. Other witnesses, who were remote, but had a view through television; people who heard things; and lastly, a general category of other. Now, in this other category, we have quite a number of people. We have had in all categories approximately 100 statements as of this morning. We have been promised approximately 150 other statements which will probably be of primary interest to the procedures panel, inasmuch as these people neither heard nor observed anything, but were simply stating what they did during the test in question. That's all I have, sir.

CHAIRMAN: Thank you.

Off the record discussion.

CHAIRMAN: Mr. Williams has an additional item of action taken by the Board in approving an additional panel. Mr. Williams.

WILLIAMS: This is Panel 21, Service Module Disposition. We discussed it yesterday at the meeting, and it was approved at the Executive Session last night. The task description is, "This task involves the planning and execution of necessary service module activity beginning at the time of Board approval for Command Module demate. This task will be performed by appropriate Apollo line organizational elements in accordance with a Board approved plan which identifies the Board requirements for documentation control of this activity."

CHAIRMAN: Thank you, Mr. Williams. This action reflects a suggestion made in the morning meeting yesterday, resulting in the action taken later on by the Executive Board in the afternoon.

The meeting was adjourned at 11:31.

FEBRUARY 9, 1967

CHAIRMAN:

The February 9 general meeting is now in session. First, I would like to point out that we have felt the need to establish our own letterhead for the use of the Review Board and its panels. The nature of our responsibilities is such that it was inappropriate to use other letterheads. We have formed our own letterheads. All correspondence going out of here from the Board will be on this letterhead. It says National Aeronautics and Space Administration, Apollo 204 Review Board.

In action of the Executive Session yesterday afternoon the Board approved a standardized diagram for use by all Board Members and Panels. The diagram is designated the "Apollo 204 Orientation Drawing." It is to be used to depict exact locations of equipment or activities referenced in documents and reports. The drawing is on exhibit here in this room.

(Off the Record Discussion.)

CHAIRMAN:

Copies of this drawing will be distributed today to all the Panel Members and Board Members and others who have a need for this drawing.

In yesterday's general meeting it was brought up that there was a need for the development of workable procedures for an effective program for testing systems and components as they are moved from the spacecraft to the plants of prime contractors investigating them. As a result of the discussion, an ad hoc committee meeting was called to meet with Mr. Malley, Counsel to the Board, at 1:00 PM to prepare recommendations for the Board on this matter. That panel prepared a proposed method of handling this problem which was presented in the Executive Session of the Board in the afternoon meeting. The Board approved in principal a method of classifying material so that the intent and requirement for rigid controls, and proper control by the Board, of certain material could be followed, but that other material could be handled in such a way that we could have a workable arrangement that would not impede our progress in the entire program. The classifications of material that were developed are as follows:

- A. Highly relevant material under rigid control.
- B. Relevant materials subject to normal program procedures.
- C. Material released from Board jurisdiction.

Category A material which must be sent off site for testing, analysis or other reasons to satisfy requirements of the review will be accompanied by representatives or a witness designated by the Board. Appropriate quality control and contractor personnel must also accompany the Board representative.

Category B material sent off site need not be accompanied by a Board-appointed representative.

Category C requires no further comment since it will be released from Board jurisdiction.

(Off the record discussion.)

CHAIRMAN: We'll call on Mr. Williams now for a progress report.

WILLIAMS: Col. Borman will give the work progress on the pad.

BORMAN: Yesterday we completed all the outstanding TPS's and these included removing the main parachute and several other inspection items. I have a copy of this I'll submit for the official record. Today, we have a rather light load on the spacecraft. As of this time we have some TPS's that have been authorized that are in preparation and these will be worked as soon as they are completed. The main one will be electrical resistance check and continuity checks in mapping of damaged wiring. That was the extent of the activity yesterday and for today, sir.

CHAIRMAN: Thank you, Col. Borman. Will you please continue, Mr. Williams.

WILLIAMS: First item I will pass on is the one that was approved yesterday - analysis of rotation hand controller in the same way that we did the translation hand controller.

Item 64: Is to remove stowed crew systems equipment from the spacecraft. The reason for removing loose equipment is to eliminate damage, primarily, - here it's the cameras and the wire bundles that were not connected with the spacecraft wiring at the time of the incident. We feel it's satisfactory time to remove them now and place them in the PIB building.

As you recall we had an item yesterday to inspect the command-module, service-module, umbilical guillotine and what we're interested in here is to inspect it and see if there is any way we would dislodge evidence. The inspection shows that we can use action Item 65 to remove the guillotine. What we're primarily interested in is to remove the pyro device.

Now Item 66 we're getting into disconnecting plugs. I'd like to discuss Items 66 and 70 at the same time. To measure continuity and pin-to-pin check of all wires through the fly-away umbilical, if there's no visual evidence of fire damage. This is the main umbilical that goes into the spacecraft. We discussed this for about an hour this morning, the pros and cons, and I feel that by removing this and the inspection of it, we can ring into the spacecraft and find out more information on the wire bundles in the spacecraft. It will be removal of GSE umbilicals from the spacecraft.

PETRONE: You're not proposing removal - you're just saying check?

WILLIAMS: No, check involves removal.

PETRONE: You've got to disconnect the umbilical?

WILLIAMS: That's right.

PETRONE: You cannot make it through the interface?

WILLIAMS: No, that's why I'm highlighting this one point. I'm assuming that we could discuss it during the discussion period.

Item 67: Is continuity and pin-to-pin check of all wires, the service module, GSE access connector. There's nothing tied on to the wire bundle now. It's a GSE plug; there's no removal of any wire bundle.

Item 68: Is in the same category as continuity and pin-to-pin check of all wires terminating at RCSC, GSE-connector. This is ringing into the spacecraft without removal of wire bundles.

Item 69: Is the continuity and pin-to-pin check of all wires in the tower disconnects to establish the configuration of it.

Item 70: Is in the same category as 66, continuity and pin-to-pin check of all wires to the command-module/service-module umbilical if there is no visual evidence of fire damage in the area. The reason is to establish configuration.

Item 71: Is to determine the configuration of sequential systems using GSE connectors. This is to establish the configuration.

Item 72: Is to determine the configuration of spacecraft wiring associated with the event inputs of the "Caution Warning" system. There is a plug with about 8 resistors in it that we want to remove that was a flight team. It was to change the scaling factor on certain measurements of "Caution - Warning." The mod was put in the plug at the GSE point. We discussed this one also. What we want to do is ring out the "Caution - Warning" system through this GSE plug.

Item 73: We had a preliminary meeting on the ECU removal and analysis yesterday and I don't think we'll be able to give the Board a presentation on what we expect to do on this before tomorrow afternoon. I would like to check with the people again today and if it's satisfactory I would like to give the Board a presentation of the ECU plan sometime tomorrow afternoon.

Items 73 to 77: Were preliminary plans leading up to getting more visibility into the ECU.

Item 73: Is the removal of the O₂ valve panel.

Item 74: Is inspect the CO₂ absorber element; analysis is the charcoal absorber for traces of possible early combustion products and source materials.

Item 75: Is remove the water valve panel for additional visibility required after O₂ panel removal.

Item 76: Is a chemical analysis of selected ash material from the spacecraft.

Item 77: Is to remove 17 screws from the Lithium hydroxide access panel to obtain access.

Item 78: Is to remove the octopus and corba cables from the command module. Reason is to prevent further damage to cabling during command module work and troubleshoot the communication keying problem encountered during the test.

Item 79: Is the release of non-accident associated miscellaneous materials from

levels 6, 7, and 8.

CHAIRMAN: Thank you, Mr. Williams.

(Off the record discussion:)

CHAIRMAN: The discussion has brought out the need for clarification of certain items relative to the fact that they do involve the disconnection of certain of the equipment. I would like to ask Mr. Williams to comment on a plan to provide this clarification. Mr. Williams.

WILLIAMS: Yes, sir, we'll modify our list for the record and point out the item numbers that require the disconnection of flight bundles. Primarily items 66, 70, and 72.

CHAIRMAN: Thank you, Mr. Williams.

(Off the record discussion:)

CHAIRMAN: I would like to ask Mr. Yardley if he can clarify the actual intent of the phrase "establish configuration" which appears in many of the items that we're discussing.

YARDLEY: The real intent is to establish the damage configuration to the electrical system. We would take the information that we obtained by unplugging these items and measuring and compare them to the previous information before the accident. The differences would define the damage configuration. We would then take this damage and go further into the spacecraft looking for potential ignition sources.

CHAIRMAN: Thank you, Mr. Yardley.

(Off the record discussion:)

CHAIRMAN: The list of items presented by Mr. Williams is approved subject to the condition, that the clarification of certain items previously mentioned will be provided in the final listing; and further that with reference to Item 79, that clarification of the manner in which this item is to be administered will be provided the Board in Executive Session this afternoon at which time they will be in a position to take action on that item.

(Off the record discussion:)

CHAIRMAN: Dr. Faget will continue with a progress report.

FAGET: The item for the day concerns a power glitch. All the deductions concern the AC Bus 2 glitch at approximately 23:30:55, point to the problem being associated with an AC source rather than a DC source. Because AC Bus 2 is fed from DC Bus B and because DC Bus B feeds the Biomed recorder, it is quite possible that the tape from this recorder will help validate the deduction. One possible explanation for the AC glitch would be if the crew had the telecommunications on AC Bus 1 instead of AC Bus 2, - switching from AC 1 to 2 at this time would produce the results indicated by the data. The records are carefully being reviewed from crew ingress to the time of the incident, to determine if any switching to AC Bus 1 had occurred earlier.

A structures assignment report has been passed out. This consists of a list of all structural damage from a thorough inspection. No discussion or analysis as to the possible cause, other than that implied in the description of the damage is included. Two main categories are listed: first, damage of major significance. Damage in this area is classified into a number of categories such as metal, where primary failure is cracking; metal where primary failure is due to melting and so forth. Damage of minor insignificance includes such things as cracked glass, melted plastic, and things of that nature.

(Off the record discussion:)

FAGET:

Starting with today, we plan to prepare a Board action summary sheet, which will be passed out daily. I haven't got them here at this time, they are being reproduced and will be put in the boxes for the various Board Members and others who get this type of material. This summary sheet lists the Board actions by number; the description of the Board action; the reason for the action; the date at which the Board approved the action; the TPS number that resulted from that action; the summary of the results of the TPS's work; and whether or not the action is completed or still open. In today's listing I have all of the Board action numbers from 0026 to 0062. We weren't keeping quite as good a record prior to 0026, but we will have those from 0001 to 0025 tomorrow. As I said earlier, these sheets will be updated daily and the updated sheets will be passed out at the meeting.

CHAIRMAN:

Thank you, Mr. Faget.

(Off the record discussion:)

CHAIRMAN:

The Chair wishes to point out that the standardized drawing that was referred to earlier is actually on exhibit here for the members of this meeting to look at. I think it was pointed out earlier that it will be distributed to all those who have a need for it, - that is copies of it will be distributed this afternoon.

(Meeting adjourned at 11:43)

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FEBRUARY 10, 1967



CHAIRMAN:

In the first part of the Executive Session activities yesterday we met with the Panels, not only the Chairmen but also the membership to hear a brief report of their activities up to now. Each Chairman presented a brief statement supported by a written statement that he provided the Board. This review is considered by the Board to have been very successful in accomplishing the purpose of getting an overall view of the actions of the Panels up to now. So we are very grateful for the effort that all the Board Monitors, the Panel Chairmen and the Panel Members did in making this review possible. With reference to work schedules for this weekend, the current plan is that there will not be formal meetings, either of the General Meeting or the Executive Sessions, Saturday and Sunday. The pacing items in this investigation are the work at Complex 34 and the PIB. It is the understanding of the Board at this time that the approved plan for work at these activities, which will be further supplemented by the Executive Session this afternoon, will cover this entire period to the extent that formal meetings will not be required. There will be people on hand, including the Chairman, to handle emergency questions that may arise.

In order to obtain a proper understanding and assessment of the manning requirements to carry out the program that is in progress, we will place on the agenda for next Tuesday's General Meeting a report from each of the Board Members, (the Board Monitors) of an assessment of the manning requirements for the Panels for which they are responsible. This will provide us with an assessment of the manning requirements to execute the program as we have laid it out in our plans that were developed a few days ago.

I will now ask Mr. Williams if he is ready with the progress report for today. Mr. Williams?

WILLIAMS:

I would like to call on Colonel Borman first concerning the work at the Pad.

BORMAN:

The Spacecraft now is being worked on the TPS 049, which is the electrical continuity check. We estimate two plus days to complete this. We also have some TPS's in preparation, ready to start Monday morning. First priority will be to X-ray the glycol tanks. We have approval for three people on the Spacecraft and we will be removing the cobra cables. We will also be removing some of the GSE from around the Spacecraft. The work now is going into the detail pin-to-pin and pin-to-ground electrical continuity checks that we approved two days ago.

CHAIRMAN:

Thank you, Colonel Borman. Mr. Williams, will you continue the report?

WILLIAMS:

The Phase A Removal and Test Plans were approved last night at the Executive Session, Items 0079 and 0080. Item 0079 is, release the GSE to support electrical test. This GSE includes 6 TPS's.

CHAIRMAN:

To interrupt a moment. For the benefit of the people here, the Chair would like to remind you that we left as unfinished business yesterday, clarification of certain items in Mr. Williams' report, and particularly Item 0079, which was taken off in the Board Executive Session yesterday afternoon. Approval was given subject to the understanding that it will be discussed here this morning

in the General Session. This, I take it, is the action that Mr. Williams is now covering. Mr. Williams?

