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SKYLAB EXPERIENCE BULLETIN NO. 19

FOOD SYSTEM

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National Aeronautics and Space Administration

LYNDON B. JOHNSON SPACE CENTER

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ERRATA: Pages 167 to 170 are missing from this "original."

MAN-MACHINE ENGINEERING DATA APPLICATIONS OF SKYLAB EXPERIMENTS M487/M516

BULLETIN NO. 19

This document is the nineteenth in a series of releases which are intended to make available to NASA and contractor personnel those results from the Skylab Man-Machine Engineering Experiments which have design and requirements relevance to current projects and programs. This method of data distribution has been instituted as a convenient way to provide access to Skylab experience.

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FOOD SYSTEM

SUMMARY

The Skylab food system represents a significant accomplishment in the research necessary to maintain the health and well being of a crewmember subjected to the environmental stresses of a long space mission. With the experiences of the Skylab missions now available, it is obvious that prepared foods can be eaten from open containers using conventional utensils. From the knowledge gained from these experiences, there exists the opportunity to make additional refinements and improvements to a very successful food system. Some of the more significant knowledge gained from the Skylab experience include the following:

- The food tray concept for dining was well accepted by all crewmembers.
- The utensils worked nicely for retention of fluids and moist foods.
- The adhesive forces retained the food within the open containers very well.
- Many of the food cans with plastic membranes and the food bags ballooned drastically when reconstituted and/or heated.
- Much of the water supplied to the wardroom contained air bubbles.
- The beverage dispenser was difficult to operate and the drinking insert allowed air into the drink.
- Lengthy reconstitution times were required for some of the food and drinks.
- Food in general was less tasty in flight than on the ground.
- Finding an acceptable means to dispense seasoning proved difficult.
- The wardroom table was too low.
- The triangular shoes were the preferred restraint for use at the wardroom table.
- The frozen food was by far the most enjoyable food available.

- The chiller needed a food restraint system inside to keep articles from floating out.
- Food and drink spills occurred quite frequently.
- Not being allowed to make menu changes when desired was quite an irritant.
- Most crewmembers expressed the desire for a pantry style food storage scheme.

PRE-SKYLAB DESIGN

The space feeding system for man's orbital Mercury missions was food in metal toothpaste type tubes and dry bite-sized foods. However, the experience gained in the food packaging and inflight handling led to the evolution of the Gemini and Apollo food systems. For the Gemini program, an effort was begun to design and formulate foods and packages which were lightweight, low volume, low residue, high energy, acceptable, stable at spacecraft temperatures, could be consumed in zero gravity, and would reconstitute with water. A category of food that evolved was compressed and dehydrated ready-to-eat cube foods that included meat, fruit, dessert, and bread types. The uniform shape, high caloric density, and variety of flavors made the food ideally suited for the engineering requirements of space flight. Dehydrated fruits, beverages, salads, desserts, meats, and soups which required water for rehydration prior to consumption were also developed. These rehydratable foods were packaged in specially designed laminated plastic bags which had a valve for water insertion at one end and a 0.75 in. (1.9 cm) feeder passageway at the other end through which food could be consumed. Each meal was over-wrapped in an aluminum-foil-plastic-laminate which also served as a garbage bag for inflight stowage of used food after each meal.

The initial Apollo food system was basically the same as that which was provided the Gemini program. However, extensive changes in the types of food and packaging were implemented for later Apollo flights after it was determined that the initial system required too much time and effort for meal preparation and consumption, functional failures occurred in the rehydratable packages, and the crews preferred foods more familiar in appearance, flavor, and method of consumption. The changes became obvious on Christmas Day during man's first successful lunar orbital mission. Borman, Lovell, and Anders opened a thermostabilized flexible bag of turkey chunks and gravy and ate with a spoon. This food required no water for rehydration since the normal water content was retained. The meal was quite a morale booster.

SKYLAB DESIGN

The Skylab food system provided equipment and supplies needed for the storage, preparation, consumption, and cleanup. Sufficient food, beverage, and support items for one 28-day mission and two 56-day missions plus twenty percent contingency was initially launched. This 2500 pounds of food and accessories were launched onboard the orbital workshop and an additional 350 pounds were launched aboard the three command modules.

The Skylab menu included the following food types:

- Rehydratable
- Thermostabilized
- Frozen
- Beverages
- Natural Form

The following paragraphs provide design description of food system operational equipment.

Food Tray

A serving tray (Figure 1) was provided for use by each crewmember at the wardroom table. Each tray had four large and four small cavities to retain the food packages by friction fit. Three of the large cavities had heating elements capable of heating food to approximately 150°F (65°C). A portion of the tray surface contained magnets to retain the utensils. Each food tray had a timer capable of being pre-set up to 12 hours. At the end of the pre-set time, 28 VDC power was applied to the selected heating elements. A removable food tray lid was provided to cover the food when heating. The tray was secured to the food table by means of two dial type latches located on each side of the food tray.

Eating Utensils

Reusable 3/4-size utensils were supplied in sets consisting of a knife, fork, and spoon, made from stainless steel. One set was allocated per

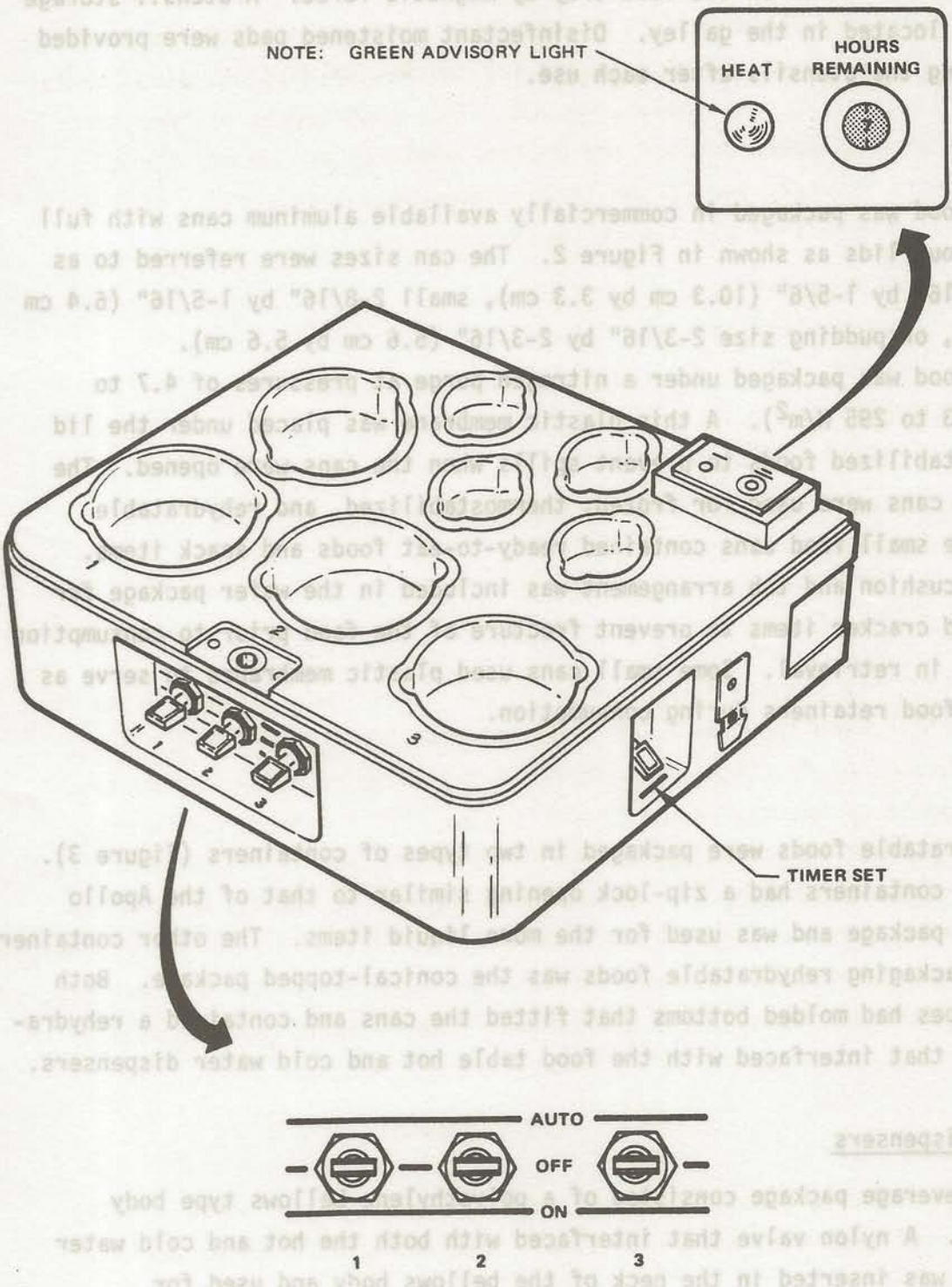

FIGURE 1: FOOD TRAY

crewmember and three additional sets were spares (12 sets total). The knife had a pointed tip to penetrate the food can membranes when necessary. The utensils were retained on the food tray by magnetic force. A utensil storage locker was located in the galley. Disinfectant moistened pads were provided for cleaning the utensils after each use.

Food Cans

The food was packaged in commercially available aluminum cans with full panel pullout lids as shown in Figure 2. The can sizes were referred to as large 4-1/16" by 1-5/6" (10.3 cm by 3.3 cm), small 2-8/16" by 1-5/16" (6.4 cm by 3.3 cm), or pudding size 2-3/16" by 2-3/16" (5.6 cm by 5.6 cm).

The food was packaged under a nitrogen purge at pressures of 4.7 to 8 psia (173 to 295 N/m^2). A thin plastic membrane was placed under the lid of thermostabilized foods to prevent spills when the cans were opened. The large food cans were used for frozen, thermostabilized, and rehydratable foods. The small food cans contained ready-to-eat foods and snack items. A plastic cushion and tab arrangement was included in the wafer package for biscuit and cracker items to prevent fracture of the food prior to consumption and to aid in retrieval. Some small cans used plastic membranes to serve as temporary food retainers during consumption.

Food Bags

Rehydratable foods were packaged in two types of containers (Figure 3). One of the containers had a zip-lock opening similar to that of the Apollo spoon-bowl package and was used for the more liquid items. The other container used for packaging rehydratable foods was the conical-topped package. Both package types had molded bottoms that fitted the cans and contained a rehydration valve that interfaced with the food table hot and cold water dispensers.

Beverage Dispensers

The beverage package consisted of a polyethylene bellows type body (Figure 4). A nylon valve that interfaced with both the hot and cold water dispensers was inserted in the neck of the bellows body and used for

FIGURE 2: FOOD CANS

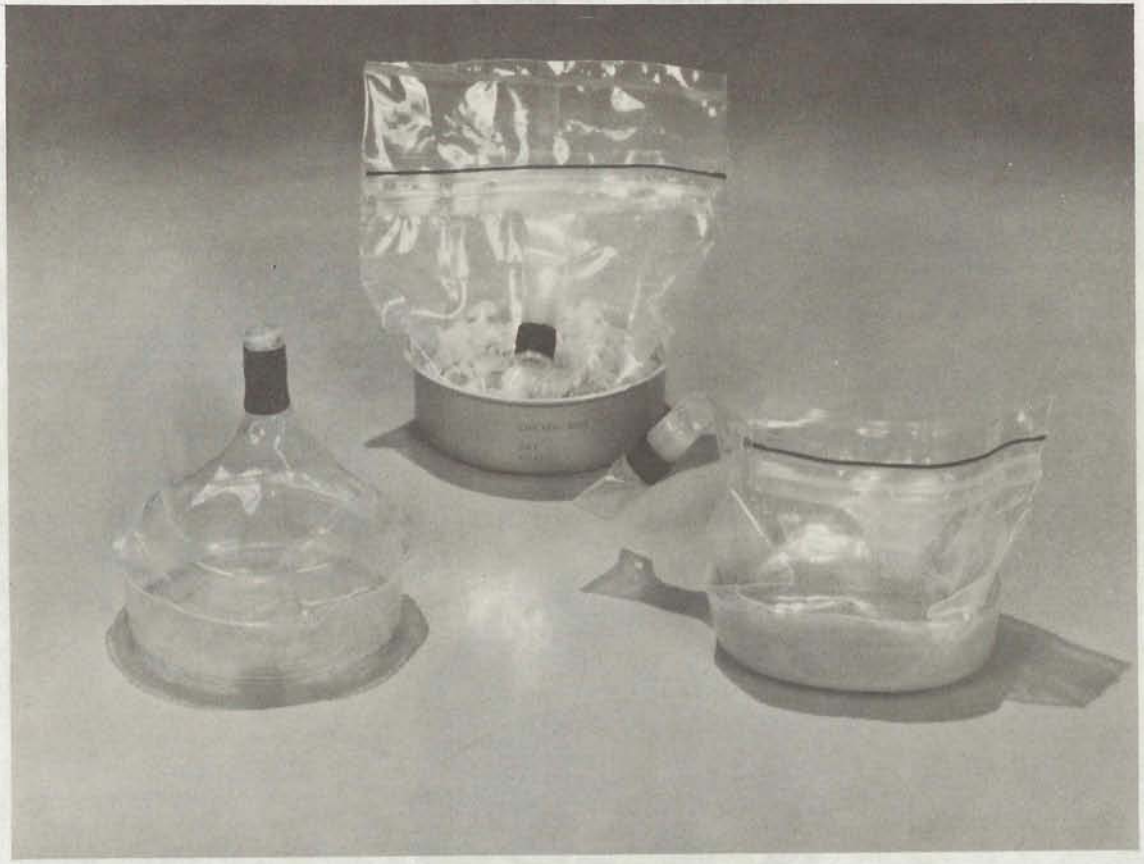

FIGURE 3: FOOD BAGS

FIGURE 4: BEVERAGE DISPENSER

reconstitution. A nylon tube for drinking was then inserted into the valve. The package was compressed in a vacuum-packed, stored state. The reconstituted beverage package extended in length to accommodate the water quantity required by the individual item. The package had a capacity for the addition of up to nine ounces of water.

Seasoning Dispensers

The salt packet dispenser consisted of a spring-loaded, aluminum housing containing 251 salt packets. These individual salt packets were fabricated from laminated plastic and contained a 25 percent (by weight) solution of sodium chloride in distilled water. An extra supply of seasoning that included liquid tabasco sauce, granular pepper, onion powder, and garlic powder in commercially available packages was launched with the SL3 crew. For SL4 a squeeze bottle with a collapsed inner bag was used for liquid pepper, liquid garlic, and tabasco sauce. As the liquid was expelled, the inner bag would inflate. This prevented mixing of air with the liquid. Crystal salt was packaged in modified Apollo beverage packages for the SL4 resupply. The design was to rehydrate the salt in flight and use a syringe to dispense the liquid salt.

Wardroom Table Equipment

Inflight food preparation and consumption was accomplished at the food table. The food table, illustrated in Figure 5, allowed three crewmen to prepare and consume their food simultaneously.

A removable table cover was stored in the ceiling grid above the food table when not in use.

The food table pedestal housed the water chiller and heater. The water chiller provided cold water through a dispenser valve on the table's upper surface for reconstitution of chilled rehydrated foods and beverages. In addition, the water chiller provided cold water to three drinking water dispensers. The water heater provided hot water for reconstitution of foods and beverages. Figures 6 through 8 illustrate the basic configuration and arrangement of these items.

FIGURE 5: FOOD TABLE AND RESTRAINTS

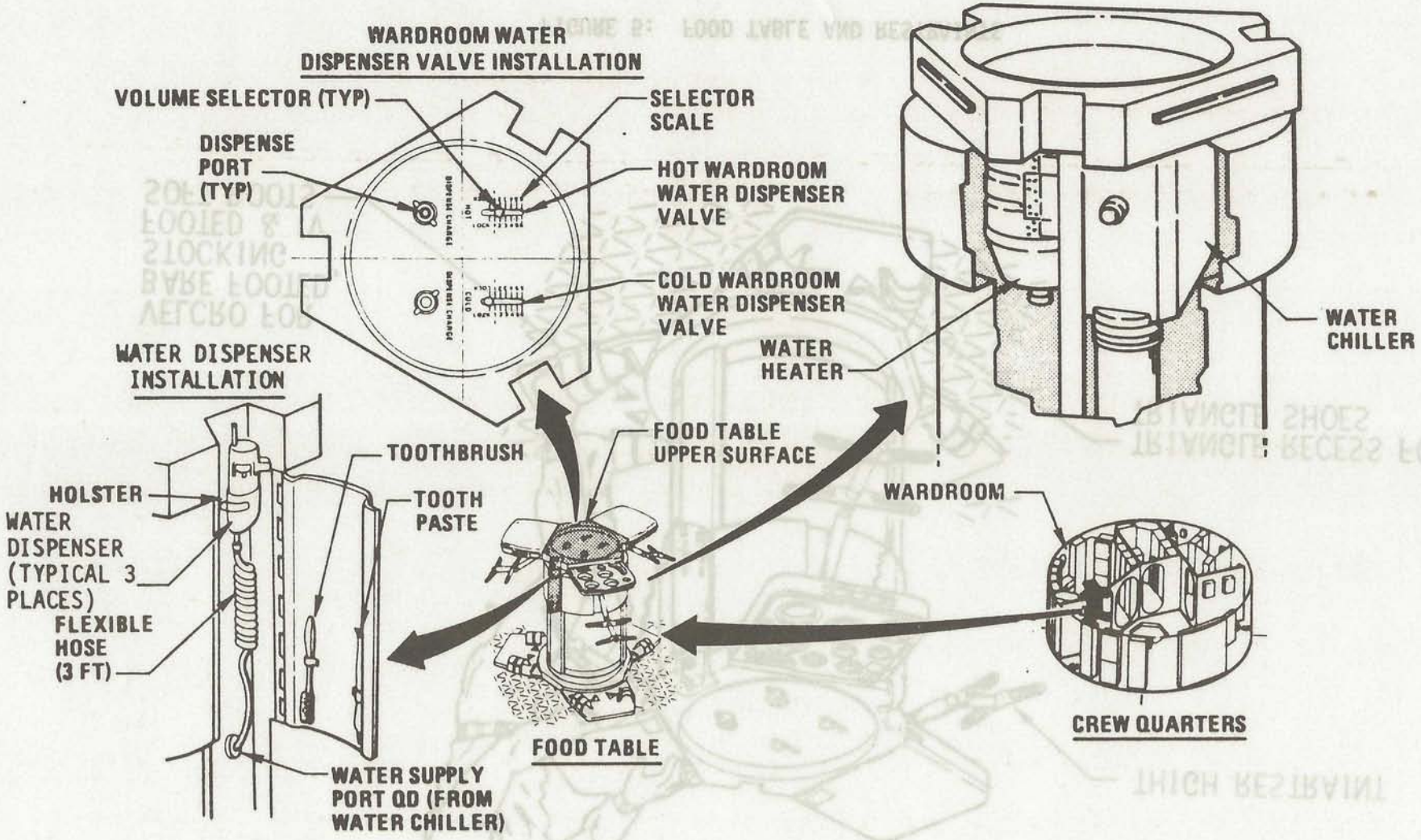

FIGURE 6: WATER SYSTEM, WARDROOM TABLE

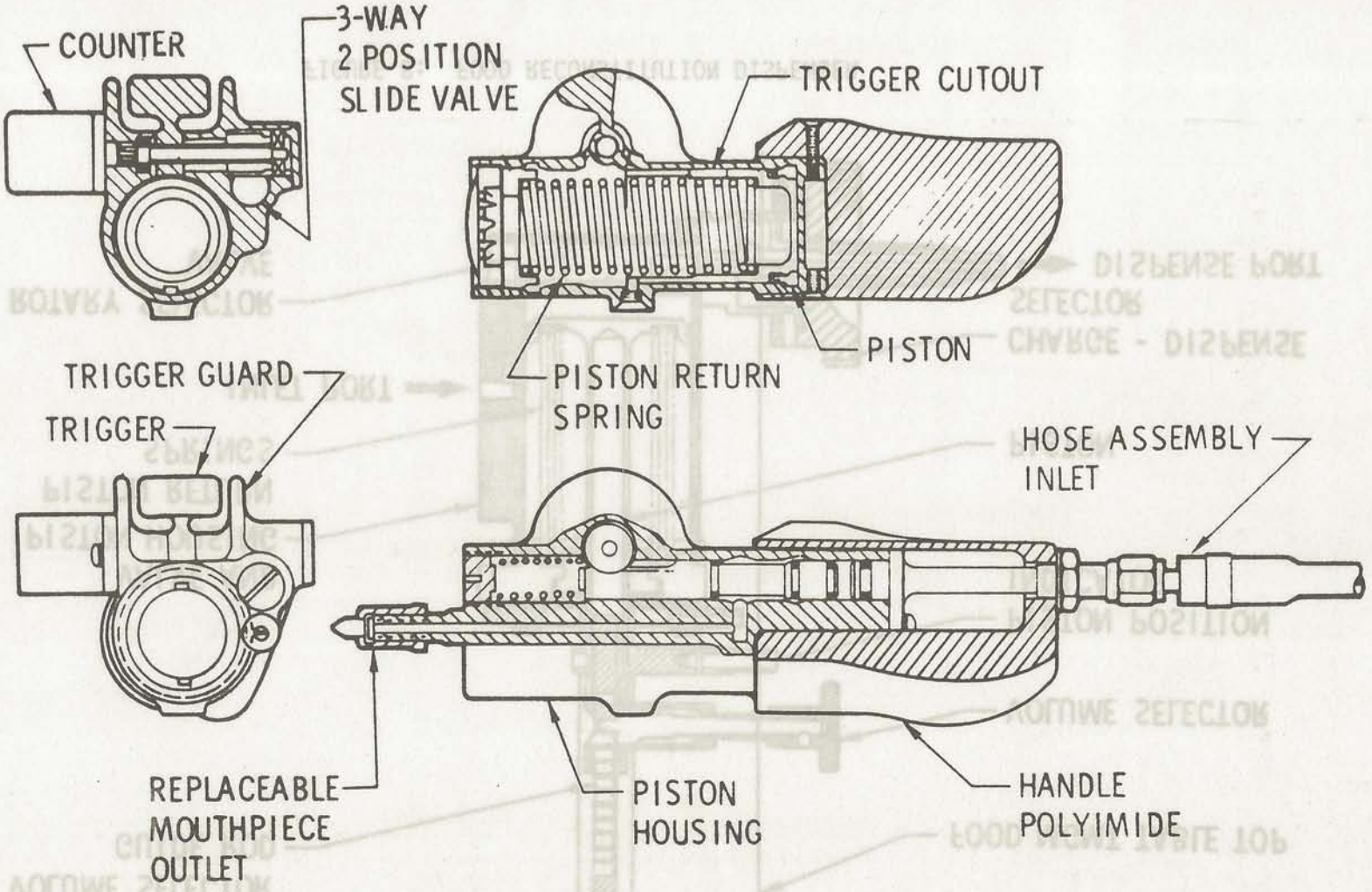

FIGURE 7: DRINKING WATER DISPENSER

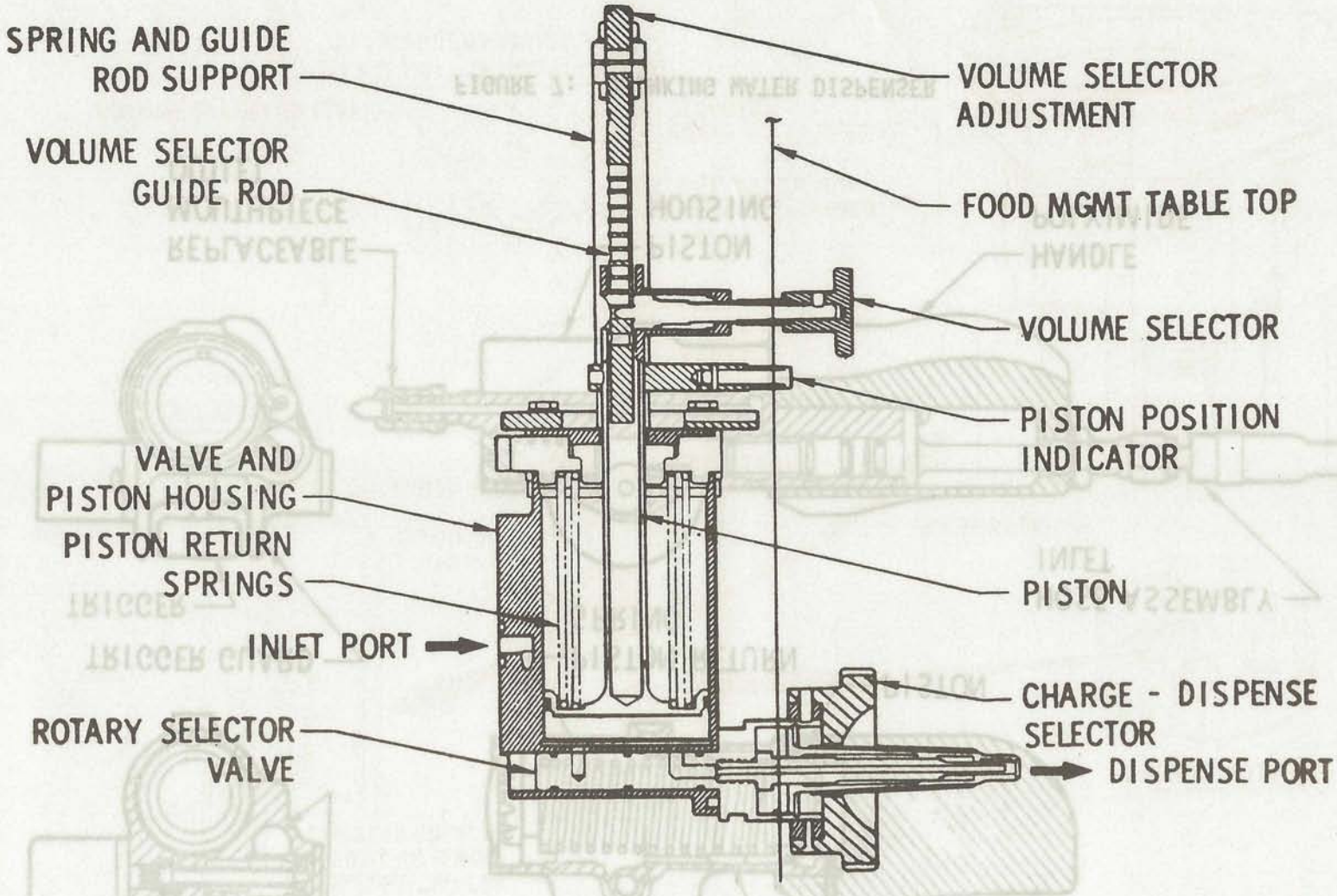

FIGURE 8: FOOD RECONSTITUTION DISPENSER

Each of the three food table eating stations was provided a set of permanent foot restraints and an adjustable thigh restraint as illustrated in Figure 5. The foot restraints were composed of two adjustable straps for barefoot restraint and receptacles to accept and retain the cleats of the triangle shoes.

The adjustable thigh restraint, used in conjunction with the foot restraints, provided a means of stabilizing the crewman while occupying the food management station.

Food Freezers and Chiller

There were five food freezers in the OWS, three located in the forward compartment and two in the wardroom. These freezers were used to launch and maintain frozen food packages. The single food chiller, located in the wardroom, was used during launch as storage for an ambient food module, and on-orbit for stowage of left-over food items and heat sensitive medical supplies. Each of the food freezers contained enough food for three crewmen for 28 days; approximately 50.4 pounds (732.6 kilograms) of frozen food, such as steaks, prime rib, ice cream, etc. All frozen food was contained in cans and overcans as illustrated in Figure 9.

The freezer and chiller compartment designs accommodated the standard food canister restraints during launch and orbital use. The freezers were foam filled shells with a trigger latch operated foam filled door. Each door/freezer interface was a vented gasket, which helped the refrigeration system to maintain the frozen food at approximately -10°F (-24°C).

Ambient Food Storage

Figures 10 and 11 depict the ambient food supply storage. The food cans were packaged for launch according to package diameter and use sequence in either large or small sealed aluminum overcans 16 inches (40.6 cm) long. "Herringbone" retainers were used for extracting the individual cans from the overcan. These overcans maintained a 5 psia (184.5 N/m^2) internal pressure and provided protection to the vacuum packed individual cans through the mission launch.

