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SUBCONTRACTOR CRITICAL DESIGN REVIEW
ON THE
WASTE COLLECTOR SYSTEM

Location The CDR was held over the telephone with NASA and Rockwell
and at KSC, NASA at JSC, GE at Valley Forge, PA., and Rockwell
Date at Downey. It was held on November 21 and 22, 1977.

Attendees:

Rockwell Downey

O. T. Stoll
B. L. Mann
B. Hill
G. E. Laubach
C. Perry
J. C. Olmstead
S. Yamauchi
G. E. Kindelberger

NASA JSC

J. C. Brady
S. Liebergot
W. Thornton
T. Neal
H. Rotter

NASA/Rockwell KSC

E. Wright/NASA
A. McGee /NASA
D. Lowen /RI
J. Little/RI

GE

R. Murray
J. Mangialardi
N. Cerone
F. Disanto
M. Dellabona
S. Hunt
A. Allen
J. Sartor
H. Rosen
E. Glenfield
C. Karnes

RID Items: See Attachment (1)

Product Approval: See Attachment (2)

Open Action Items: Refer to the RIDs for RID Actions; other Actions are noted below.

1. GE - Will study transport tube removals on the ground for ease of cleaning the commode and removable in flight to facilitate the insertion of the contingency bags.
 - . To be completed December 18, 1977.
2. GE - Did not provide complete design information on the seat belt.
 - . Drawings will be provided by December 2, 1977.
3. GE - . Will define the gear case lubrication by January 15, 1978.
4. GE - Will ask Dick Sauer of NASA to provide Skylab odor filter design concept. Mr. Sauer will be at GE on another contract and, hopefully, can provide the data at the time.
5. GE - To determine the source of the odors from the 30 day test unit during use cycle.
 - . Complete by December 15, 1977.
 - (It was reported by Dr. Thornton of NASA not to be objectional but would like to know the source.)
6. GE - Will run a test on the separator with one electrical phase out to determine operating characteristics.
 - . Test complete, January 5, 1978.
7. GE - To run tests and to conduct analysis to determine the dew point around the collector and the collector minimum temperature.
 - . Complete by January 2, 1978.

8. GE/RI - Noise engineers to hold a separate phone conversation to discuss the noise report and make recommendations for specification compliance. The phone conversation will be held on November 23, 1977 and the recommendations will be completed at a later date.
9. RI - Determine the low points in the Rockwell furnished tubing which interface with the hygiene drain and airlock waste water drain.
Complete by December 15, 1977.
10. RI/NASA - Will hold a phone meeting on November 30, 1977, on the documentation required from GE to support the teardown, cleaning and re-assembly of the waste collector after each flight.* *Done (see note 11)*
11. RI - Will determine what method is to be used to procure odor filters which must be replaced after each flight.
To be completed by December 15, 1977.
12. NASA/KSC - Has indicated that they desire to assist GE in the teardown, cleaning and assembly of the waste collector from the 30 day user test. GE stated the work would be done during the week of January 9, 1978. NASA will notify Rockwell thru normal channels of their plans.

* Meeting was held as scheduled, and Rockwell will provide MEA (Maintenance Engineering Analysis) which will define dis-assembly/cleaning/assembly/checkout procedures.

Discussion:

The RIDs and GE's comments to the RIDs were reviewed and disposition made. The RIDs are included in attachment (3). All actions required by the RIDs are shown on the RIDs and are not discussed here. Other items that were discussed are presented below.

1. NASA/KSC - Presented an outline of their plan for handling and cleaning the WCS. This plan is shown in Attachment (4). GE recommended the the commode be sterilized before disassembly. NASA stated their research indicated this was not necessary. However, after they assist GE in cleaning the development unit (see Action Item 12), they will again consider. It was also brought out in this discussion that biocide, detergents, and sterilization agents to be used has not been firmed up. NASA (Dick Sauer) will recommend agents and Rockwell will ask GE to comment on their compatibility with the hardware -(see Action Item 12).
2. NASA - Provided user comments from the neutral buoyancy test. These are shown in Attachment (5). The main discussion centered around the seat belt comments. Comment Number 2 indicated the seat belt did not keep the subject secured snugly to the seat. Comment Number 4 stated the lap (seat) belt was satisfactory. GE pointed out that the NASA squawked seat belt design at the crew station review at Downey. At that time the seat belt has a 15 pound restraining force. The NASA stated the force was too restraining. The belt in the buoyancy test had approximately

two pounds restraining force. Jim Brady (NASA) suggested the design be changed so that the user could cinch the belt down tight. Dr. Stacey Hunt of GE stated that the seat belt used in the zero g test were the type that could be cinched down and the users objected. GE stated they had another concept in mind. Rockwell suggested that GE make up a new concept belt and send to NASA for a buoyancy test. NASA indicated they were not interested. All of the details of the seat belt design were not provided in the CDR data pack. Rockwell asked GE to provide the additional data (see Action Item 2), and the discussion would be continued at a later date.