WILLIAMS:

That is correct. Item 0079, release of GSE to support electrical test. This GSE includes 6 TPS's. Launch Complex 34 TPS 5562561. GSE is as follows: One Breakout box X00-076, three battery sub-unit cables, one support test equipment cable and one milliohmmeter. Reason is, this GSE is required to support electrical test. Item 0080 is to perform translation control electrical operation verification. This includes checking the installation resistance and push-to-talk function. The reason is to check the electrical function and translation hand control which includes the talk leads. Item 0081 is removal of aluminum wickets that cover switches in the SCS main display console. Both sides of SCS direction. These wickets were in the line of the fracture of the translation hand controller. Reason: to examine and determine if melting or fracture were the mode of failure. Item 0084 is to remove a metal chip located in ECU demand regulator, left-hand equipment bay. Reason: to perform metalurgical analyses of metal chip which may aid to find thermo profile. Item 0085 is to perform electrical check of rotation hand controller. Previous work on the Rotation Controller 0063 was to perform mechanical inspection. This is to check functions from the Controller to the appropriate SCS in the J-box stub. Check function from pin-to-ground. This needs to be accomplished prior to seat removal. The reason is the continuity check. Item 0085 to perform translation controller pin-to-pin to vehicle ground point continuity check. Previous work, 0043, was mechanical inspection. Reason is to verify the Translation Controller to the Spacecraft interface. Item 0087 is to measure continuity of push-to-talk function on the SCMD cobra cable. Reason is to verify interfaces. Item 0088 is a portion of the hand control, both translation and rotational wiring which is attached to the right-hand couch and couch supports struts. In order to complete couch removal, this wiring was cut in two places. The continuity test needs to be run on the wiring on the couch to the SCS junction box on the couch. This equipment is located in the PIB. Reason is to verify continuity.

CHAIRMAN:

Thank you, Mr. Williams.

WILLIAMS:

I would like to add that we will have an overall Removal Plan available around four o'clock this afternoon on the removal and various test and removal of ECS. And from this, rather than do it in individual items, we would like to present to the Board the overall plan and then break it down at that particular time and get approval for removal and test on that phase.

CHAIRMAN:

Are you preparing that for the Executive Session this afternoon?

WILLIAMS:

Yes, so we can present it at the Executive Session.

CHAIRMAN:

Thank you, Mr. Williams. Dr. Faget will continue with the progress report.

FAGET:

There are several handouts that have been given out already. The first one, the one we started with yesterday, which is a summary report of Action Items, and includes at this time number 0026 through 0080, I had hoped that we would have the 0 to 0025 Items included but I think we need more time to research the records and get this straightened out. We have every reason to believe that we will have them in this form sometime next week. The next handout is the Integration Analysis status report. It looks much like the other one but deals with a different thing. It deals with the investigation of each and

FAGET:

every item under consideration and we have them listed by description, status and conclusions. Each finding has a particular number assigned to it. As the Board saw yesterday in the Action Center, we have these displayed on a large board on the wall inside the room. Accompanying our status report, there is another report that goes with it. These are the conclusions and the findings. If you look at the first report I talked about, wherever you see a conclusion marked with an "X", that means that's a closed out item, and we will have conclusion. For instance, #6 VHF-FM video drops out for thirty milliseconds at 233054. It's an indication that the investigation is completed and the action in this case says it did not cause the incident. And we have a little paragraph on that particular conclusion here. In the event that anyone is interested in knowing more about the conclusion that what is contained in this paragraph, we have a complete file on each one of these findings in the Status Support Room and you are welcome to go up there and look at the folder. Of course, we cannot let the folder leave the room. At this time we have nothing in the conclusion column under the title "May have contributed to the incident". We have one more handout that's being passed out to the Board today. It is a summary description of the ECS oxygen system that was prepared by Frank Samonski and is in five parts as indicated on the cover sheet. Oxygen system description, the cyclic accumulator operation description, oxygen system schematic, oxygen system characteristics and a tabular summary of anomalies and associated notes. Monday or Tuesday we hope to have a written status similar to the oxygen description on the Communications System status at and prior to the time of the incident. That concludes my report.

CHAIRMAN:

Thank you Dr. Faget. This meeting is adjourned at 11:16 a.m.

FEBRUARY 13, 1967

CHAIRMAN:

At the start of this general meeting, we have just witnessed a photographic study, completed at Houston at the Manned Spacecraft Center, a photographic study obtained with Vehicle No. 8 which shows what can be seen through the hatch window with the television monitor with various degrees of external and internal lighting. The record of this study will be available for correlation with eye witness accounts.

Dr. Seamans spent most of Friday here and one item of business that was agreed upon is that at the earliest possible date he wishes to obtain significant information and tentative findings. The subject of flame propagation. I'll ask Dr. Van Dolah for verification of the understanding that we have, that it may be possible to make such a reporting to Dr. Seamans by Wednesday of this week. Dr. Van Dolah, do you have any comments?

VAN DOLAH:

yes sir, Mr. Chairman. This we agreed to prepare, and will have it in your hands late today or tomorrow.

CHAIRMAN:

Thank you, Dr. Van Dolah.

Also, we have tentative plans for a meeting of this Board with the Deputy Administrator and such others as may be required for review of our progress, a review of the activities of the panels for guidance of the Apollo Program. This meeting will tentatively be held February 22nd or 23rd, 1967, here at the Cape. This understanding; however, is tentative and will be confirmed at a later date.

We are obtaining considerable help from a few people that reported to assist the activities of the panels. One from Langley Research Center, representing the Life Support Program activities there and 7 from Marshall Space Flight Center from various activities there. I will ask Mr. Geer if he can briefly outline the activities or assignments that these people will be engaged in here - Mr. Geer.

GEER:

Mr. Chairman. Mr. Key from Marshall has been working Panel #2 and Mr. Krupnick from Marshall, Panel #5. Mr. Brooks from Marshall is Panel #7, Mr. Rio from Marshall, Panel #8, and Mr. Hypes, Langley, who is interested in the life support area, we assigned him to Panel #9, and Mr. Haley, Marshall, is Panel #18, Mr. Glass from Marshall, Panel #18, and Mr. Cole, Marshall, Panel #18. That's all.

CHAIRMAN:

Thank you, Mr. Geer.

In a meeting with the panel members on February 9, 1967, Mr. Jeffs brought up the question about names on panel reports. The Board has decided that Panel reports will be signed by the Panel Chairman only. The administrative procedure involved in putting that matter into our system will be developed by Panel #15. As regards the concern that may have underlied Mr. Jeffs' suggestion that we need assurance that the Chairman of panels are not withholding an important minority opinion from proper considerations, we are asking that the Board monitors will assume the responsibility for assuring that minority views are given proper consideration and that serious differences that are not resolved are brought to the attention of the Board.

I would like to ask Mr. Geer whether the Panel #15 work in developing administrative procedure to deal with the control and release of material for testing and analysis has been prepared and distributed. Mr. Geer.

GEER:

Mr. Chairman, the Procedure #11 has been developed and has been distributed this morning. And this procedure actually covers all the material related to this incident and we have broken it down actually into the three categories; Category A is this material is considered highly relevant and is to be maintained under rigid Board control. Category B is that material which would fall under normal program procedures. Category C is material released from Board jurisdiction. The procedure by which this material will be handled is spelled out in Administrative Procedure #11. And, it should be remembered that all categories, all spacecraft and GSE and all material related to this incident falls in Category A before it is degraded to B or C and does come directly under the control of this Board. Thank you.

CHAIRMAN:

Thank you, Mr. Geer.

I will now ask Mr. Williams for a presentation of report of progress. Mr. Williams.

WILLIAMS:

Col. Borman, will you give the Pad report.

BORMAN:

Within the past 24 hours TPS 89, 63, 65, 66, 82 and 90 have been closed-out. These include making GSE continuity checks, removing the water panel, removing the oxygen panel, removing a selected metal chip and photographing it, removing panel C15 and 1A52, and also removing a CO2 sensor. On the pad now, we are working TPS's that include checking the continuity of the launch escape system, we are testing the O2 system, we are planning to remove the 1 lb. oxygen bottle and we are going to attempt to drain any water glycol that may remain in the system. The X-ray of the tanks has been completed and we are attempting to see if there is any valuable data on that. A great deal of the work now is being done outside the command module and we do have an opportunity now for people to investigate the inside if there are any valid requests.

CHAIRMAN:

Thank you, Col. Borman. Will you please continue, Mr. Williams.

WILLIAMS:

Yes, sir. We only have two additional Board items. One would be taken care of by this administrative procedure, but we would like to get an okay now. In order to determine the cause of communication problems encountered in the AS-204 plugs out test, it is requested the following equipment be released from impoundment. Some of it has already been released, some hasn't. I think the one that hasn't is the astronaut astro-communicators console A48 KS panel and the MSTC test conductor panel, the OIS RF located in ACE Station #1, ACE Station tape recorder voice channel, and the MOLC S-Band and VHF voice tape recorder during reported communications problem approximately 30 minutes prior to the incident. Reason is intended to simulate, as close as possible, configuration of total voice communication system involved in the test with particular emphasis placed on OIS channels Black 2, 3, 4, and associated off-site circuits. Item 0109, the cameras that were on board the spacecraft were located over at the PIB and was removed by another action item. It appears that the lenses are off, but we would like to develop the film in the camera. Cameras have already been removed from the spacecraft and the reason is there

is a possibility some of the crew activities were filmed during the plugs-out test. I think we're at a point now where we can have tomorrow, a detailed electrical review like we had of the ECS system, a removal and an investigation. It should be ready some time tonight. We'll review it and maybe we can shoot for tomorrow afternoon the electrical sequences.

(Off the record discussion)

CHAIRMAN: The items proposed by Mr. Williams are approved. I understand that Dr. Faget has a report to make. Dr. Faget.

FAGET: My report today consists of the results from Board action items. This is the report that will be prepared daily. Today's report also includes the first twenty-five Board actions. These were not included in the previous reports.

CHAIRMAN: This meeting is adjourned at 11:39.

FEBRUARY 14, 1967

CHAIRMAN: The meeting is now in session. The plans for obtaining panel reports and the subsequent action to coordinate these reports and prepare them for presentation to Dr. Scamans so that they will constitute an assessment of significant information and tentative findings is fairly well planned. The meeting with Dr. Scamans will occur on the afternoon of February 22 here. This meeting with Dr. Scamans will be preceded by a report, that has been prepared from all this assessment, before the board here on the afternoon of the 21st. At that meeting Dr. Mueller and members of his staff are being invited to sit in and discuss the report with us.

The period from 5:00 PM, Friday of this week until the afternoon of Tuesday February (22) will be utilized to coordinate and finalize the draft summaries presented by the panels into the form of the presentation that we are preparing to make to Dr. Scamans on Wednesday, February 22nd.

In the executive session yesterday, the Board approved a suggestion by Dr. Faget that it would be appropriate to have suit experts participate in the action of this review for the purpose of helping to assess the significance of the suit damage and also to provide a useful information regarding future suit designs.

I'd like to ask Dr. Faget whether the action that was approved has reached a status that people are really on their way to participate in that.

FAGET: Two people from the MSC Crew Systems Division will spend a day here Thursday. They will ask for one or two people from the David Clark Company to accompany them. I don't know about the David Clark people, but I do know the MSC people will be here Thursday.

CHAIRMAN: Thank you, Dr. Faget.

BORMAN: We're now entering a period of reduced activity within the spacecraft. The overall plan is to prepare TPS' to clear up the work prior to moving the spacecraft on Friday. We have now in work a TPS to remove the surge tank and we're also draining the water glycol. This is currently in work. Plans for the day are to initiate the TPS to check the vacuum on the cold plates, water glycol cold plates, and also to inspect wiring that might be moved during the move to do the ring-out on the command and service modules umbilicals. These hopefully will be completed tomorrow. We'll use Thursday to clean up the spacecraft and we'll move it on Friday.

CHAIRMAN: Thank you, Colonel Borman.

Will you proceed, Mr. Williams.

WILLIAMS: Yes, sir. We have developed the overall electrical plan similar in nature as we developed the ECU removal plan last week and would like to present this to the Board, possibly three o'clock this afternoon. And from this approval of the electrical plan we'll start sequencing the other systems into it for Phase C operation back in the PIB Building.

CHAIRMAN: Thank you.

WILLIAMS: If that's all right with the Board at three o'clock, we'd like to set it up.

CHAIRMAN: This is an action that you wish to bring before the Board at three?

WILLIAMS: Right.

CHAIRMAN: For approval.

WILLIAMS: For approval of the electrical and sequential test plant.

CHAIRMAN: We will be prepared to take that action at three o'clock, as recommended by Mr. Williams.

WILLIAMS: I have item 113 of about five items today to inspect the spacecraft 012 service module and record damage.

WILLIAMS: The reason is to determine the general condition of the service module and give a description of any specific damage.

Item 114 is inspect the main display console DSKY and wiring harness, will require removal of an access plate. There are no cables being broken below the DSKY. Reasons to determine the general condition of main display console and DSKY -- its wiring harness.

Item 115 to make pin-to-pin resistance check and the GN and GSE access connective. Reason is to determine further the extent of the damage to the spacecraft wiring harness. There is no cabling hooked up to this GSE connector at this time.

Item 116 -- Remove the gas chromatograph Hughes connector from spacecraft and perform lab. analysis. Reason is connector was uncapped throughout the test and analysis needs to be made of this connector to determine if it could be an ignition source.

Item 117 is to remove the CO2 absorber cannister from the aft bulk-head in front of the ECU. Reason for this is the CO2 absorber cannister must be removed prior to the ECU removal.

There is another item here that was passed out, of change in the categories from A to C on a lot of material on the pad and also the PIB.

My suggestion is that the Board review it for the remainder of the day and possibly make a decision on its disposition at the executive board meeting this afternoon at 4 o'clock.

CHAIRMAN: Thank you.

(Off the record discussion)

CHAIRMAN: After discussion, it is agreed that items 113 to items 117 recommended by Mr. Williams are approved. His recommendation that the Executive Session this afternoon review the recommendations for change of status, classification of material is also approved.

The progress report will be continued with Dr. Faget making a report.

FAGET:

The daily progress reports on summary of board actions and the status of the analysis is hereby submitted. At this time, we still have nothing in the conclusion column that would be listed as "may have contributed to the incident".

CHAIRMAN:

Thank you. Just wish to comment on the request that was made Friday for board members to come in with an assessment of the manning requirements for the activities of the panels with which they are associated. The review of that problem shows that the manning requirements supplemented by actions of the last several days seem to leave only one area that we need address ourselves to and that is in the area of assembly of report under Colonel Strang. He needs some additional help and we will take up with him the problem of getting additional help.

This meeting is adjourned at 11:46.

FEBRUARY 15, 1967

CHAIRMAN: The first portion of the meeting this morning was spent in a general discussion of the communications system as outlined to us by personnel who are handling this part of the review. With reference to the item discussed yesterday concerning the integrated electrical sequential test plan which was to be discussed with the board at 3 PM, I wish to report that that meeting was held, and as a result of that meeting certain of the detailed items involved in the overall plan were approved and will be reported in a progress report today. In addition the overall plan was approved in principle as a basis for planning the detailed items which will be submitted to the board for approval.