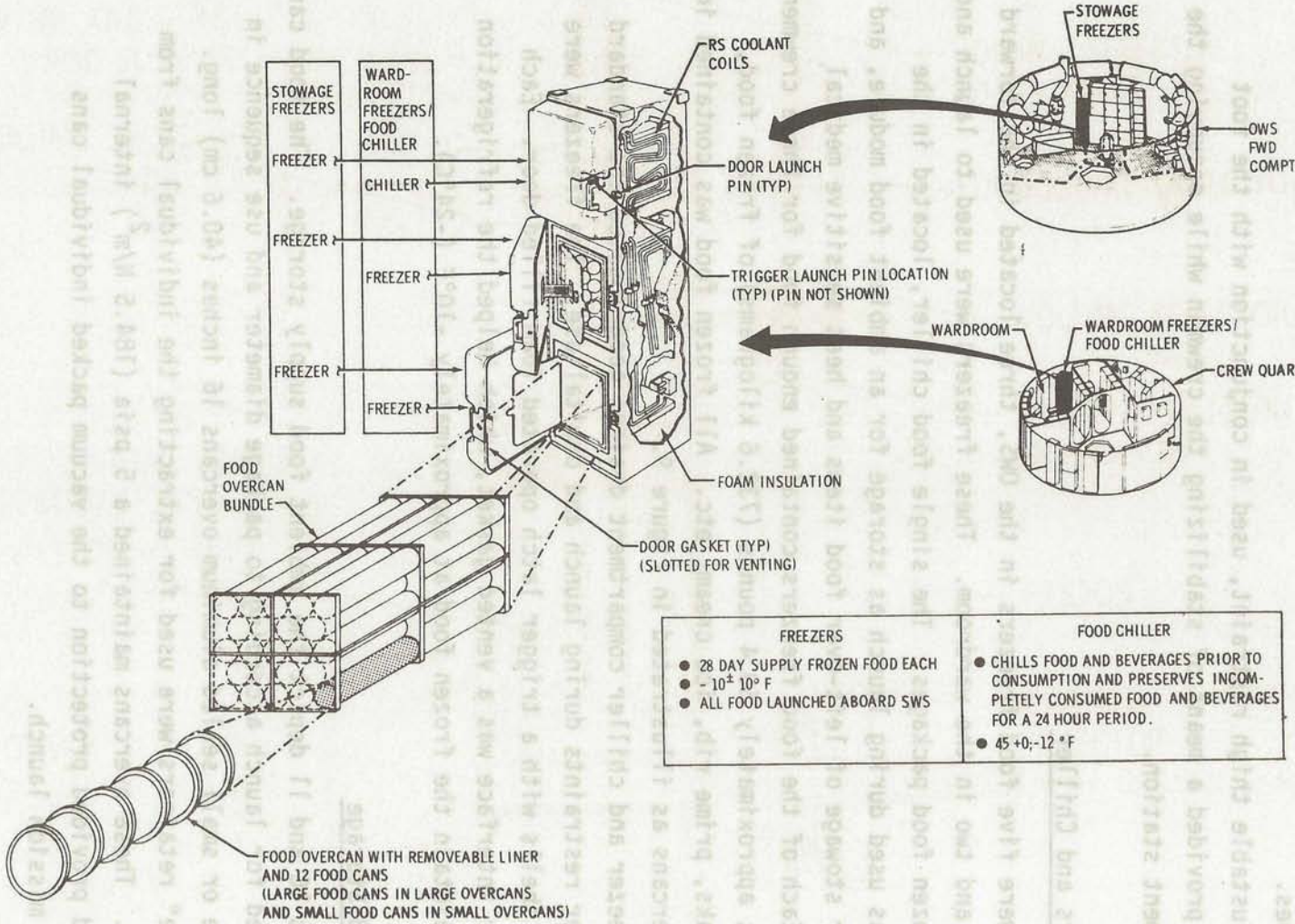

FIGURE 9: CHILLED AND FROZEN FOOD STORAGE

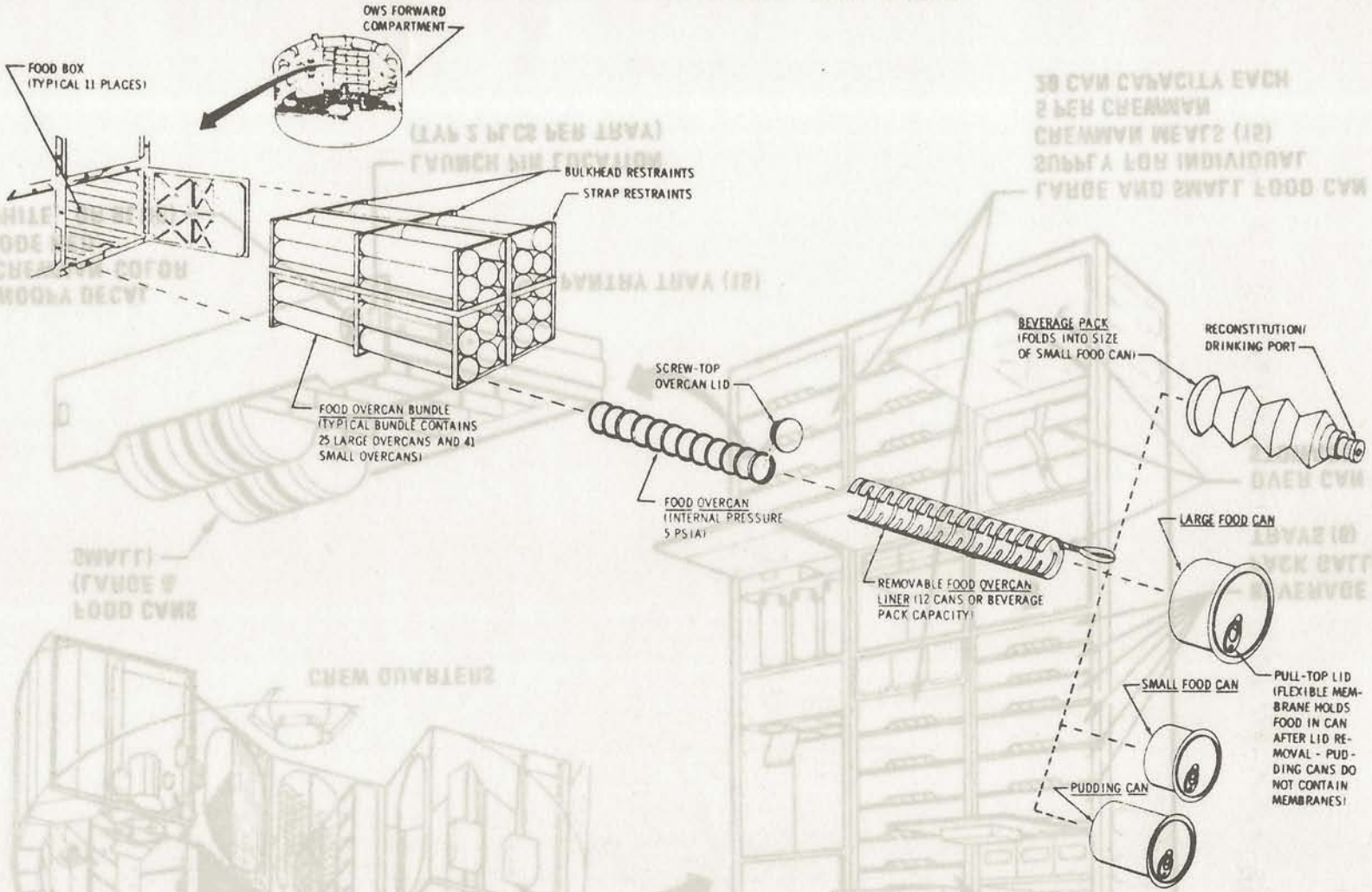

FIGURE 10: AMBINET FOOD STORAGE

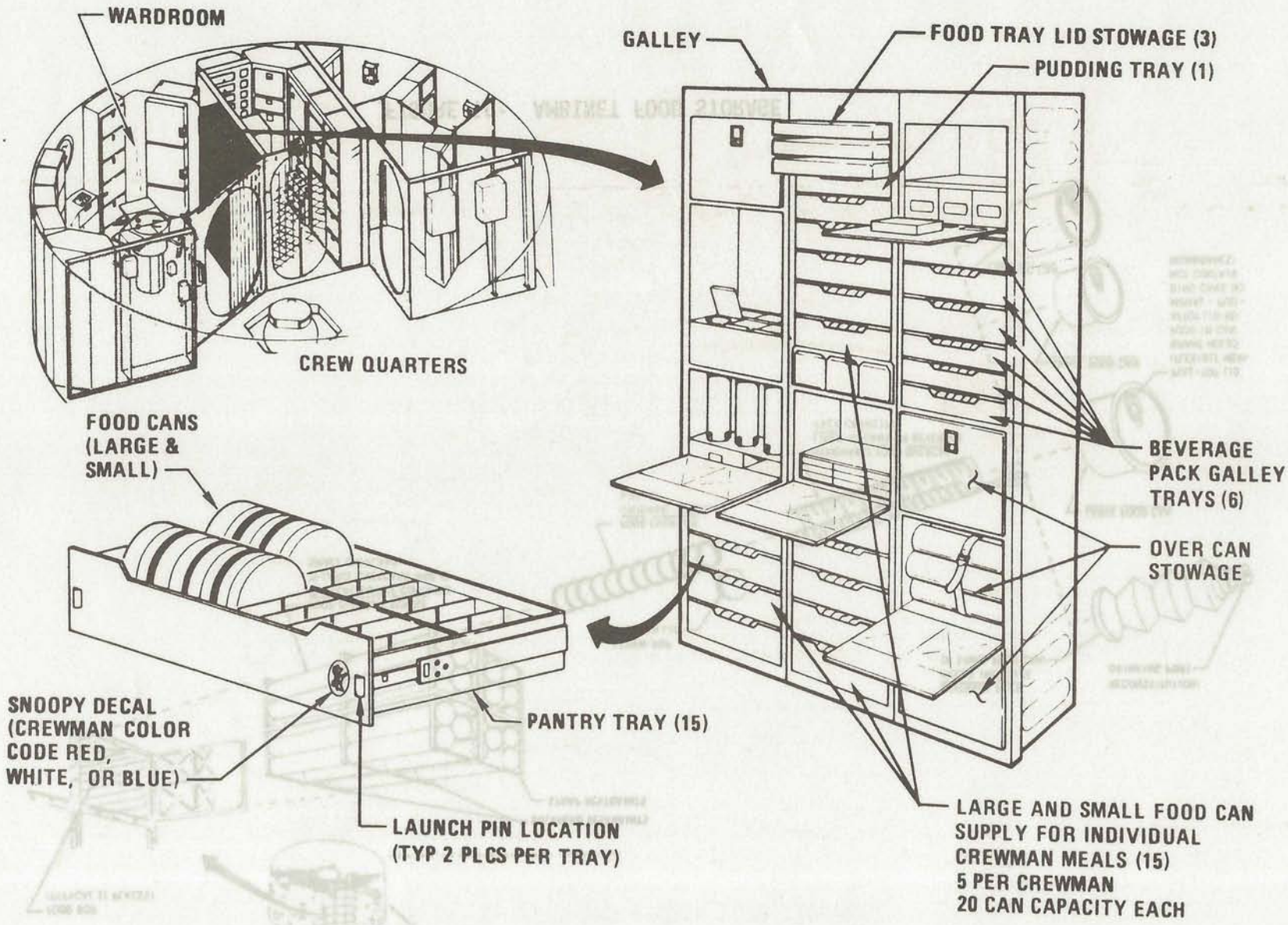

FIGURE 11: DAILY AMBINET FOOD SUPPLY

FIGURE 12: FROZEN FOOD RESTRAINT ASSEMBLY

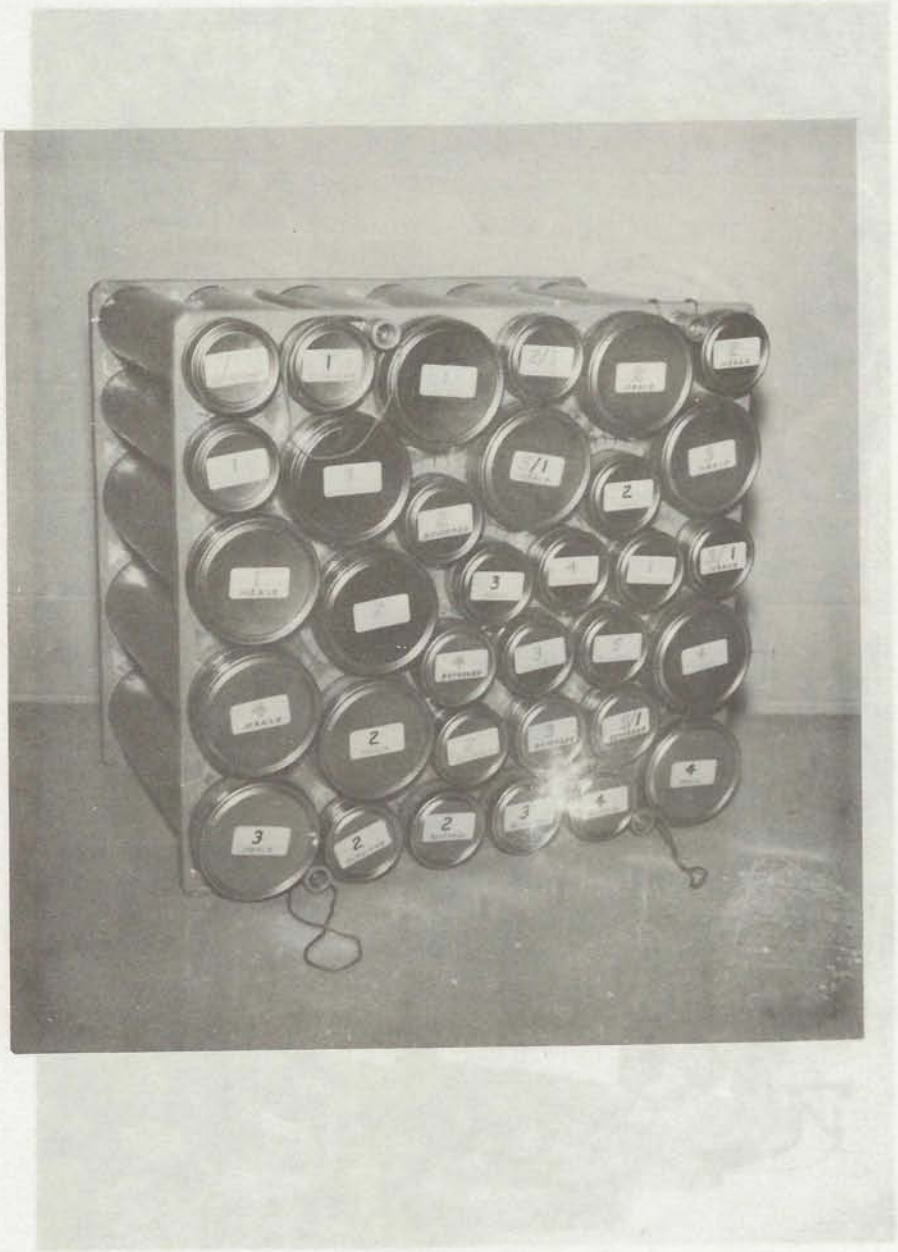

FIGURE 13: AMBIENT FOOD RESTRAINT ASSEMBLY

The overcans were stored in restraint assemblies consisting of aluminum end plates separated by aluminum rods. These restraint assemblies provided support for the canisters during launch and served as an interface between the canisters and the storage lockers. Frozen food was stowed ten canisters per restraint assembly (Figure 12), whereas ambient food restraint assemblies each held 12 large canisters and 21 small canisters (Figure 13). The stowage sequence and the combinations of items in the small canisters were organized with respect to crew menus and physical constraints of the galley storage area. Each ambient restraint assembly contained an approximate six-day complement of food.

SKYLAB EXPERIENCE

Food Tray

The food tray concept for dining (Figure 14) was well accepted and contributed to making the dining periods very enjoyable, although some felt the food was not quite hot enough. The use of the timers when heating food was quite satisfactory. A typical procedure for using the timer was to place the item to be heated for the following meal into the tray at the conclusion of the prior meal and set the timer as required. The food requiring the longest time for heating, 1-1/2 hours, was the frozen steak.

Several crewmembers commented that the tray cavities should accept and retain a wider size range of food cans and drink containers. It was quite common for the small food cans and drink containers to float out of the food tray because they didn't stick to the friction set of the cavity.

The latch (Figure 15) for the food tray and tray top did not always work as expected:

> "That leads me to another very unsatisfactory arrangement, that is, the little latch in the food tray is a piece of junk. It usually didn't work on mine anyway. If you do try to get it working, lots of time it'll push right down to through the bottom. Then you can't get it loose without using a knife or a couple of knives on it." (Ref. 2.27)

FIGURE 14 : FOOD TRAY DINING CONCEPT

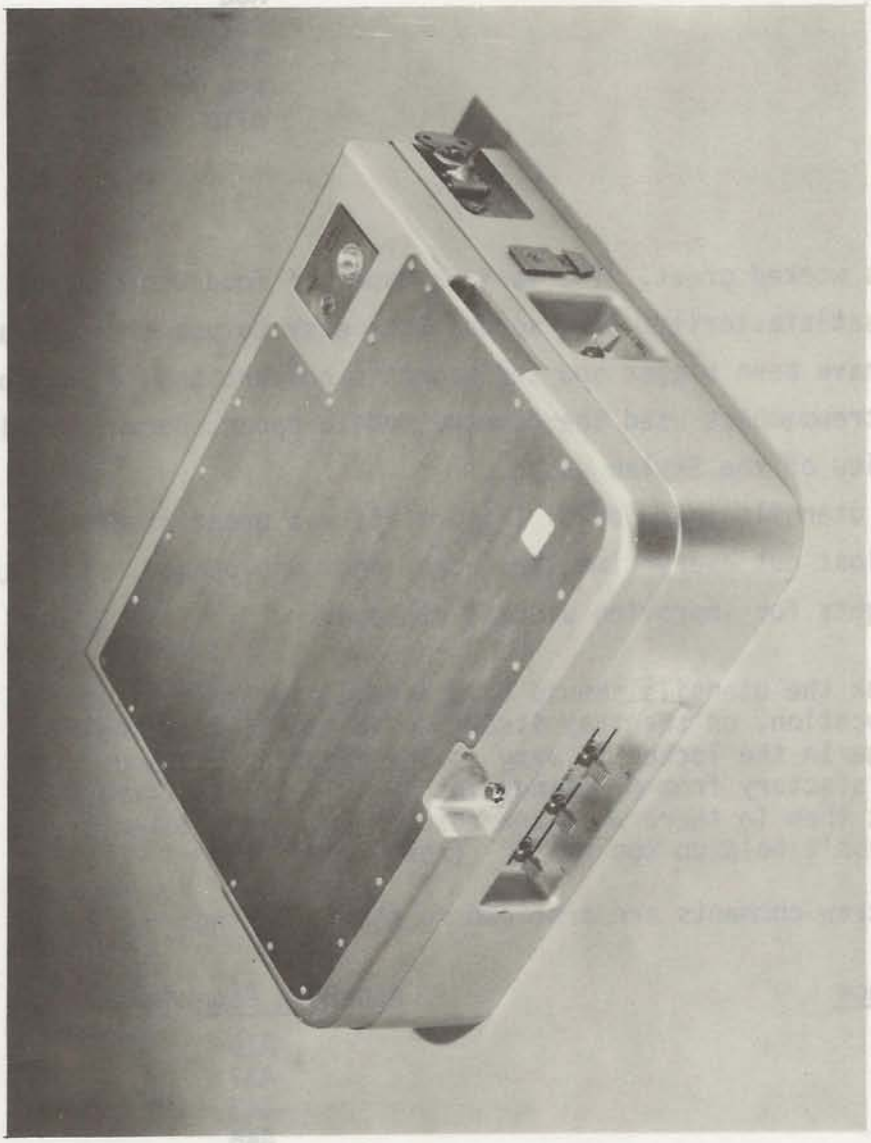

FIGURE 15: FOOD TRAY WITH REMOVABLE TOP

Additional crew comments about the food trays are provided in the following:

Reference	Appendix Page Number
1.6	A7
1.8	A9
1.10	A13
2.3	A42
2.9	A52
2.12	A62
2.14	A64
2.27	A94
3.11	A118

Eating Utensils

The utensils worked great. The various types of food would stick to the spoon quite satisfactorily. The spoons were easy to use although all utensils should have been bigger and the magnetic holders should have been stronger. Some crewmembers used the command module spoon, because of its large size, in lieu of the Skylab spoon.

Storing the utensils in a locker (Figure 16) was unsatisfactory. Utensils would float out every time the locker door was opened. The SL4 PLT offered his thoughts for improving utensil storage:

> "I think the utensils should have a good storage position; the location, on the tray itself or in it. I find the storage in the locker is very inconvenient to use and unsatisfactory from my standpoint. It is a lot of trouble to get them in there when the restraint is unsatisfactory. It doesn't hold up too well." (Ref. 3.16)

Additional crew comments are provided in the following:

Reference	Appendix Page Number
1.8	A10
1.20	A37
2.3	A43
2.7	A48
2.9	A54
2.11	A60
3.10	A116
3.14	A122
3.15	A125
3.16	A126
3.40	A167

FIGURE 16: UTENSIL STOWAGE

Food Cans

The crews found it much more pleasant to be able to eat from an open food can rather than having to open and close containers such as the spoon bowl packages.

The membrane on the thermostabilized foods was quite irritating. The fluids and foods would stick to the diaphragm such that when the diaphragm was cut off, it was like cracking a whip, food would go flying. Another problem with the membrane was that when the food was heated, outgassing would cause the membrane to balloon drastically. Then came the messy job of piercing.

Opening of the food cans was by means of a pull tab. Tab failure was experienced on occasion. The tab would simply break off when attempting to open a can. Although it did not happen, the SL4 CDR felt the potential was there for a crewmember to cut himself on a sharp edge (Figure 17) when opening a can. (Ref. 3.40)

Additional comments are provided in the following:

Reference	Appendix Page Number
1.17	A21
1.18	A22
1.19	A23
1.20	A38
2.3	A42
2.9	A53
2.10	A56
2.29	A97
3.10	A116
3.12	A119
3.14	A122
3.40	A167
3.41	A169

Food Bags

The food bags considered the most convenient to use were the conical bags (Figure 18).

Reconstitution of rehydratables caused many of the bags to swell severely as evidenced on the third day of the SL2 mission when the crew reported a bag failure. Outgassing caused the bag to rupture sending corn everywhere. Air in the water supply was another big factor in causing bags to swell. The swelling meant that the food could not sit and rehydrate and then be heated because the food tray lid could not be closed due to the ballooned bags.