It appears that the cleaning of the commode waste collector could be greatly facilitated if the transport tube was removable. Also GE indicated the contingency bags could not be disposed of into the waste collector without the use of a stick, screw driver, etc., to push the bag off of the tines (see RID 71). GE also stated that if the transport tube could be removed in flight, in case of a slinger motor failure, the bags may be inserted without the use of a stick. GE took an Action item (see Action Item 1) to study and determine the impact of redesign to make the transport tube removable.

The question was raised as to the type of grease used in the gear box. GE stated they thought it is Crytox. They will determine and notify (see Action Item 3).

Dr. Thornton of NASA was at GE and participated in the user test. He commented that there was a slight odor when the collector was in use and suspected the odor was from around the seat and not from the odor filter. GE took an Action Item (5) to determine where the odor came from and also compare the orbiter filter and the Skylab filter. GE will ask Dick Sauer to provide the Skylab drawing when he is back there on another contract on November 30, 1977. (see Action Item 4.)

There was some discussion as to the separator performance with one electrical phase out. GE said they will run the test and provide the data (see Action Item 6).

GE presented data which indicated that after four defecations, one right after the other, the wall of commode dropped 18 F below ambient and stayed there for approximately 20 minutes before starting to increase. This is an unrealistic condition, but after one use the temperature also drops. GE was asked to determine the dew point around the commode and commode wall temperature and perform a study to determine if a problem exists and the amount of condensation that might occur. Rockwell stated GE should assume the wall temperature is 63 F for the cold case and the air ingested by the urine inlet and commode inlet from the cabin has a dew point of 57 F (Action Item 7).

GE presented data which indicated the specification noise limit of NC 55 is exceeded, without an enclosure, in the frequency range of 1000 Hertz. Also, lower frequency noise is conducted to the frame. A number of corrective measures were discussed including inserting a muffler, either upstream or downstream, of the odor filter to eliminate the high frequency problem. The muffler would have to extend outside of the specification envelope. Rockwell and GE noise experts will hold further conversations and recommend a fix (Action Item 8).

GE indicated a problem has occurred during development test. There are low points in the inlet lines to the water separator which are no problem in flight but are in ground checkout. The separator does not have sufficient suction to remove the water. This water could then "slug" the separator in-flight causing water carryover. GE is-revising the tubing runs to eliminate this problem in the WCS. However, there are other tubing runs on the orbiter side of the interface which are below the separators. Rockwell will determine which runs are so located and a method of draining the runs before launch. (see Action Item 9.) GE also stated that in one g the separators will stall if over loaded and will not clear except through a drain port.* There is no problem in zero g unless the over load is so great that water is carried over into the odor filter. GE recommends a spare filter be carried.

* Possibility exists that water may also penetrate to the motor when vehicle is vertical.

NASA/KSC stated that additional documentation is needed from GE to prepare teardown, cleaning, assembly and checkout procedures. The information should be in the form of ICDs, tech orders, etc. GE is not contractually covered to provide these documents. It was agreed that Rockwell and NASA would discuss this in a separate telecon with maintainability representative (see Action Item 10).

It was determined that spare odor filters have not been ordered to support the VFT program. The filter must be replaced after each flight. There was a question as to what means should be used to provide these filters, i.e., spares or DDT&E. Rockwell took an Action Item (11) to determine the correct method.

GE asked the status of EDCPs. Rockwell replied that EDCP WCS-002 has been disapproved because funding is not available. WCS-003 is still in the approval cycle and is expected to be approved.

Additional Discussion:

During user test at GE urine filter plugged with mucous material. GE to look into providing double filter at urinal to permit removal of filter fix cleaning and still prevent foreign objects from entering line.

Thirty day user test will complete December 9, however, GE will continue test until 210 man-days have been accumulated for the commode.