Col. Borman has just presented for consideration by the board a list of items or items of material proposed for release from Category A to Category C. These items are listed on 59 pages. The discussion brought out the need for certain revisions of the proposals and the final action on this entire list will be taken this afternoon in the Executive Session of the Board.

I will now ask Mr. Williams if he is ready with the progress reports.

WILLIAMS: Yes, Col. Borman do you want to give the status report?

BORMAN: Yes, the spacecraft work is again preceding rather slowly, we were not able to remove the surge tank and we are going to have to wait till we get the environmental control unit out before we remove the surge tank. This is a difficult operation, - they made a special tool but they still could not get it out, so that we will have to delay that until we remove the ECU.

The continuity check and the umbilicals are proceeding. We have a plan now to demate the spacecraft from the service module and that also is proceeding. The leak check of the water glycol system, we have a TPS for that and that is in work right now on the spacecraft. In attempting to drain the water glycol out of the spacecraft, they were only to get about one quart out of the system and this may be due to the we don't know how much is still left in the reservoir, but to date we have only been able to get one quart out of the system. The plan for today is to start cleaning up there on the Level 6 and 7 in preparation for movement on Friday and we're preceding with the approved TPS's.

CHAIRMAN: Thank you Col. Borman. Mr. Williams do you have other progress reports to present?

WILLIAMS: Yes, we reviewed the electrical plan yesterday afternoon at 3 o'clock and the proposed board actions are listed here as the results of the tentative approval. I would propose rather than read them all off the three pages that you could consider them during the rest of the day and approve them.

CHAIRMAN: Mr. Williams has just presented to the board for proposed board action items 118 to 138. These items will be taken up for final action in the executive session this afternoon.

Col. Borman has just submitted for approval of the Board an additional four pages of items for material release and the items are approved as recommended, subject to the understanding that the complete list of items that he submitted for

approval today, including the previous 59 pages, will be brought to the Board tomorrow with the continuous numbering system that will identify the items.

With further reference to the proposed list of actions submitted by for board approval by Mr. Williams, items 118 to 138, these items will be submitted tomorrow morning at the general meeting for action rather than to the executive session this afternoon.

In continuation of the progress reports we are waiting for a report from Dr. Faget.

FAGET:

First, I have the status of the analysis. We're submitting that today on a new form which includes a little bit more information. We have 92 items listed. Of these seventeen have been completed. Three other item numbers have been marked void as work has been dropped or grouped into other categories, however, we expect to use these numbers on new work in the future. At present there are still no items upon which work is completed that falls into the category, "May have contributed to the incident". We also are submitting conclusion summary sheets from seven recently closed out items. I would like to propose that instead of bringing the analysis up to date every day like we have been doing, that we do this in the future just on Fridays and Tuesdays because of the large amount of work involved. I will bring in each day the conclusion summary sheets on those that have reached a conclusion. I also propose that we do the same thing on the summary status of the board approved action. These also will be submitted just on Fridays and Tuesdays. This will eliminate a lot of reproduction of the same material every day. I also have a summary "write up" on the use of liquid material and solvents used in spacecraft 012 for such uses as cleaning, painting and bonding during January 1967. This summary was prepared by Panel 6 (Historical Data) and has been submitted to Panel 18 as a matter of record.

I thought the board would be interested in it. In addition to the oral report which you have heard, there is a written summary on the communications systems submitted today. That concludes my report.

CHAIRMAN:

Thank you Dr. Faget, Dr. Faget made a proposal for simplifying the form of reporting progress and presenting action items that would result in a large reduction in the paper work and the discussion has brought out an agreement that this is a desirable action. The understanding is that the reporting forms will be simplified by having a complete summarization twice a week with each day a presentation of pertinent items that are of interest to the Board and should be brought to the Board's attention during the intervening period.

The meeting is adjourned at 12:52.

FEBRUARY 16, 1967

CHAIRMAN: In yesterday's meeting, you will recall that we agreed that an up-dated material release record will be distributed in this morning's meeting. I will ask Col. Borman if he has taken that action. Col. Borman.

BORMAN: Yes, sir. We have transcribed 35 of the items that were approved by the Board yesterday. We have them in the permanent material release record and this will be kept as a permanent record for the Board. Other items that we approve will be added sequentially.

CHAIRMAN: In yesterday's morning meeting a list of proposed action items were presented by Mr. Williams, Items 118 to 138. It was agreed that more time was required for review of these items, that the action would be deferred for consideration at this morning's meeting so that we will get the benefit of advice of more people who had a chance to see the proposed items. I will ask Mr. Williams now if the list that has been circulated here this morning is the same list that we had yesterday or for any comments regarding any changes or additions that we should consider at this time.

WILLIAMS: Yes, it is the same list with the correction as mentioned yesterday on Item 120. Panel 150, a loose piece of equipment, should be removed and we will remove it after we get the Command Module back to the PIB and wiring checked to establish wiring configuration. That is the only change on the lists at this time.

(Off the record discussion.)

CHAIRMAN: In the discussion of the items previously referred to by Mr. Williams, it appears that they are probably satisfactory. In addition, he has presented Items 139 thru 143 for consideration. Item 143 is an urgent item as regards the need for early approval. In the light of the discussion, Item 143 is approved at this time, all remaining items I think will be approved in the Executive Session this afternoon unless we learn something that will bring up the need for some modification between now and then. Mr. Williams, are you prepared now to proceed with your progress report for the day?

WILLIAMS: Yes, sir. I think we covered the items previously to action items, and the plan that we have now is to get an overall schedule for Phase C and D by Monday. That's a completely integrated schedule of all systems that should carry the rest of the work in the Command Module, ECS, communications, instrumentation, etc., on one Master Plan and we're shooting to have this by either Sunday or Monday.

CHAIRMAN: Thank you, Mr. Williams. Do you have anything else to report? Do other members of your Committee have items to report?

WILLIAMS: Col. Borman has a work report.

BORMAN: Yes sir. We are proceeding with disconnecting the inverters, continuity check of the cabin fan, and, of course, work is going on in preparation for the spacecraft move. The indications are that the spacecraft will be moved at noon tomorrow and go directly to the PIB building. All the work that's posted today is in direct support of the move.

CHAIRMAN:

Col. Borman, you have a recommendation about work shifts. I'd like to ask you to state what that request is.

BORMAN:

Yes sir, after the spacecraft is moved to the PIB building, I request that we be allowed to go on a two shift, 6-day a week operation, with the understanding that the technicians will be on call in the event the workload increases. The basis for this request is the fact that we are not able to program enough work in to keep the people busy 24 hours a day at this stage of the operation.

CHAIRMAN:

The recommendation made by Col. Borman is approved. In continuation of the progress reports we will now hear from Dr. Faget.

FAGET:

I have two items that have been closed out by Panel 18, Integration Analysis Panel. These are Items 15 and 52, one has to do with the inertial guidance system, it has been concluded that the changes in the readings of the inertial guidance system are associated with the increase and subsequent decrease of the pressure of the Command Module prior to and subsequent to the ruptured pressure vessel. The other has to do with the investigation of a waste management system blower that failed on a test of Spacecraft 008. It has been concluded that this failure is not connected with the instruments on Spacecraft 012. That ends the report.

CHAIRMAN:

Thank you, Dr. Faget.
This meeting is adjourned at 11:21.

FEBRUARY 17, 1967

CHAIRMAN:

The panel meeting is now in session at 10:44. In the Executive Session yesterday the Board approved items 118 thru 142 that were discussed in the morning meeting. The morning meeting you will recall approved 143 because of the urgent nature. In addition, one other item was added in the Executive Session, 144. It was urgent and it was approved and will be added to the list of approved items available for all parties concerned.

Mr. Williams has additional items to present for discussion this morning, for consideration of this body: Mr. Williams.

WILLIAMS:

Item 144, approved last night at the Executive Session, was the removal of the TV container that was laying on the floor of the spacecraft. The reason for removing it was that we did not want it laying loose on the floor during the move of the spacecraft from the pad to the PIB.

Item 145 is to remove panel 24, it requires the removal of screws and disconnection of wires. The reason we want to remove this panel is that it represents a constraint on the removal of the ECU. We have to remove the panel to get at the bolts to remove the ECU.

Item 146 is demate the Service Module SLA combination from the launch vehicle. Required to remove the Service Module SLA combination from the launch complex and move it over to the MSOB Building.

Item 147 is analyze the contents of squeeze bottles located in white room at the time of the accident. The reason is several instances of odors both in the spacecraft and on the work platform were reported.

CHAIRMAN:

After consideration of these items there seems to be no objection or comment. They will be brought to the Executive Session this afternoon for approval.

Col. Borman, you have a request concerning the approval of items previously discussed. Will you state the request, please?

BORMAN:

Yes, sir. These are items we discussed on the 15th regarding items that are located now in the PIB and will be disposed of in accordance with the Board's wishes. We have now categorized and itemized every item and I would like to have items 36 through 55 noted as approved by the Board in accordance with the decisions that were reached on the 15th.

(Off the record discussion.)

CHAIRMAN:

Thank you, Col. Borman. Are there any further comments? If there are no further comments, the recommendation made by Col. Borman is approved.

In yesterday's Executive Session, the Board approved a general plan for the disassembly procedures that will place the responsibility for the execution of the individual steps in the hands of the Coordinating Committee, or the Chairman of the Coordinating Committee and I'll ask Mr. Williams to discuss that procedure.

WILLIAMS:

The procedures will be, that the Board will appoint a government witness to witness disassembly of the ECS system. This man will be responsible for the disassembly and assure that it is carried out along the guidelines that are approved by the Board. The disassembly will be performed at KSC in the Life Support Building Test Cell. Paper work used will be the normal TPS paperwork that requires the normal signatures of the Integration Committee, the Fire Group, and a Board member of the PCC group. At the end of each major disassembly, such as the oxygen panel, a test report will be written. The plan will show the various routes that may be taken during the disassembly. An attempt will be made at a functional check first. If this fails we will go directly to disassembly, a report will be written covering disassembly and malfunction of individual components. The plan as stated could start work around the 20th of February and end up the latter part of March, about the 20th.

CHAIRMAN:

Thank you, Mr. Williams. The plan that was discussed by Mr. Williams will require that the steps taken by reported at regular intervals to the Board and significant findings as soon as they occur. The intervals of reporting will be not less than a week, probably twice a week would be more appropriate.

A problem of access to the PIB has arisen because of the large number of people that have a need to be in there and the requirement that not too many be there at any one time. This is being worked on and I think satisfactory solutions seem to be in hand but there will be further detailed consideration given this problem and an administrative procedure distributed to cover the plan that actually is worked out.

In yesterday's general meeting it was agreed that we would obtain a report from Dr. Faget regarding additional testing items that resulted from the anomaly review of the preceding day and I would like to have Dr. Faget report of those items at this time.

FAGET:

Specifically, we plan to do the following: We will use spacecraft 2 TVI which is a special spacecraft for test in the space environment simulation laboratory at Houston. The following test will be made to further pursue the oxygen system anomalies, that is, the high O₂ flow rate just prior to the fire alarm and the suit flow drop to zero and back to normal shortly after that time. We will investigate the following: leaks in pressure suits, the effect of cabin pressure rise with the face plate open, and the effect of physical force to restrict the flow of oxygen within the suit. All these tests will be made with the hatch open with air in the cabin; however, for the first and third of these tests we will require O₂ in the suit loop. In pursuit of the gimbal motion anomaly we will analyze all the data we can get our hands on from a number of different system tests to associate particular crew action with gimbal motion, i.e., such things as throwing switches, egress and movement within the cabin. We will use spacecraft 008 in Houston to associate possible effects on the chromatograph channel with various things such as crew motion within the spacecraft. The verification of glycol data is continuing. This is awaiting further strip-out of temperature parameters from the records to determine total enthalpy change within the system. This is the complete report at this time.

CHAIRMAN:

Thank you, Dr. Faget. Another action item discussed in yesterday's general meeting pertained to an assessment of the activities people external to the spacecraft during the period of the incident. Col. Baxter has undertaken to get

information on that, and I think he is prepared to report at this time. Col. Baxter.

BAXTER:

Yes Sir. As of late last night we checked all the crew people that were on the third shift. None had any memory or recollection of having touched or leaned up against the capsule or Service Module, Command Module or Service Module in the 15 minutes preceding the incident, except one individual, we were following up this morning, who had been adjusting some N2O4 lines for clearance from the umbilical, standing on a ladder down at the Service Module, and we will follow up on that. But this is the only possible adjustment or movement or contact with either Command Module or Service Module near the time of the incident.

CHAIRMAN:

Thank you, Col. Baxter. Are there progress reports that are to be made now, Mr. Williams, Col. Borman?

WILLIAMS:

Yes, mine is on the record already. I believe Col. Borman can give you a status report of the spacecraft.

BORMAN:

Yes, Sir. The spacecraft is still on schedule as far as the move goes. We plan to start hoisting it at noon today and it should be in the PIB building at 1600.

Everything has been checked out and so far, it is going according to schedule.

CHAIRMAN:

Thank you, Col. Borman. Is there anything further, Dr. Faget?

FAGET:

The status of the analysis items under investigation by Integration Analysis Panel is submitted with their interim report. To summarize, 92 items were listed. Of these investigated, 24 have been completed and one item has been closed. Five other item numbers have been marked void as work had been dropped or re-grouped into other categories. Action item number 20 - momentary interruption of the VHF-FM and S-Band data has now been reopened to allow the investigation of post-test motor switches. At present, there are still no items upon which work is completed that fall into the category "May have contributed to the incident". On the status of Board actions, the Board Action Status Summary is also submitted today. There are a total of 144 Board Actions. Of these, 49 have been closed and 95 remain open. Of those remaining open, 48 are still awaiting the TPS's will be completed after the Command Module has been transported to the PIB. Of the 47 Board actions in work, many of the TPS's have been completed but the summary is yet to be submitted. That completes the report.

CHAIRMAN:

Thank you, Dr. Faget.

(Off the record discussion.)

CHAIRMAN:

Further efforts in the test described by Dr. Faget involved the use of oxygen atmosphere for suit experiments; the concern over testing with osyben prompted considerable discussion. The matter is being resolved in this manner by the Board, that the testing which will be done at MSC will be subject to the approval of the Director, Manned Spacecraft Center who has the responsibility and authority to approve such programs as may be required.