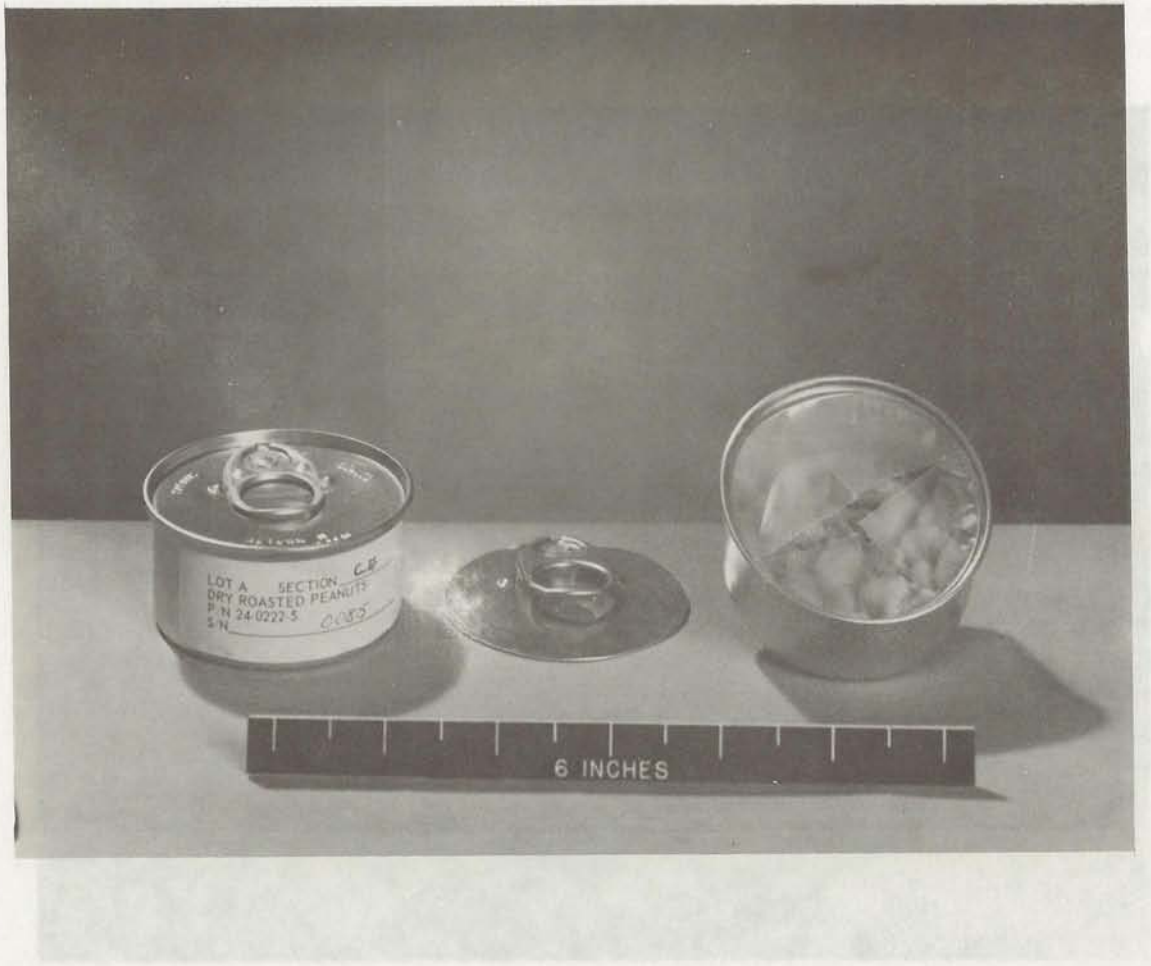

FIGURE 17: FOOD CAN LID REMOVAL

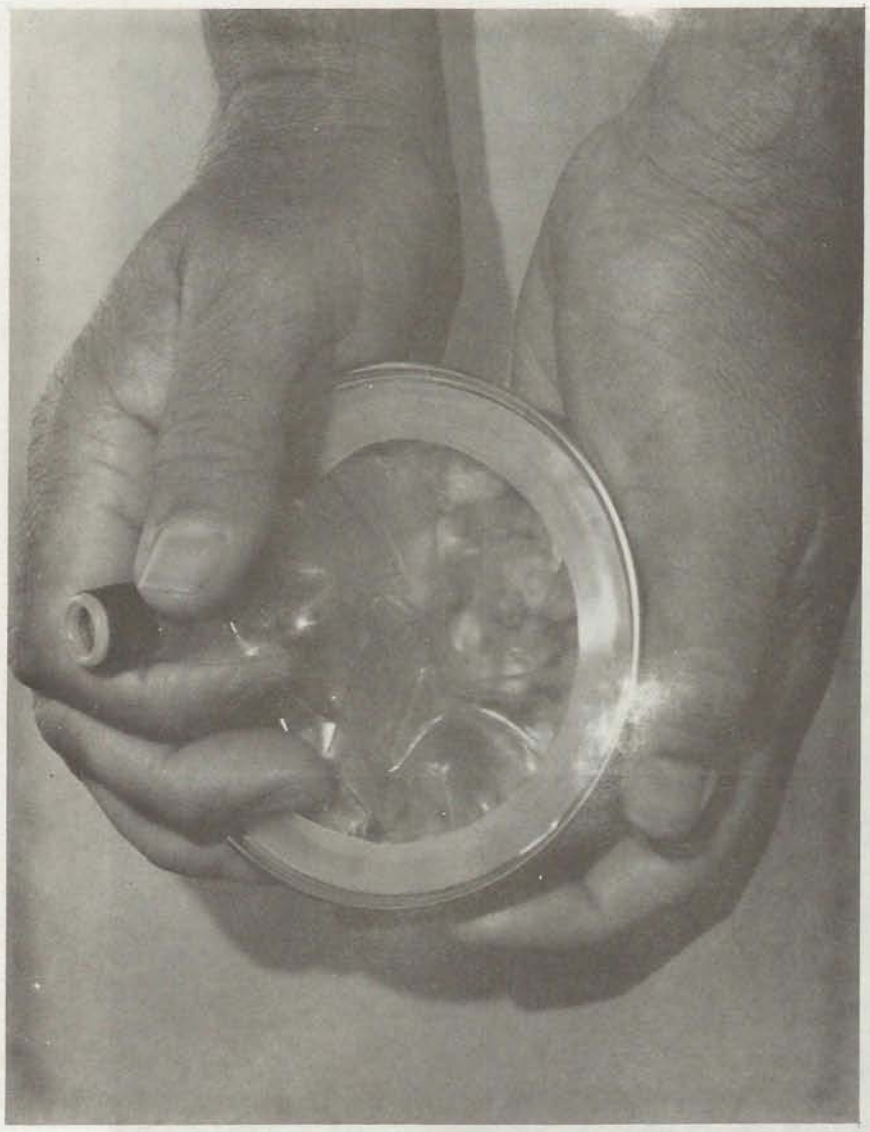

FIGURE 18: CONICAL FOOD BAG

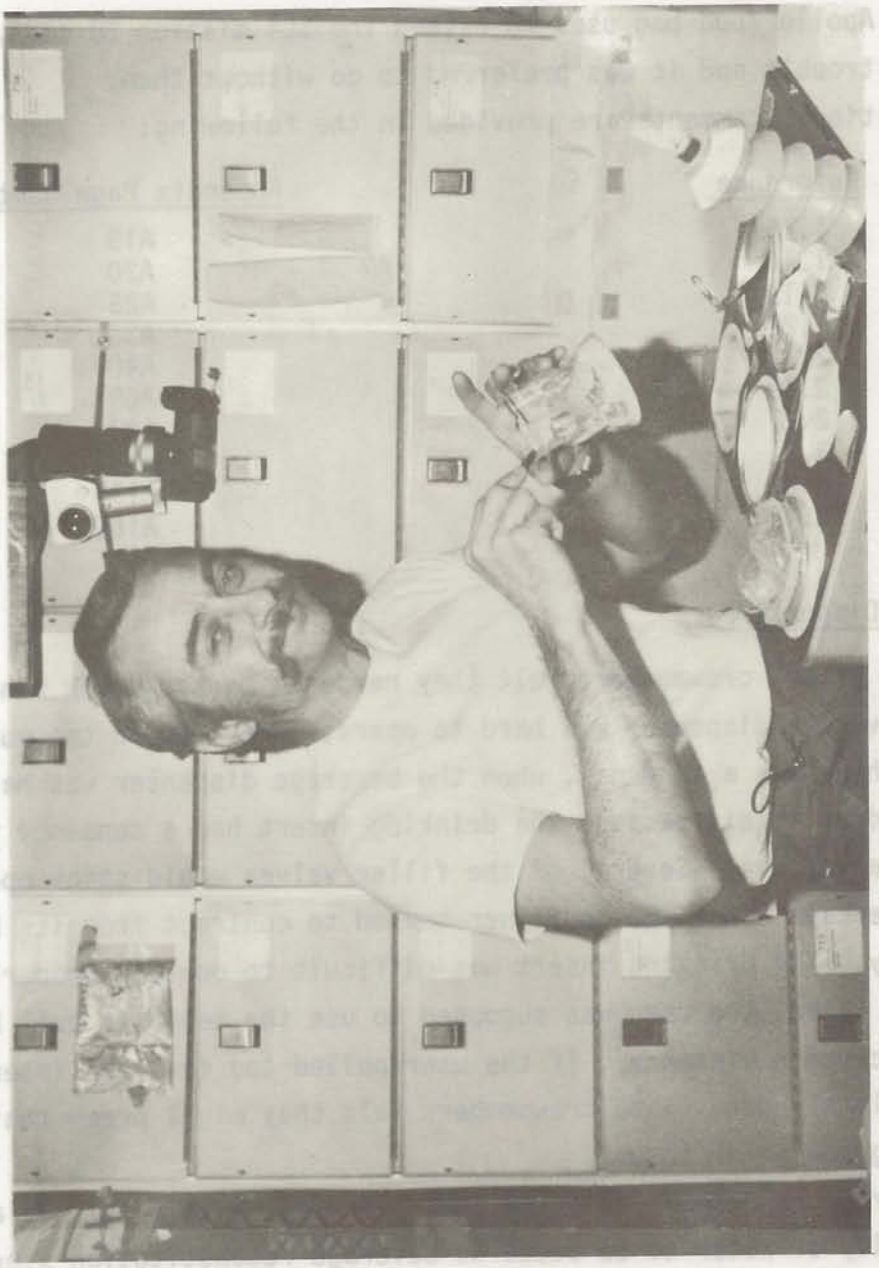

FIGURE 19: USE OF SPOONBOWL PACK

The spoonbowl packs (Figure 19) were not satisfactory because when they were rehydrated and kneaded, the fluid tended to seap through the zipper opening into the part to be cut. There would be an immediate mess when the bag was cut. Also the small Skylab spoons were not long enough to eat out of the wet pack without getting the fingers messy because the pack was about as long as the spoon.

The Apollo food bag used to extend the SL4 mission 28 days, was considered too much trouble and it was preferred to do without them.

Additional comments are provided in the following:

Reference	Appendix Page Number
1.15	A19
1.16	A20
1.19	A25
1.20	A36
2.1	A40
2.18	A69
2.27	A93
3.21	A133
3.22	A134
3.40	A166

Beverage Dispensers

Some of the crewmembers felt they needed a better drink container. The Skylab beverage dispenser was hard to operate and allowed too much air in the drink. There was a tendency, when the beverage dispenser was half full or less, to draw in air because the drinking insert had a tendency to keep the filling valve open. Several of the filler valves would stick open allowing drink to escape since the container tended to contract from its built-in elasticity. The drinking insert was difficult to operate properly. To close the drink valve, the user was supposed to use the teeth to pull back the insert a certain distance. If the user pulled too far, the insert would come completely out. Some crewmembers felt they might break their teeth when using the drink insert.

Several crewmembers remarked that 7-1/2 oz. (171.3 Kg) was a poor choice for quantity of water to be added to beverage reconstitution since the quantity selection on the reconstitution dispenser went to 6 oz. (137 Kg). It was suggested that the drink size should have been 8 oz. (182.7 Kg) instead of 7-1/2 oz. (171.3 Kg).

Poor reconstitution was noted for drinks such as the apple, cherry, and instant breakfast. The apple drink was one of the poorer performers requiring up to twelve hours for reconstitution.

Crew comments about the drink dispenser are provided in the following:

Reference	Appendix Page Number
1.4	A5
1.6	A7
1.8	A10
1.19	A26
2.2	A41
2.5	A45
2.9	A52
2.10	A57
2.26	A90
2.27	A91
2.30	A100
3.11	A118
3.14	A123

Condiment Dispensers

Food in general tended to be less tasty in zero gravity than on the ground. Because of this blandness, seasoning was very desirable. Finding an acceptable dispenser proved difficult. Several configurations were tried. These ranged from the salt and pepper packets (Figure 20) to plastic containers with the spices in suspension or liquid form. A procedure for dispensing the spices did evolve that seemed to work quite well. Using a plastic container with the spice in suspension, a bubble of spice would be squirted onto the back side of the spoon before the spice decided to back flow over the nozzle. The spoon was then used to spread the spice over the top of the food.

Additional comments about the seasoning dispenser are provided in the following:

Reference	Appendix Page Number
1.7	A8
1.8	A10
1.19	A28
1.20	A35
2.9	A54
2.10	A57

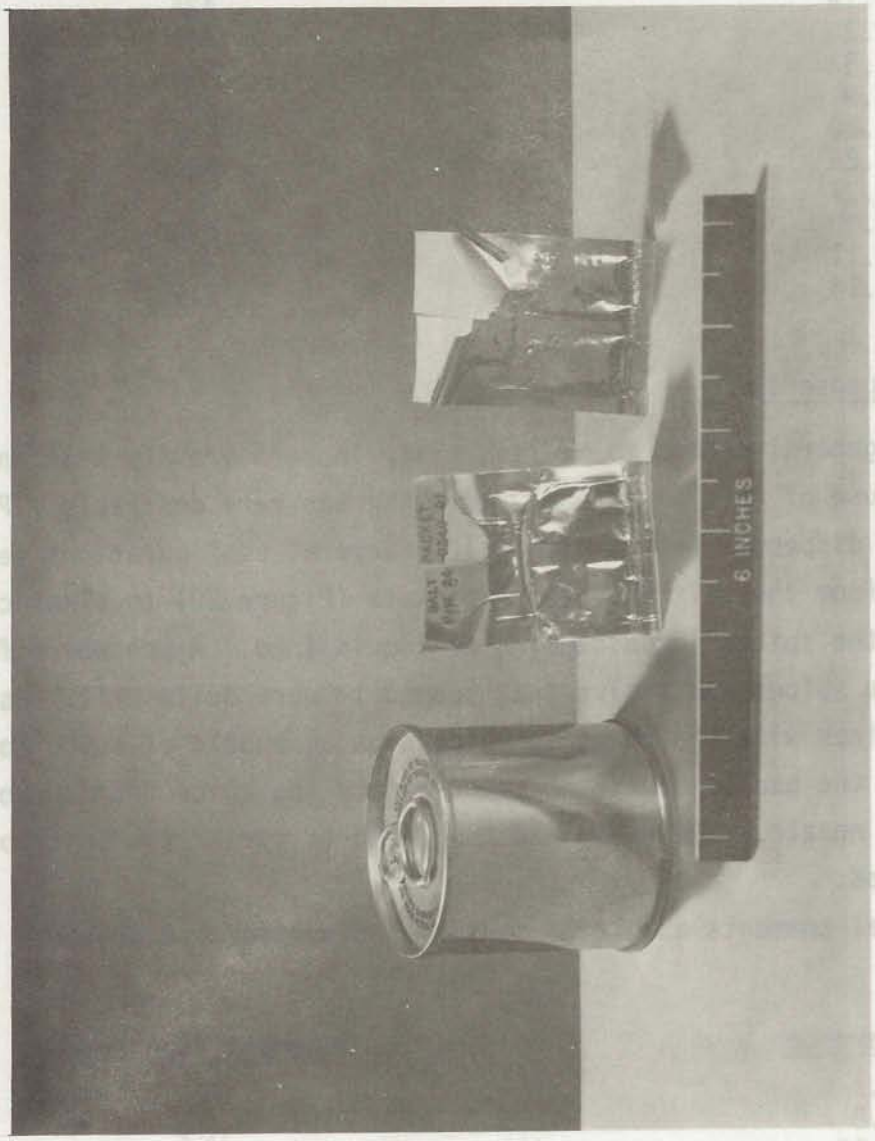

FIGURE 20: SALT PACKET

Reference	Appendix Page Number
2.11	A60
2.19	A74
2.26	A90
3.8	A111
3.10	A116
3.12	A119
3.14	A122

Wardroom Table

The wardroom table (Figure 21) performed adequately as an eating station. It also served as a desk for paperwork and a convenient meeting place.

The height of the wardroom table for supporting eating and office functions was judged a bit low as indicated in the following assessment by the SL4 CDR:

> "I've about done a 180 on my opinion of the food table. I said a little while ago that I thought the food table height was just fine. But after another month of hunching over the table to eat, I've decided that it's not such a hot deal after all; that really the food table ought to be about chest high, and that's about where you would work, too, if you wanted to use it for a desk." (Ref. 3.28)

Additionally, a light would have been desirable when using the table for office functions. A complaint voiced by several crewmembers was the location of the table interfering with the wardroom traffic pattern. If the SPT and CDR were eating, the PLT had to go over the top of the table or slide around the floor to get by. Also, the table was too close to the wall. This caused the trash bag hanging on the wall to get in the way. If the trash bag was located out of the way of the CDR, the PLT and SPT could not reach it. It was quite handy for the table to be close to the wall when reaching into the food drawers.

Additional comments concerning the wardroom table are provided in the following:

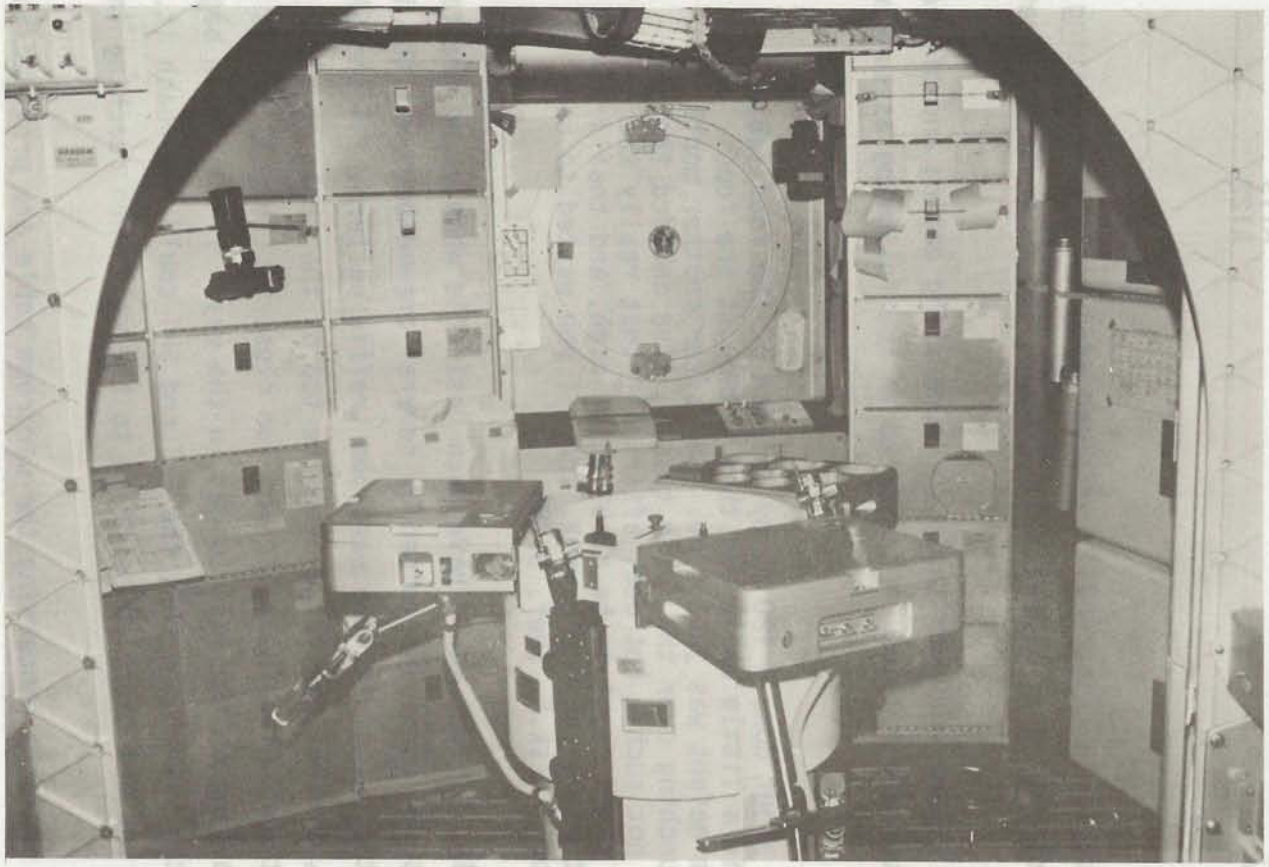

FIGURE 21: WARDROOM TABLE

Reference	Appendix Page Number
1.4	A4
1.6	A7
1.10	A13
1.12	A16
1.13	A17
2.9	A51
2.10	A56
3.28	A143
3.31	A146
3.32	A147
3.30	A161
3.41	A170

Drinking Water Dispenser

The drink dispenser was frequently referred to as an excellent piece of equipment. It was regarded as extremely convenient and easy to use. One dispenser for each crewmember made it quite easy to monitor fluid intake. All the crewmember had to do was log in his dispenser meter reading once a day. A suggestion made by several crewmembers was to increase the amount of rubber on the top of the dispenser to protect the user's teeth. Every once in a while a crewmember would hit his teeth with the water gun sufficiently hard to cause concern about the possibility of breaking a tooth. The SL4 PLT commented that the dispenser seemed unnecessarily large.

A problem frequently mentioned, though not attributable to the dispenser, was air in the water. The SL4 PLT stated that sometimes he would get a steady flow from the drink nozzle but at other times it would be almost frothy.

> "We do definitely have gas in the water because you can feel it in your mouth when you take a drink out of the drink gun." (Ref. 3.3)

Additional comments are provided in the following:

Reference	Appendix Page Number
1.3	A3
1.6	A7
1.8	A9
1.19	A30
2.9	A52
2.12	A62
3.5	A107
3.14	A121

Food Reconstitution Dispenser

The food reconstitution dispenser (Figure 22) worked very well although some kind of handhold to react against was needed. It was rather difficult to press down when adding water to rehydratables. Another design feature commented on was the six ounce maximum metering capability. It was suggested that the food reconstitution dispenser should dispense up to eight ounces since this is the maximum required for reconstitution of an individual food item.

Additional comments about the food reconstitution dispenser are provided in the following:

Reference	Appendix Page Number
1.6	A7
2.3	A43
2.9	A51
2.10	A56
3.11	A118
3.18	A129

Restraints

The wardroom table thigh restraints were not considered mandatory, although they seemed to work satisfactorily. The thigh restraints required concurrent use with the foot restraints for maximum usefulness. In addition to using the thigh restraints as designed, a convenient procedure was to hook the knees over the inner most of the two cross members and with light pressure on the toes against the table pedestal maintain body position.

Use of the triangular shoes for restraint at the wardroom table was preferred over use of the light duty foot restraints or the thigh restraints. However, there were not enough triangles underneath the table because much of the area had been used up by structures of various kinds. The SL4 crew increased the number of useable traingles under the table by removing the solid floor around the pedestal base. This greatly improved the foot restraint situation.

Comments on the light duty foot restraint ranged from adequate to unacceptable. The SL4 PLT provided a comment that is typical for the wardroom light duty foot restraint.

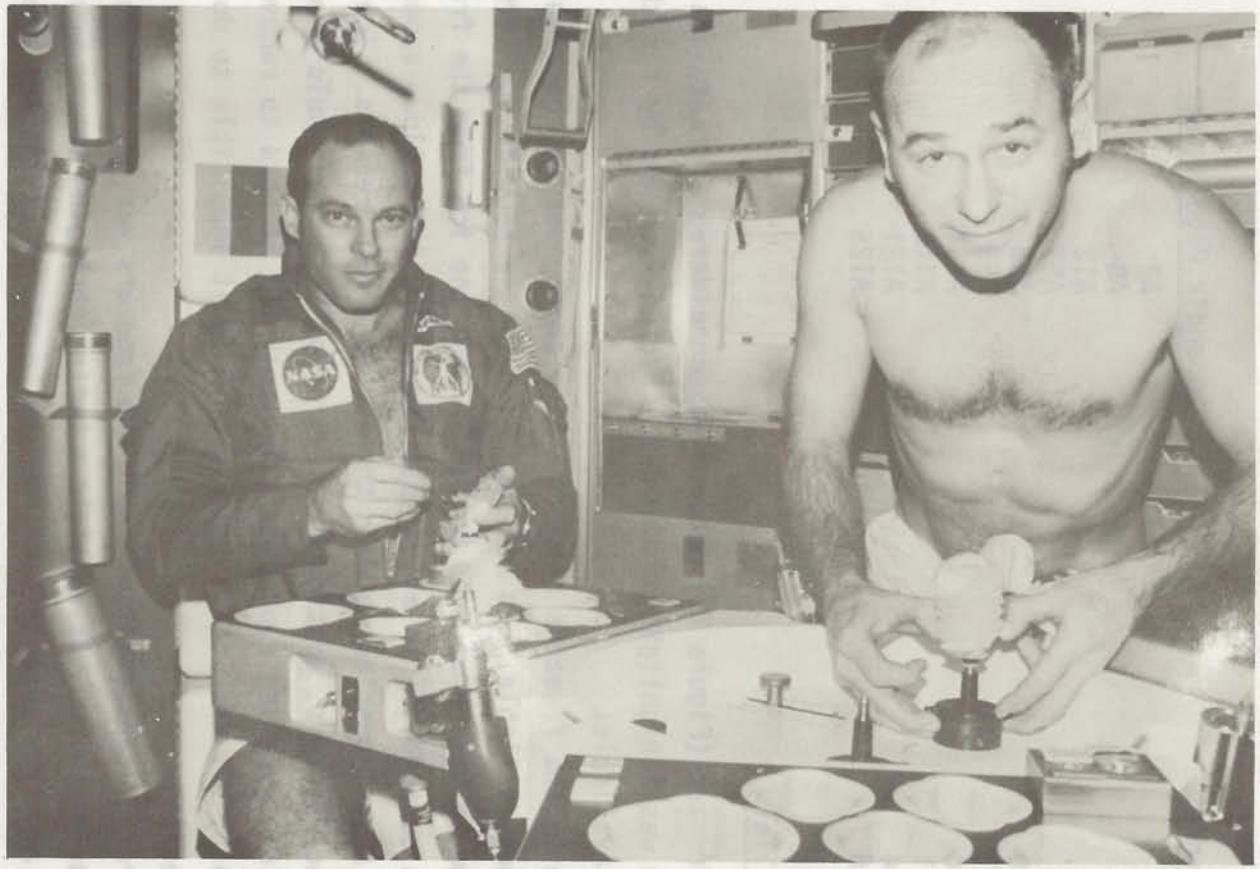

FIGURE 22: FOOD RECONSTITUTION DISPENSER

"Wardroom light-duty foot restraints are just like the head (restraints), they're unacceptable. They don't even serve the utility function for which they were designed." (Ref. 3.11)

The crew comments about the wardroom restraints are provided in the following:

Reference	Appendix Page Number
1.6	A7
1.8	A8
1.9	A12
2.9	A52
2.10	A56
2.11	A59
3.10	A114
3.11	A118
3.14	A121
3.16	A126

Freezer and Chiller

Having a freezer (Figure 23) onboard was considered a great idea because the frozen food was a highlight of the day. Frozen food was by far the most enjoyable food available.

Defrosting of the freezers proved to be a chore because the right kind of tools were not available. It was suggested that a regular ice scraper or a putty knife would have been much better in that the ice from the freezers could have been scraped off in a lot less time. The ice buildup appeared to be a result of a seal problem between the two wardroom freezers. Ice would form between the freezers, setting up an air flow path that would speed up the ice formation, creating a problem. Not only was it hard to remove the ice and the frost, but the little inner door made it impossible to do the best job of cleaning.

Another area of consideration about the freezers was the storage efficiency being very low. It was felt a better packaging scheme would permit as much as fifty percent more food to be stored within the freezer.

Moisture buildup in the chiller, which had to be wiped out occasionally, caused some concern. There were several tin cans in the chiller that rusted. The food chiller was not used exclusively for food. There were many things

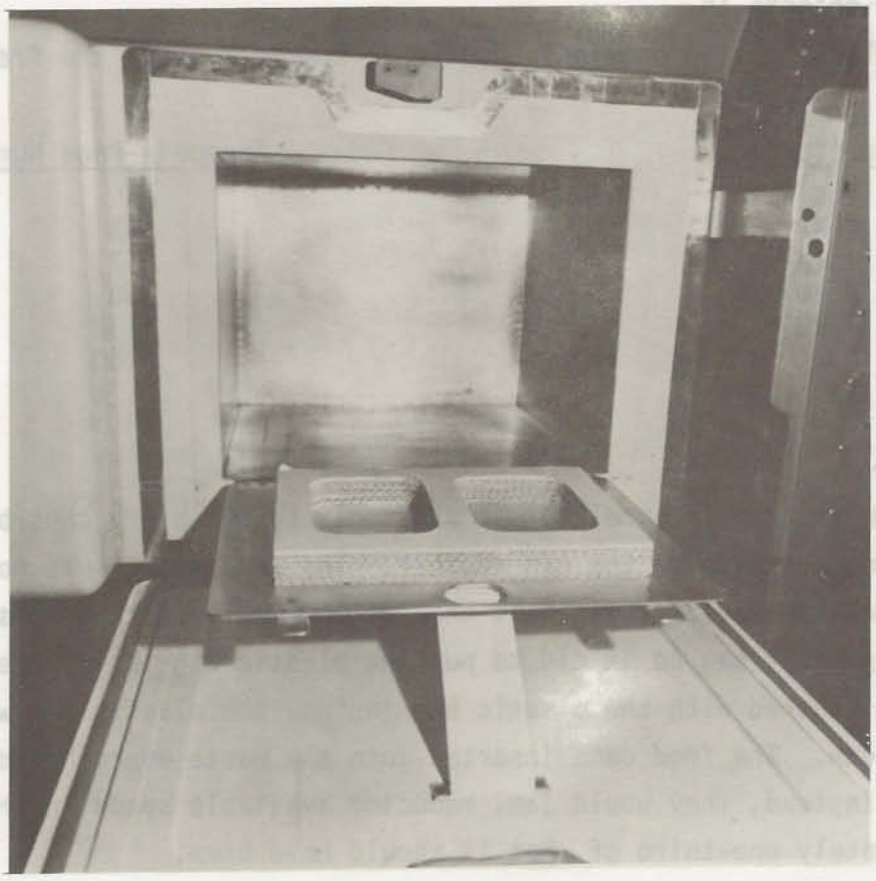

FIGURE 23: FOOD FREEZER

mixed in there, from penicillin to food cans to heat sinks. It was felt that the non-food items should have been in a different chiller. There was no restraint system inside the chiller either. The crewmember would open the door and put stuff in while trying to keep the other stuff from floating out. When a crewmember wanted to get something out, he had to pick what he was looking for from among all the other floating objects while trying to keep these other objects in.

The following list provides additional comments about the freezer and chiller:

Reference	Appendix Page Number
1.5	A6
2.3	A43
2.16	A67
2.20	A80
3.20	A132
3.34	A150

Can Crusher

The can crusher (Figure 24) was used only to crush dry cans because the moist cans made a mess in the can crusher. The can crusher was not used on a regular basis because it was felt that it took as much room to store a flat can in its plastic bag as it did to put the plastic bag inside the can. When the can was crushed with the plastic bag inside, the plastic bag would pop out of the can. The food cans inserted into the waste overcan did not all lie flat. Instead, they would jam, reducing available space in the overcan to approximately one-third of what it should have been.

Cleanup

Several problems associated with housekeeping chores within the wardroom were encountered. There was no handy place for the SL2 SPT to dispose of food trash. What he did was hang a disposal bag on the snaps between his station and the door. Another problem in the wardroom was the spattering of food. Some of the food spills went through the triangle grid floor and ceiling to end up who knows where. Food spills occurred quite frequently when cutting the membrane off the meat dishes after they had been heated up and the container had become pressurized. Some liquid spills occurred when shaking a drink

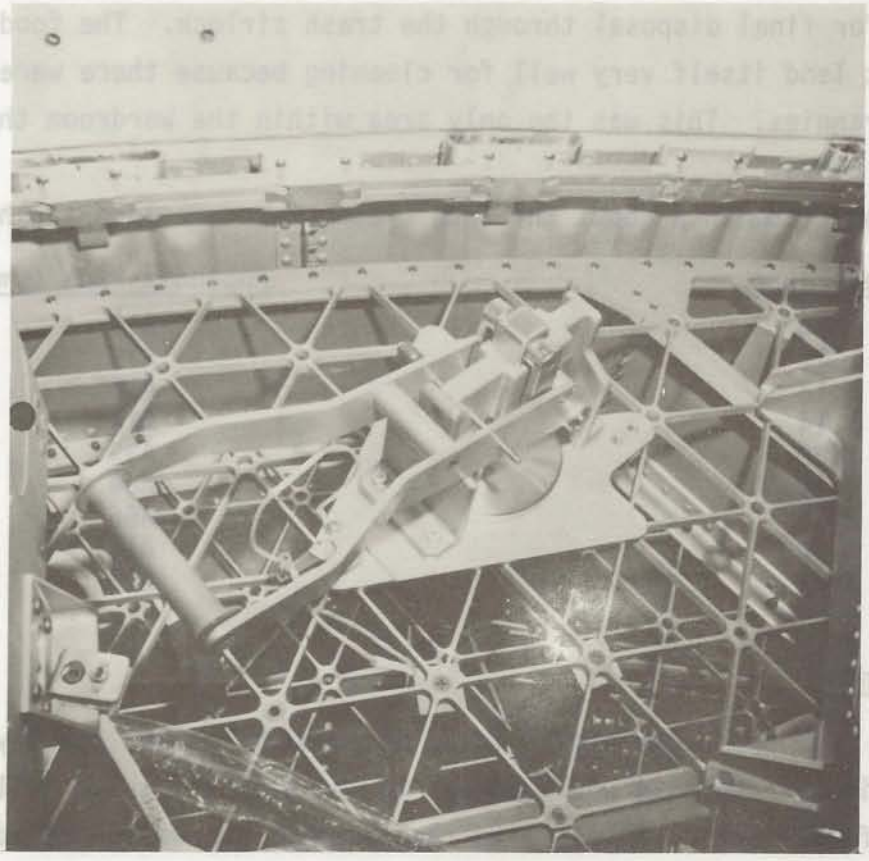

FIGURE 24: CAN CRUSHER

container during reconstitution. Whenever a spill occurred, the procedure was to immediately clean it up. The way the wardroom was cleaned up was to take a wet rag and scrub all the spots wherever they were found.