Col. Borman has submitted for approval by the Board a material release item

number 56 - ECU 02 Flow Rate Transducer - the requested action is approved.

The Panel reports have been submitted by the Panels in preparation for the review that is in progress for presentation to Dr. Seamans next week. The Board will review these reports and ask that Panel Chairman meet with the Board this afternoon in this room at 4:00.

The meeting is adjourned at 11:35 a.m.

FEBRUARY 18, 1967

CHAIRMAN:

The meeting is now in session. The primary purpose of the meeting this morning is to discuss the preparation of material for the interim report to be made to the Deputy Administrator next week. Yesterday we received draft statements from the Panel Chairman. Copies of all those draft statements which constitute working papers for the purpose of supporting the preparation of the report for the Deputy Administrator will be made available to all panels. There will be a folder such as this prepared for each panel. The distribution will be controlled. These are controlled working papers. Any other use or the disclosure to other people will be arranged for as necessary by the Board.

In the discussion of the designation of these as working papers, the significant point to keep in mind is that at this stage they do not constitute the opinions in any manner of the Board. They are simply working papers that have been submitted for the purpose of preparation of the report that we are now working on.

In the executive session this morning, we approved two items that were presented for approval by Mr. Williams.

Will you describe those items, Mr. Williams?

WILLIAMS:

Yes, sir. Item 48 is remove the CM aft heat shield. And the reason for this is, need to provide better visibility of the CM external aft structure. We are noting going to remove the heat shield this weekend or the early part of next week, but what we are going to do is take the necessary steps now that we are in the alignment stand to drill out the ablative plugs. The second item is remove the crew compartment heat shield. This is needed to provide better access and visibility to CM external structure. We are not going to remove the heat shield this weekend or next week. The present plan is to remove the ECU starting Monday. We want to remove the ECU before we drop the heat shield and we have to generate TPS' to shore up the flooring when we drop the heat shield. All we are going to do this weekend is to take the necessary steps to remove the ablative plugs, to get at the bolts.

CHAIRMAN:

Thank you, Mr. Williams. The discussion of the steps being taken to prepare the report for the Deputy Administrator and the other items of business have been completed.

CHAIRMAN:

This meeting is adjourned at 11 a.m.

FEBRUARY 20, 1967

CHAIRMAN: This meeting is now in session on February 20, 1967, at 10:38. Over the week-end there were several meetings concerned with the preparation for the meeting with Dr. Seamans on Wednesday. There was an Executive Session at 8:00 A.M. on Saturday; another Executive Session at 3:00 P.M. Sunday, February 19, 1967; and, other informal meetings, primarily concerned with the preparation for the meeting with Dr. Seamans on Wednesday, next.

There will be an Executive Session this afternoon at 3:00 P.M. in the Board Room concerned primarily with the continued review of the material being prepared for presentation to Dr. Seamans on Wednesday. Any other matters that arise or require Board action will also be considered at that time.

I would like to have a progress report of the work at the Pad and at the PIB and I will ask Col. Borman to report on that.

BORMAN: As you know the spacecraft is now in the PIB and we are preparing to remove the Environmental Control Unit. We are putting in the structure that has been designed to assist in the removal. We are also doing resistance checks on the electrical cabling that have been approved by the Board and we hope to get into the removal of the ECU at 1300 today. The GSE is being disconnected from the Service Module and we are preparing the service module for removal.

CHAIRMAN: When will that be done?

BORMAN: The preparation should be completed at 1600 today and we will move it tomorrow or Wednesday.

CHAIRMAN: Thank you, Col. Borman. Is there anything to report on the PIB? Do you have a report on that?

BORMAN: Yes, sir. All the activity that I referred on the spacecraft is, of course, occurring in the PIB. The spacecraft was removed to the PIB, as you know, Friday, and we are now in a weight and balance jig. We have also done some work in preparation for removing the heat shield, but we are constraining the heat shield removal until we have the Environmental Control Unit out of the spacecraft because of the weight involved.

CHAIRMAN: Thank you. I would like to ask Mr. Geer as to what arrangements have been made for a proper disposition here at Kennedy for the Service Module. Mr. Geer.

GEER: The Service Module will be moved to the MSO Building on Tuesday. A specified area has been set up for the S/M and will be under security control.

CHAIRMAN: Thank you, Mr. Geer.

(Off the record discussion.)

CHAIRMAN: The discussion has just brought out the need for a definite planning of the complete release of material at the Pad following removal of the Service Module. We will attempt to have a study made that can be reported to this Board within the next two days.

I will ask Mr. Williams if he has a progress report to present to us at this time? Mr. Williams?

WILLIAMS:

Yes, sir. We have two action items that came up when the meeting started and the first action item is the removal of personal effects, materials from the couches to Room 106 of the PIB Building. I think we have approved the inventory of the items and so forth, and we now have a TPS to actually physically remove the items from the couches to the PIB, to Room 106. That's action item 150. 151 is to move the hand-controller wire bundle that hampers the removal of the ECU. We want to "ring" the wire bundle out with the push-to-talk circuit before movement, it's in the way of removing the ECU. We checked with the fire people and they have no objection.

(Off the record discussion.)

CHAIRMAN:

The items just proposed by Mr. Williams have been carefully considered by parties interested and are approved.

I understand that Mr. Williams is prepared to designate the person who will represent the Board in the operation of removing the ECU. Mr. Williams can you report on that?

WILLIAMS:

Yes, sir. We would like to nominate Mr. Doug Hampton from KSC to be the Board witness on the ECU component testing.

CHAIRMAN:

Very well.

This meeting is adjourned at 11:03.

FEBRUARY 21, 1967

CHAIRMAN: This meeting is now in session at 10:54. I will ask Mr. Williams for a progress report. Mr. Williams.

WILLIAMS: The report presented yesterday, the CM equipment removal plan has been reviewed by MSC, KSC and North American personnel. They feel that this is the way to go on the removal of the equipment inside the Command Module. The action item today is No. 152, a demate of the Service Module from the SLA here in the MSO Building when the Service Module -SLA is removed from the pad. Reason is to allow better access. Status of Board action as of February 20th is as follows: The total Board actions are 151, closed Board actions 61, open Board actions need TPS's 37, in work 53. Most of these Board actions requiring TPS's will be completed after looking inside the S/C and will be completed after the Command Module is transported to the PIB. Of the 53 Board actions in work, many of the TPS's have been completed but lack TPS summaries. That is all I have for today.

CHAIRMAN: Thank you, Mr. Williams. The Command Module equipment removal plan presented by Mr. Williams has been thoroughly reviewed by all interested parties and is now approved by the Board.

Col. Borman has submitted for consideration a list of 14 items, for consideration of release, and a list of material to be released. These items will be considered and action by the Board will be taken in a subsequent meeting. These items are unnumbered at the present time.

CHAIRMAN: Col. Borman has some proposed urgent action items that he would like to present to the Board. Col. Borman.

BORMAN: Yes, sir. I would like to have action on items 69-72 in our material release record. The items are Log Books from the Unified S-Band station, an air duct used on Spacecraft 012 to supply circulating air that is now needed for Spacecraft 017, and two mounting racks for GSE that have previously been released. These are items 69-72.

CHAIRMAN: Is there any discussion of these items? There being no discussion, these items are approved. Col. Borman will continue with a progress report.

BORMAN: Yes, sir. The ECU removal continues in progress. It's now estimated to be completed at 1700. We're continuing to resistance check the cabling in the spacecraft in coordination with the ECU removal. The Service Module and the SLA should be removed today from the launch pad at the MSOB.

CHAIRMAN: Thank you Col. Borman. I will ask Dr. Faget for a progress report.

FAGET: We're submitting our status and analysis end of the items under investigation by the Investigation Analysis Panel, 93 items now are listed. Of these, investigation on 26 items has been completed. Four items have been marked void as work has been dropped or regrouped in other categories.

At present, there is still no items which we are to complete according to the category "May have contributed to the incident." There are also a number of

conclusions from some of the investigation that have been under way. The write up sheets are submitted on these items.

(Off the record discussion.)

CHAIRMAN:

Dr. Faget during an off the record discussion, did note some of the progress that is being made in the testing that is proceeding at MSC with particular reference to a better understanding of glycol. He will be prepared with a more detailed report later, probably by tomorrow.

This meeting is adjourned at 11:30.

FEBRUARY 22, 1967

CHAIRMAN: This meeting is now in session at 10:40.

With reference to attendance at the meeting this afternoon, it is clear that many of the Panel Chairmen are not really required at the meeting. The Board members are being asked to review the list of Panel Chairmen to determine which ones can be excused and to advise the secretary of the results of that survey.

We have just discussed the problem of filing and material that must be retained by the Board, with reference to selecting what material must be retained in the file and what can be actually released. Col. Strang will prepare some comments concerning this problem for consideration of the Board within the next few days.

Col. Borman has submitted the list of items that were discussed yesterday for consideration by the Board as suitable for material release. The items have been considered by the appropriate people, certain amendments have been made. They have been numbered from 73 to 86 and they are now approved.

Col. Borman has a request for an additional number of items for release and I'll ask him to describe those items.

BORMAN: Yes, sir. We would like to have released the normal operational land lines that connect the ACE in the MSOB with the launch pad. And also, various and sundry items or pieces of test equipment that were located in trailers on Pad 34, but that were not in any way connected to the spacecraft or had anything to do with the test. These would be items number 87 through 103.

CHAIRMAN: These items have been considered by the Board and the request is approved.

Mr. Williams has some proposed action items. Mr. Williams.

WILLIAMS: The plan that was approved yesterday on total equipment removal plan, right hand lower equipment bay and main display console panel, has been assigned action item 153.

Item 154 is to photograph the remains of suits, connectors and personal effects. Filming to be directed by Dr. Kelley or his designee. Films to be processed as restricted data; all negatives and prints to be returned to Dr. Kelly. 155 is remove from all three suits - cobra cable adapter, bio-medical harness, suits side communications harness, helmet side communications harness and signal conditions. Reason: released to determine fire damage and evidence of arcing. Item 156 - Following 155, determine electrical continuity both of released equipment, separately and in series.

Item 157 is perform chemical analysis of residue collected from various locations in all three suits.

CHAIRMAN: The items proposed by Mr. Williams for Board action, items 153 to 157, have been reviewed by the Board and are approved. Dr. Faget has a report of progress in some special tests that are underway. Dr. Faget.

FAGET: This hand-out I have today is a memorandum from Dr. Downs of Manned

Spacecraft Center. The subject is "Some Investigations on Potential Hazards of Spillage of Glycol Water RS89A Coolant that was used in Spacecraft 012." I'll have additional information on the same subject, hopefully tomorrow.

CHAIRMAN:

Thank you.

Several days ago we asked the Panel Chairmen to supply figures as to how many people were directly involved in the tasks for which they had responsibility. A summation of the reports obtained from that survey show a total of 600 government and 900 industry personnel. This number, in the opinion of the Board, is probably a minimal number in that it accounts for the direct support and certainly, in all cases, there are more people involved than those represented by this count.

Meeting adjourned at 11:31.

MARCH 1, 1967

CHAIRMAN:

This meeting is now in session at 10:43. As a matter of record I will point out that because of the interim report to the Administrator and the deliberate break of the sequence of meetings over the weekend there has been a period of several days in which there has been no regular session. There have been certain special meetings and executive meetings throughout this period. The meeting on the 24th was at 10:30; it was a special meeting chaired by Col. Strang to take up with the Panel Chairmen the problem of getting reports finished and organizing the business of the panels. This meeting was followed by an action taken in the executive meeting on February 25th at which a release was made that I signed, directed to all Panel Chairmen, firming the agreements made at that special meeting as to when they expected to have their reports finished. The one thing that we need to keep in mind, at this time, is that having set this machinery in motion we have reached the stage where the Panel work has been completed and we need a finished report that can be accepted by the Board. The Panel Reports must be acceptable to the Board before the Panels can be dismissed. The completion of reports is something that we must pay attention to from now on.

I will ask Col. Borman to describe the items 104 to 122 which were approved by the Board in the Executive Session at the meeting on the afternoon of February 23. Col. Borman.

BORMAN:

Yes, sir. Item 104 was the approval to release bulk spares, spacecraft spares, nuts, bolts, wires and so on, that have been impounded, as needed in support of the other Spacecraft 017. Remaining items of 105 through 122 were items that are associated with the service structure. They were located on levels 6, 7 and 8, during the test, but were not in any connected with the incident. They have all been inspected and returned upon the approval of 105 through 122, to normal use.

CHAIRMAN:

Thank you, Col. Borman. I've asked Col. Borman to continue with the description of Borman to continue with the description of Action Items that were taken up at the meeting on February 24th.

BORMAN:

Yes, sir. We have 123 which releases a tool bag which was located on level 7. The contents were recorded and returned to the owner, and Action Item 124 was the release of Launch Complex 34; all areas below the adjustable level 5, not to include the spacecraft GSE. This was checked, all the areas were inventoried, walked down and released.

CHAIRMAN:

Thank you, Col. Borman. I'll ask Mr. Williams for a discussion of other items that were approved in the meeting of the 24th, Items 158 and 162.

WILLIAMS:

Yes sir, Action Item 158 was the overall plan for the action for the stabilization control system tests that would be performed on the system after it was removed from the spacecraft.

Item 159 was to conduct the test on the Spacecraft 012 pressure hatch, the reason was to find out why a wrench that was used could not be inserted in the hatch as far as it should go.

Item 160 was approval to conduct low level continuity test on all equipment removed from the Spacecraft 012. The reason, so that continuity tests can be conducted on all removed equipment as soon as possible after removal.

Item 161 was approval to conduct non-destructive laboratory inspections and analyses of all equipment removed from Spacecraft 012. The reason is that laboratory analysis and tests can be conducted on all equipment as soon as possible after removal from the Spacecraft.

Item 162 was to conduct inspections and functional test on Spacecraft 012 cobra cables and the reason is to determine a possible ignition source.

CHAIRMAN:

Thank you, Mr. Williams. I would like to ask Mr. Williams to continue a discussion of Action Items that have been approved, Action Item 163, it was an urgent item that came up on February 27. Will you continue, Mr. Williams?

WILLIAMS:

Yes, the action items I am formally presenting to the Board today is 163, 164, and 165.

Action Item 163 is the Service Module Investigation Plan; we passed it out this morning for all members of the Board to review. It looks like it is about the best detailed plan we have had so far. The reason is to investigate the service module used during Spacecraft 012 accident to determine if it was related to the cause of the fire.

Action Item 164 is to conduct G&N computer investigation and the reason is to possibly obtain additional data from the erasable memory.

Action Item 165 is to conduct test on the MDAS recorder from Spacecraft 012, and the reason, to determine if installed recorder was DC glitch sensitive similar with those found with test article.

CHAIRMAN:

Thank you, Mr. Williams.

(Off the record discussion)

CHAIRMAN:

Following a discussion of the items that were presented Mr. Williams it appears that they are satisfactory and that they are hereby approved by the Board. I would like to refer back to the series of meetings last week at which the Board participated in the presentations to the DEPUTY Administrator here at KSC and then Friday in a meeting with the Administrator in Washington. At the later meeting I participated along with Dr. Van Dolah and Col. Borman. We made a presentation of significant information and tentative findings and I think I can say that perhaps an important milestone has been passed in that we have been able to give the Administrator the benefit of a great deal of significant information of value in directing the course of action that must be taken in the Apollo Program from here on out.

(Off the record discussion)

CHAIRMAN:

We have just had an extensive discussion of the steps in the problems that we face in completing the Apollo 204 Review, so that we can have a definite completion date that is supported by a workable plan. We have already gone on record as stating that the final report will be available near the end of this

month. The planning necessary to bring this about will be discussed in the Executive Meeting this afternoon. It appears from consideration of the business appropriate to the general meetings that we can dispense with the General Meeting tomorrow. The next meeting will be held at 10:30 Friday, March 3rd and then there will be another one Monday at 10:30, March 6th. I'll ask Mr. Williams for a report of progress or presentation of Action Items that must be considered by the Board. Mr. Williams.

WILLIAMS:

Yes, we passed out this morning an Amendment to Action Item 153; it is to pick up additional items on the lower equipment bay removal list and the right hand equipment bay, and the ECU. The first phase of the ECU inspection is completed, various X-rays were taken, and the ECU was moved over to the Launch Support Building last night for disassembly.

CHAIRMAN:

The Action Item proposed by Mr. Williams will be considered in the Executive Meeting this afternoon. Col. Borman has some action items proposed for consideration. Col. Borman.

BORMAN:

Yes, sir, I would like to have the Board's approval to change categories from A to C for the following items. Number 127 is a pressure test stand that was used to reduce the pressure between the K bottles and the Service Module entrance. It was not located in the White Room; it was on the southeast corner of 8A. The constraint prior to release is none. This equipment has been sampled and no unusual amounts of contaminants were found. Analysis is in the hands of Panel 16. Item 128, I'd like to release the entire voice operational intercom system that was used for the 204 Plugs-Out Test. The intercom system has been thoroughly documented by the voice communication Panel, a group of Panel 9, and a test was run on it last week. These circuits are needed for other tests.

Finally, there is Item 129, a protective pressure unit to maintain a pressure on the service propulsion tanks. The Service Module, as you know, has been removed from the gantry and there is no reason to believe that there is any connection between this and the incident.

(Off the record discussion)

CHAIRMAN:

After consideration of the recommended action just proposed by Col. Borman, the Board approves the release of the change of category of these items, as recommended. Dr. Faget has a progress report. Dr. Faget.

FAGET:

I have a report summary of the status analysis up to March 1st. There are six new items that have been added, and three items have been closed since February 24th. A summary of the closed items is attached. To this date, there are 104 items listed of which 66 remain open, 37 are closed, and one marked void. There are still no items which were closed that fall into the category "could have contributed to the accident".

(Off the record discussion and film)

CHAIRMAN:

Thank you, Dr. Faget. Dr. Faget has just shown a film of a test that was made at MSC in the boilerplate model to investigate the flame propagation with materials that were installed to simulate those that were in the 204 vehicle. It appears from the results of this test that MSC has made considerable progress in developing a tool with which to conduct flammability test and one that will

be very valuable in qualifying materials that will be ultimately used in the
Spacecraft.

CHAIRMAN: This meeting is adjourned at 11:59.

MARCH 3, 1967

CHAIRMAN:

This meeting is now in session at 10:35. We've asked the Panel Chairmen to meet with us today so that we can discuss the preparation of Panel Reports. Before we get into that matter I will ask for a report of action items that were taken in the last two Executive Sessions on the afternoon of Wednesday, March 1 and Thursday afternoon, March 2. I'll ask Mr. Williams if he will describe the action items that were taken up at the meeting. Mr. Williams.

WILLIAMS:

Yes, does the Secretary have the Action Item Numbers? We modified Action Item 153 and what we did was include Revision I which picked up several other panels that were in the lower equipment bay and also in the right hand equipment bay; it is part of the disassembly plan of the internal parts of the spacecraft.

Action Item 166 was, "remove and analyze non-functional equipment and debris from the Command Module floor", and the reason to investigate relative positions of equipment, and possibly determine the time that the equipment arrived there.

Action Item 167 was remove the floor of the Gas Chromatograph Compartment. The reasons, to investigate the harnesses located under this floor.

168 - ECS Phase C and D Test and Disassembly Plan. The reason, to investigate and analyze all components of the ECS subsystem.

And Action Item 169 was a plan of action - the interior lighting flood lights and the reason is to investigate and analyze all components of the interior lighting subsystem.

CHAIRMAN:

Thank you, Mr. Williams. I would like to ask Col. Borman for an assessment of the Disassembly Plan as to when he thinks that it will be completed. Col. Borman.

BORMAN:

Yes, sir, the Chairman of Panel 4, Mr. Simpkinson, assured me that by next Friday we should be essentially complete with the disassembly of the Spacecraft. We would like to have permission to operate a three-shift operation when we start removing the heat shield, but unless there are some unforeseen holdups we should essentially have the Spacecraft dismantled by next Friday.

CHAIRMAN:

Thank you, Col. Borman.

(Off the record discussion and reports from the panel chairmen.)

CHAIRMAN:

We have just listened to a report of the Chairmen of the Panels as to the progress that they have made and their expectation of meeting the dates that were agreed upon last week. The summation shows that the Panels are operating in accord with the schedules that were agreed upon and the entire effort supports the objective of providing the Board with Panel Reports that will permit the completion of a Board Report near the end of this month.

Col. Borman has a report to make.

BORMAN: Yes sir, we have just received the first interim report back from the FBI on the work that they have been doing on the flight logs and other flight books that were in the spacecraft. I would like to turn this into the Secretary for future reference.

CHAIRMAN: Thank you, Col. Borman.

(Off the record discussion)

CHAIRMAN: In a discussion, it appears that a new schedule of General Meetings will meet the requirements for the future. These meetings will be held on Monday, Wednesday and Friday. The schedule for Executive Meetings will not be altered by this change in meeting schedules, in other words, Executive meetings will continue to be held at 4 o'clock each day.

CHAIRMAN: This meeting is adjourned at 11:33.

MARCH 6, 1967

CHAIRMAN: This meeting is in session at 10:43.

(Off the record discussion)

CHAIRMAN: We will have a report by Mr. Mardel on data analysis this morning. Mr. Mardel.

MARDEL: The most significant thing we found over the weekend, Friday evening, in inspecting the wiring in the vicinity of the junction box in the lower left hand equipment bay, we did find an indication of an arc in a wire. We then went back to the cover plate and found a like-indication that lined up fairly well, within an eighth of an inch on the cover plate itself. We're saying now that in the area where we think the fire initiated, we do have an arc indication. I'll bring down photographs to go through it in more detail. At the present time, we are going to take the cover plate and go through a metallurgical analysis to try to determine if the arc occurred when the cover plate was cold or when the cover plate was hot. We'll try to find out was it an initiator, or was it an effect from the fire. At the same time we're cutting away the gas chromatograph compartment shelf, inspecting the wiring beneath the shelf. We'll also unlace the wiring and try to identify exactly which wire it was that shorted to the cover plate. We'll try to find out what it carries. So we'll have more information on this later today. Now, if I could, I would like to bring some photographs down showing the detail.

CHAIRMAN: Thank you, Mr. Mardel.

(Off the record discussion)

CHAIRMAN: We'll have a status report from Mr. Simpkinson regarding the disassembly; also, I understand he has some proposed Board Action Items. Mr. Simpkinson.

SIMPKINSON: That is correct. We proceeded with the disassembly along a schedule that we've all had. We've nearly reached the end of that; however, there were several items added, many items, and in taking a relook at the schedule Saturday, we felt that it would be more advantageous to remove the heat shields, both the aft shield and the crew compartment heat shield, as soon as we could get to them. So I have here a schedule for the Board's approval, to go ahead and do that, which, step by step, uncovers a gas chromatograph area for inspection and then removes Panel 150, a C15/1A52 Junction Box, and a waste management Panel 202, unclamps some ECU lines, inspects the floor area, and supports the aft bulkhead, or the floor, from the top of the Command Module, and then removes some excess items from the floor that have to be removed in order to use this support, and then prepares for and removes the aft head shield. We will then move the entire Command Module, with the aft heat shield removed, over to the impounded area, and then remove the aft heat shield. This schedule is prepared here for, unfortunately, two 8-hour shifts and I have just talked to the crew and they'll start tomorrow morning with 24-hour coverage, which would advance this about a day and a half. In other words, we would be in a posture to continue with normal disassembly work of the added items about March 10th. So we would essentially complete the job of disassembly required to take off the aft heat shield and do that, and take off the crew compartment heat shield

and be ready to continue Friday, March 10th, if that meets with your approval.

CHAIRMAN: Thank you. We will now have a discussion of the proposed schedule.

(Off the record discussion.)

CHAIRMAN: The discussion has brought out the understanding that the proposed action items are a revision of the plan that was approved last Friday. It does appear desirable to go ahead with this revision because it will permit the aft heat shield to be removed at an earlier date than would otherwise be possible, the removal of the aft heat shield is of great interest to the Board. According to the plan that is proposed, the aft heat shield probably will be an interruption of further work on the interior of the spacecraft starting Wednesday and lasting about three days. The advantages of this proposed revision are such, that the action is approved at this time.

(Off the record discussion)

CHAIRMAN: Mr. Simpkinson has some proposed Action Items that he now wishes to submit to the Board for consideration.

SIMPKINSON: Item 170 - Remove the Command Module aft bulkhead, which is the floor. The reason: For metallurgical evaluation required to define the origin, mode, and sequence of failure in the Command Module primary structure; Item 171 - Move the SLA-5 which was involved in the accident from the integrated test stand to storage area, in the MSO High Bay. This item is self-explanatory. We have completely exonerated the SLA-5 from the incident. 172 - Conduct an S-band voice tape evaluation by Mr. Michael Luce of NASA-MSC; the reason: we feel we would like to have a second look by a different party of the last few minutes of the voice tape. Item 173 - Conduct an S-band voice tape evaluation by an outside agency, probably Civil Aeronautics Board for the same reason. In other words, we feel we would like our own evaluation by MSC, as well as two outside agencies. Item 174 - Perform metallurgical analysis on the LEB junction box cover-plate arcing spot, and an analysis of the nylon edging grommet and its adhesive cement. The reason: to determine if the arc occurred when the metal cover was cold or hot, and if the grommet or its adhesive could have propagated the flame. Item 175 - Unlace the wire bundle leading from LEB junction box. Identify and remove the wire that appears to have caused the arc spot on the cover plate and perform a metallurgical analysis of the wire. The reason: to determine the metal flow content and to conclusively establish that arc did occur. Item 176 - Remove connector connecting Command Pilot suit with PGA cable. This is to isolate location of shorts in PGA and bio-med and communication harness assemblies. Item 177 - Remove portion of wires of Command Pilot's bio-med harness, the communication harness, conduct a metallurgical analysis, recheck remaining portions for shorts. The reason: to isolate the location of shorts and to establish temperatures that wires were subjected to. That completes the eight items for action for the Board as of today.

CHAIRMAN: Thank you, Mr. Simpkinson. We'll go off the record for discussion of these items.

(Off the record discussion)

CHAIRMAN: After discussion of the items just proposed by Mr. Simpkinson, it is noted that one word should be changed in Item 176, changing the word "remove" to

"disconnect". The items are in urgent need of approval in order that work may progress and the discussion discloses no reason why they cannot be approved at this time. They are, there approved.

(Off the record discussion)

CHAIRMAN: Mr. Simpkinson has another item regarding the classification of material and he wishes to ask for the approval of it.

SIMPKINSON: This is item 0147 of the material release record. It is a switching console part number G16-850130. It is located at the MSOB sequential lab. Room 3412. It normally is located there, and was impounded there. Its purpose is to connect one of three identical transmission lines from the Spacecraft to the RF System Checkout Unit. This is merely a piece of switch gear that is impounded. We feel there is no constraint and would like it to go from Category A to Category C.

CHAIRMAN: Thank you, Mr. Simpkinson.

(Off the record discussion)

CHAIRMAN: The requested action is approved.

(Off the record discussion)

CHAIRMAN: We have a report of action taken by the newly constituted Screening Committee that is screening the items associated with the Command Module to determine whether they should be in Category A or B. Mr. Sasseen has a report to make on the action to date.

(Off the record discussion)

CHAIRMAN: Mr. Sassees will proceed with the report.

SASSEEN: Per your instruction we formed a screening committee for the purposes of categorizing the Command Module equipment, in either Category A or Category B as was defined earlier. I'm going to be the Chairman and the Panel will be co-chaired by Mr. Don Mayhue from MSC and Mr. Dave Levine from North American. We categorized the spacecraft into its 16 subsystems. We've had 39 people assigned to support this effort. They will arrive this evening, and we will hold a formation meeting tomorrow. Instructions have been written to define this operation and the charter of the group. They have been incorporated into Administrative Procedure 5C. I believe you all reviewed this instruction Thursday afternoon and approved it. In addition, we've developed forms to allow each subsystem to log every one of its parts and we've developed a form to permit justifying the reclassification of each of these parts. All of this was also incorporated into the Administrative Procedure 5C. We have, in addition, two lists of discrepancies and open items that we are going to use to essentially restrain hardware from being transferred from A to B. The first of these lists was published by Panel 8 and given to us. The second of these lists is currently being made up and it will include all all open discrepancies and interim discrepancies on equipment that was experienced during this particular test. I believe that's the status.

CHAIRMAN: Thank you Mr. Sasseen.

(Off the record discussion)

CHAIRMAN: During the weekend, several of the Board members were active in reviewing the transcripts and other material in preparation for its inclusion in the final report. In accordance with the work schedules that have been set up, there was no action of the disassembly people on Sunday.