The crews developed a procedure for storage and disposal of the used food cans; as soon as the overcans in the waste food compartment area were full, they would be removed from the wells and a herringbone, used to restrain individual food cans, would be placed around the outside of each overcan. The six overcans were then inserted or emptied into four or five trash bags once a day for final disposal through the trash airlock. The food disposal area did not lend itself very well for cleaning because there were too many nooks and crannies. This was the only area within the wardroom that created undesirable odors.

Additional comments about the food cleanup are provided in the following:

Reference	Appendix Page Number
1.10	A13
1.11	A15
1.13	A17
1.14	A18
1.20	A39
2.14	A64
2.15	A66
3.40	A167
3.41	A171

Food Adherence

Eating from open cans proved to be no problem in zero gravity. Anything with water in its contents would adhere to the utensils quite well. There were a few foods that crumbled, like the sausage, and would not adhere. The SL2 CDR provided some comments that sum up eating from open containers in zero gravity:

> "Say, while we got you, we might comment a little bit about some of the new stuff we've run into today, like some of the food in the cans. I had stewed tomatoes for lunch. I'd be betting they would be real hard to handle up here, and it turned out that even as goopy as they are, they were real simple to handle, and the same way with the other less viscous materials that we've had on our lunch today, like the turkey and gravy, and the chicken and gravy." (Ref. 1.1)

Additional comments are provided in the following:

Reference	Appendix Page Number
1.1	A1
1.19	A25
3.9	A113
3.41	A169

Preparation

Most of the reconstituted foods needed several hours for reconstitution. Many of the crewmembers did not give the rehydration the time it required. In the words of the SL4 CDR:

> "Most of the time we rehydrated the food and ate it immediately whether it was prerehydrated or not. Sometimes your corn was a little crunchy or your veal was a tad crunchy or you found little pocket of powdered sauce in the spaghetti or veal that didn't get fully rehydrated. We just ate it anyway because we did not have time to fool with rehydrating early and putting it in the tray.
>
> For future rehydration, it looks to me like you probably ought to give up on this nicety of rehydration and letting it sit for half hour or two hours or something like that. You better start figuring right now if you are going to rehydrate food, it had better be instantly rehydratable in 5 or 7 minutes, then ready to eat." (Ref. 3.40)

In addition to the lengthy reconstitution time required, another problem was encountered with the rehydratables. Air in the water increased the volume of the food bag so much in many cases that the food tray lid could not be closed. This meant that the food could not be rehydrated and then heated and let sit in preparation for the next meal. This was unfortunate because many of the foods required long rehydration times to make them really palatable.

Crew comments about food adherence are provided in the following:

Reference	Appendix Page Number
1.9	A11
1.17	A21
1.19	A23
1.20	A33
2.19	A71

Reference	Appendix Page Number
2.22	A83
2.29	A98
3.33	A148
3.40	A164

Food Transfer

Too much time was spent handling the ambient and frozen food transfer. Each can had to be handled two or three times. The SL4 PLT suggested that instead of removing each individual can, the herringbone could have been used for transfer if it would have mated with the food drawers. This would have cut down on food transfer time considerably.

Menu

The SL4 CDR provided a comment that summarized the general opinion of the food:

> "We all agree that the food was good. There were areas where it could be improved. The frozen food was best and the thermostabilized food next best. We would certainly suggest that for extended missions, the rehydratables should be minimized." (Ref. 3.38)

Food in general tended to be less tasty inflight than preflight or postflight even though it was from the same lot. This dictates that the food should have a good taste before it is ever sent up.

Virtually every crewmember felt a wider range of menu choices should be made available. Allowances for changes in taste were desired. It was felt that a rather substantial pantry should be available so when a crewmember gets tired of eating certain foods, other foods would be available. If somebody is trying to keep track of a mineral balance, all that would be required is to report the menu change. The freedom to eat in a similar manner as a crewmember eats on the ground was considered a very strong requirement for the future.

The following references provide additional comments:

Reference	Appendix Page Number
1.15	A15
1.19	A28
1.20	A32
2.18	A69
3.25	A139
3.26	A141
3.27	A142
3.37	A156
3.38	A159

Food Storage

A pantry style storage system was desired versus the existing storage scheme (Figure 25) that had the food cans sequenced by meal. The existing system was fine until an item would come up missing from a particular menu, then it would have to be located or replaced from overage (Figure 26). Locating a particular food from overage proved to be quite difficult:

> "We finally had to spend quite a few manhours, I think about 5 to 6 manhours, in rearranging all the overage food in a pantry fashion so that it could be easily obtained when we need to come up and fill up a food bag for a high-density day." (Ref. 3.9)

The SL4 CDR suggested that in the future that meal storage should be used strictly for meals with the overage food stored separately, pantry style.

An additional item that caused concern was that an individual's food storage in the wardroom was inconvenient to his station at the wardroom table. Everybody had to climb over each other to get to one of the food lockers.

Crew comments are provided below:

Reference	Appendix Page Number
1.2	A2
1.19	A30
2.12	A62
2.19	A73
3.9	A112
3.23	A137
3.35	A153
3.37	A156

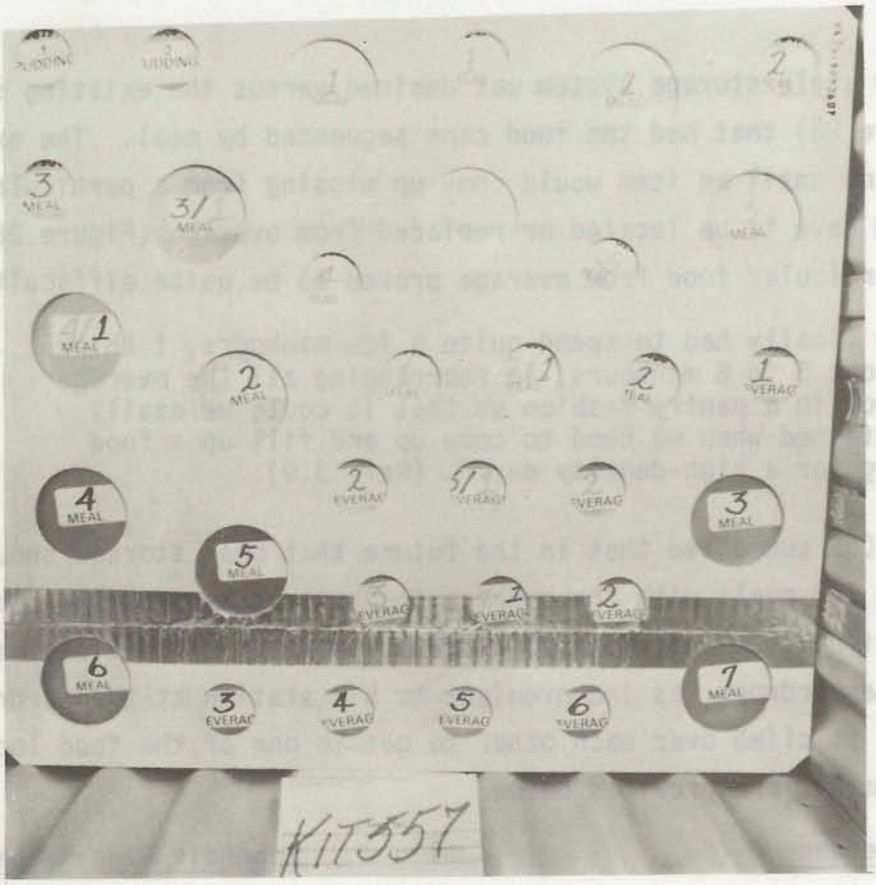

FIGURE 25: AMBIENT FOOD STORAGE

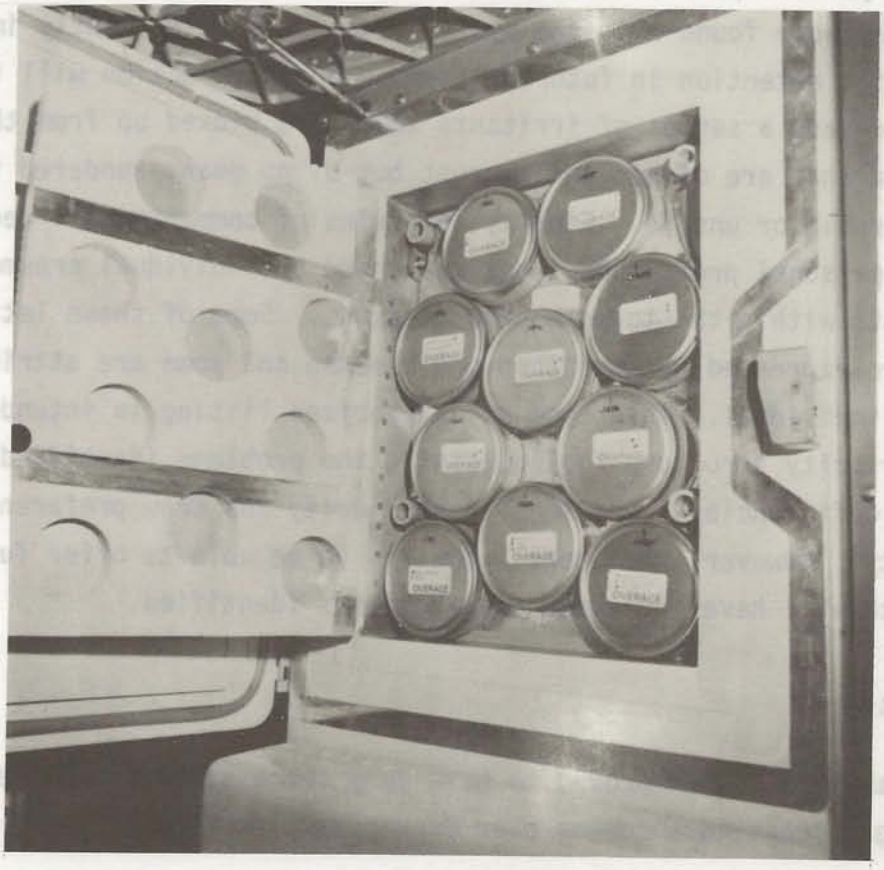

FIGURE 26: OVERAGE FOOD STORAGE

CONCLUSIONS/RECOMMENDATIONS

The conclusions and recommendations will be presented in several categories. First, an overall assessment of the food system will be presented with emphasis on specific points of interest. Next, a listing will be provided of faults that were found with the system which seem sufficiently important to merit design attention in future systems. Another section will follow which will address a series of irritants that were picked up from the inflight data that are of design interest but by no means rendered the system inoperable or unsafe. Finally, a series of comments will record some of the personal preference items expressed by individual crewmen at various points within the three manned missions. Some of these latter opinions were expressed by more than one crewman and some are attributable to only one individual. This type of categorized listing is intended to provide a priority structure for addressing the problems identified, with engineering deficiencies receiving first priority and crew preference items last priority. However, the overall goal is to be able to offer future designs which will have addressed all the items identified.

System Assessment

- The Skylab food system proved to be a very successful system, representing a significant advancement over previous space food systems.
- The food tray concept was well accepted and should be baselined for future missions.
- Eating from an open food container in a conventional manner was a pleasant experience. Retention of the food within the open container was quite satisfactory. The use of open food cans should be continued.
- The utensils worked nicely for transfer of all the moist foods from container to the mouth.

- Onboard frozen food storage facilities functioned quite well throughout the missions. The frozen foods were by far the most enjoyable.

- The water gun was regarded as an excellent piece of equipment.

- For the first time in manned space flight, food was heated by the direct application of conductive heat. The system performed very well.

Engineering Deficiencies

- The location of the wardroom table caused interference with room traffic patterns.

- The food reconstitution dispenser needed some kind of handhold to react against when pressing down on the dispenser to add water to rehydratables. Additionally, it should dispense up to 8 oz. (182.7 g) of water since this is the maximum amount required for any individual food item.

- The inflight transfer of ambient and frozen food to the galley required handling of the food two to three times.

- A restraint system is needed inside the food chiller to keep food items from floating out when the chiller door is opened.

- Cans with moist food made quite a mess in the can crusher. Only dry cans should be crushed if the Skylab can crusher configuration is used again.

Annoyances/Nuisances

- One category of beverage powder required up to twelve hours for reconstitution.

- Food and drink spills occurred frequently. Cleanup was not an easy chore because of the grid floor as well as other hard to get to spots. The use of a wet rag became standard cleanup procedure for food spills.

- Many of the rehydratable foods required lengthy reconstitution time. As a result, most crewmen ate the food without allowing sufficient time for complete rehydration.
- The pull tabs on the food cans failed on occasion by breaking off during opening of a can.
- Fluid would seep through the zipper opening of the spoonbowl pack during rehydration.

Crew Preference

- Food in general was less tasty in flight than on the ground and seasoning was therefore very desirable. This has been attributed to: change in taste perception, incomplete food rehydration, and high environmental temperatures in the OWS food storage lockers.
- Finding an acceptable seasoning dispenser proved to be difficult. The most acceptable method for dispensing seasoning was by using a plastic squeeze container with the seasoning in suspension or liquid form.
- The height of the wardroom table was a bit low. Future designs should have provisions for accommodating the anthropometric range of anticipated users.
- An ice scraper would be desirable in the future to make the chore of defrosting the freezer easier.
- Utensils were ineffective for retention of dry crumbly foods, therefore, these foods created a problem.
- Larger sized utensils would be desirable in the future.
- The food chiller should be used exclusively for food, rather than also serving as a temporary repository for transient items other than food.
- An additional amount of rubber on the water gun tip may be desirable to protect the user's teeth.

- A better beverage dispenser is needed. The Skylab beverage dispenser was difficult to operate and the drinking insert allowed air to flow into the drink package.

- The freedom to make menu changes and eat in a similar manner as a crew-member eats on the ground is considered a strong requirement for future missions.

- A pantry style food storage scheme is highly desirable versus preflight menu selection and storage by meal sequence.

- Air in the water supply was a factor in causing food bags to swell and in causing incomplete rehydration of some foods.

- A better beverage dispenser is needed. The Skylab beverage dispenser was difficult to operate and the drinking insert allowed air to flow into the drink package.

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RAW DATA APPENDIX

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REFERENCE	SOURCE	PAGE
2.8	SL3 Dump Tape 222 02 38 12/635	A-49
2.9	SL3 Dump Tape 223-06/7	A-51
2.10	SL3 Dump Tape 223-08/7	A-56
2.11	SL3 Dump Tape 227-02/3	A-59
2.12	SL3 Dump Tape 229-13/1	A-61
2.13	SL3 Dump Tape 229-13/3	A-63
2.14	SL3 Dump Tape 246-01/1	A-64
2.15	SL3 Dump Tape 253-01/13	A-66
2.16	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 5-9	A-67
2.17	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 5-70	A-68
2.18	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 5-13, 14	A-69
2.19	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 6-7	A-71
2.20	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 8-4	A-80
2.21	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 12-18, 19	A-81
2.22	SL3 Technical Crew Debriefing, October 4, 1973 JSC 08478, p. 14-2	A-83
2.23	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 14-3	A-84
2.24	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 14-8	A-88
2.25	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 16-4	A-89
2.26	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 23-9	A-90
2.27	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 23-10	A-91
2.28	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 23-15	A-96
2.29	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 23-16	A-97

REFERENCE	SOURCE	PAGE
2.30	SL3 Technical Crew Debriefing, October 4, 1973, JSC 08478, p. 23-18	A-99
3.1	SL4 Tag Tape 323-02/1	A-102
3.2	SL4 Tag Tape 323-04/2	A-103
3.3	SL4 Tag Tape 323-08/2	A-104
3.4	SL4 Tag Tape 324-02/3	A-106
3.5	SL4 Dump Tape 332-08/9	A-107
3.6	SL4 Dump Tape 332-08/10	A-108
3.7	SL4 Dump Tape 332-11/2	A-109
3.8	SL4 Dump Tape 332-11/7	A-111
3.9	SL4 Dump Tape 332-02/8	A-112
3.10	SL4 Dump Tape 338-02/8	A-114
3.11	SL4 Dump Tape 344-06/9	A-117
3.12	SL4 Dump Tape 344-06/11	A-119
3.13	SL4 Dump Tape 344-06/12	A-120
3.14	SL4 Dump Tape 344-06/22	A-121
3.15	SL4 Dump Tape 347-05/3	A-124
3.16	SL4 Dump Tape 347-05/5	A-126
3.17	SL4 Dump Tape 347-05/6	A-127
3.18	SL4 Dump Tape 347-11/3	A-129
3.19	SL4 Dump Tape 347-11/4	A-130
3.20	SL4 Dump Tape 347-11/6	A-132
3.21	SL4 Dump Tape 352-07/3	A-133
3.22	SL4 Dump Tape 356-05/5	A-134
3.23	SL4 Dump Tape 361-12/2	A-137
3.24	SL4 Dump Tape 361-12/3	A-138
3.25	SL4 Dump Tape 365-10/10	A-139
3.26	SL4 Dump Tape 002-08/7	A-141
3.27	SL4 Dump Tape 002-08/10	A-142
3.28	SL4 Dump Tape 007-11/3	A-143
3.29	SL4 Dump Tape 014-01/2	A-144
3.30	SL4 Dump Tape 014-01/3	A-145

REFERENCE	SOURCE		PAGE
3.31	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 5-16	A-146
3.32	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 5-41	A-147
3.33	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 6-17	A-148
3.34	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 12-29	A-150
3.35	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 12-42	A-153
3.36	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 12-55	A-155
3.37	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 14-1	A-156
3.38	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 14-137	A-159
3.39	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 14-139	A-161
3.40	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 23-3	A-162
3.41	SL4	System Debriefing, March 6-7, 1974, JSC 08833, p. 89	A-168
3.42	SL4	Technical Crew Debriefing, February 22, 1974, JSC 08809, p. 12-53	A-171
3.43	SL3	Corollary Experiments Debriefing, October 16, 1973, JSC 08482, p. 14	A-172

PLT Yes, I see them, but I don't think they are going to be in the way.

CC And, CDR; we've got about 40 seconds from LOS here. We're going to see you at Guam at 09:10.

CDR Guam at 09:10. Roger.

CC Roger.

22 10 42 CC Skylab, Houston. We're AOS at Guam for the next 12 minutes.

CDR Roger. Houston.

CC Skylab, Houston. On VHF, request you select omni Bravo.

CC Skylab, Houston. Request omni Bravo.

CC Skylab, Houston. We still have several minutes left in Guam pass. I think we dropped out because of a shading problem on the OWS. How do you read?

CDR Okay. We read you loud and clear, now. We wondered what happened to you.

CC Well, we just hid for a while, there.

CDR Boy, I've had some big things on my noses in space before, but this is by far the biggest. They sure beat the Agena or the LM.

CC (Laughter) Roger.

CDR Dinner's going pretty good, except Paul found another one of them tree trunks in the asparagus.

CC (Laughter) Roger.

CDR Say, while we got you, we might comment a little bit about some of the new stuff we've run into today, like - like some of the food in the cans. I had the stewed tomatoes for lunch. And, I'd be betting they would be real hard to handle up here, and it turned out that even as goopy as they are, they were real simple to handle, and the same way with the

Final
TAG Tape 148-11
Time: 18:09:54 to 19:21:50

SKYLAB AIR-TO-GROUND VOICE TRANSCRIPTION

18 09 54	CC	Skylab, Houston through Carnarvon for 8-1/2 minutes.
	CREW	...
18 17 42	CC	Skylab, Houston. One minute to LOS. Guam at 25.
	CDR	Say, Hank, did I remember you say we're going to have a trim burn today?
	CC	That's affirmative. It'll come after dinner tonight, Pete. A little after 01:00.
	CDR	A little after 01:00. Okay.
	CDR	Commander Weitz has just entered the waste management compartment to see if our new equipment is work - I mean, that's the most serious test to date.
	CC	Roger. Copy.
18 24 50	CC	Skylab, Houston through Guam, 6 minutes.
	CDR	Hi, Houston through Guam. As soon as we come out in the day side, can I inhibit momentum dump for this BMF decal?
	CC	Okay, stand by. I'll get an answer on that.
	CDR	Okay. Give me a time to do it.
	SPT	Houston, SPT.
	CC	Go ahead.
18 26 09	SPT	Rate of the temperature in the food locker 562 is 99-1/2 degrees. And what stations do you want this - the TV turned on over? Or shall I just leave it run?
	CC	We'd like to get it turned on at about 18 - or just prior to 18:48. Say about 18:45. That's about 20 minutes from now.
	SPT	I'll try and remember. If I don't, holler.

near it, is brackish - blackish mucus inside, and reddish with pink bubbles on top. It is thought to multiply and is said to be a combination of various bacteria. To date, samples collected have died before they could be analyzed. And for the sports news. Again the Indianapolis 500 was postponed until hopefully this morning. Rain is again expected, however; so race officials are cautious about whether the race will make its third starting date. And the Houston Astros lost to Pittsburg, 4 to 2 on Monday. And they lost last night to the Cubs, 7 to 1. The White Sox beat Cleveland twice Monday, 6 to 3 in 21 innings of the suspended game and 4 to nothing in the regular scheduled game. And that's all we have for this morning on the morning's news.

12 33 56 PLT Roger, Houston. It looks like a beautiful morning down there.

CC Great. I think you can probably see it better than we can in here. Flight Director tells me that it is magnificent out this morning. It looks like a good day for an EREP.

PLT We sure hope so. We can see from Matagorda all the the way on up to coast. How about scheduling another EREP pass to get the blob?

CC We'll work on it.

CDR Hey, Crip. I've got something for you.

CC Go.

CDR Our cold water drink dispenser is beginning to - leak just a little bit, so - in the systems handbook on page 4-81 has the procedures. There's no rush but obviously it's going to need to be changed out here on of these days, so how about noting it down to schedule it because it looks like it's a fairly lengthy procedure. I really don't want to take the time to look and see, but I remember doing it a long time ago and it's oozing just a little bit but it obviously has go a bad O-ring in it.

CC Roger. Could you say where its leaking at, Pete?

The portable foot restraint platform in the MDA: the CDR used it yesterday for an EREP run, and it appeared to work quite well. He said he was quite happy with it. The portable PGA foot restraints we have not used. Portable handholds: the only place we've really used them is in the vicinity of the bicycle ergometer, and we - were attempting to figure out how in heaven's name we can really ride that bicycle and get some work done in a fairly reasonable manner. Portable equipment restraints: you could never have too many of those, ... tethers, bungees, universal mounts. The one thing that you're always looking for in a vehicle and we never - there are never too many straps or Velcro - correction: not straps, snaps - never too many snaps or Velcro patches in the vehicle itself. The ATM seat/backrest restraint has been used. It's got the airline pipe belt on it, which is a necessity. Velcro just doesn't do the job in zero g for a belt. You look at the belt on the M131 chair, and it is practically negative, useless. The conical shoe cleats, we are still evaluating. They come in handy at times in that they are quick and easy to use relative to the triangles; however, the one drawback to them is that occasionally they get caught in the grid when you don't want them to. Let's see now. Waste management: I, as a new boy, and hearing horror stories from the old heads, have been ... deliriously surprised with the operation of the waste management equipment, the fecal collection and the urine collection both. The air stream on the fecal collection unit works quite well. You must - I have found personally that you must use the belt, and I must use the handhold and pull myself down on the seat to make sure you get a good seal. The better the seal you got around the lid of the seat, the better the equipment seems to work. The urine collection equipment: once we found out that it didn't work right unless you had a fecal bag in, otherwise you don't get enough suction to the urine receiver, works quite well. It is - it stays surprisingly clean, and after some 4 days of use, the urine receiver and hose has no odor, which I was concerned about prior to launch.

19 19 37 PLT

Okay. Pressing on to page 3-4, food management. The wardroom table is, as far as an eating station, is very nice. Just like training. The thigh restraints I use two ways: either as designed or I also hook

my knees over the innermost of the two crossmembers. I find that I personally don't use the footstraps at all. I just hook my knees over the thigh restraints and, with light pressure on the toes against the table pedestal, maintain myself in position there. So that covers the first three, I guess. The food reconstitution dispenser is - is good. Let me look at your definitions.

19 23 20 PLT

Okay, tape recorder. I find that for I don't know how long I've been holding the record switch up on this COMM box instead of the intercom box. Hopefully, (cough) I got the run down on work restraints. I got page 3-3 on there. I'll do page 3-4 over again. The wardroom table is convenient. It's - we've been using it just as we have in training. The thigh restraints I use two ways. One is to put my legs in in the ... method. The other is I hook my knees over the innermost of the two crossmembers and with light toe pressure against the work table pedestal, I maintain position that way. The foot restraint - for either the straps or the triangle fittings I haven't been using at all. Food reconstitution dispenser: those water dispensers need some kind of handhold in their vicinity.

19 24 16 PLT

It's fairly difficult to press down on it, especially a juice bag, which is filling and unpleating it's accordian style at the same time. I think we need some sort of small fingerhold not a handhold, right around those water dispensers. The water gun works, as I suppose you know, it's easy to use. It takes about three shots of water before you get chilled water, but that's all right. The food tray has worked out fine. The beverage dispensers are too small. Each accordian dispenser that you put in there for each accordian container we put in there seems to be around 1.05 times as big as the drawer's design. The drawers need to be about 10 percent bigger than they are. They're hard to open, hard to close, hard to get drinks in and out of. The freezing dispenser has worked fine. The eating utensils have worked fine. It is a necessity that they be held in place magnetically. The teaspoon, I still think, is too small. Although I have brought my large spoon down out of the command module. The miscellaneous column, the sleep restraint is extremely useful, versatile, and very good, I think. You can

CC We copy. That makes everyone happy.

PLT Yes. Unfortunately, the freezers aren't doing as well. We got a fairly good frost buildup around the seal line on the freezer doors; frost and ice.

CC Copy that.

13 05 15 PLT Hey, also, Bill, I see on that teleprinter they wanted to finish the conversation I was having with you yesterday when the fire alarm went off. What I was saying about the doors is we always had discussions before I mentioned compression walking and about access panels and walls, as it were. And some people opted for large round holes because you would be moving about head first. Well, it's not so; and I don't know, I still feel there's a fair amount of the - the carryover of one-g training in your attitude in here. But we finally translate from place to place essentially in an erect position; erect or semisitting. These doors are - are really just what you want, even in zero g.

CC Copy that. The one-g carryover works pretty well in zero g.

13 06 05 PLT Yes. Yes, you don't go head first. You push off, and if it's convenient, you go head first; if it's convenient, you go feet first; but most of the time we just move forward or laterally.

CC Copy that. Thank you, Paul.

13 06 30 CDR Houston -

13 06 34 CDR Houston, be advised that I got M151 set up including the high intensity light so we'll have that on 183 today.

13 06 42 CC Copy that, Pete.

CDR You all owe me one. I got up 10 minutes early.

CC (Laughter) Copy again, Pete.

13 06 56 PLT Okay, Bill. On message 0809 Foxtrot from yesterday were some questions; and question number 3 referred to S052, which I'll answer if everybody's ready.

Final
Dump Tape 154-03
Time: 13:44:09 to 14:18:19

14 02 17	SPT	Okay, channel B, we're back to food management equipment now. The wardroom table, the eating station is fine, except for the comments on the foot restraints, which are of the same type as the head foot restraints, which are inadequate. The thigh restraints do their job, but require foot restraints along with them in order to be maximally useful. And the option exists of hooking the mushroom into a triangle. We do that sometimes. Again, there aren't enough triangles underneath these various working stations, in particular, in the wardroom, because so much of the area has been used up by structures of various kinds. So the idea of having a slip-in foot restraint there is good, but we need a better kind.
14 03 06	CC	... Hawaii at 14:14.
	CDR	Roger.
	SPT	Okay, food reconstitution dispenser, no problems, really. You need a little something to react aginst when you're pushing the food down into the water dispenser. Generally, you either brace yourself with your thigh restraints or you put one hand on the edge of - of the food table and pull at that while you push down with the other hand. The water gun is just fine. It's an excellent piece of equipment. The food tray is okay, except that the friction set should be spring clamped or something of that sort, so that it can tolerate food cans and, in particular, drink containers of a wider dispersion of sizes. A very common event is for a small food tray - small food can or drink container to just go wandering off, because it doesn't stick in the friction sets. Aside from that, it's a fine thing. The food cans are okay, with the split-the-seam proviso. The beverage dispensers have a couple of drawbacks. They are adequate; they are doing the job. But aside from the failure-type things, such as valves that leak air backwards and seam failures that we've had, none of which, by the way has been catastrophic, the problem with the beverage dispensers is that the tendency, when they are half full or less, is for them to suck air. And the nozzle you have to flip into the top in order to drink has a tendency to stay in place and allow them to suck air, which gives you a mixture of half beverage

and half air, and that's not good. Okay, seasoning dispensers - I don't use the salt much. It tends to bounce off the food a lot. It doesn't taste very good. I think that needs work. The eating utensils are fine. The sleep restraint, I think, is an excellent thing. The only improvement I would make to it at all is to put an additional elastic strap lower down. You wouldn't have to use it if you didn't want to, but I think it would be handy. The trash airlock: so far, so good. It's easy to use, with the exeption of closing and locking the doors is almost a two-man job, because of the forces required to compress the seal. Its reliability, of course, remains to be seen. The vacuum cleaner, fortunately, I haven't had to use. I have never liked it. I don't think it sucks enough, but I haven't used it on the flight. And the wardroom table for non-eating uses. The only non-eating use that I've put it to, aside from just sitting there reading pads, is making notes, and it's quite adequate for making notes. You don't need a flat surface. So all you need is the restraint - something to lean your elbows on so you can exert pressure with your pencil. And that's it for 487-3.