CHAIRMAN: This meeting is adjourned at 11:26 am.

MARCH 8, 1967

CHAIRMAN: This meeting is now in session at 10:41 a.m. I would like Col. Borman to report on the disassembly of the heat shields. Col. Borman.

BORMAN: Yes, sir. The aft heat shield was removed last night and confirmed that the crack, the eruption in the structure was about two-thirds of the way around the aft bulkhead, not completely around. The work that now is in process leading to the removal of the forward heat shield and we hope to have this accomplished by tomorrow.

CHAIRMAN: Thank you, Col. Borman.

(Off the record discussion)

CHAIRMAN: Before the Executive Board Meeting yesterday afternoon, the Board and some of the personnel interested in fire hazard witnessed the film from MSC covering Test Number 2 from the Mockup Flame Propagation Series of tests that are underway at MSC. The Board feels that the procedures being followed constitute a valid one for permitting studies of flame propagation as applied to an assessment of the hazards that will be very useful in qualifying the materials that are used in the future.

(Off the record discussion)

CHAIRMAN: I'll ask Dr. Faget to report further on the item discussed by Mr. Mardel in Monday's meeting regarding the LEB junction box cover plate as it relates to possible source of ignition.

FAGET: The cover plate has been delivered to the Malfunction Analysis Branch and is awaiting analysis there. A section of the wire that presumably made contact with this cover plate will also be removed from the spacecraft, and when it arrives at the laboratory, a metallurgical analysis will be made to ascertain that the arcing did indeed take place. And, if possible, the exact nature of the arcing will be determined. Also, I think we would like an analysis of the molten material along the bottom of the plate. This will ascertain that the chaffing strip was indeed nylon as opposed to, perhaps, teflon. An effort has been completed to determine the function of the wire in question. This wire is a DC power line that goes from the stability control system in the command module up to the plus yaw thrusters on the service module. This wire is normally powered with 28 volts through a 20 amp circuit breaker. I think that is about all we can say at this time. Further analysis and work is underway.

VAN DOLAH: Can you verify the buss?

FAGET: This should be on buss A but we cannot verify that it is indeed on buss A. There is some question.

CHAIRMAN: Thank you, Dr. Faget.

(Off the record discussion)

We have just learned of some further information about the circuit, Mr. Levine,

will you make a statement regarding that?

LEVINE: The circuit breaker that was in the circuit from the DC power supposedly, buss A, was supposed to have been in the closed circuit condition, circuit breaker physically in, and was found after the incident to be in that position.

CHAIRMAN: Thank you, Mr. Levine.

(Off the record discussion)

CHAIRMAN: I would like to acknowledge the receipt, from Mr. J.J. Williams of a status of Board actions dated March 7, and made available to all the Board Members.

(Off the record discussion)

I would like to now have Col. Borman present a proposed Board action for discussion.

BORMAN: This is Board Action No. 178. It's an attempt to streamline the procedures required for removing samples for analysis from the spacecraft. It gives approval from removal of samples based upon the discretion of the systems engineers, electrical systems engineers, and the Fire Panel involved. I think it would help greatly in expediting the work of the investigation.

CHAIRMAN: Thank you, Col. Borman. This item has been previously discussed by the Board Members and in the light of that discussion, this Action Item No. 178 is approved.

(Off the record discussion)

CHAIRMAN: Dr. Faget has a progress report to make.

FAGET: The summary of the status of the analysis of items under investigation along with a complete summary of all items considered closed are included in this week's submittal. Only one new Item, No. 34, arcing noted on junction box cover plate and this is discussed earlier today by myself. As of this date, 104 items are listed of which 59 remain open. There's still no items in which the analysis have been completed that fall in the category of having contributed to the incident.

There is also submitted at this time a special report on the investigation of the AS-204 main batteries and pyrotechnic batteries. This report has a cover sheet and a great number of pages of substantiating data.

(Off the record discussion)

CHAIRMAN: There has been some discussion of the battery report that Dr. Faget was making and some clarification of that report that I would like to have Dr. Faget summarize at this time.

FAGET: There are two Items to summarize, first on page 9 of Appendix A of the report, paragraph 7. Reference is made to arcing that was indicated on the lugs of the negative terminal of battery B. Subsequent to the writing of this report, the spacecraft discrepancy reports have been examined and discrepancy report 0248

on September 23, 1966, indicates that an arc was indeed drawn on the terminal lug. The other item of interest has to do with discussion of hydrogen that may be vented from the batteries. The re-entry and recovery batteries are all vented overboard through a manifold. The pyrotechnic batteries are not vented except through a relief valve. Tests have been carried out to determine the amount of time required for battery hydrogen to accumulate sufficiently to open the relief valve. It would be a matter of several days, even at elevated battery temperature. Therefore the 60 CC of hydrogen gas which could be expelled in one venting is a very remote possibility for the Plugs-Out Test.

CHAIRMAN:

Thank you, Dr. Faget.

(Off the record discussion)

This meeting is adjourned at 11:21.

MARCH 10, 1967

CHAIRMAN: This meeting is now in session at 10:36 a.m. I am asking the Board Members to advise the Secretary regarding any requirements for secretarial support during the week-end to support the activities of Panels. I would like to have the Board Monitors find out from their Panels what the requirements are.

(Off the record discussion)

CHAIRMAN: We have asked Mr. Sasseen to report on the activities of the Screening Committee. I think you are prepared to report--are you, Mr. Sasseen?

SASSEEN: We have reviewed items with eleven different sub-systems groups, each of these one at a time and I'll tell you about where we stand. The Sabilization Control System people broke their subsystem into 14 different packages, we will recommend all of these items be Category B. The Structures people broke their entire assembly into 18 items; we will recommend all these also be Category B. The Earth Landing System people broke their assembly into 5 items; this is also complete except we are having the two antennas under the forward deck verified by the Communications people; we will recommend all these 5 items also be Category B. Pyrotechnic people broke their assembly into 14 different items; it looks like it will all also be Category B. We expect to treat the Launch Escape System as one assembly and recommend to you that it be placed in Category C. We still have the optical portion of this to be verified. The Guidance and Navigation people have 16 items. We reviewed 8 of them since the other 8 are still in the spacecraft. Three of them are completed to our satisfaction and the other 5, of course, require another review. The Reaction Control System people have a total of 12 items; they will also be recommended Category B; but their material still needs a rewrite. We talked to the Controls and Displays people, the Instrumentation people, the Communications people, and the Power people; we reviewed all their items, we sent them all back for a rewrite, and we expect to have this completed by Tuesday. The Environmental Control System people we talked to this morning; they are not in very good shape, as most of their components need a considerable amount of testing, so in all probability by next week we will not recommend any of their equipment go to Category B. Of the items that will probably remain in Category A, ECS stuff, there is an S-band Power Amplifier, I believe, that has a little more investigation because of a hole in it. The VHF AM transmitter with its keying problem will probably have to stay there, the Audio Center with the hot mike. There is another device which you probably haven't talked about, called a Circuit Interrupter, that, in essence, breaks the Command Module from the Service Module at the time of in-flight separation. It's not really part of harnessing, but it's buried so deeply in the harnessing that you can't take it out without a physical disassembly. Chances are that we will recommend this remain in Category A and be treated like the rest of the harnessing in the spacecraft. By next Tuesday or Wednesday, we should have a large composite MRR of most all of these items for you. This is basically where we stand.

CHAIRMAN: Thank you, Mr. Sasseen.

(Off the record discussion)

CHAIRMAN:

We have discussed the report that Mr. Sasseen made, and we are very appreciative of the work that they have accomplished to date; they made very good progress in carrying out the responsibilities that were assigned to them, and it appears from the progress that has been made that by the middle of next week at our General Meeting on Wednesday, we can expect a report that will be close to a final report of the actions that this Committee has taken in preparing recommendations to the Board for the proper classification of materials of the Command Module.

(Off the record discussion)

CHAIRMAN:

There is a need to consider the reclassification of the heat shield, the aft heat shield, and the crew compartment heat shield which had been removed from the Command Module, to Category B. This action will reduce the necessary guard service. The discussion has shown that this action is appropriate. We, therefore, approve at this time the classification of those two items at Category B.

(Off the record discussion)

CHAIRMAN:

Colonel Borman had some Action Items to present to the Board.

BORMAN:

These are MRR items that were released in Executive Session and I would like to make a matter of record. No. 148 released the Launch Complex No. 34 back to operational status, Category C. This was completed in Executive Session on the 6th of March; 149 released the Q-ball on the top of the Launch Escape System and was completed on 7 March; No. 150 released the Service Propulsion Engine Gimbal Locking Links on 7 March; 151 released the Pitch Electronic Control Assembly as spacecraft spare, it's needed for support of Spacecraft 17 that was completed on the 9th of March; 152, the Roll Electronic Control Assembly for the same reason, on the 9th of March; 153 was a tool box that was inventoried and the contents recorded, released on the 9th of March; 154, another tool box, released on the 9th of March with the same constraints.

CHAIRMAN:

Thank you, Colonel Borman.

(Off the record discussion)

CHAIRMAN:

Dr. Van Dolah has an Action Item that he will describe concerning an action that was taken in the Executive Meeting yesterday afternoon.

VAN DOLAH:

Action Item 179 calls for conducting low level continuity checks on all harnesses and equipment remaining on Spacecraft 12. This is to facilitate spacecraft electrical ring-out; it was approved in Executive Session on the 9th of March.

CHAIRMAN:

Thank you, Dr. Van Dolah.

(Off the record discussion)

CHAIRMAN:

I ask Colonel Borman for a report on disassembly progress.

BORMAN:

The forward or the crew compartment heat shield has been removed, and the component disassembly and removal is proceeding. We now have a schedule that shows the entire spacecraft disassembly process completed by 18 March.

This may slip because of some further wire ring-out that we are doing while the spacecraft is in its present configuration.

CHAIRMAN: Thank you, Colonel Borman.

(Off the record discussion)

CHAIRMAN: In the Executive Session yesterday afternoon, an item concerning the handling of the wire bundles during disassembly was discussed and I would like to have Dr. Faget to comment on that.

FAGET: Now that the systems are in the final stages of removal from the spacecraft, the only significant remaining hardware that could have contributed or been associated with the fire remaining in the spacecraft are the wire bundles themselves and the water-glycol plumbing and cold plates. This morning we have instituted an effort to determine the best plan for investigating these two items. Hopefully we will be able to remove the wire harnesses from the spacecraft in a way that will both optimize the inspection of the wiring as well as minimize any disturbance in the loss of evidence that might be in the wiring.

CHAIRMAN: Thank you, Dr. Faget.

(Off the record discussion)

CHAIRMAN: I would like to have Dr. Faget give a report on the test work in progress at MSC.

FAGET: There has been another mock-up test carried on at MSC which was completed Wednesday afternoon. This was test in which the boiler plate mock-up was filled with oxygen at a 5 psi pressure; unlike the previous test, the internal configuration was a flight configuration as opposed to the plugs-out configuration. The significant difference in combustibles was that the two large cushions were not in the spacecraft. Also, the nylon covers over the suit hoses were not present. With the exception of those two items, the combustibles were just about the same. In this test the fire progressed much more slowly, the cabin relief valve lifted at 6 psi and the flow through the cabin relief valve was adequate to control the pressure in the capsule, it never exceeded 6½ psi and the fire went out after 5 or 6 minutes without consuming all of the combustibles. As a matter of fact, only the left side of the capsule was burned, and half of the left couch. We have a movie showing the progress of that fire and the damage that resulted, and I'd like to show it at this time.

CHAIRMAN: Thank you, Dr. Faget, we will proceed to show the movie that Dr. Faget just described.

(Off the record discussion and film)

CHAIRMAN: After viewing the film presented by Dr. Faget, it appears that the difference between the flame propagation, combustion process in this test as compared with the earlier test was well summarized by the statement made by Dr. Faget before showing the movie.

(Off the record discussion)

(Sheet 3 of 4)

CHAIRMAN:

In the Executive Session yesterday afternoon, the Board appointed Mr. Robert Bruce, who arrived from the Langley Research Center, as an Alternate Board Designated Agent for the ECS investigation.

(Off the record discussion)

CHAIRMAN:

This meeting is adjourned at 11:33 a.m.

MARCH 13, 1967

CHAIRMAN: This meeting is now in session at 19:41. The weekend has passed without formal meeting since Friday afternoon at the Executive Session. Considerable progress has been made in the acquisition and assessment of Panel Reports. Several have been received and distributed. I think it would be appropriate to ask Col. Strang for assessment of the activities of Panel 17. Col. Strang, do you have something to say about that?

STRANG: Yes sir. As of 11 March, six of the 21 Panels submitted their final reports. These are from Panels 2, 12, 13, 16, 19 and 20. The reports were reproduced and distributed to the Board members for individual study and Board review. That's all at this time.

CHAIRMAN: Thank you Col. Strang. I might add that we are acquiring some additional technical engineering support to assist in the editing of the Panel reports. We are expecting two people from Langley to report in tonight and I expect also one additional man from MSC. They will support activities from Panel 17.

(Off the record discussion)

CHAIRMAN: Mr. Malley has also acquired some additional help over the weekend. Mr. Malley, would you like to say something about that?

MALLEY: Mr. Robert Allnutt, the Assistant General Counsel for Patent Matters, NASA Headquarters, is here today to assist in the legal review of the Panel reports and to assist in the preparation of the Final Report particularly, with respect to the Findings - Determinations Section of the Final Report.

CHAIRMAN: Thank you, Mr. Malley.

(Off the record discussion)

CHAIRMAN: The Board is proceeding to review the Panel reports with the Chairmen and such others as they need, to assist them in the overall review with the Board, and the plans are this afternoon for a review of Panel 20 report at 1:30, and following that, we hope also to cover panel reports for Panels 12, 16 and 19.

(Off the record discussion)

CHAIRMAN: In the Executive Session Friday afternoon, action was taken on two items of material release. I would like to ask Mr. Simpkinson to describe those items and also to make a progress report on disassembly.

SIMPKINSON: The two items that were put up for material release record on Friday were 155 and 156. There were similar items, tool kits for the suit technicians that at the time of the incident were in the transfer van and not used. We required inventory prior to release and will release these items as soon as the inventories are completed. That is the report on material releases. As far as disassembly goes over the weekend: we worked Friday all day, until midnight, and Saturday and did get about two or three hours of electrical inspection of the harnessing that's left; quite a bit of that to go yet. Other than that, we removed a number of small items, toe plate and harness from the PCA's, a group of solenoids and we have no new things to report in the disassembly. We are

proceeding along our present schedule, which shows complete disassembly by the 18th; however, we may have to lengthen this somewhat due to the electrical checkout which we're putting in as we can.

(Off the record discussion)

CHAIRMAN: The discussion of the wire inspection program shows that considerable study and attention is underway, and that by Wednesday's general meeting, we can expect a fairly detailed program to be presented to the Board.

(Off the record discussion)

CHAIRMAN: I would like to ask Mr. Williams to present a progress report.

WILLIAMS: This is a progress report on the dismantling of the ECU System. Saturday night, they completed the continuity check of the ECS ECU wiring harness and they disassembled, or removed the lithium hydroxide canister assembly. At the present time, they are running a leak check on the water glycol portion of the ECU. This should be completed sometime this morning and following the leak check, they'll start dismantling the various components on the ECU package itself.

CHAIRMAN: Thank you, Mr. Williams.

(Off the record discussion)

CHAIRMAN: Mr. Williams has an Action Item to propose.

WILLIAMS: We have a modification, the second revision to Action Item 153, which is the Command Module equipment removal plan. It was passed out this morning to the Board, and the items that were added to the basic plan is shown by two asterisks along side of the items in the plan.

(Off the record discussion)

CHAIRMAN: On the basis of the discussion, the item just proposed is approved at this time.

(Off the record discussion)

CHAIRMAN: Witness statements were distributed to Board Members and Panel members in accordance with the plan that was made for their use in pursuing the work on the review. We now require that all copies of these witness statements be returned to Panel 12. I would like to ask that all Board members and Board Monitors advise their panels to that effect.

(Off the record discussion)

CHAIRMAN: This meeting is adjourned at 11 o'clock.

MARCH 15, 1967

CHAIRMAN: This meeting is in session at 10:37. I would like to ask that Panel Chairmen be present at the next meeting of this body, the General Meeting Friday morning; that is, all Panel Chairmen except those who have already completed their responsibilities to the Board and whose reports have been accepted.

(Off the record discussion)

CHAIRMAN: I would like to ask Col. Borman to review the Material Release Items that have been accumulated during the last day or so.

BORMAN: Sir, I have Items 157 through 160; these include spare batteries, that were stored in the battery shop for release and for support of other programs, Item 161 was the Service Module which was approved for release to "C" category yesterday afternoon. That brings up up to date on all the records.

CHAIRMAN: Thank you, Col. Borman.

(Off the record discussion)

CHAIRMAN: I would like to ask Mr. Williams to make a report of the progress being made in the plan and execution of the disassembly.

WILLIAMS: The disassembly of the spacecraft is progressing along the following line: The primary interest now is in the electrical wiring harnesses, and we're using the second shift for the electrical people to inspect the wire harness in place, with permission to cut some of the structure away so they can get a better observation of the wire harnesses that go behind structure. The disassembly of the components are being taken care of on the first shift with the electrical inspection, the ring-out of the cables taken place on the second shift.

(Off the record discussion)

CHAIRMAN: Mr. Williams, are you prepared to make a distribution of the items up to date now which action has been taken.

WILLIAMS: Yes sir, we've passed out our status of the Board actions today, and the total Board actions so far, a total of 179. The closed items are 95; the open items are 84: TPS's completed, but need engineering analysis - 41; TPS's in work - 35, and we need TPS's on eight (8).

CHAIRMAN: Thank you, Mr. Williams.

(Off the record discussion)

CHAIRMAN: I'll ask Dr. Faget to make a report of the progress of the Integration and Analysis Panel.

FAGET: The up-dated status of the analysis under investigation by Integration and Analysis Panel has been passed out this morning. Only one new item, Number 105, which is an investigation of a possible short in the suit wiring of the Command Pilot's suit, has been added to the investigation. Twenty items have been

(Sheet 1 of 2)

closed since March 8th. As of this date, 105 items are listed of which 40 remain open and 65 have been closed. Integration Analysis summaries for the 20 newly closed items are attached. There is still no item for which analysis has been completed which fall into category "MAY HAVE CAUSED THE ACCIDENT". And, also, I am handing out a report this morning which is the result of the Mobility Evaluation Test results that was conducted on 28 February, Mock-Up Two.

CHAIRMAN: Thank you, Dr. Faget.

(Off the record discussion)

CHAIRMAN: I would like to have a report from Col. Strang, on the progress of Panel 17.

STRANG: In a special session on March 13, 1967, the Board reviewed and approved Final Panel Reports 12, 16, 19, and 20. In another special session March 14, 1967, the Board approved Final Report of Panel 21. The Final Report of Panel 13, previously reviewed, was approved by the Board Executive Session, March 14. All reports approved by the Board are being processed for final editing and printing. Panel 17 has received and distributed to the Board, Final Panel Reports 2 and 6 for individual study prior to Board review. At this time, for today's session, we have Final Panel Report 6, for review.

CHAIRMAN: Thank you, Col. Strang.

(Off the record discussion)

CHAIRMAN: After some discussion, we have rearranged the schedule for this afternoon to have Panel 5 report to the Board at 1:00 and, Panel 6 to come in later at around three o'clock.

(Off the record discussion)

CHAIRMAN: This meeting is adjourned at 10:55.

MARCH 17, 1967

CHAIRMAN: This meeting is now in session at 10:36. I've asked the Panel Chairmen to meet with us this morning, because we wanted to review the situation relative to the preparation of the Panel Reports and their acceptance and coordination by the Board.

(Off the record discussion)

CHAIRMAN: The discussion of the Board with the Panel Chairmen was concerned with the problems that we now see in completing the Panel Reports and incorporating the substance of those reports into the Final Report of the Board.

(Off the record discussion)

CHAIRMAN: I'd like to ask Mr. Simpkinson to describe the status of the disassembly of the spacecraft.

SIMPKINSON: The spacecraft down at the PIB has been undergoing disassembly now for some time, and we are about at the stage of, I would say, and we are about at the stage of, I would say, more than 90 percent complete with that phase of the investigation. To sum it up, we have a total of about 40 more tasks left out of several hundred that we have already worked and these 40 consist of about 20 more removals of items that are very low, or practically no-suspect, non-functional panels and crew system components that were just in there with no connection to them. These final items are being removed to gain complete visibility of the inside of the spacecraft. The other 20 of the 40 tasks consist of TPS's (work orders) to run resistance checks and continuity checks of the harnesses. The remaining work out there at this point in time appears to consist of about five or six days which will be spent removing essentially these non-functional parts. Also, we're spending eight hours a day, as you know, with the electrical people going over the harnesses practically wire by wire looking for any indication of the origin of the fire. That's about where we stand at the moment.

CHAIRMAN: Thank you Mr. Simpkinson. I would like to ask Mr. Williams to report on the progress of the study of the ECU.

WILLIAMS: The ECU was completely taken apart by last Wednesday. The components of the ECU that will be disassembled in the Malfunction Investigation Lab are now in the bonded area in the MSOB Building. We should have an overall plan to show the various dates that we expected disassembly of the individual components of the ECU by Monday and we'll give a status of what we've found so far in the examination of the components in the plan at the Monday Board Meeting.

CHAIRMAN: Thank you Mr. Williams. Col. Borman has an action item to propose for the preparation by the Board.

BORMAN: Yes sir, I have five items that I would like to get released from Category "A" to Category "C". No. 162 the rate gyro assembly. 163 is an attitude gyro accelerometer assembly. 164 auxiliary electronic control assembly. 165 is a displays electronic control assembly. 166 is a gimbal position attitude set indicator. These items were stored in the warehouse or have arrived on the Cape since

the accident. They were not installed in the Spacecraft 012 at any time and they are required to support Spacecraft 017's operation.

CHAIRMAN: Thank you, Col. Borman.

---(Off the record discussion)

CHAIRMAN: In view of the discussion among the recommended actions, these actions are approved. I will ask Mr. Sasseen to report on the activities of the and progress of the Screening Committee. Mr. Sasseen.

SASSEEN: The Screening Committee has reviewed to date 312 items of the Spacecraft equipment. I would recommend that 171 of these go into Category B. We have published a preliminary report in justifying each one of these items as describing the condition. We have 49 more items, some of which are still in the Spacecraft and should be removed by Wednesday. We expect to review these additional items and be finished by next Friday.

CHAIRMAN: Thank you, Mr. Sasseen. Mr. Williams has an action item to propose for consideration by the Board.

WILLIAMS: Action Item 180, approve or utilize the open TPS technique for Action Item 160, which is "Conduct low level continuity tests on all equipment removed from the Spacecraft 012"; and Action Item 179, "Conduct low level continuity checks on all harnesses and equipment remaining in Spacecraft 012". This technique utilized on Action Item 178 which was, "Approval to remove small samples of material from Spacecraft 012 and send them to the Lab for analysis", has proven to be an effective time-saver in that a separate TPS properly signed and distribution was not required.

CHAIRMAN: Thank you, Mr. Williams. I am assured that this matter has been given sufficient consideration so that it can be approved at this time, so therefore, it is approved. This meeting is adjourned at 11:16.

MARCH 20, 1967

CHAIRMAN: This meeting is now in session at 10:35 a.m. The weekend has been a busy one for the Board and Panel Members. I'd like to ask Colonel Strang to summarize the weekend activity on the report preparation.

STRANG: As of 19 March 1967, the Board has reviewed and accepted, subject to editorial corrections, the final reports of Panels 1, 8, 10, 12, 13, 14, 15, 16, 19, 20 and 21. Also, the Board has reviewed and accepted, except for the Findings and Determinations, the final reports of Panel 5. Panel 17 has received the final reports from Panels 3, 4 and 17. These reports were distributed for individual study for Board Members. That's all.

CHAIRMAN: Thank you, Colonel Strang. I would like to ask Colonel Borman for a report on Material Release Items. Colonel Borman.

BORMAN: Yes, sir, I have several items, they're Material Release Items Number 167 through Number 192. They were approved in the Executive Session on Sunday, that was yesterday, the 19th of March. I won't list them all specifically. They're generally miscellaneous items that were located in the area of the spacecraft during the incident but, all have been determined to have no-effect, or no-cause, or no-relation to the incident. They have all been released from Category "A" to Category "C".

CHAIRMAN: Thank you. Colonel Borman.

(Off the record discussion)

CHAIRMAN: I understand Mr. Williams has some action items to propose to the Board. Mr. Williams.

WILLIAMS: Yes, I have two action items. Item 181, utilize TPS technique to remove all debris from the aft bulkhead and vacuum, photograph and grid aft bulkhead prior to removal and vacuuming. No additional work will be accomplished under Board Action 0166. The reason is to allow inspection of the floor and better access with the Command Module. Action Item 182, return Inverter #2 to the vendor for detailed investigation. The reason, to investigate known anomalies associated with the inverter and determine their relationship, if any, to the accident.

CHAIRMAN: Thank you, Mr. Williams.

(Off the record discussion)

CHAIRMAN: I'd like to ask Dr. Van Dolah to comment on the first proposed action item just presented by Mr. Williams.

VAN DOLAH: An additional reason for this action item is to remove all of the debris, all material located on the floor, excluding of course, wire bundles. This material will be examined visually and thick sections of the material will be examined by X-ray and other techniques to insure that nothing unsuspected is in it.

CHAIRMAN: Thank you, Dr. Van Dolah.

(Off the record discussion)

CHAIRMAN:

Mr. Sasseen of the Equipment Screening Committee has brought to the Board for consideration a proposed action item that pertains to AC Inverter No. 2. The proposal is that this item which is a Category "A" item of equipment be returned to clear up any suspicion that applies to an anomaly, or rather any relationship to the accident. The action item carries with it, the recommendation that Mr. E. E. Eastman of MSC, be designated as an agent of the Board for this action. I would like to have the Board consider this recommendation.

(Off the record discussion)

CHAIRMAN:

It is the consensus that this action be approved. The proposal therefore is approved.

CHAIRMAN:

I would like to have a progress report from Dr. Faget. Dr. Faget.

FAGET:

The wiring on the Spacecraft 012 has been inspected. Inspection was completed this weekend. This inspection consisted of separating all wires from the bundles and inspecting visually each wire individually. The location of possible shorts and arcs in the wiring was noted. In addition, notation of fire damage and other anomalies in the wiring was made. A complete report on wiring inspection will be submitted at a later date.

CHAIRMAN:

Thank you, Dr. Faget.

(Off the record discussion)

CHAIRMAN:

We departed from a normal schedule that we've been following recently and yesterday (Sunday, March 19) kept the PIB open for an investigation. I would like to ask Dr. Van Dolah to comment on the work that went on there yesterday. Dr. Van Dolah.

VAN DOLAH:

The investigation concerned the question of the development of static electricity on a suited crewman. It was carried out in Spacecraft 014. The conditions were made as nearly similar to those that prevailed at the time of the accident as could be made. The air inside the cabin was very dry, and the suit loop was fed with dry air. A full report on the results will be presented.

CHAIRMAN:

Thank you, Dr. Van Dolah. I would like to say that this afternoon the Board will meet with Dr. Gilruth, a group from the program staff at MSC, and the contractor to discuss joints in the spacecraft. This meeting will take place about 1:00 p.m.

(Off the record discussion)

CHAIRMAN:

We have received a status report from Mr. Hampton and Mr. Bruce regarding the ECS review and examination that is underway. It appears that the subject of the status of this effort should be presented at the Executive Session this afternoon at 4 o'clock.

CHAIRMAN:

This meeting is adjourned at 11:03.

MARCH 22, 1967

CHAIRMAN: This meeting is in session at 10:41 a.m. The Board spent some time this morning in witnessing a demonstration of the operation of the hatches at the PIB to obtain a complete understanding of the operation of opening the hatches from the inside and from the outside. Following the demonstration of the hatch operation at the PIB, the Board went to the ACE Control Room to get first-hand knowledge of the operations that are carried on there. The Board has been spending most of its time in reviewing panel reports, and I'd like to ask Major Butler, in the absence of Colonel Strang, to report on the progress that has been made. Major Butler.