14 18 07 SPT Fire alarm. I think we learned our lesson on that. I really do. ... - -

14 18 10 CDR Hello, friendly B channel, this is the CDR, S183 at 14:18:00 - -

14 18 15 CC Okay, Joe, ... have a look at it.

14 18 18 SPT Thank you.

14 18 19 CDR Sequence 1 of the pad star fields - make it star field 252, Plate 06 and 07 were taken on time and then star field 301 was completed at 14:18 per pad. That's the end of this night's session on S183.

END OF TAPE

I think, excellently placed, but leave a lot to be desired, in that the strap over the foot restraint, which is made again out of that fireproof, not-very-strong material, is a pain in the neck. And it hangs up the CDR's urine drawer going in and out all the time. And they are difficult to fit. They don't hold well because of the excessive amount of plastic material, whatever it is. However, when you do get your feet in them, especially in front of the window, or using the mirror when you're shaving, washing your hands or anything, I find them quite adequate and ... very well, and they are excellently placed.

16 45 13 CDR The drying stations work all right. The towels have a tendency to float out into the work area. Due to the air flow, we have found ... does an excellent job. The shower worked very well, but it took longer than expected. The amount of water is adequate. It sprayed the water on and it's very good. The only thing is the amount of time it takes to dry it up afterwards, and that takes a fair amount of time. There could be improvements to the water container and that ... on the back side of where the controls are. It is difficult to fill and maintain a ... bring it around and back to the other side but these are all minor, and the shower works ... operate every day, make you feel very good. And other than the fact that it takes a little while to glop up the water, I think it's very good.

16 46 20 CDR The wardroom table - it's adequate as to the area ... off-duty rather than anyplace else. Thigh restraints worked very well. However, I think that the wardroom light-duty foot restraints and they - give them very poor again, because I can't use them because they're flat on the floor and the material is too stiff - it's hard to get your feet in them, and therefore most of the time, if I should have my triangular shoes on, I lock into the triangles. Next one. The water gun works very well. We have have no trouble with the water gun. The food trays are excellent. We had no

trouble with the food cans. The beverage dispensers again leave a little something to be desired. Putting them on the reconstitution valve and doing all those good things with the little nozzle flopping around and ... are really not too - not too satisfactory. The water had air in it. There's no doubt about it that everyone of the drinks full of air bubbles and ... caution if you have air bubbles ... drink it right ... air bubbles ...

CDR Yes, the salt squirts out okay, if you like liquid salt. (Yawn) And it's better than no salt at all. They are a kind of a pain in the neck. You pull open, and I prefer cutting because when you pull them open there's no telling which way they're going to spray. When they're cut open they spray fairly uniformly ... The eating utensils are fine, although I find that I can use both a bigger fork and a bigger spoon ... three Skylab-sized knife, fork, and spoon set.

16 48 16 CDR The sleep restraint, I think works very well. Again, I think there could be more improvements to it if they would have ... the materials that hold you against the back more solid rather than the three straps. I think this would be an improvement, but the basic idea of being able to hold yourself against the back with a strap has worked very well. The only thing that I've left, and I don't really care for is I don't like ... my head (yawn) so I usually slide down far enough in the shaft to put my head next to the - underneath part of the pillow or on the side of the pillow that faces towards my feet and move back up so ... so that the side of the pillow holds my head back in towards my body, and I sleep in all four positions ... my right side, left side, back, and roll all over the way over facing the ...

CDR ...

for ground comm, they've been terrible because of the feedback. We always had it in one g, 15 psi. In the chamber out at St. Louis in the MDA, we didn't have much feedback and things looked pretty rosy then. But here you're continually going around and Houston calls and you answer, and it squeals and you've got to go down and turn down another volume.

22 42 45 CDR Part of that problem is very specific. If you don't - we use the box in the wardroom mainly, and if you turn on the box in the experiment compartment here, you've got to run over ... by the M131 chair it seems that's the wardroom one. By the same token, they've changed the wardroom one ... to cure the SAL airlock boxes, and so we have to continually leave those off; and if you're working in SAL and another guy's in the wardroom and you're both trying to talk to Houston, then you're really in trouble.

22 43 23 SPT How satisfactory are the food management and dining accommodations? How well does the food adhere to the utensils when eating? Would a closer tray-to-mouth proximity have improved eating ease? ... first ...

PLT I think that the constraints at the food table could be improved. Particularly the foot part of it.

22 43 45 CDR I always - you know what I always ...

PLT I think the basic idea of going to the family style is good. There are small inconveniences in the wardroom where people have to climb all over each other to get at the trash box or the stowage locker for dirty cans, for the wetwipes, for the meal trays. But that kind of thing is not the basic feasibility of the design. It's just a little efficiency expertism [?] in the layout.

PLT Yes my wife ...

SPT Yes. And the wardroom window is worth it's weight in the spacecraft. It's terrific.

CDR The one thing that we asked most, though - and this is a chronic problem - ... but to this day nobody has successfully got the gas, whatever gas it is, out of the water. We have problems rehydrating our food right now, especially with the hot water. When we

rehydrate the bags, fill them all the way up - we opened the seal inside on the food fold bag so that the food's already up ... you go to cut it, and that makes that too difficult to handle. It makes getting the food difficult to handle, and it blows the bag up. Now - -

22 45 20 SPT Yes, I think what's partially ... the matter ... pushed a button and left the dehydrated food more and more like the ... It's a better variety of food product [?].

22 45 33 CDR Yes. ... But even so, it would be nice to jab the gas out of the water first. If you drink - -

SPT Oh, it would be great for that. Although a lot of the - to me a lot of the trouble involved is making it real dehydrated.

CDR Yes. I agree.

22 45 52 PLT Following that layout I think - I think it's a bad idea to have the head right next to the sleeping compartment, expecially with the layout we have, with the urine separators and the blower in the common bulkhead between the two. If somebody gets up at night and has to go to the bathroom, and you turn on the separator and the blower, and it's - you tend to wake up people that are sleeping.

SPT What safety problems have arisen that are directly related to habitability?

PLT None.

SC ...

SPT (Laughter) What unanticipated problems have occured in performing various activation, housekeeping, or experiment activities to date? Are there any common difficulties that can be traced to inadequacies of design, onboard provisions, or preflight preparations?

CDR I think the answer to that question is a very general answer. I think we were pleasantly surprised to

Final
Dump Tape 159-12
Time: 21:14:41 to 22:38:15

21 14 41 CDR Hi, there, friendly B channel. This is the CDR on day 159. The time is 21:15, and I would like to give you M487-3 Bravo, starting on page 3-6 of the Evaluation Experiments Checklist. I would like to start out by talking about the wardroom and using your guidelines. Overall I - I rate the wardroom very good. The general arrangements, the orientation of the compartments are basically very good. What - Well, I'll get to it. Basically, they are very good. The volume of the compartment is adequate.

21 15 46 SPT Okay, back to M171 for a minute. The percent O_2 post-run is 72.13. It changes with time. The percent H_2O is 5.64, dropping 5.57, 5.51, for instance. The percent CO_2 is 1.97, 1.96, 1.97. That one's fairly stable. Okay, it's yours, Pete.

21 16 18 CDR Okay, we're back with M487-3 Bravo. The volume of the wardroom is adequate. Ceiling and floor proximity are fine. There is no problem there. Ingress and egress are all right, but it could be a little bit better. The PLT's location in the corner - If everybody is eating, he has to either go over the top of the table or slide around the floor to get by the CDR or the SPT. And the trash collection provisions leave something to be desired. Now let me say that where the trash bag ... are located, one guys has to ... quite a ways to get to the trash bags, and - namely, the CDR. If you put the trash bag behind him where there is a location, then the other two guys can't reach it at all. So, we could do a little bit better on trash collection. And the other thing is the wet trash, where we can ... wet trash in the can - the can holder area, that tends to get a little dirty in there, and we have to keep after it - cleaning it. And I'll have some more comments about that in a minute. The stowage volume and access is all right, except the tray that holds the pudding doesn't really hold the pudding adequately. The ... trays for the SPT and the PLT are too close together, and they hang up in one another all the time because the - the ... knobs that are between the two sometimes stick out, either up or down, between the trays, and hang in the lower or upper tray. The food stowage is basically all pretty good, and it could probably by spread out a little bit better with respect to ...

21 18 32 SPT ...

CDR And it doesn't ... very well. Now the personnel mobility aids we don't - excuse me, temporary equipment restraints basically work well. We don't have too much trouble anyway. Other than that, the personnel mobility aids are - those don't really apply in the wardroom. You don't need any anywhere for that matter. You can ... yourself anywhere you want in the vehicle. The personnel restraint devices work fairly well except for the - the foot straps which are basically a good idea, but the material they're made from makes them very difficult to operate. Thermal comfort has been good. Noise level is extremely low, and the illumination is good. And, of course, we enjoy very much the wardroom window ... us a good view of the Earth and the stars at night. And it's very pleasant.

21 19 35 CDR One of the problems in the wardroom is keeping it clean. We have the grid floor. We have the grid above, and we have many little perturbances that - lockers that have little old locker doors on top of them with the wet wipes and so forth. And there are certain foods that are very difficult to handle, and you just can't help but have a little bit of water - a little bit of food - liquid food get away from you. And these settle on these various places of the grid, and so forth. And it's very, very difficult to clean the wardroom. So, in future design, I would suggest that we go to some arrangement - wall, ceiling, and cabinet structure - that is basically easier to clean, at the same time bearing in mind the location of the various cabinets and their functions with respect to the people that are using that room.

21 20 31 CDR So much for the wardroom. The waste management compartment I think basically is, again, very good. The general arrangement and orientation of the compartment are fairly good. The location of the compartment next to the sleep compartment is not good because the blower runs. You can hear in the sleep compartments and so forth. So, it is just the location. The volume is fine. (Yawn) ... really doesn't bother us any. Ingress/egress is okay. The trash collection is all right, but yet the - A little improvement in trash collection - I would think that especially the wet

Final
Dump Tape 159-12
Time: 21:14:41 to 22:38:15

21 33 41 SPT Friendly tape recorder, this is the SPT at 21:33 with a M487-3 Bravo, starting with evaluations of the various compartments. The wardroom: General arrangement is pretty good. I have some nit picks, being the SPT, that I do not have a handy place to put food trash - with a ... of my side of the vehicle - of the room. What we're doing is hanging a disposal bag on the snaps between my seat and the door, which serves - and also serves for the food and the shower bags and whatever else is around. There is - there do tend to be some bottlenecks in the food area in both obtaining one's food and disposing of cans. However, I think it was a good job for the amount of room involved.

21 34 39 SPT The wardroom window is outstanding. Its size is very good. Certainly let's not make them any smaller. Its field of view is also excellent. I understand that's partly coincidence, on account of the meteoroid shield being missing. I think it would have been a shame if we'd had the smaller field of view. And the other thing about the wardroom, of course, is that, since we eat there, we spatter a great deal. And either the food is going to have to be better engineered to make it more spatter-proof and/or the room in which the eating occurs is going to have to be made relatively spatter-tight and easily cleanable. All right. Continuing that, the volume, as I said, is marginal. The ceiling/floor proximity is good. Ingress/egress provisions are good. We need the large opening. We rarely to never use the curtain across it. Trash collection I've already covered. Stowage volume is okay. Access - it's fine except for mealtime. Temporary equipment restraints - we're using a lot of bungees spread on the little holes between the locker doors. This is okay; however, the bungees tend to slip off and - something similar but with a little better restraint and the elasticity incorporated would be good.

21 36 11 SPT I don't understand what personnel mobility aids are. Personnel restraint devices - since I don't wear my triangle shoes with triangles on them, I can't use the little triangles at the base. And I prefer to have something I can use the mushrooms with. The thigh restraints are okay. I have a feeling that something better will - will ultimately be developed, but they are convenient to get in and out of. Thermal comfort and noise level are excellent. Illumination is low as it is pretty much throughout the ship.

Final
Dump Tape 159-13
Time: 23:00:03 to 00:00:58

23 00 03 CDR Hello, there, friendly B channel. It's your old CDR with the Evening Status Report for day 159. Are you ready for this? Alfa: CDR, 155; SPT, 100; PLT fell down on the job today, 210. Bravo: CDR, 4010; SPT, 7218; PLT, 3670. Charlie: CDR, 6.074, 6.071, 6.069; SPT, 6.641, 6.641, 6.639; PLT, 6.793, 6.795 and 6.790. Delta: for the CDR, it's a 2/20/2400, 1/05/0250; for the SPT it's a 2/17/2300; the PLT did an M092/171 today, so he didn't have any. Echo: Echo for the CDR is a none; for the SPT, a none; and PLT is a none. That's the end of the Evening Status Report. Good evening to you.

23 47 56 PLT Hello, B channel. This is the PLT with his comments on M487-3 Bravo. Evaluating compartments was first: habitability parameters. Talk about the wardroom first. General arrangement and orientation is - was adequate, I guess. That is, it's adequate from an arrangement standpoint. Stand by. It's adequate from an arrangement standpoint. It's good for an orientation, it's in a good place. It's centrally located as kind of the living area down there. The arrangement is too close - the eating table is too close to the wall. Now it's handy to be close when you're trying to reach into food drawers and such, but the SPT can't ... his food drawers directly, anyway. If you hang any trash bags on the wall, which is a requirement, then they get in the way. Other than that it's pretty good; it just needs to be a little bigger, and I guess that's the .... Which is the next one? Now I've confused the two, let me think about it. Oh, on arrangement. Then I guess I'd say that the eating table is pushed too far to the refrigerator and a replen down there. The ... floor proximity is good. Ingress/egress positions not special, except the large door, which is good. As I mentioned previously in another comment to the ground, the - the large doors - the one-g type doors shape and size is - is good in zero g because you don't move around head first you move around in an - essentially in a vertical position. You just push off and you go scooting around either vertical or semi-sitting. Very good. Trash collection, I mentioned the trash bags previously. There are some wet, dry trash in there, but they're only behind the PLT. Consequently, he's the only guy that uses them. Other people keep their own trash bags - disposal bags

position in there, for relaxation, rather than the one that you assume when you're in zero-g, you relax. You can move your legs, or arch your back, or do something with it, and - and it will stay there, because of the straps, and I find that much more comfortable, than free floating in the bag.

02 08 09 SPT What non-eating instruments have been ... to the wardroom table? Would a design modification of the table and its associated restraints be desirable for any or all uses?

PLT As far as I know, the only other use we've found for the wardroom table, we've not had the cover back on the center part of the table, the water dispenser at all. I have, on occasion put the cover on my tray ... usually, we've taken to leaving the covers off. I have on occasion put the cover on my tray and used it as a desk.

SPT ... serves as well for a desk as it does for a table.

02 08 45 PLT Yes, I think if - if we're looking at the ideal world, and we wanted a desk, you'd want a larger flat area with things on it, with a light, a good light. And things on it to hold a number of papers and pencils down while you're using it. You know, you want your checklist there and your notebook there and you'd want someplace so that - so you wouldn't have to hold your hand on it all the time, which is a problem I have when I'm writing notes, or copying something at this wardroom table.

SPT Pete, you got any comments?

CDR Yes ...

SPT What sanitation problems have developed, and how have you dealt with them? The only problems we've had, has been the spattering of food in the wardroom and we've dealt with them by assiduous and frequent cleaning.

PLT Right.

SPT What is the most disconcerting personal hygiene problem you have encountered?

Final
Dump Tape 160-01
Time: 01:04:45 to 02:16:00

PLT Like my partner's breath.

02 09 41 SPT I was going to say my partner's odor from the other end of his body. (Laughter)

02 09 47 CDR Actually, I haven't really encountered any problems.

PLT No, we really haven't.

SPT No, it's very good.

PLT No ... seen too many ... think it would be the hardware. How much ...

02 10 01 SPT I look at this kind of like - like camping out. I mean if you went to a camp ... You got to keep the place in good shape, you got to keep the deck swept, the walls cleaned out, the windows clean. We do the same thing here.

PLT The only thing is, I think, you don't - you don't clean windows, and wipe down the walls, and vacuum clean the ... really without ...

SPT The hardware's been adequate. The only thing that I just asked the ground for today - something to clean the windows with.

PLT You take pictures ... one window, and really it's hard to keep it clean enough. You need some kind of solvent to cut the grease off the windows.

CDR ...

SPT I agree. I think we need better detergents all around. We've got water, and we've got biocide to wipe down with. They design what we holler for. We need the water ...

CDR I think we should have, in the wardroom ... solid ceiling and pay a little bit more attention to making all the walls smoother, because I don't think in zero-g, no matter how we design the food, we're going to prevent splattering.

PLT ... 99 ...

Final
Dump Tape 166-12
Time: 16:29:12 to 17:25:46

16 29 12 CDR M171, on the CDR. The CAL N_2, O_2, CO_2 bottle pressure is 1559. Stowage folks, the cutter pliers which were formally located in toolbox drawer 2 Delta are with us no longer. The CDR attempted to cut the spheres off of the M553 wheel. One of the jaws on the cutter pliers snapped right off. The remaining useless handles have been thrown out. That's all.

16 30 58 SPT For the food people. The chili has been the most troublesome dish in the whole menu from the standpoint of mess. When the chili is heated, it pressurizes and apparently vaporizes under the surface. But its texture never changes until you open the cellophane top, at which time it explodes and great cubettes and gobbets of chili go flying all over and it's bad news (music). It's so bad that we've decided that the next and last time we have chili on the menu, which is on day 28, and we've already cleaned up and are in the process of deactivating, we can't afford that kind of nonsense. So we're going to substitute filets from the frozen overage, for the chili and you can make your menu calculations accordingly. End of message.

16 32 10 CDR (Music) - TM people, during the building block - the JOP 3 performance, following our plan today, the S055 was left in MECHANICAL REFERENCE - and inadvertently, and we ran the whole thing in MECHANICAl, for what that's worth. End of message.

16 32 50 CDR Okay, tape recorder. The CAL N_2, H_2O bottle pressure is 1556. And the MS SAMPLE INLET GAS PRESSURE is 5.033. (Laughter) The oxygen concentration is 73.65. The percent water is 3.16. (Laughter) The percent CO_2 is 2.19, and if that doesn't add up to 100 percent, it's not surprising. (Laughter)

16 41 11 CDR Now the new MS SAMPLE INLET PRESSURE is 5.034.

17 12 46 SPT CO_2 is 1. - 2.01; water is 4.44; and oxygen is 72.46.

17 25 46 SPT I need a lawyer, a mouthpiece. All right, this is the SPT, with the debriefing questions to the M131-2. Question number 1, I don't think the answer has

Final
Dump Tape 167-04
Time: 11:24:51 to 11:37:04

11 24 51 PLT Hello, friendly tape recorder; it's the PLT with the 47-3 this day, evaluating the frequency of use. Okay, starting with the jacket; used it almost daily. You got to keep in mind we're in a little off - nominal situation, although we're basically nominal, that is, with MDA heaters on. There was a span of about 2 or 3 days ago which - the middle of which was about 3 days ago. The span of 2 or 3 days, the middle of which was about 3 days ago, then which MDA was warm enough that the jacket was not required. However, there was before that, and as it is now, we're - have the MDA heaters off in order to help keep the workshop temperatures down. Therefore, it is warm in the workshop and chilly in the MDA, and a jacket is an extremely useful item. The IV boots, I prefer them - much prefer them to the triangle shoes, and wear them every day at every opportunity, but I do not require the triangle shoes. The IV gloves I have only worn one time, and that was on our initial entry into the hot, hot workshop when we were handling the extensions on the sail. I have not used them since. The bump hat has not been out of its locker. The pillow on the sleep restraint; sometimes I used it and sometimes I don't; I haven't really decided. Blankets, I have not used at all. The light baffle I have not put up, since I have not been sleeping in my sleep compartment; same with the privacy curtain. Penlight is used almost every day and carried at all times. Scissors is used every day, is kept at the meal table and that's where it's used - mostly, almost exclusively, is used for opening food packages, and also for trimming the teleprinter messages. The tool caddie was used during activation. I found it fairly handy at the time; it has not been used since. I don't miss it. The portable fan - we have used the portable fan. It goes along with the - my time estimates on when the MDA heaters were on. When the workshop was cool at low Beta angles, we took it down for 3 or 4 days; it is now back up. We have one portable fan mounted in the workshop dome opening, directing warm workshop air onto the OWS heat exchanger inlet. We have used the portable fan each time. The tape player, we could not get by without it. We used the one in the wardroom, although not as much as we did in training. The one that gets used the most, by me, is the one that we have - one of the sleep restraint tape players that we've plugged

Final
Dump Tape 167-12
Time: 13:52:26 to 14:15:58

14 13 34 PLT The drying stations are - are excellent, yet they have not taken as much of a set from keeping things in them as we've seen in the trainer, and they're an excellent idea. The shower: we now have three showers under our belt. It's very good. It's a long process of almost 45 minutes by the time you get in until you get out due to getting up the water. If there only were a better way, of which I have no suggestions, for to gather up the water, it'd be much more enjoyable. As it is right now, you wash and then it takes you another 20 or 30 minutes to get the water off yourself and out of the shower.

14 14 16 PLT Food management: The wardroom table - Nothing's changed. My evaluation of it for the thigh restraint or their light-duty foot - foot restraint. Food reconstitution dispensers: I mentioned my only comments on it previously. The water gun is fine; the food tray is all right. The food cans: I've got no complaints on them, except for the thermal stabilized items. That cellophane diaphragm, or whatever it's made of, is the worst part of the whole system. When you cut it off, you've got this sloppy mess that the fluids and the food sticks to. When you tear the last bit off, it's like cracking the whip, and bits and pieces of - of food go out - go flying all over the room. It's a messy thing. The beverage dispensers are all right. The seasoning dispensers are all right. The pudding drawer, for whatever reason, does not hold the cans in. It is very much an annoyance to continually have to be restowing cans in the pudding drawer. The eating utensils are fine. In miscellaneous: the ... restraint is all right. The trash airlock is fine. The vacuum cleaner is fine. And the wardroom table for non-eating uses - Except I think I said this before; we really need a brightly - a brighter light. I think that each crewman ought to have his own directional light like a small desk high-intensity lamp so you can read and write by it.

14 15 56 PLT That's all the comments for now. Thank you.

END OF TAPE

Final
Dump Tape 171-01
Time: 07:52:17 to 08:33:22

07 52 17 SPT Good morning, B channel. Are you ready for about your last PRD daily readings? The commander is 44134; the SPT, 18188; and the PLT, 06215.

08 24 23 SPT Hello, B channel. This is for experiment M110. And these are the serial numbers on the little blood sample vials: CDR's is 12, the PLT's is 7, and the SPT's is number 5. End of message.

08 33 22 SPT B channel, for the food people, the SPT this morning has had his first can failure. On opening the top of the can, the ham had oozed out from its little niche. It was pale and runny and smelled bad. And I threw it away. End of message.

END OF TAPE

WEITZ (CONT'D) clogged. By visual inspection, you couldn't see anything wrong with it. We disposed of it, put the new filter in and the whole system worked fine from then on. On fecal collection, my only comment would be that I would like to see a more pliable sealing device between the unit and the man. In other words, you had to get in the right attitude and you had to exert a considerable force in the proper direction to make a good seal around the edges of the seat. I would like to see a little more pliable and flexible so that you didn't have to direct a great deal of your attention to maintaining contact.

The largest single irritating factor in the food inflight was the membrane across the top of the thermostabilized food. We wound up heating the thermostabilized food in the can with the metal lid secure to avoid any ruptures that may occur during the heating. On the meats, in particular, when you take the metal lid off, the diaphragm would be tight as a drum. You could actually almost play a tune on it. It felt like metal, it was so tight. You then came up with the problem of piercing this membrane to relieve the pressure inside it, which we wound up doing by covering the whole lid with a wipe, a couple of tissues, which resulted in the loss - not significant, but enough to be messy amount - of the fluid from within the can.

WEITZ (CONT'D) Then came the onerous task of removing this stinking membrane from the can, which you wound up cutting around the edge or trying to, but it always seemed that you got to that last half inch or so trying to separate the membrane from the edge of the can and the juices just collected on it. They would wind up being a fairly large glob where the membrane connected to the can. When you separated it from the can, you flipped juice all over the place, beef juice, peach juice, whatever it was. Everybody complained about it. It is not the way to go, unless you make that membrane such that it is much easier to remove some way.

KERWIN I think a key point in there is that we did want to remove the membrane more or less completely. We found that once we'd done that, the food was rather easy to eat in most cases. The only problem I remember having was with the big chunks of meat. As you cut them, preparatory to eating them bite by bite, the chunks that were left over would tend to float out of the can, if you weren't careful. I'm trying to make a positive design point, that you can eat food from cans with the whole top open in zero g. I thought preflight that the way to go might be just to cut a slit or an X in the membrane, and ease the food out through that.

WEITZ | The X or slit method didn't work. It would have been worse, because it flipped liquid every time you took a spoonful. The edges of the membrane where you cut it would spawn droplets outward. That's why we would remove the whole membrane.

KERWIN | The foods were very edible. Any thing that stays together the least amount is easy to eat that way in zero g. It's a nice way to go. We used that method with the rehydratable foods also by cutting large sections of the top of those inner bags off so that we had free access to the food.

WEITZ | I cut as much off as I could.

KERWIN | As much as you can. You kind of squeeze it down sometimes and you get a little bit of food in the cone that you cut off the top, but it's not a problem. The problem with rehydratables is primarily related to air in the water, whether it be air or steam. It's worse with hot water, so there's probably a certain amount of water vapor involved. It increases the volume of the bag so much when you rehydrate it that in many cases you couldn't get the tray lid back on. That meant that you could not rehydrate the food and then heat it, and let it sit in preparation for the next meal. That's unfortunate because many of those foods require long rehydration times to make them really palatible, things like the spaghetti, the macaroni.

WEITZ | All the vegetables.

KERWIN | All the vegetables, yes. Asparagus, beans, corn - you can't rehydrate those things. Even the potatoes, you'd wind up with layers of powdered potato around the bottom corners of the can that you really couldn't get with simple mashing, particularly because it's hard to mash those things when they're taut with gas. They'd balloon up like little Chinese pyramids if you'd get the water in them. That's a packaging problem that should be resolved for the future. Another packaging problem was that the spoonbowl packs did not work out well. When you rehydrate those and then knead them a little bit to mix them, the fluid tended to seep through the zipper opening into the place where you had to cut. When you cut, you immediately had a mess. You'd have messy scissors and messy fingers and messy napkins and whatever else. A mess and some loss of food were unavoidable. We were disappointed in the spoonbowl packs. I think that anything but a very thin soup would probably have been edible out of an open top bowl, if you devise a better method than the membrane to give access to them.

The drinks. We had some leaks along seams, in both drinks and rehydratables. I had a couple of nozzle failures in the drinks where the nozzle would stick open and spurt drink out as the

KERWIN (CONT'D)

container tended to contract from its built-in elasticity. The other problem I had with the drinks was that little insert that you had to put into the nozzle and then push forward with your teeth to get the drink out. When you let go of that thing, you were supposed to pull back on it to close the flap again. That was hard to do. You had to pull back just the right amount to close the flap, but not too much or it would come completely out and then you'd have to reset it again. The upshot of it was that you'd either let go with your teeth and the drink would keep on coming out because you hadn't pulled it far enough, or you'd get air into the drink. Then the next mouthful would be 90 percent air and 10 percent drink. We wound up swallowing a lot of air in the drinks. We need a better drink container.

The other outstanding problem that I remember - the crackers are terribly crummy and you get a lot of dry crumbs around. They tend to break when you take them out of the package and they crumble. The biscuits, yes. Those are mechanical problems.

Palatability - the outstanding poor performers were the vegetables. I'm trying to think of an exception. The only exception we had were the tomatoes, which were pretty good. The rehydratable vegetables were uniformly crummy. They were bad

KERWIN (CONT'D)

tasting, they were bad in texture, part of that was a rehydration problem, part of it was poor selection. The asparagus tended to be very chewy.

Food in general tends to be more tasteless up there than it is on the ground. And it's the same food. We all noticed postflight, that the food tastes better and has more taste, even though it's from the same lot and out of the same can, than it does in flight. That says that the food should be properly seasoned and should have good definite taste to it before you ever send it up. This food didn't have much taste, and what it did seemed to be wrong. I had one other vegetable that tasted pretty good to me and that was sweet potatoes. I don't think the other guys had any. Since we were on a standard diet that we were pretty well forced to consume, we wound up at almost every meal with one or two items that we had to hold our nose and fight our way through to get to those items that were good, like the frozen foods, and the drinks. That's something that definitely ought to be fixed. I would certainly like to see for the last Skylab mission considerable flexibility on the part of the crew in selecting some of the things like vegetables out of overage. I think that acceptance of deviations from rigid mineral tolerances, we ought to be able to

KERWIN (CONT'D)

make those by that time. We ought simply to assure that the crew is getting enough of the essential nutrients, including vitamins, in a day's meal, and that the people on the ground keep track of that. One mistake that all of us, including myself, made preflight was not to pay enough attention to the vitamin content of the food. We were assured by the food people that the foods had enough vitamins in them. That is true, provided (a) that you eat everything in your particular menu with no deviation and (b) that the food is not subjected to heat stress. In retrospect, it's a great shame that we didn't have vitamin pills up there as supplements. And it's a shame in the period in which the workshop was in thermal difficulties that immediate attention wasn't paid to the very obvious fact that some of the vitamins are not thermostable. I don't know how much, if any, damage this did to our physiology during flight, but it certainly was an oversight. Fortunately, the estimated inflight caloric levels were pretty good for the three of us. We did not tend to leave a lot of food unconsumed once we were in the saddle up there. By the same token, we did not tend to need a lot of food over and above our diets. We existed on gray tape and butter cookies and made out okay. I still think that with the upcoming crew

KERWIN (CONT'D)

you may have some problems with people who aren't eating all their diets everyday or with people who are demanding more food than their menu calls for. Certainly in the future, particularly for palatability and in part for nutrition, we ought to be feeding the individuals what their body tells them they need in flight, rather than a standard diet from which deviations are very difficult to make. Taking the supplements was no problem. I will say this, that the ground turnover of our dietary information and their supplement instructions were well done. They were prompt, the format was reasonably easy to follow, the pills were reasonably easy to take and that did not present a problem.

Our fluid intake didn't present a problem. The water guns are extremely convenient. They're easy to use. The fact that you have one gun for each crewman and all you have to do is log the water once a day makes it easy. The fact that there are some calorie-free drinks on board, if you want to take something that tastes better than water, is a good thing. The apple drink takes 12 hours to reconstitute. That's not a good one. The other drinks were okay.

I guess we ought to mention that in the future the wardroom should be so arranged that an individual's food stowage is

KERWIN (CONT'D)

convenient to his seat and place in the wardroom rather than everybody having to climb over each other in order to get to one locker.

M074. We talked about it in connection with the feces mass measurement. We did very little mass measurement with food because we tended either not to eat an item at all or to consume virtually all of it. I mean within the limits of packaging. As far as I am concerned, the procedures for mass measuring food were never really spelled out as to the number of napkins you ought to use and it didn't bother me because I went that whole flight without ever mass measuring the partly consumed items.

M092. Stowage: We could cover that for 92, 93, and 171 also. The leg bands had rather complicated stowage inserts. They were not convenient to use and tended to get the line tangled up. In some cases it was hard to close the drawer after you put the leg bands back. The rest of the stowage for those experiments was okay.

The setup for the experiments was reasonable. The checklist was excellent. The operation of the experiments was pretty much the same way we did it during training. As far as noise

KERWIN That gets back to this point. There are items in that menu that are not palatable, that are not well designed. We talked about which ones they are. I'd like to see the on-going crews given more lattitude to substitute for those items.

CONRAD Yes, that goes in the difference noticable and food inflight versus preflight. I think we have to be extremely careful between changes to food because of the "eat" versus our change in taste. Having never eaten a preflight diet before, I would like to say that the foods that I did not like on the ground I countinued not to like in the air. I choked them down though most of the time. Then some foods turned up that I really didn't like in flight that were a lot better on the ground. Again, I can't say for sure if it was because they were heated or desensitivity of the taste buds, or what up there. A good example was the chili, and I think that was a heat factor. We all agreed that the chili got greasy, had big globs of grease in it, and I think it was due to the heat. We all got to where we didn't like the chili.

WEITZ There was a notable differente in the fact that everything is flatter.

KERWIN Taste and smell were dulled up there for some reason.

CONRAD Therefore, you tend to like the zippy foods.

WEITZ | The ones that were tolerable on the ground became less tolerable in flight, because of that reason. That kind of ties into the next one, the change in food preference. The foods I liked, I continued to like. The foods I didn't like, my dislike for them increased, primarily the reconstitutable vegetables I disliked them more and more as the flight progressed.

KERWIN | You didn't like the bread.

WEITZ | I really didn't like it, but I didn't dislike it as much as you did.

CONRAD | We have a couple comments on that. One of them was when we were restricted on the use of our heater. I think that one of the mistakes that we made was not letting some of that food reconstitute long enough and that added to the bad taste of it. I found out that if I reconstituted the peas, the beans, and the asparagus early, and then reheated them, I still didn't like them, but they were a lot easier to choke down than when I added the hot water, shook up the bag and then tried to get them down. They didn't reconstitute as well. There were several foods, the macaroni was another one, that needed to be reconstituted and let set. Spagetti and meat sauce was another.

WEITZ	Most of the reconstituted foods, other than soups and potatoes, needed several hours of reconstituting. Chicken and rice is an example. You can tell by looking. The portions were still acceptable in flight.
CONRAD	I got it all down, but I still think there were too many fruits. On the ground as well as in the air, there are too many pineapples, few too many peaches and things for me.
KERWIN	I felt the same way Pete did, both in preflight and inflight. Put this down as personal preference. You have different sized stomachs and appetites. The system doesn't accommodate for those right now. I think the most acceptable foods were by and large the frozen foods.
CONRAD	Yes, I support that.
WEITZ	They were foods you liked before.
KERWIN	Skylab not to the contrary, they were great.
CONRAD	And I guess the favorite amongst us all was not a frozen food. It was German potato salad.'
KERWIN	Unfortunately, we used up all the overage in the vehicle, all four cans. I don't know if there's any room at all in Al's command module for food, but if there is they ought to look at

KERWIN (CONT'D)	some of these tastier items that can be substituted for some of the poorer items.
WEITZ	You know what made the potato salad, it was a little zingy. It had just a little taste of vinegar and onion.
CONRAD	The bacon was almost too sharp on the ground, too salty, but we really looked forward to it.
KERWIN	We're eating a hospital diet. It's a bland diet, and it gets worse up there.
CONRAD	I think one thing we enjoyed in flight was the sausage, more so than on the ground and, again, it had some zing to it.
	Now Food Preparation and Consumption. We've talked about the rehydration, but we have not mentioned the gas. Now, I think the gas was probably too cold. I think there was some in the packages, and I still think there was some in the water.
KERWIN	Yes, there was some in the water, and there was some water vapor that came out when you used hot water. It was worse with the hot water, than with the cold.
CONRAD	We deliberately took some films of bags that were filled with hot water, that expanded them to their fullest.

CONRAD (CONT'D) When we got to the reconstituting, rehydratable hot food early we would have to let the air out of the package. We would have to go to the trouble to let the air out of the package so that we could put it back into the can and put the lid on. An example was the fruit tray.

KERWIN Yes, you would have to let the air out of it, and that was not a terribly easy thing to do. In many cases we walked by and Pete's tray lid would be popped off, because he was heating some food in there, and it was too big for the slot. It was hard to get the tray on top of it. Something that was interesting to me was, when you reconstituted one of those rehydratable foods and it wound up with a lot of gas in it, it was a pyramid shaped package, with a big flat bottom, and a cone-shaped top. The air would pretty much concentrate in the top or cone-shaped part of the package. Now, that can't be gravity, so it must have to do with surface tension and the shape of the package. That's a point to keep in mind for future design, because you can make air concentrate. You got more surface tension around the sharp radius corners, where the food stuck in the bottom. That was lucky because it made it possible to cut the top off the packages, without losing a lot of food.

KERWIN (CONT'D) The food temperature was good. The only thing along that line was, of course, that we could not heat our coffee. You had to put it in with hot water and then you had to drink it quick before it cooled off. It was certainly hot enough to start with. But those drink containers did not lend themselves to sipping a drink, and drinking over a period of 5 or 10 minutes, as you ordinarily do with a cup of coffee, because they tended to suck back air. They also cooled off very rapidly, and were a little bit difficult to drink out of. I think we need a better drink package for the future. We all thought that the water was reasonably good.

CONRAD Yes, I was never really aware of any iodine taste or anything like that in it.

KERWIN Use of the spoon-bowl package. We've already commented that the spoon-bowl package, was not fully satisfactory, because the food would leak through the zipper, up into the part you would have to cut. Which made it messy to open the package.

CONRAD Yes, this was due to that expansion again.

KERWIN Yes, the gas would form in there and this would force the food right on up.

Use of spoons. Super! Once you have negotiated the top off your package, and once you've gotten rid of that messy membrane

KERWIN (CONT'D) that is in the nonrehydratables, the fruits, meat, and so on, it was great. The food sticks to the spoon and it was easy to get.

Opening the cans. We had very few failures of the little pop tops. We had about two I would say in the whole flight. Nobody cut themselves on sharp edges. We did have a problem getting the membranes out, because they were messy, they would spawn big globules of juice up toward the ceiling and on the walls, and on you and everything else.

CONRAD Mainly, that was on the hot foods, though. It wasn't so bad on the fruit.

KERWIN No, it wasn't under pressure, and the fluid was a little thicker, and it wouldn't spawn so much, but it's potentially there. Opening of cans. Consumption from cans is very easy; consumption from the rehydratable packages can be very difficult. The liquid particularly sticks to the creases and the folds in that rather thick, heavy plastic, and you can't get all of it out.

Food Waste Stowage. Function of the Germicidal Tablet Pouch.

CONRAD We never used it..

KERWIN There were some germicidal tablets in the command module. People, we confess we never used them. We got rid of that trash quick enough, that we didn't have to.

CONRAD I resealed it over in the big plastic packages and we transferred that the next day, and it was gone out the trash air lock.

KERWIN Undesirable Odors. I think we already debriefed on this. The only time we got them from food, was in the garbage can slots, and from food sticking to the lids in them.

WEITZ I never smelled it.

KERWIN Fecal Container. Had we not debriefed the fecal container. If they mean the big black rubber bag, that works okay.

KERWIN You need it on reentry, and you might or might not need it on launch. It's fine. I debriefed on the urine system.

CONRAD The only thing there was the one clog on the urine system, and that was no strain.

WEITZ Yes, I debriefed that.

CONRAD Water. I wasn't aware of any chlorine taste in the command module and/or any odor. I already said we didn't notice the iodine taste.

Final Dump Tape 217-04/D-91
Time: 217:11:45 to 217:11:49

217 11 46 01	CDR	Hello. This is for the food people. Malcolm Smith would be a likely candidate, along with Rita. We got a friendly Rice Crispies this morning, and I filled them up with water. And it's one of those spoon bowl packs, and the seal never seems to take place in the area where it should. So when you mix up your Rice Crispies, instead of having - being able to cut along the black line, you have to cut right near the top, because the Rice Crispies is moved up past the bast - bacle - black line. Now that's not new - bews because apparently it happened a lot on the previous mission, but I thought I'd let you know we seem to continue to have the problem here.
217 11 46 46	CDR	CDR out.

END OF TAPE

219 17 23 29	SPT	SPT out.
219 17 35 00	SPT	This is the SPT on channel B, recording information for the biomed people and for those associated with the food and water intake of the crew. All of our drinks are listed at 7-1/2 ounces. This is like the orange, lemonade, grape, and so forth. We found that 8 ounces makes a better fill and a prop - a better dilution of the grape and so forth, and so we're going to start making all of our drinks from now on with 8 ounces instead of 7-1/2. And we will not report this as extra water. You will just simply have to note every time that we've got that on our menu - grape or orange, et cetera - that - so it should all have 8 ounces of water included. And that will be standard from now on unless we tell you otherwise.
	PLT	Not for cocoa and instant - -
	SPT	That does not include cocoa or instant breakfast, which are already pretty full cans and can probably not take the extra 8 ounces of water. But all the rest of the drinks can.
219 17 35 58	SPT	SPT out.
219 17 36 05	CDR	Okay I'm CALing for the 171 - CDR again. This is a CAL $N_2/O_2/CO_2$. The Gas PRESS is 1.68; the PERCENT CO_2 is 2.14' PERCENT H_2O, 3.71' the PERCENT O_2, 71.75.
219 17 43 45	CDR	Okay, this is the CDR with the same 171 again. I am now recording the - N_2/H_2O psi; it's 1441.
219 17 49 29	CDR	Okay, this is CDR again; I am now recording the CABIN pressure; 4.942.
219 17 50 16	CDR	I am now recording CABIN AIR, O_2, 72.39; H_2O, 3.11; CO_2, 2.07.

END OF TAPE

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easy. You could have built - They could have built the I-beams that way or put a number of washers. That way every place that you went, you could put your triangle down. This would mean time savings and, certainly, that's what the name of the game is. So that would be - one thing - one of my first thoughts. How about yours?

222 02 07 19 SPT I second the motion that we need to stabilize ourselves. I'm not as happy with the triangle shoes as I think I'd ought to be, however. They do work well enough. They hold you where you need it and, without it, we'd be in a heck of a lot worse shape. But I think we had ought to work hard on something like a magnetic device that you could tether yourself to even more easily than the triangle shoes.

222 02 07 37 SPT Now going on to other things in there. We ought to have some other thoughts. The - Oh, for example, the mineral supplements down here in the food. The mineral supplements in ... are a sorry mess. They come in very tight packages. They are arranged in a locker so that it's almost impossible to get them slid in without catching on the little, thin metal plates that cannot be seen. And when they do catch on those little metal plates, they normally tear off some of the mineral supplements that go with them. Now these things should ought to be in some sort of an easily-dispensed - device so that we could just meter them out - one, two, three, or four out of little spigots or something like that. So a complete redesign of - of ways to take pills and things like that - vitamins and so forth - had ought to be redesigned.

222 02 08 28 SPT As far as the food is concerned, some of the cans don't fit the size of the slots. There'd ought to be better control on the position. I had to put napkins around some of my small cans to make them fit into the slots so that they don't all float out and get lost. They should have been done better. Most of the wet - wetpacks - I suppose they are satisfactory by Apollo standards, but they're not very satisfactory by Earth-based or even Skylab standards. Too many of the food packages - When

you open them up, there's air on the inside. And it'll, first of all, blow food around the spacecraft when you first open it up; then, secondly, the two edges tend to squeeze back together and squeeze pea soup or mashed potatoes or whatever is liquid and gooey on the inside up out of the li - out of the edge. And so I don't think those wetpacks are a satisfactory design for food containers. The things we are drinking from, I think, are reasonably satisfactory. They work out pretty well. Jack, have you got some remarks?

222 02 09 28 PLT

Yes, I don't think the wetpacks are well designed either. It turns out that, when you fill them, like Owen says, they've got mostly air in them, and the food comes up past the little black line that you're supposed to cut. When you do cut, why a lot of the - the food from the inside comes out and it goes out around the outside of the bag and gets on your scissors. Also, you can't eat out of them with the short spoon that we've got without getting your fingers all messy because the spoon is about as long as the pack is. The only way you can get around it is to get that super shovel that comes in with the - command module food and use it. The extra volume inside the wetpacks also doesn't permit the food to reconstitute well as it does in the smaller packs. So I think the wetpacks are real losers.

222 02 10 21 SPT

I think there are some other things which are well designed in the spacecraft. I think the general wardroom eating arrangement, the way that the food is reconstituted, and - and so forth, and the table in the center works very well, and the water guns work good. I have no complaint about the way the food gets heated in the tray. I think that's good. And the layout of the pantry is also good. And it's a super idea to have the freezer in the pantry there because the frozen food has kind of been the highlight of the day.

222 02 10 53 PLT

I think another great design is the - the waste management system. It's essentially a no-mess operation. And the only thing that takes a little time - It takes 30 seconds to have a bowel movement and about 10 to 15 more minutes to log

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all the data and snap the new bag in place. So that installation of the new bag could be designed in a - in a more efficient manner.

222 02 11 20 PLT One of the systems that does bug me on the spacecraft is the video tape recorder. Anytime you want to video tape something you got to go and turn on that - you have to go and turn on the recorder, which is way up in the MDA. So that, when you've got various scenes that you want to take down in the workshop, you've got to work from clear up in the MDA to get them on the tape. And when you want to turn them off, you've got to go back up there to turn them off. There ought to be a switch down here somewhere where you can - down in the wardroom area where you could turn the video tape recorder off. Al, do you have any comments?

222 02 11 57 PLT Oh, by the way, the sleeping bags are really good. I enjoy sleeping in the - in the sleeping bag. It's - I think the design is - is very good, particularly with the - the elastic straps. It kind of makes you feel like you're laying against something. And I sometimes sleep on my side, on my back, on my stomach; so it's kind of like at home. It's very comfortable and convenient sleeping, and the temperature's just right also.

222 02 12 25 CDR One of the things I think is good in here, also, is the general - the general use of colors and materials. We've noticed that the - the workshop stays extremely clean. About the only thing that gets dirty is a food opening sometimes causes spurts. For example, as you heat it - any of the food - it'll expand the gas slightly, and then when you break the membrane in the top, food will fly out. Now food flies out when you're eating it sometimes, but mostly the - the former rather than the latter. And that'll get on the walls. But this material is fairly easy to clean. And it just doesn't seem to rust. It doesn't seem to collect dirt. There doesn't seem to be much in the way of housecleaning to be done other than wiping off the dirt that comes from the food - or the food spots, I guess.

222 02 13 20 CDR And then, cleaning the screens you have - from the fans that blow the air around. Now those turned out to be pretty easy to clean because they're all conveniently located. And I think that's been a very good design effort. ... the only fans we use have the right diameter screens on them and also have easy access to cleaning, because it looks like everything is going to proceed up there, particularly if you have a good airflow.

222 02 13 46 CDR Now Jack indicated that he thought the temperature was okay. Well, I felt that ... it, it's been a little bit warm. It's been up in the 80's. My personal feeling is that we'd like to have the spacecraft down around the 70's or 75, somewhere like that. But I could be wrong, but that's kind of a feeling I've got.

222 02 14 08 CDR Discuss, just a minute, the - the food-handling equipment gone over - been discussed here. The food seems to be - from my point of view, seems to be good. The drinks are a little bit hard to - to reconstitute - some of them, because there's no little convenient handles on them to grip them - to push them down on the dispensers. They're easy enough to drink out of. They're easy enough, and they don't leak too bad. They're just sometimes hard to fill. I think that could be improved by maybe making the plastic a little bit bigger ... There's excessive cans around. We've got - Today, we have almost six cans of - of waste material; most of it cans or the plastic that comes inside. And I can't imagine that - that there's all that sort of need, really. It seems to me there must be a better way to keep this food, in the sense that they put it in all individual cans. Now I don't know exactly how you do that when you know you've got three crewmembers, so let's cook a bigger meal and put it around. I don't think that's too good either because everybody is - kind of wants his own thing. It seems to me there may be another way. I don't know the answer.

222 02 15 20 CDR And then finally, when we're finished, we put them in some little garbage dispensers. These are fairly inadequate because they just don't hold enough. You have to empty them way too frequently.

squealing all the time. You have to go around adjusting them to make sure that the feedback doesn't - that it transmits properly. But the feedback problem has got to be solved the next time around. And back to the window business again. I know that O. and I've been trying to look out the window to see things going underneath the spacecraft, but it's just over the edge of the window and I can't see it. If I had another window 90 degrees on the other side, why, I'd be much more able to look around than I am now.

222 02 24 04	PLT	Well, let's see, we - we want to comment on how well the food adheres to the utensils when eating, and it adheres very well except for things like sausage for example; it crumbles all up and doesn't adhere to the spoon at all. Biscuits obviously (chuckle) don't adhere. The cookies are very crumbly. But most other foods that have at least an amount of - of fluids in them do adhere, like cornflakes or peas or corn or - Those kind of things adhere quite well. For example, I don't see any need, as the question proposed here, to decrease the tray-to-mouth proximity to improve the eating ease. At least these are quite adequate right now, and it's very simple to bend down or squat down if necessary. Now we want to discuss any anticipated - -
	SPT	... discuss - -
	PLT	Here you go.
	SPT	Discuss ... (laughter) ...
222 02 25 08	CDR	Okay. Talking a little bit about the utensils. Seems to me that the utensils are good enough, certainly they could be a little bit - a little bit larger. They could be more like home utensils. You should be less worried about trying to make it smaller enough to fit on the spacecraft ... light. I think they should have stronger magnets in them so they grab the trays tight - quite a

bit harder than they do. The - the thing that seems to bother the crew that I've noticed is not the fact that the food doesn't stick to the spoon, but as you're taking food out of the tray or out of somewhere else - out of somewhere else, you hit the plastic covering, and when you do, it knocks the food away and the plastic's hard to trim. The only ones that are easy to trim are like the - the plastic around the cookies because it's got a hard edge and you can trim it with your knife right up to it. And every bit of the food should be somehow like that. I know that we've got a deal we take the bags out and knead them so that they rehydrate fully. But there should - at the same time, we - there's the need to be able to trim them better. Now they're - they're tough. They're - the plastic's tough necessarily, but there must be some better scissors or better method of cutting them so that they - they completely expose the bowl and then we can make periodic - if it doesn't - check on something ... away.

Have you got anything to say, O.?

222 02 26 36 SPT Now, let's talk about the humidity, lighting, noise temperatures, and such.

PLT Okay, the lighting is a little dim in most places, and that could be improved. It's not office-type lighting. In fact, they have individual lights that you can turn on and off to suit your tastes in various areas, however.

SPT ...

222 02 27 03 PLT Yes. Well, come on over. I'll show you.

SPT ...

CDR ... talk about - about the lighting.

222 02 27 10 PLT Okay, we want to discuss noise, temperature, humidity, and airflow.

satisfied the other day when - before we got the sail up when it was hitting around 75 to 80. It was a little warm, but it cooled off after we got the lights off and so forth. And it warmed up in the afternoon, and we circulated around in here with everything from full trousers and shirts to skivvies and - and seemed to feel quite comfortable temperature-wise in any of those clothes. Humidity-wise, it's fairly dry in here. Our noses are dry and - and do some bleeding still after 2 weeks in the mission. Lips are dry and are not really chapped, but on the verge of getting chapped. One nice thing is that it doesn't take you long to dry off after exercise. You don't sweat much and stink a lot. It doesn't smell like a locker room in here. Al is - -

CDR ... stink like a locker room (laughter).

SPT Let's hope it doesn't ...

222 02 30 40 PLT (Laughter) We have some disagreement on the smell. It doesn't smell like a locker room (laughter), but frequently like an outhouse (laughter). We haven't lost our sense of humor, anyway; but smells don't seem to persist too much in here for some reason since we've fairly decent airflow, which is the next subject. The airflow, I think, does help to maintain the - the - the comfortable atmosphere, and, of course, that's also what causes all the junk to collect on the screen ... centrifuge ... collector ... and that kind of thing.

SPT And ... slightly. ... they are retained in a miserable sort of a container ...

222 02 32 31 SPT I was just commenting that the silverware needs a better container. Something that will really hold them in. The ones we've got, they float out every time we open the door. Also something that you can clean and keep clean and have ready access to. That's a particularly bad-designed object.

222 02 32 46 PLT Something else that we use a lot are these little spring bungees. We just stretch them across the lockers and stick everything behind them. So it looks like to me that if we make one of these things

were, at your head where you weren't, or anywhere. You got the whole spacecraft, almost, to - to fool with. Now I don't think there's any way offhand, to design out of this other than to say that the question asked - preflight preparation. And I don't know how you'd measure it, but I think you could save some significant time the first few days. It's a difficult thing. I don't think we have the problem now, but we certainly did at the - at the outset of the - the flight.

222 02 37 29 SPT I think we could use a lot more Velcro around the spacecraft. Because we were still putting up patches all around places where we want to put things. That's one reason we got so many doggone springs stuck all around because we don't have any Velcro at hand to hold things to nearby where we want to work. And I think that's a significant design - capability.

CDR ...

PLT ...

CDR ...

222 02 37 56 SPT Better adhering type of Velcro that we could attach in flight in spots right where we want it.

PLT Yes.

SPT Get some better springs so we could put the stuff around where we want it.

PLT ...

CDR ...

SPT Not that bad, though.

222 02 38 12 PLT We certainly use this chiller behind us. I didn't know whether we would or not. This chiller was almost an afterthought, as I understand it. And we finally got the IMSS container out, although the IMSS stuff is in there. And we had the stuff nearly - nearly full when I took the stuff. And that really makes it much better for us.

	SPT	Produce, drinks and food ... food? What kind of food? ... all that goes in there. And we certainly appreciate having it available. It makes it much more palatable. ... out.
222 02 38 55	PLT	What significant improvations - impro - improvisations (procedural, equipment arrangements, or modifications) have you accomplished as a result of adapting and living and working in zero g?
222 02 39 07	CDR	Well, I made a significant improvement, I think, in our sleeping quarters. The air enters at the bottom. I've taken my sleeping bag and mounted it upside down. It doesn't bother me at all to sleep that way, and it does definitely improve the flow of air. It lets it come from the top of you and flow down past you, instead of coming up from your feet into your nose, into your mouth. I found it is effective for my - the dryness in my nose; it made it much more moist, and I found I was able to sleep better just because I was closer to the air vent and was able to control it. Previously, I had to lean out and touch the - the vents and move them around. So I think that that's a - a - a significant improvement.
222 02 39 52	CDR	Another one is the - the bedclothes themselves could be even a little more like Earth. They're a little bit baggy down at the toes; make them a little bit more Earthlike. And the - and the straps that holds us in, they're excellent, particularly the one around the head. My suggestion would be to add. Double the number of straps and also improve the headband arrangement. It has, right now, a really - a rather poor ... I think I made one comment on that - come out with it sort of belted and ... belt it to the SWS ...
222 02 40 34	CDR	Though modifications have been significant when it comes to number of spacecraft now - SWS and the like, but as Owen pointed out it costs a lot to build those - in - to a better operation.

prevent things floating out. It's got two inner flaps, two outer flaps. What should have been done or maybe what could be done now is to take the scissors and remove the inner flaps. That leaves the outer flaps. Then when you want to get in it, just flip them open and you're right in the box. Having two additional flaps doesn't keep the items particularly in there. All it does is make you have to work harder to remove them. These restraints are definitely - eliminate that - if it were possible.

223 19 33 12 CDR

Let's talk a few minutes about the wardroom table. The wardroom table has the advantage of being the main meeting place of the - of the flight. It's nice to sit around it. It's convenient. The handhold - I mean the legholds, the foot - leg restraints, the footholds seem to be very good about keeping you in position. And the general layout of the table is good. I think that the idea of having hot water and cold water right in the middle where everyone can get at it equally is good. I think maybe we should of had some sort of same thing there where everybody could get at his food just as easy. We've got the food in the pantry. And the pantry idea is good if you put everything in there and then you go get the ones you want out. Now we've got everything that dispersed in individual - type drawers. And we could have very simply put each person's food near him. Now I'm not in favor of doing that. I'm in favor of having a true pantry, so when it comes time to eat, you go and look in the orange place to get out your orange and all that other. I think that would facilitate not only getting dinner ready, but it would facilitate changing the menu and it would definitely facilitate stowage because then you could wander out when something ran low and just find a big box of orange juice - let's say. Pick a bunch of orange juices then and put it back in stowage, instead of having to wait a certain amount of time, and put them in sequence. In other words, we'd operate just as we do the towels - washrags, which have worked out well.