BUTLER: Yes sir, as of March 12, the Board has reviewed and accepted, subject to editorial changes, the final reports of Panels 1, 4, 5, 8, 10, 12, 13, 14, 15, 16, 17, 19, 20 and 21. The final reports from Panels 7 and 11 have been distributed to the Board for individual study. Board review of these latter two reports is scheduled for today, starting with Panel 11 at 1:00 p.m. The final reports from Panels 15, 16, 17, 19 and 21 have been submitted for printing. The final reports from Panels 10, 13, 14 and 20 are presently being edited and should be submitted for printing later today or early tomorrow morning. Lastly, the final reports from Panels 1, 4, 5, 8 and 12 are being retyped and will be available for editing this afternoon or tomorrow morning.

CHAIRMAN: Thank you, Major Butler.

(Off the record discussion)

CHAIRMAN: Following Major Butler's report, discussions brought out that veri-typing required is posing a problem that is now being examined as to whether or not the facilities for typing are going to be able to keep pace with the requirements. This matter will be looked into after this meeting is adjourned. Colonel Borman.

BORMAN: Yes, sir. In the Executive Session last evening, we approved Items 194 through 199, which are miscellaneous items that were located on Level 8 of the gantry. They had no association with the spacecraft and were not physically connected to the spacecraft at the time of the accident.

CHAIRMAN: Thank you, Colonel Borman. We have additional progress reports this morning, I believe, or reports to be distributed. Mr. Williams, do you have reports to make or distribute this morning?

WILLIAMS: Yes, sir, I have distributed the status of the Board action items to date. There are no new action items to be presented to the Board today.

CHAIRMAN: Thank you, Mr. Williams. Dr. Faget has a report to make. Dr. Faget.

FAGET: An updated status of the analysis of the items under investigation by the Integration Analysis Panel is hereby submitted. No new items have been added. 13 items have been closed since March 15. As of this date, 105 items are listed, of which 27 remain open and 78 are closed. There are still no items upon which analysis has been completed that fall into the category, "may have caused the accident."

CHAIRMAN: Thank you, Dr. Faget.

(Off the record discussion)

CHAIRMAN: This meeting is adjourned at 10:56 a.m.

March 31, 1967

CHAIRMAN: This meeting is now in session at 10:33. I would like to ask Colonel Strang for a report on the progress of Panel Reports preparation. Colonel Strang.

STRANG: Reports from the following Panels have had printer's copies prepared and distributed to the Board for final review: 4, 10, 14, 16, 17, 19 and 21. Most of these Reports have been returned by Board Members for final editing and printing. The following Panel Reports are being processed for preparation of printer's copies as of this date: 3, 5, 7, 11 and possibly 6. Printer's copies of Panel Reports 1, 13, 15 and 20 are to be distributed to the Board today for their final individual review. Final draft copies of Panel Reports 2, 8, 7 and 12 are still being individually reviewed by Board Members. After return of these Reports to Panel 17, they will be processed for preparation of printer's copies and subsequently distributed to the Board for final review. The Final Report from Panel 18, is still undergoing rewrite by the Panel.

CHAIRMAN: Thank you, Colonel Strang. I would like to ask Dr. Faget for a report I believe he is prepared to make. Dr. Faget.

FAGET: I have the final status report. One new item has been added to the 105 items under investigation by the Integration and Analysis Panel since March 22, 1967. As of this date, 79 items have been formally closed and the remaining 27 are still undergoing the validation and determination process. Twenty-six of the remaining open investigation items are not significant with respect to being the potential ignition source. Ten cases of arced, shorted and/or suspicious looking wiring have been identified. From these 10 items, only one is considered a possible cause of the accident. The one possible cause is the wiring providing instrumentation power for some of the Environmental Control System. This wiring contains both DC bus A and DC bus B electrical power, and is located along the floor on the Command Pilot's side in the Command Module in the vicinity of the lithium hydroxide canisters. A special report has been submitted by the Environment Control System (ECS) Investigation Committee. Out of the 78 ECS components, 58 were categorized as non-fire initiators and 20 as a possible fire initiator by this committee. Conservative criteria was used in classifying components as non-initiators. Further investigation is in work to establish whether or not the remaining 20 items are, in fact, possible initiators.

(Off the record discussion)

CHAIRMAN: I would like to ask Colonel Borman to present items upon which he requires action.

BORMAN: Yes, sir, I have two MRR items that I would like to propose. Number 1 - we would like to remove from Category A to Category C all parts and equipment, excluding records, that were not physically attached to the Spacecraft at the time of the accident.

CHAIRMAN: I believe that this proposed action is a desirable one, acceptable to all the Board Members. That being the case, these recommendations are approved. Do you have something further to report on, Colonel Borman?

BORMAN: Yes, sir. We're taking steps to obtain a container from the Navy that will be located here at KSC in which we can store the Spacecraft. Work is in progress now to provide a proper storage place for all the items and equipment in the Spacecraft.

CHAIRMAN: Thank you, Colonel Borman.

(Off the record discussion)

CHAIRMAN: The screening committee, as reported in an earlier meeting by Mr. Sasseen, has presented the Board with the results of the screening of the parts, components and assemblies of the Spacecraft and their recommendations as to how they should be categorized. The Board accepts the Report of this committee as the basis for custody and for further analyses of these parts, components and assemblies.

(Off the record discussion)

CHAIRMAN: We are now in the final stages of preparation on our Report to the Administrator and it is no longer necessary to adhere to the schedule of meetings that we have been following. There will be no further General Sessions or Executive Sessions until we recess, except on call of Chairman.

(Off the record discussion)

CHAIRMAN: This meeting is adjourned at 10:55.

MARCH 28, 1967

CHAIRMAN: This General Session called this morning, March the 28th, is now in session at 10:30 a.m. This is a meeting that was postponed from Friday morning the 24th of March. On Friday morning Panel Report Reviews were in progress and it was determined that it would be unnecessary to interfere with that by having a General Session, a decision was made to postpone the meeting till this morning. During the weekend the Board was in recess, however, work continued in the preparation of Panel Reports.

(Off the record discussion)

CHAIRMAN: I'd like to ask Col. Strang to report on progress in preparation of these reports.

STRANG: Yes sir, Mr. Chairman, a follow-on review by the Board of the Final Reports from Panels 5, 7, 9 and 18 is required. The Panel 18 report will be available for Board Review at 9 a.m. March 29, 1967. Eleven Panel Reports have been submitted for varityping. After these Reports have been varityped, copies will be provided to each Board Member and Counsel, for individual review and corrections prior to the actual printing of the Report. Panels 2 and 7 have been requested to prepare a narrative of Spacecraft 012 test sequences and their objectives. This narrative should contain the significant events up to T-10 hold before the accident. Panels 3, 11 and 12 have been requested to prepare a narrative on the time-line of events from the start of the T-10 minute hold through the medical determination of death. Panel 18 has been requested to prepare a narrative on the investigation and analysis activities of the Board. This covers the period of time immediately after the determination of the cause of death through the completion of the Apollo 204 Board Review activities.

CHAIRMAN: Thank you Col. Strang.

(Off the record discussion)

CHAIRMAN: Mr. Sasseen is here this morning to report on the status of the Screening Committee's activities. Mr. Sasseen.

SASSEEN: The Screening Committee closed its books on the 24th of March; with a small regrouping, there are 300 items that were included, the regrouping was in crew systems. Of these we are recommending 238 items to be transferred to Category B and in addition there are 54 ECS items which will be covered in the ECS Committee's report and not ours. This leaves a total of eight items that we would recommend remain in Category A, I'll go over them here. (1) One of them is an instrumentation J-Box which is essentially a portion of the ship's harness. (2) The Statis Inverter #2 that was sent back to the vendor, (3) the kick plate, or cover plate for the Lower Equipment Bay Junction Box that had the arc on it. (4) There is a main display console panel #8 where a wire was apparently off the structure. (5) The Bio-Medical Octopus Cable, we don't intend to exonerate; (6) the Command Pilot's Cobra Cable is also remaining in Category A since there was not a positive investigation to say conclusively that there could be no arcing. (7) The Command Pilot's torso harness is in the same Category and thus for obvious reasons so is (8) the Velcro and debris traps in the Spacecraft. These 300 items did not include harnessing tubing or some of those small, permanently attached items.

CHAIRMAN: Thank you Mr. Sasscen.

The Board will review this Report and determine whether it agrees with all the actions. I think we will be able to act on this within the next day or so. Thank you very much.

(Off the record discussion)

CHAIRMAN: I've been concerned that early in this Review we injected into the record a figure for the melting point of aluminum, 1400 degrees. I'm not quite certain how that figure originated. It is a surprisingly high figure for aluminum. In view of that fact we recently took action to determine what the actual melting point of the aluminum involved in the Spacecraft is. There is, of course, a wide range for melting points of aluminum. Samples were taken and tests run here at the laboratory. I'd like Mr. Geer to comment on where those samples were obtained from and what figures were obtained for a melting point.

GEER: The samples were taken from the tubing of the 900 psi oxygen system, the water-glycol system, and the 20 psi oxygen system. Tests were run on the 6061-T6 aluminum tubing and the melting point on all of them was found to be 1241°F.

CHAIRMAN: Thank you Mr. Geer.

CHAIRMAN: It is my understanding that that figure corresponds to the point where the aluminum actually becomes liquid.

(Off the record discussion)

CHAIRMAN: I'll ask Col. Borman to make a report on certain action items for material release and the disassembly program. Col. Borman.

BORMAN: Yes sir, we had Item 200 which was approved over the weekend, the couches from Spacecraft 014 were released to Category C to be sent to Houston. I have two other items, one is trash that was removed from the garbage cans in the White Room, the fire panel and interested parties have checked through the residue and they can find nothing relevant to the accident. We'd like that placed in Category C. The other is Clean Room clothing that has been soiled from normal use and we'd like to return that back to the normal channels.

CHAIRMAN: Thank you Col. Borman

(Off the record discussion)

CHAIRMAN: The proposed recommended material release items are approved. Will you please continue with your report, Col. Borman?

BORMAN: Yes sir, we have essentially completely disassembled the Spacecraft, the visibility of the parts and all the areas of the structure is complete. As of today we have logged 1241 separate items through the Bond Room for display to interested parties. Of these 1241 items approximately 1000 came from the C/M directly.

CHAIRMAN: I'd like to ask Col. Borman at what time was disassembly completed? Col. Borman.

BORMAN:

Yes sir, disassembly of the Spacecraft was completed on the 27th of March during the first shift.

CHAIRMAN:

Thank you Col. Borman.

(Off the record discussion)

CHAIRMAN:

This afternoon an exercise will be set up in the PIB to clarify the events associated with the actual opening of the hatches. Eye witnesses and other people who are concerned with recording the events will be on hand to clarify the record pertaining to that portion of the incident. Board Members are advised of this and are encouraged to attend if they can.

(Off the record discussion)

CHAIRMAN:

In view of the way the General Session schedule has worked out it will be unnecessary to have a meeting tomorrow morning in accordance with the usual schedule. The next General Session will be held Friday morning at the usual time. This meeting is now adjourned at 11:13 a.m.

MARCH 31, 1967

CHAIRMAN: This meeting is now in session at 10:33. I would like to ask Colonel Strang for a report on the progress of Panel Reports preparation. Colonel Strang.

STRANG: Reports from the following Panels have had printer's copies prepared and distributed to the Board for final review: 4, 10, 14, 16, 17, 19 and 21. Most of these Reports have been returned by Board Members for final editing and printing. The following Panel Reports are being processed for preparation of printer's copies as of this date: 3, 5, 7, 11 and possibly 6. Printer's copies of Panel Reports 1, 13, 15 and 20 are to be distributed to the Board today for their final individual review. Final draft copies of Panel Reports 2, 8, 7 and 12 are still being individually reviewed by Board Members. After return of these Reports to Panel 17, they will be processed for preparation of printer's copies and subsequently distributed to the Board for final review. The Final Report from Panel 18 is still undergoing rewrite by the Panel.

CHAIRMAN: Thank you, Colonel Strang. I would like to ask Dr. Faget for a report I believe he is prepared to make. Dr. Faget.

FAGET: I have the final status report. One new item has been added to the 105 items under investigation by the Integration and Analysis Panel since March 22, 1967. As of this date, 79 items have been formally closed and the remaining 27 are still undergoing the validation and determination process. Twenty-six of the remaining open investigation items are not significant with respect to being the potential ignition source. Ten cases of arced, shorted and/or suspicious looking wiring have been identified. From these 10 items, only one is considered a possible cause of the accident. The one possible cause is the wiring providing instrumentation power for some of the Environmental Control System. This wiring contains both DC bus A and DC bus B electrical power, and is located along the floor on the Command Pilot's side in the Command Module in the vicinity of the lithium hydroxide canisters. A special report has been submitted by the Environment Control System (ECS) Investigation Committee. Out of the 78 ECS components, 58 were categorized as non-fire initiators and 20 as a possible fire initiator by this committee. Conservative criteria was used in classifying components as non-initiators. Further investigation is in work to establish whether or not the remaining 20 items are, in fact, possible initiators.

(Off the record discussion.)

CHAIRMAN: I would like to ask Colonel Borman to present items upon which he requires action.

BORMAN: Yes, sir. I have two MRR items that I would like to propose. Number 1 - we would like to remove from Category A to Category C the complete Launch Escape System that was on Spacecraft 12 at the time of the accident. Secondly - I'd like approval for a general MRR that would release from Category A to Category C all parts and equipment, excluding records, that were not physically attached to the Spacecraft at the time of the accident.

CHAIRMAN: I believe that this proposed action is a desirable one, acceptable to all the Board Members. That being the case, these recommendations are approved. Do you have something further to report on, Colonel Borman?

BORMAN: Yes, sir. We're taking steps to obtain a container from the Navy that will be located here at KSC in which we can store the Spacecraft. Work is in

progress now to provide a proper storage place for all the items and equipment in the Spacecraft.

CHAIRMAN: Thank you, Colonel Borman.

(Off the record discussion.)

CHAIRMAN: The screening committee, as reported in an earlier meeting by Mr. Sasscen, has presented the Board with the results of the screening of the parts, components and assemblies of the Spacecraft and their recommendations as to how they should be categorized. The Board accepts the Report of this committee as the basis for custody and for further analyses of these parts, components and assemblies.

(Off the record discussion.)

CHAIRMAN: We are now in the final stages of preparation on our Report to the Administrator and it is no longer necessary to adhere to the schedule of meetings that we have been following. There will be no further General Sessions or Executive Sessions until we recess, except on call of Chairman.

(Off the record discussion.)

CHAIRMAN: This meeting is adjourned at 10:55.