223 19 34 49 CDR	Another - the trays themselves are excellent. The - the we'll probably get to that in a few minutes. Let's - let's - That's - general talk.
223 19 34 59 CDR	Let's talk about thigh restraints. Thigh restraints are good. They're able to adjust tightly enough and at angles that are pleasing to the individual. I don't think they're exceptionally good without the - foot restraints because they're very small and you can't get a torque off of them. I think they might be improved if you put the front part of the foot restraint - of the thigh restraint and made it not longer, but wider. In other words, so it covers more of the - of the thigh up and down. Which would give you a place to torque off of, allow you to move around a little bit easier. But, all in all, I would have to rate those as a adequate - wardroom table, I would rate as a very good.
223 19 35 45 CDR	Wardroom light-duty food restraints, very poor. Very seldom does the food stick just right because the cloth that's over the cans is the size of the opening. I found that you can squeeze the cans a little bit and make them concentric and they'll stick pretty well. There are no other light-duty foot [sic] restraints except putting on the Velcro, which we did. Now it seems to me that we need maybe a spring on each side and some Velcro around it - in intelligent places so that we could - slap the - the - our drinks and eats on the table without always having to put them inside. In addition, when the cover goes on, it's difficult to attach anything to the table and - for example, the magnetic feature doesn't seem to work on the box. So that needs to be enhanced a little more to make it as simple as possible. Also we need a nice stowage place for the knife, fork, and spoon on the tray or - The one we've got now is plastic and it takes you forever to get it in there and when it's in there, it doesn't come out right.
223 19 36 52 CDR	Water gun seems adequate, fits good, puts out the right amount out and it's easy, too. I'd have to admit the water gun's good. I would tend to make a bigger rubber flap on it from the point of view that every once in a while you hit your teeth

with it. And it's possible to bust your teeth if you're not careful and that would be a bad thing. There's a lot of mass there and you really need to have the front part of it - not have that metal front area with the rubber tip. It should probably be all rubber.

223 19 37 16 CDR

Food cans need more quality - quality control. Way too heavy for the job they do. I don't know the answer. It's certainly a lot better to eat out of them than it is to just take those plastic packs and hold them in your hand. Because this way it looks like you're getting a plate dinner. There's got to be some way to minimize the can weight. Beverage dispensers seem to have worked okay. I would have to give, by the way, the - the water gun an excellent and the food tray a - a very good. Food cans, I would give an adequate - adequate to poor because of the total weight and time. It's amazing how much ... can take up. Beverage dispensers we were talking about, I have to give them a very good. The only thing I can think about them bad is it takes time sometimes you get the top off the beverage dispenser and that's time and effort. We'd like to do away with that. Must be some better way than that to snap it ...

223 19 38 59 CDR

Okay, there we are again. We'll continue on. Beverage dispensers, we talked about - or did we? Beverage dispensers seem to be okay. They need something near the top to push them down. Plus get them open. This is the same for the food - just cans or what's inside the cans. It's hard to grip the little neck of it to push the thing over the water dispenser. Needs a little bit more of a ridge - plate. Now the beverage dispensers seem to work okay. We had minimum leakage and the like. But the thing we didn't have was an easy ability to get the drink portion in. I always had the feeling that it was conceivable to break your front teeth off on that - as you put it in, if you got that little insert cockeyed, so I've been using my fingers. There must be a tilt valve or something we could attach to it where you drank and then - I mean you filled and then when you were ready drink, you just tilted it. There must be a design

	somewhere of that, and I'm sure there is. It probably leaks. It seems to me we should stop there.
223 19 40 03 CDR	Seasoning dispensers, we had several kinds. The salt - salt was way too much trouble to get just a little old small amount of salt in those packages and I know the experimenters probably got ... in here. But actually we need something that'll dispense salt. Now one thing that I've noticed works well. I had a pep - pepper in a can up here. I pointed the pepper out and squeezed the can a little, and a squirt of pepper came out. Now it has the disadvantage of if I didn't watch out and move the can, it would just come out on its own. I had a bottle up here with garlic salt. I found it was very difficult to get anything out of the bottle even shaking it, tipping it - tapping on the back with a finger. What occurred was that the stuff came out and instead of heading right down to the plate, it meandered off. I think the best bet is to come up with something like these little catsup dispensers or mustard dispensers that are plastic and suspend these spices in some sort of liquid. And then when you want some, just as you done the salt except put them in bigger things and you can get more. And then when somebody wants some, you can take the cap off, point it down there and squeeze, just like you squeeze mustard on down at the ball games. Except in this case, it would be pepper or garlic pepper, or anything else. The glass worked poorly. The next best thing is the metal because you can kind of squirt them out by squeezing on the side of the can and getting all that kind of effect. The best is some sort of little plastic squirter that you can squirt. And you can direct it just to the right place, too.
223 19 41 33 CDR	Eating utensils, too small. Should be just normal eating size. Working around with a little old knife, fork, and spoon is ridiculous. We don't eat that way at home. You don't eat that way at home. Why would you want us to eat this way up in space? You've got a billion tons of equipment up here and it certainly wouldn't hurt to have the right-size knives, forks, and spoons.

223 19 41 50 CDR

Miscellaneous. I give the eating utensils a - By the way, they need stronger magnetic holders. I'd give them a adequate. And I'd give them a very good if they were bigger and had those stronger magnetic forces. Miscellaneous. Sleep restraint. Sleep restraint is a good thing. And the reason it's good is it's got something that holds your - I used to think it was your body down, but I'm beginning to believe that what you really like is your head held on a pillow. You've got a nice pillow that is adjustable, and it's got a holddown for the head. The straps around the body are good. They need to be wider and they need to be more of them so that you can pull yourself down more all over the place, than just three or four places. Also, I think a disadvantage of this sleep restraint is the fact that you got a lot of air captured in there. And as a result, when you - you get cold at night because you don't - you can't - need all those blankets in there. So you need some sort of method - bungees of some sort that will take the blankets and sort of pull them down on you. That way you don't have to heat such a big airspace to stay warm. You, of course, need the capability to relax that squeeze-down ability so that - so that when you want to be cooler, you can. The netting is so-so. Several of the fellows slept on the outside and I have not. I've always slept in the - in the netting. The location of the sleep restraint I don't like, because the air flows up around your nose, and it dries it out. This is a dry environment anyway. I've found it much more convenient to mount my bunk upside down. I've been sleeping that way for several days and not a bit of trouble, certainly better. Still the ventilation is a bit difficult.

223 19 43 35 CDR

Trash airlock, sorry design. And the reason it's sorry -

223 19 45 09 CDR

Okay, let's get back to the trash airlock; poor design. One, because there's a single-point failure that could drive you crazy. It needs - we need much more effort on trash disposal at the space station. I never realized what a total amount of time it takes to work the problem. Having to put them in - in bags is time consuming

time - even when we're vacuuming. And the vacuum will take the - the stuff off the screen even though the - that fan up there is running.

223 23 25 11 PLT	Okay, next page, food management equipment. Wardroom table, I gave that an excellent. That's - Everything works very well there. We always have the table top stowed up above.
223 23 25 25 PLT	The thigh restraints, I give them excellent, also. I use them every time I'm there. The wardroom light-duty foot restraints; they're pretty so-so. I give them adequate, I guess. They come out of their slots and they're a real bugger to put back in. So I've got one that's hanging out now and I'm just using the left foot at the moment until I get around to getting a screwdriver or something to stick those back in with. I - I use primarily the - the cutout for the triangle shoes because that's what I've got on most of the time. And I use a triangle shoe cutout and a thigh restraint for stabilization at the wardroom.
223 23 26 08 PLT	Food reconstitution dispenser works real well. I haven't had any major spills; they've been charging up and dispensing satisfactorily.
223 23 26 20 PLT	The watergun is a good device also. I have no complaints about it at all.
223 23 26 25 PLT	The food tray, I got no complaints about that either. And we had to put a little Velcro on top of it to hold our drinks down, but the food tray seems to work very good.
223 23 26 34 PLT	Food cans, they - they're working all right, too. I noticed, however, that when you take a can out of the freezer, like frozen meat or ice cream, and you immediately try to tear the lid off, why instead - what happens is the little key pull off without tearing the lid off. I guess temperature's down there sufficiently so a little force on there will peel the aluminum and the key comes off. I noticed that if you let them warm up a little bit, why, they work better.

223 23 27 07 PLT	The beverage dispensers, some of them work all right; some of them don't. The ones where you don't have to have much reconstitution work pretty good. The ones like - that contain-particularly chocolate instant breakfast are pretty much unsat[isfactory] because of the - the beverage dispenser's all right, but the things inside either don't reconstitute or they all sit down in the bottom of the dispenser and don't mix up. And frequently the - I don't think we are getting all the mineral content out of the chocolate instant breakfast. And frequently your valve clogs up with that stuff and you can't get but maybe three-quarters of it out. And you have to blow on it, squeeze again, and chocolate instant breakfast in those dispensers in unsat. The applejuice and cherry drink don't reconstitute well with cold water, but we've licked that by reconstituting with hot water - letting it sit out all night to cool off; then putting it in the cooler. And that apple drink and cherry drink reconstitute very well using that technique and I started using that technique just today on the chocolate instant breakfast. I don't know how it's going to pan out yet. It may be the answer to our instant breakfast problem.
223 23 28 38 PLT	Seasoning dispensers, don't use the pepper. It kind of gets all over. I do use the tabasco; it dispenses very well. A little tap on the back end of the jar puts the squirt right where you need it. And those are the only two I've tried so far.
223 23 28 56 PLT	Eating utensils (cough) are kind of small, particularly the spoons. But they do the job. The magnetic holddown - holddowns on the food table are a good addition. Got a gripe on the wetpacks. Those things are unsatisfactory. They're completely unacceptable. The reason is is because some of them - some of them, when you fill them there's too much volume in there; and when you fill them also the liquid goes clear up to the heat seal.

It goes past the black line where you're supposed to cut. So when you go to cut, why you get that stuff all over your scissors and it runs out, and covers your scissors and it just makes a big mess. The - the liquid inside the wetpacks tends to adhere to the side of the bag and run up all around the sides. So you never have a good solid glob of food in there. It's all something that's sticking to the sides, and the center of the food pack is essentially empty and frequently there is just a big bubble across the top of of the food bag when you open it. And then when you go to put that little short spoon in there, why you get the food all over your fingers and all over the - the handle of the spoon. And then that's just a big mess, too. And the only way to lick that is to use the command module spoon, and that's the tablespoon size, and then you have the mess halfway up the spoon; but you don't have your hands in it. So, I give the wetpacks a complete unsatisfactory and that needs a little redesign. Also, the food doesn't reconstitute as well in this because there is so much empty volume that frequently you get in there and there's the - clumps of unreconstituted food, particularly with something like creamed corn.

223 23 31 02 PLT Sleep restraints I like very well. I give it a excellent to very good. I sleep with the - only with the netting and the - I guess you call it the upper blanket. I use the head restraint and I use three cushions in the head restraint. The head restraint stays on all night. I guess I don't move around too much. I don't have it on tight, just loose, loose enough to feel like I've got something on there. I think I'm going to start using the bottom blanket a little bit because it's getting a little cooler in the workshop. And I noticed that in the morning I wake up a little chilly. I use the upper straps across the body. I've loosened the bottom one. And when I sleep in the sleep restraint why I feel a light pressure. I've got the straps all loosened all the way out, but I feel a light pressure and I generally sleep on my side, although sometimes I start to sleep on

want. The whole hand washer, as I talked before is - needs to be re-thought through. Ceiling handrail - didn't know there was one. Light-duty foot restraints, lousy. The whole idea of foot restraints in the head needs to be re-thought through. Three of them are in front of the urine trays where they either mess up the trays or have to be removed as we've done, and the whole idea of foot restraints in there is very poor.

227 02 18 21 SPT Shower - we haven't even gotten around to using one here because first of all we haven't had time; secondly, we didn't think we needed it. So we don't need it very often. Personal hygiene kit should be personalized. Not this blanket, cotton-picking thing that's got a set of stuff that probably nobody wants more than 50 percent of. They should have been tailored to each individual. It wouldn't have been much trouble to do that. Now we would have liked very much to have the things that I want in there.

227 02 18 45 SPT I'm still up here trying to figure out how to trim my moustache, and it's been 18 blinking days. And I'm still not sure how I'm going to do it. As a matter of fact, I haven't even trimmed it yet, and until I figure out how, I won't. And so I hope to figure out something. If I'd had my own personalized hygiene kit I'd have had a pair of either short tweezers - short scissors in there like I have at home, or better yet I'd have had a proper razor with a - with a moustache trimmer on one edge or whatever they're called. I thought one was going to be on board but it apparently didn't make it. But the personal hygiene kit should have been personalized, and I think it's an oversight, a significant oversight, that it was not.

227 02 19 34 SPT And I guess I got some more on food management: wardroom table, not bad; thigh restraints aren't bad; wardroom light-duty foot restraints, hardly ever use them. Every time I put my shoe in that triangle that's down there on the floor, try and unlock it, it unlocks halfway and then I have to

reach down by hand, and get the thing twisted right. It's the one triangle all over the spacecraft that doesn't work right for me. Food reconstitution dispensers work fine. Those things really do a good job. Water gun is great; food tray is fine. Food cans - well, some are good and some are bad. The wet packs, I think, are lousy; beverage dispensers are fine. Seasoning dispensers are lousy - well, those salt things - good grief! One-third of them have already been cracked and leaked out, and the salt is therefore caked. Whenever you try to pick it off you get free salt floating all over. The next one-third, when you try to open them up, you pull the flaps back and then the salt sticks to that and you squeeze them, and it squirts about 60 degrees away from the direction you were pointing. So it either goes all over your buddy or all over the tray or all over the air. Now the final third you usually get on your food, so they're about one-third efficient and the other two-thirds are all over the spacecraft. Very annoying.

227 02 20 46 SPT

I consider the only seasoning dispenser we've got to be very poor, and we could certainly do a lot better if we thought through. We'll have to do that on the ground when we've got some time, not up here because we don't have time to go through all these things right now. The other seasoning we don't even have. I've given up on the pepper because my first attempt to pepper just managed to fill the compartment with pepper. I've tried to put it away into a bag and every time I open that locker I still smell pepper, and I've given up on pepper even though - although I'd like to use it.

227 02 21 17 SPT

Any other seasoning is too much trouble to fool with, and so I'm just getting along without any seasoning. Eating utensils are not bad. They need a better place to stow them. That little - my spoon flies out everytime I open the drawer, have to go retrieve it and have to Velcro it down with that strap.

229 21 46 34 CDR Okay, this is the CDR; we completed the 93 run. Believe it or not, the SPT made it through, and his total workload was a brilliant 304; 304, mind you; all that in 2 minutes.

229 21 46 46 CDR CDR out.

229 22 04 36 CDR This is the CDR, and I'm doing M487-3B. And I'll be discussing the items that are on this list trying to give them some sort of a rating. I'll try to give them a rating that's either excellent, very good, adequate, poor, unacceptable, per the guide found on page 3-2 of the Eval Checklist. It looks a little different. It says evaluate each of the following compartments with the habitability parameters; it is not required to be in the compartment being evaluated. Okay, ward-room - on each of these, I'm going to go down this list.

229 22 05 30 CDR Under wardroom, general arrangement and orienta-tion of compartment. I think it's good. I think the fact that we've got the wardroom on the minus-Z, where we can have the best wind in the place, and the minus-Z in the solar inertial air - spacecraft, during the daylight hours, looks down at the Earth. It's one of the wiser things to do. Now we do need a bigger window. That window's marginal in size and should be much larger. Of course, there should be several more windows of equal size throughout the spacecraft. Operating inside this little can just doesn't quite hack it. We have the - the ability now to carry up a little more weight, and we - I think one of the things to put them in is - is - is very safe windows, and we can use them in, not only good experiments - we got T002 out there, a lot of handheld photography - but just to relax, these things.

229 22 06 24 CDR Some of those things about the orientation of the room; it needs a desk in it. Wardroom seems to be the place where we get all the data and dispense it. Right now we got a little clipboard on the wall, and we plant our feet in the floor - but some sort of permanent desk with some snap/clip things that would allow you to do your paper work.

	A lot of it comes up in a space station, and you need a permanent place to file things, to hold things, and to set and correct items, Scotch tape dispenser built in, things of that nature.
229 22 07 00 CDR	Food? Food compartments: Okay. The - It could be a little bit easier. I - I don't think it gets the food hot - the food trays get the food quite hot enough. And the restraints are a little bit more flexible than they need to be. I - I'd like to be able to go in there and hook on to something and then just stay. The water gun idea, one for each person, is good. The watergun tip can be improved; I think you could knock your teeth out if you're not careful. It takes you a few days to be very careful about it. But the main thing is, the individual waterguns where if you're measuring water or taking a drink, you don't have to worry about what other people are doing, are okay.
229 22 07 38 CDR	It's a little bit small for getting to the refrig. Waste disposal now is fairly easy with the change in the doors so that everybody's got a trash bag. Do - do - The ability - the way your knife, fork, and food is stored; the fact that all the spices are all over in one place; the pills are over in one place; all that's a little bit difficult.
229 22 07 59 CDR	I personally favor a wardroom, or a - that has sort of food dispensing in the pantry, as opposed to - to individual meals in chronological order. If - if we had everything in a row for example, you knew the time to get peaches. You check your menu and go right to the peach place. As it is, you got to move things down in order, and if your day's menu isn't right there, you have to go hunt it. If you need some overage, you got to go find it. If you just had everything in the pantry like you do at home, and then pulled out whatever you needed, you'd be much better off.
229 22 08 35 CDR	I know in - on Earth, if you feel like some potato chips, you know where the potato chips are. You don't have to sift through 10 days of cans of everything else to find one potato chip. So I definitely recommend we get rid of this serialized, chronological food arrangement.

229 22 08 54 CDR — Comm is good in there. Lighting seems to be good. Entertainment could stand much better stereos around the room. And color scheme's okay; could be a little different. It keeps clean, even though we make a lot of mess in there. I would recommend that we use the materials that we have and then let's have just several different colors.

229 22 09 23 CDR — Not enough places to put your feet on the floor, tying them in. Trash wasn't thought of. It's kind of an add-on and had a lot of difficulty with trash, way too much time. I would say at least 15 minutes to 30 minutes a day is spent fooling with the trash in that room; no reason for it.

229 22 09 51 CDR — We need a compactor or something where we just throw it in, and forget it; once a week empty it.

229 22 10 05 CDR — Stowage is good. We got a lot of things stowed in there that we don't use very often like clothes, towels, and like I think maybe - if we could somehow stow our food there, moved it from one side of the room to the other, instead of moving from upstairs to downstairs.

229 22 10 30 CDR — Need more temporary restraints; need the same bungees we've talked about several times. They ought to be on all - all walls, all doors, built in. Then any time you wanted to fix something somewhere, you could.

229 22 10 40 CC — And, Skylab, Houston; for anybody, I got one message I'd like to relay, please.

229 22 11 58 CDR — Get back to recording. Thermal comfort's okay. Noise level's okay. Illumination: It could be more, but satisfactory. Personnel mobility aids: Well, I've noticed we always pull ourselves around using those food trays. I don't think that's particularly good. They're mounted with handlocks which aren't that strong. I guess I'd have to say that the mobility aids in there are poor. You either use the ceiling grid or pull on those food tables. Also when you're in front of the trash disposal place it - it - you got to use your foot restraints. There's no other little handbar, or anything.

Final Dump Tape 246-01/D-382
Time: 246:00:49 to 246:02:24

246 00 49 45 PLT

Okay, here's the continuation of M487-2 Charlie - by Jack on channel A. This goes to Bob Bond. And hopefully we will be able to - complete it this time, without having to break it up in pieces anymore. Got cut off by a dump there last time. So, we were talking about question 6 on page 2-6 and - we are now in paragraph E there. Waste management and cleanup chores: decided that - with the - air systems that we - blower systems that we've got in - the fecal collector and urine - drawer that - waste management is - much improved. And so - it's that item right there, the - the air-entrainment idea that - has taken a lot of the mess and a lot of the work and time out of waste management. So I think that that's a real plus and something we ought to - continue to have in - in - future systems. Cleaning up - after a waste management - exercise is - no problem. There's essentially no cleanup at all. General cleanup chores - are - a nuisance. We - we - we - I don't - think much of the idea of this biocide wipe - procedure. I think it's good to biocide wipe. But the idea of going around beforehand and first - washing with soap and water and then rinsing and letting it dry and then biocide wiping it and then going back and washing it off is too much Mickey Mouse for a biocide wipe. You ought to just waltz up to this place and biocide-wipe it off, come back later and clean it - clean it off. And just forget about all of the preliminary - scrubbing chores. We've - said enough, I think, in the past couple of weeks about - systems housekeeping, and what needs cleaning and what doesn't to - to - take care of the rest of this question.

246 00 51 47 PLT

But - generally there's not too much to clean up. I think the place that gets the messiest is the - wardroom, because - food gets loose and - and - when you're shaking up your - drinks, sometimes little drops get out and - go here and there. And when you're cutting the membrane off the - meat dishes after you've - heated them up, why they're all pressurized inside and they go squirting out and gravy or meat juice or whatever. And - then when you - when you roll that little membrane off, why a lot of the juice gets caught up in it and - there's no way to take that - little membrane off

without - at sometime or another snapping it a little bit and then the juice flies off. So, the way we've been cleaning up the - wardroom is just to - take a wet rag and go around wipingout all the walls and the lockers and then - and scrub all the spots off. And so that's the best way to do, it looks like to me. The garbage area there is the place that needs - constant attention, because it's continually messy and gets emptied every night. But - it's - probably is the dirtiest place in the whole spacecraft. And if any place needs a biocide wipe, that's the place. And - I think that that's probably the place for - most bacteria to grow right there, even as opposed to the head. I think that the head is a real clean operation compared to the garbage - operation in the - in the food compartment. Well, the rest of the area doesn't require much cleanup.

246 00 53 10 PLT In fact, I don't remember ever cleaning up, say, the upper dome or the experiment area or - anything like that because there's never anything that gets out there and makes them messy. And - so, it's no problem. To - The cleanup is not a real big problem - The only places that need it are - the head a little bit and - and the wardroom need a little bit more. Particularly the garbage area. Okay, let's talk about locomotion. Paragraph F there - either through the various compartments - you - you can - We locomote - without the firemans pole.

246 00 53 45 PLT That's a good way to go. We don't need that any more. And - you kind of push off and - pretty much go where you want to go. Now, when - we're - sort of instinctively able now to push off and wind up where we want to, in the attitude we want. If we find that we're not going in the attitude we want, why we can just tuck up and roll a little bit. Or if we're rolling too fast - why we can - extend our arms or legs or whatever to slow our rotation rate down. And it's kind - kind of come to being a natural thing. As far as going in and and out of compartments is concerned, sometimes you go in an upright position in the crew quarters area and sometimes you go on a - on a horizontal way, and if somebody's in the way you just kind of go over them. Or if there's people sitting at the

of the time. Okay, there's the - transuranic rays - nobody knows what that means, but - there they are. Now right there's our clothesbag. We just put a TSB there - not TSB, but a disposal bag there. We put our dry clothes in there that we think we can use for rags. Turns out rags are the - a real winner up here, particularly when it comes time to clean up. Trying to clean up with these little - I'm talking about cleaning the inside of the head or something like that with - with - with those little paper things is rea - is a waste of time. We use the paper things for food and wiping off urine and things like that - off ourselves. But we use rags for almost everything else. When that fills up, we just close it up and shoot it down the trash airlock and put another one up there. Anything that's wet, we put in a bag right here. Now this bag right here is the urine bag. And we always keep one there. You can tell because it's got those things sewn. But essentially, we never put more than two urine bags in it, and then we try to put a few more other items in there like wet towels and the like. But they're always here. Any wet item goes in there, from the head, and any dry item then goes over there. So this means with - with three pieces of urine, you end up putting two in there and some things and shooting it down the trash airlock in the morning. You can put one in there and it stays until the next morning, at which you'd then put another one in and then too. Sometimes you don't do this, because - you have three little ones, and you can shoot them down but mostly you try to do it with two. We haven't had any trash-airlock problems, but I'll tell you this. This whole scheme that somebody came up with that says you're going to bake it and freeze it: forget it. There is too much. It's - it's out of sight. If we ever lost that trash airlock, it would be one of the worst things that could happen. The trash even smells in 2 or 3 days up here. You - You have - you have no - you'd have no way to cope with it. It - it's incredible. And - you got to be careful.

253 02 40 42 CDR When we give an inventory of these bags at the end, if there's any doubt, bring extra bags because - that's - a small price to pay compared to what could happen, if - anything went on with - went on and you - you - had a problem.

LOUSMA IMSS transfer should be to unload the contents and then replace the contents in the cooler and then take the thermal insulation container and put it somewhere besides in the cooler.

BEAN You might add here that these refrigerator companies have all sorts of tape that will stick in freezers. When they're cold and when they're wet. Now we don't have any but you could take up a small roll and it would be one of the most useful things you could have. You could tape in some of those little inserts inside the food cans and get everybody's food and drinks controlled instead of just floating around. We could never get them stuck in there very well.

BEAN Activate suit drying station: Straightforward. In fact, it's in good condition now; just undo it and turn it on.

BEAN Transfer suits: Easy. Configure urine drawers and fecal collectors: I think you need to practice that good before you go. You need to be aware of a couple of items. You've got to have all the drawers closed to make any of them work. You've also got to have a fecal bag in the fecal container to make the urine system work. Everything has got to be put together to make any one part of the system work.

GARRIOTT Don't forget that the SPT's middle drawer needs that washer reattached or else the whole thing is not going to work. It's stuck up there. The washer is stuck in with gray tape right now. I debriefed it on channel A. Everybody should know about it; but let's not forget that it needs to be reattached before the drawers are activated.

LOUSMA It's the seal between the drawers and the wall.

GARRIOTT Correct. I see on the air duct.

BEAN Also one of the things we were worried about before we went was that we might come upon a moldy rubber or an open urine drawer and might be a lot of bugs around in there somehow. There never was. Everything was clean and dry and neat. I think it's probably going to be the same for Jerry. We left it real clean and he should be able to step in and put whatever he's got in the drawers or in the coolers. It all should work. The only thing we noticed a little bit different was that the freezers had a lot of extra ice around the doors. We had to use scrapers and we used the snap scraper from the tool kit. I'm not sure that Jerry should not take up several little ice scrapers.

LOUSMA I scraped the ice from around the freezer before we left, so there wasn't any ice at all when we left. If there's any ice when he gets there, it formed during the time we were gone.

BEAN Food transfer: Pretty straightforward.

BEAN Configure food preparation area.

LOUSMA The food preparation area, or the stowage area down in the workshop, was kind of a mess for the first 5 days because none of the CSM food fits in the trays down there. It's all in the plastic bags and it's kind of a disorganized mess. It's a red-letter day when you finish the CSM food, because it just isn't nearly as good as the workshop food.

BEAN What I would recommend for the next flight, on that food business, is that in the next day, when they configure the food area, bring down the food and then go off the CSM food right then and go to the good OWS food. Start using the OWS food right then. And then cycle the CSM food in there some time during the middle of the mission. This gets you on the best food the fastest. It gets you on the most convenient food. It gets you on the most appetizing food and it should help the transition from Earth food to space food quite a bit faster. I remember when we started eating filets how good they were and how much it helped. And get off this stuff in the little plastic packages, which are troublesome to fool with.

GARRIOTT	It's an awful inconvenient thing; the inconvenience more than the palatability because it takes so much longer and it is messier. It takes time.
BEAN	It's like eating camping out instead of sitting down to eat. You're really need to have all things going for you right at the first.
GARRIOTT	Four weeks later, we could have handled it easily.
BEAN	We could have eaten that stuff and it never would have bothered us, but right then we needed a couple of steaks. It seems to me that they should take a look at the food they have onboard, too; and maybe give them some extra good food right there the first few days; make sure that each night they have a filet. Now we know where there's some spare filets right now. And they can go up and get those out and consume them. There's some level between what we're doing now and what could be done to ease the transition, the transition over to good food and then come back later and eat that stuff.

Other CSM transfers: I don't like the way we're doing the CSM transfers right now. Here's the reason. You never know what is supposed to be in the CSM and what's supposed to be out of the CSM unless you go get a book and follow by rote. It's a little bit like moving in your house and you have a pickup truck and you only take a few things in each day. You

BEAN The other problem is you seem to think there was a possibility of somehow mixing up the blood samples as to which day a certain blood sample was taken and maybe they ought to figure a way to mark those.

GARRIOTT That is straightened out now. The only potential cause for mixup was if they did not get the word over the serial number of the blood sample, and if that's called out as it says on the checklist, then it won't ever get mixed up. But I think a nice convenient way is on that little button that is attached to each of the blood samples, if you'd just write down on there like 28 on each of the three that were taken on the 28th, 38 on each of the three that were taken on the 38th with your pen, then that would eliminate any possible confusion. That would've probably been a help.

BEAN Any other comments about those?

BEAN Let's skip the experiments because we're going start those later.

LOUSMA Food preparation: We normally prepared the food for the following meal at the meal prior to it. I guess everybody did it differently. What I would do is to make sure that the things that I wanted to be cold for the next meal were put

LOUSMA (CONT'D) in the cooler, like the applesauce and the drinks. I'd do that after the my meal for the following meal. However, I never did try to mix up the other food early; I always mixed it up on time, the time I was going to eat it. If I had something that had to be cooked like a steak or a frozen item, why I'd usually set it in the cooker and put the timer on it at the conclusion of the meal prior to the time I was going to eat it. That seemed to be a system that worked for me, and I think you two guys have different systems.

BEAN I tended to put all my cold stuff in the night before. One thing I noticed that didn't have to do with normal prep, but when we were trying to get some food out for those 3 days that we had to find food, we went to a great length to locate it all and get it all lined up and put it in our food compartment. Then we found out there were always a few items you couldn't have and so you ended up having to do a lot of work with it. I'd recommend for the SL-4 crew when they - they get up there, the first chance they should take all those overage foods set some time aside and mount down a sort of recording to a pantry where the drinks are all in one corner and then the foods are in one place and the deserts are in another, in some logical fashion. They've got three big compartments there and a lot of holes, and they could very simply do that. We gave them a

BEAN (CONT'D)

complete inventory of the food available. Maybe before they go, they could come up with a nice listing that you could post on the door on how you might want to orientate each of those chows and just allow several hours and get two guys up there and off load all that food and put it around in pantry style and then not try to get those sequenced by meal for later on when they need to use that food. When they need to use that food later and they say, "Okay, today you're going to do such and such," the guy just floats up there, knowing that the drinks are up in the left-hand corner, and gets lemonade or whatever else is there. The whole idea of - trying to arrange them serially and then putting it in order so you can eat it is just a lot of double work. You do it once and you put it in the tray, and it's not quite right because some foods were not available and it just makes you do it again now. Might as well just skip that now and do it the one time when you just float up and find it, because floating up to the compartments is not that much further than the little trays right beside you, if you got them in pantry style.

GARRIOTT

Talking about the food. I thought I was kind of running behind the schedule for the full 60 days. I will be talking more about that a little later. But that's the reason I didn't

GARRIOTT (CONT'D)

do some things which I think I would have preferred to do if given more time, like seasoning. I tried pepper once and then quit because it went over the compartment, and I just didn't want to take the time to put any extra seasoning on my food. The salt was miserable; I think those packets are bordering on unacceptable. These little shakers that we have right now, they could have a little sticky tab or something like that, to which the salt grains will stick, put on them that would be much better for putting salt on foods. I'm not certain that will work right, but I think we ought to think about using it on SL-4 and be one heck of a lot better than those lousy salt packets. We took short cuts with the seasoning of food several times. We had a few, I guess we had seven packages that failed. Probably the numbers were not too large to worry about. The wetpacks like the soups and stuff that need to be opened with the parting or the squeeze together sides ended up with food all over your fingers and every place else. But I guess there's really no point in worrying about it at this stage since it's already on board.

LOUSMA

My comment on the food packs, wetpacks is that it's an unacceptable design and shouldn't be continued in the future. The apple drink and the cherry drink won't mix with cold water very well. So we wound up mixing those with hot water and then they reconstituted very well and left them outside to cool off

LOUSMA (CONT'T)

to room and then put them in a cooler. The same way with the chocolate instant breakfast; it would not reconstitute with cold water so you had to do it with hot water and leave it sitting outside and then put it in a cooler. So those three items ought to be mixed up with cold or warm and then fixed later and put in the cooler. Then the wet packets were the only packets or bags or fruit containers on which I had any failures consistently.

BEAN

Let me say some more about spices. We made a lot of comments about spices over at channel A that are available. My feeling would be that you would want a lot of spices up there. We commented on the way that you ought to fly them up there and use them. The thing that seems to work the best that we had available was squirting it out like when I squirted pepper out of those little cans, I could squeeze the sides of the can and get the pepper out. That still wasn't too great. The things that you couldn't squeeze and squirt out like garlic salt which was in these little shakers, well, the minute you open the lid and look between the lid and the shaker, that's where all the garlic was. You just couldn't use it there. My feeling is that you wanted somehow to get this material suspended in a liquid like like you have catsup in one of those plastic squeezers and then have a small opening up there and

BEAN (CONT'D) kind of squirt the material right on your food. For example, pepper could be in one of those with a small opening, suspended in some sort of liquid. It might even work without being suspended and then you point that end of the dispenser right in the food and then squeeze on the side. This not only keeps the pepper from getting funny velocities and going all over place but also points it right at the food and when you squeeze the side, then it flys toward the food and lands on it. I think that we certainly ought to take up some pepper and some other solids in a device like that to see how it works out. My feeling is that it would work out pretty good.

LOUSMA The Tabasco bottle worked pretty good, I thought, you just shake it and a blob of Tabasco would come out and hit on your food. The only thing is, if you shook too hard, it would splatter and a few little bubbles would go around. I thought it was acceptable. The horseradish dispenser had the same problem as the garlic dispenser had the first go.

BEAN I wasn't crazy about that tabasco dispenser. Once you took the lid off and shook it, things went for the food pretty good but the problem is, on mine, always had Tabasco sauce in the lid. Then when I screwed the lid back on, the Tabasco sauce would end up all on the lid and on the bottle - the capillary action there; I had to clean off the lid. And every

BEAN (CONT'D)	time I opened the lid, I ended up, I think, wasting about half. I wiped about the same amount off the bottle each time as I'd actually put on the food, so I ended up having to use twice as much. The total mission I used over a bottle and a half of Tabasco. It never was quite as good as if the food had been in a squeeze container. It was sure better than what we had the garlic salt and the like in. Eat Period: Owen and Jack.
GARRIOTT:	We didn't try to eat together because of time constraints. We found it more efficient to eat otherwise. I think we would have probably enjoyed meals had we had the opportunity to eat together. If you're pressed for time and if you're trying to get a lot done, that's not the most efficient way. So, I have no complaints about the way we did it; it's just the way we had to work.
LOUSMA	I'd like to reiterate. They have to eat at regular times.
BEAN	It's too easy up there in periods of high workloads to just let your meals slip. You tend to let that slide because it can slide and you'll end up all a sudden finding you're eating lunch at 4:00 in the afternoon which means not only have you taken a chance of dehydrating partially, but now you got another meal coming along in a hour or so which you're having a tough time in getting it down. I think that the food, and

BEAN (CONT'D) like we've talked about earlier in the report, eating on time and going to sleep on time and exercising are the three most important things you can do. So particularly during activation when you're at a little bit of a high workload and excited, the more primary things ought to be to get your meals prepared and set down at the right time. Let me make another kind of comment here, I notice Owen didn't do and he seems to be satisfied but it didn't satisfy me. I enjoyed the meals much more if I prepared them beforehand and sort of put them there and turned on the timer and then came back at mealtime and then all I had to do was open the freezer and get out the cold stuff and get out the biscuits or something. I did not like to sit down to a meal and have to put hot water in something and need it. I always like to make the meal after the previous meal and when it came time to eat you just sat down. I think that's a personal opinion thing. Each person should find out what makes the meal the best for him in the most enjoyable way and where you can eat it the best. Try to keep doing that day after day because you don't want to get behind in these meals. You want to eat all the food and you want to enjoy it because it is one of the nicest times of the day.

GARRIOTT I agreed that I would have preferred it that way but I mentioned a moment ago I always felt pressed for time. I never felt at

GARRIOTT (CONT'D) the end of a meal that I had time to get the next meal ready; I had to go do something else. It was always because I felt too pressed to get it done in the most desirable manner.

LOUSMA I noted that it's a real paradox that the things that suffer when you want to get something done or you're running behind are number 1: the eat period; second, the excerise period; and third, going to bed on time. And those are the three highest priority items that you need to do on time and regularly.

BEAN You're right. But somehow when an experiment shows up with a number on it, you feel you have to do it right then. If you didn't do it and the experiment were postponed for 3 days, there are hardly any experiments that couldn't have been postponed for 3 days, you'd never know it.

GARRIOTT That is what it would require. It wouldn't require slipping it in hours, it normally requires slipping it in days. MO92/93 had their windows that you had to make, and these windows were only 30 minutes wide. You know you wouldn't have missed an EREP pass for anything.

BEAN No, you better not miss those.

GARRIOTT And the ATM - you have sunrise at a certain time and if you missed it, you've missed it. The same thing is true of every

BEAN You know right away if the lights don't work. You're looking around and it gets dark.

LOUSMA You're talking about deactivation here, but your comment is applicable.

BEAN Right. I'd skip it for deactivation. Lighting checks is like walking around your house and checking all the bulbs. You notice them if they go out.

LOUSMA Frozen Food Transfer: The only comment there is all the freezers were scraped clear of ice around the doors before we left.

BEAN We got most of our overage frozen food in one can upstairs in the frozen food box.

LOUSMA Top frozen locker has two cans of overage frozen food.

BEAN When you get full urine containers in the waste management compartment, if they don't fit in the freezers flat on the floor, you have to sort of cock them up a little bit to get them to fit in. But it's no trouble.

BEAN General Housekeeping: First of all I think you do way too much housekeeping. We talked about this on channel A. There's too much housekeeping that's sent up. For example, cleaning the fecal seat. You can look at the fecal seat.

If they've got adequate confidence in the system, you might as well use the water coolant because it is more comfortable. But if they are concerned about the systems, I think you could do the film exchange without it.

BEAN Lock Compartment: Works great. I think in the EVAs you want to add on an extra couple of wrist tethers. Just hung in the lock compartment for the things that might come up that you want to tether to. Use for any reason; they don't get in the way and they are always useful.

LOUSMA Refrigeration; Food and Urine Freezing: Freezers work good. Food, Urine, and Water Chilling: The chiller was always full of adrift items. The IMSS stuff was never fastened down. Most of the other stuff was just drifting around all the time and it would be nice if there was a way to fasten it.

BEAN We attempted to put some new snaps in, which lasted just for a few days. Then they unsnapped.

LOUSMA The bonding agent won't work with the refrigerator dampness. All the ones we put in came out and the ones that were initially there stayed.

BEAN Before this flight, they were trying to get in some epoxy and they never made it for one reason or another; flammability,

BEAN (CONT'D) possibly. They ought to look at that again. Just about anything you can do in one-g, you can figure out a way to do in zero-g and you don't have any danger. Our recommendation is to get some good epoxy up there. You could bond some things in there that would allow the chiller to work correctly. It could also bond down that rubber grommet in the urine system. If they're worried about flammability, take one and put it in a beta cloth bag, or something like that. There's no spark sources up there, and I never saw any sparks or anything, did you?

LOUSMA No.

GARRIOTT We did notice a little bit of static electricity toward the end of the flight.

LOUSMA As far as those things go, you need the same kind of things to work with as you need at home in your tool bench. Epoxy is one of those things you don't get along without at home and I think you need it up there as well.

12.4 CREW SYSTEMS

LOUSMA Restraints and Mobility Aids: That's a pretty big subject there, Ed. I think the biggest and the best restraint we had was the triangle shoes, I never tried anything different because they worked so darn well and they seemed to be what I needed, but you sure can't get by without them.

BEAN (CONT'D) and they just merely said, "... what are you putting spices on?" We'd let them know and then assume that we were using the same amount of spices per meal on certain items prior to flight.

BEAN One other thing that I noticed, at least in my case, I tended to added a little extra water to some foods. I always put an extra half of ounce in the macaroni, and a little extra ounce in something else. I think the thing to do is, before you go, establish which of these you're going to put a little extra water in and let them know so they can plan it or when you get back take a list of the foods and show them which ones you added a little extra water too. It get's to be a problem trying to remember what you added water to each day. It will be best if you record it just as we did for our drinks. We always had 8 ounces instead of 7-1/2. Any other comments about that one? Any way we can help Jerry in his game?

GARRIOTT Urine, Feces, and Vomitus Collection and Preflight Base Line Data: There was continual comment in my own case about urine volumes in flight which turned out all to be referenced to the last week of ground base data. I'm not sure that the last week preflight is necessarily a good reference. This is something that Dr. Buchanan and others will have to compare and think about. I'm just not certain that the preflight

GARRIOTT (CONT'D) base line data was an adequate basis for very much inflight monitoring and decision making. I'm saying they ought to look at more than 1 week.

BEAN Since we did 3 weeks of preflight data, you wonder what happened to the other 2 weeks.

GARRIOTT That's right.

BEAN They ought to have that information available on what the other crews did those 3 weeks such that when you ask them, they have the numbers at hand instead of having to go generate them. It gave me a feeling all the time when we asked questions, that they had the data around in raw form but nobody had reduced it and looked at it and tried to draw any conclusions from it unless we happened to ask.

GARRIOTT Bioassay of Body Fluids: As far as the collections are concerned, I thought it was pretty doggone well organized preflight and inflight and what little bit we've seen postflight. I don't know how it could be organized much more conveniently than it has been from our standpoint.

GARRIOTT Menu Deviations: Preflight menu for example and postflight menus, I think are distinctly different from inflight and it's a change that we very much appreciate. We know the

GARRIOTT (CONT'D)

first week we had a lot of deviations due to the fact that we weren't feeling well. After that, we got on to it and I think stayed pretty well. My own view is that the medical protocol was considerably too strict right from the start; there should have been greater individual variation allowed. I will again use my own situation as an example: I should have been allowed a higher protein level, which I think my normal diet would have included and there should not have been such a uniform requirement laid on the crewman all across the board. The one exception, of course, was Jack since he was so far out on the extreme. He was raised in many of these catagories, and I think that same sort of flexibility should have been allowed to other crewman to make it more like their normal sort of diet. I also would suggest that even such important minerals as the sodium or calcium should have had a greater variability. Then the man who likes to drink milk or the man who wants extra chocolate instant breakfast could have had a different level established as his norm than the other man, for example, who likes heavy starches or a menu more heavily oriented toward starch. As it was, we were all more or less put into the same slot. I think this showed up in the difficulty in finding satisfactory menus, for all of us. The deviations that we did reach in flight were painful to come by; nevertheless they were made

CARRIOTT (CONT'D) and I think ended up reasonably satisfactory, considering the fact that we only had so much of so many varieties of food on board. I think we do appreciate the work that everybody went to to accommodate us and work with us when we really felt a deviation was required.

BEAN I think they ought to decide once and for all whether the objective of the experiment is to get on a certain diet and stay there or to get on a certain group of minerals and stay there. For example: in flight we found out several times that we could deviate from the menu if we just let them know and then they could send you the proper number of pills or give you an alternate food. Before flight every time you wanted an alternate food or wanted to cut out something, it was a big fiasco to get it done. Finally you got it done and everybody agreed that it was okay, and that it wouldn't harm the experiment and that you were operating on your controlled numbers. It seems to me that it ought to be part of the normal operation if a crewman gets tired of tuna in the middle of the flight, he shouldn't have to wrestle with the food world for 3, 4, or 5 days to get the tuna out and something else in. They ought to have planned ahead. If tuna becomes a bad thing for an individual they ought to be ready to accept something else. Same thing if just 1 day

BEAN (CONT'D)

he doesn't feel like eating lemon pudding. They ought to be able to stand the fact that he's not going to eat it and tell him what pills to take in lieu of the lemon pudding. Generally speaking, their answer was that you can't change too much, but when you really got down to the facts of the matter you could have changed about anything. I believe that you could have eaten nothing for 1 day and they could have given you pills to survive that day. Now this is an extreme example but somewhere there ought to be more flexibility and a desire on the part of the people here preflight and postflight to change your menu. There's just a big reluctance to change it; finally, when they realize they have to do it, they are able to do it correctly and without problems. There ought to be a general attitude change about varying your menus; it would be a lot more helpful to the individual.

LOUSMA

I was pretty happy with my menu. There was some question whether or not I might have had too much before I left, but I felt it was just the right amount and that any less would have left me hungry. With the exception of tunafish and bread, I was able to stay right on the diet with no problems. I just tested the tunafish and I still don't like it. Other than that I was quite happy with the alteration to my diet to eat something else as opposed to tuna and bread.

GARRIOTT (CONT'D) that permitted me to eat and drink what I wanted and then report that to the ground. Of course that is a whole different concept from the way 71-73 was organized. I'm not so sure that Skylab is really ready for the controlled sort of diet that 71-73 imposed which might be more apporpriate for bed rest studies or patients who are confined to a hospital and have no other tasks or major responsibilities. In our case the medical experiments were a major responsibility but by no means a total task. I'm inclined to think that it would have been better from the overall program standpoint to have included an experiment which would have allowed the subject within rather wide limits to eat and drink as he pleased and report this to the ground. If supplements were necessary, then they would have been up-linked the way they were in this case. Of course, this doesn't help us in planning for SL-4 and to this extent perhaps our comments pertain only to future programs. I was never happy with the restrictions as tight as they have been for 71-73 nor do I think it was necessarily the best sort of dietary program to impose on a Skylab crew faced with a variety of important tasks to accomplish.

GARRIOTT M074 - Specimen Mass Measurement: On 74, we replaced one of the electronic units; it's about a 5 to 10 minute job, no problem. Calibrations I thought went well. One of the

BEAN (CONT'D) Drink Bag: we used the drink bags although they sort of tasted funny. I recommend that, if you're going to be out for a long while on EVA, you fill up the old drink bag because it doesn't hurt. It doesn't seem to occupy much space and gives you a fallback position. They did say from the ground that we all lost quite a bit of water even though we didn't feel like it.

BEAN Antifog: Antifog went well.

GARRIOTT Didn't both of us use that bag, although I don't think we needed them at the time?

BEAN I still don't think so. I never got thirsty. The only time I used them was just to use them.

LOUSMA I think it would be good if they would allow you to put some kind of other nourishment in the suit. There's some kind of stuff that you can put in there to eat. We took samples; i.e., candy bars, fruit, et cetera. During that one EVA, it was 6-1/2 hours. We not only missed lunch but we went well into the afternoon before we got anything to eat.

GARRIOTT Personally, I feel too uneasy about taking anything else inside the helmet where you can't touch it.

BEAN (CONT'D) there all the time or even really made much difference except psychologically because you always felt like now the taste of the food was under your control. If you wanted some hot food that day, you could put a lot of pepper on it. If you wanted it to be bland that day you could make it bland. Before the spices you were stuck, but this way it's at least partially under your control which has a lot of psychological advantages.

LOUSMA One thing I noticed that did not rehydrate very well was the meat and the spaghetti. That stuff just never seemed to get redehyrated.

LOUSMA The meat was very bad.

GARRIOTT There was a lot of gristle in the cotton-picking stuff. The fellow who canned the asparagus couldn't tell the difference between the stem and the stalk. The asparagus was all stalk and very little tip.

LOUSMA We wound up using lots of drinks. I think we each had one extra drink per day, and the first ones to go were the apples, cherries, and strawberries. Then we started working into anything else that we could find that was fair game.

BEAN Toward the end, we actually got into some of SL-4's drinks. They were all in one compartment and we listed the ones we took very carefully and only took the ones that were replaceable from Earth, namely the lemonade. Most of those I drank and recorded and I think Jerry's going to have to take up lemonade to replace those we took. I guess the total number to be about 15.

LOUSMA Food Preparation and Consumption; Problems with rehydration (mixing; gas): I found three kinds of drinks that didn't rehydrate very well were apple drink, cherry drink and instant breakfast. I wound up mixing all with hot water, shaking them up good, then leaving outside to cool at room temperature and finally putting them into the freezer. They were good that way. We mixed most of our cold drinks with 8 ounces of cold water instead of 7-1/2. It tasted like it needed it and it was a lot easier to slip two 4's in there than to move the lever from 3-1/2 to 4 every time. Surprisingly enough, those didn't leak very much either. All in all, the packaging was very good with the exception the spoon-bowl packs which tended to get some of the moist cereal or whatever under the seal. When you finally cut it, you had a little bit of a mess on your hands. The rest of it was pretty good.

LOUSMA

I can't tell you enough bad things about spoons-bowl packaging. When I introduced water, the food that was in a spoon-bowl package that must have given off a lot of gas was corn. It would blow the whole package right up like a balloon. The contents, when you mixed them up, tended to adhere to the side of the package and so they never make a nice neat glob down in the package. Instead, they make kind of a coating around the whole inside of the spoon-bowl package so that you had to scrape if off the inside of the package. When you went to cut the top off, frequently the contents that had seeped up into the area where you had to make the cut came oozing out. Then you would open it and frequently there'd be a bubble across the top and the rest of it would cling to the sides of the spoon-bowl package. There's no way to shake it down into the the can like you did the other foods. You'd give them a little spin and all the contents would go to the bottom like potatoes, for example. The only way to eat out of there without getting a big mess was to use the command module soup spoon. Otherwise you'd have that stuff all over your finger tips because the spoon wasn't big enough to reach down in there and get it all out. It was generally a mess to eat out of those packages. That's the thing I didn't like about them most. The other thing was that they were the only packages that consistently had failures during rehydration. They were the ones that had the leaks most often.

23-11

BEAN | Also I notice that some of those spoon bowls, maybe all of them, didn't have the little cap on them that closed them like we had on most of the food and also on the drinks. They had that kind of crumpled celluloid end such that you had to trim off and then be careful as you put on. Those little cap ends are much better. You could cut those off with your knife and they always popped off clean; the other ends were a little bit more trouble. We found that the hot and cold water did not have any gas in it, but when we put hot water in certain items you found gas came from the items themselves. For example, the corn made gas and the spaghetti made a little gas. The veal made a lot of gas. The chicken and rice made a little gas. There were just certain foods that the minute you put hot water in there they made a lot gas. Now I found that I could always vent mine. I kept a little extra spout off one of the drinks and I would spin my food around and get the food at the bottom and put the little vent in there and let the gas out. If you get much gas in there along with the liquid, you can't put the lid on your food tray and get it warmed up.

GARRIOTT | I vented mine with the tip of my knife. I just normally shook it down; I would just give it a flip holding on to the water inlet port. That would throw the food to the bottom and then press the valve with the tip of my knife.

LOUSMA | If you want to keep it warm like that you've got to let that gas out because otherwise you can't get the lid on your food tray. That leads me to another very unsatisfactory arrangement, that is, the little latch in that food tray is a piece of junk. It usually didn't work on mine anyway. If you do try to get it working, lots of time it'll push right down to through the bottom. Then you can't get it loose without using a knife or a couple of knives on it.

GARRIOTT | We've two spare trays setting out in the dome lockers that might just be worth Bill and probably Jerry replacing theirs since those two seem to be the worst. Get those new trays and see if they work. They have the old ones as back up anyway.

LOUSMA | Sometimes you had to hold them down with tape. Most of the time you just kept them off of there because they were a nuisance. Everytime you go by there, and touch it, the thing would pop off and go floating around somewhere.

BEAN | Good point. Another thing, it'd be desirable if those things would just get a little bit hotter than they do. I found that the food was never was quite as hot as I would have liked it. It never seemed to reach the boiling point of water. I recommend that when they build one of these in the future that they put a little adjustment on there so you

BEAN (CONT'D) can make it a little hotter, either with a screwdriver or hand controlled but not err so much on the cool side. I particularly didn't like the chili there because the chili was always luke warm. There's one kind of latch I consider unacceptable on the spacecraft. That's the kind you use to hold down the lid on the EREP C&D, or the hold down lid on the S019 AMS and optical canister boxes. Those things don'have any friction in the hinges. You've got about four dial latches on each of those lids. You've got to make sure you hold all those dial latches. They are unacceptable. You got to make sure you hold them all down, otherwise you can't get the lid open.

GARRIOTT You would be if you had friction at the hinge point.

LOUSMA The message is don't make hinges without friction in the hinges. In this particular case, you get three down and there is still one latched and you try to open the lid and you can't, so you put that one down and another floats up. Continuous nuisance. Another thing that works kind of hard is the place where you repressurize the nitrogen bottles for the maneuvering unit experiments. The stowage location of the gas pressure hose works very hard. You got to really pull and tug and it's better to leave it off.

LOUSMA	When you get a food can out of the frozen locker and try to take the lid off to cook it, the temperature has made it such that the first thing that happens is the snap breaks off and you can't get the lid off. So you got to let the cans warm up after you get them out of the freezer before you take the lid off. I only cooked steak about an hour or hour and a half. It was a lot better, juicier that way. If you don't eat that steak in a hurry after you break the little membrane, it's all dried out because it is such a dry atmosphere. It dries out your meat very quickly. You have to get with it if you really want to have a good steak.
BEAN	Water flavor: I didn't notice any, did you? I could tell it when I drank water out of the water gun. But when I mixed it with the food or had it in a drink, I couldn't determine if it really had a flavor. It seemed to be acceptable.
LOUSMA	I didn't think there was any unusal amount of gas in the water, did you?
GARRIOTT	I didn't notice any. I thought the flavor was the same. I didn't notice any at all.
LOUSMA	I used the big spoon. The rest of the tools seemed to work quite well.

BEAN	Opening Cans: One thing still puzzles me about those cans. We opened all sorts of cans up there, and several times my hands slipped and ran down the edge of the can, and if it had been any of those cans at home, it would have cut the heck out of it, yet those cans never cut me. So I'm not sure exactly how they designed them, but some way they are made so that the edges aren't just that sharp. I just had incredible luck in rubbing against them and didn't cut myself.
LOUSMA	You want to be careful about leaving these little metal filings, we mentioned before, getting in your food. I noticed two times when I took the lid off, there was a little metal curlicue, sharp-pointed filing came off and was lying on the food. So if you ate one of those things it might scratch your insides a little bit.
BEAN	Both the diced peaches and the dried apricots, when I ate them, several times I bit down on a nice little peach seed in there somewhere. Apparently, in those two items, you have a potential for breaking or chipping your teeth. I would suggest when you eat either of them that you be very careful.
BEAN	Consumption from Cans: It worked great.
LOUSMA	Food Waste Stowage: Function of the Germicidal Tablet: I don't think we ever used it. Use of germicidal tablets was zero.

BEAN

The garbage never stayed around long enough to give you a problem. A good technique is anytime you have a clean can such as you might have at the end of vanilla wafers, or at the end of the vanilla wafers, or at the end of bread, or at the end of many of the foods that had a plastic inner liner, let's say chicken and rice - you would throw out the plastic inner liner. This allows us to get more waste in those six cans, and we didn't have to empty them but once a day. We didn't have much in the way of smell over there, I did notice that, if you didn't change your trash bag in your locker right near your food station faily frequently, let's say at least once a week, that it would begin to smell in there because you put tops of drinks and sometimes drinks in there. That was the only area I noticed around the whole spacecraft, except sometimes my urine drawer, that had any sort of smell at all. Everything else smelled nice and clean and fresh.

LOUSMA

Let me mention two other foods that I forgot. One is the turkey and gravy. It didn't seem to matter how much you heated the turkey and gravy, it never got hot enough or it never would cook long enough to break down the grease that was supposed to form the gravy. You wound up having to mix it yourself or just take it the way it was. The pork tenderloin never seemed to have enough gravy in there

LOUSMA (CONT'D) to soak up the dressing and so some of the dressing was kind of hard and dry. You had to cut it up and sort of eat it like a piece of meat.

Fecal Container: We used it during entry for the urine bags.

Urine System: We didn't use it in the command module. We already discussed the one in the SWS.

Bean Water: Command module water did not have a chlorine taste. It was real good as long as we used it.

LOUSMA It was a little gassy, as I remember. But we didn't use it very much like you say.

Gas/Water Separator: I think we all made it a point to drink extra water, even though we some times felt we didn't need it. Just make sure we didn't get dehydrated and had enough in us. I don't remember being thirsty except maybe during EVA. There was always plenty of ways to satisfy your thirst if you got that way.

BEAN I felt that a couple of times up there I was headed toward dehydration. The only way that I knew it was not was the fact that I had noticed, on a day-by-day basis that my urine volume was going down. One day it would be 130 and

BEAN (CONT'D)

then the next day 100 and the next day 90 and 80. I would say, I'm getting dehydrated. Now the first time this happened I wasn't so alert to it and actually got a run-down feeling. I didn't pass my LBNP and that's when I got alerted to the fact that something was different. I felt bad for a couple of days before I had done that. Looking back on it now, I'm pretty sure that it was strictly dehydration. It was because I wasn't working hard to get enough water in me. I never felt the whole mission that if I hadn't been monitoring my urine and hadn't been going out of the way to drink water and drinks that my natural desire for water would have been enough to keep me from becoming dehydrated. Every day up there, in order to keep my urine volumn up, I had to drink much more than I wanted to. I had to go by and take sips. I had to go by and drink drinks and I had much preferred to just to forget it. I hadn't noticed that tendency here on Earth in the years that I had been milling around down here, so it seems to me that maybe something with the repositioning of this fluid also interferred with your natural desire to drink water. It also could be the fact that we were not taking very much in the way of salt. So your no salt doesn't make you thirsty, but I think it is important for each individual to keep an eye on his urine volume and if he

BEAN (CONT'D)	begins to start down, he should start drinking more water to keep it up. Try to find out what his preflight level is and make an effort to keep that baby at least that high. If it start going low, start drinking even though you don't want to; it might help you out.
LOUSMA	The only other time I can remember being thirsty was just before entry, where we sat in the command module for so long and it was hot and humid. We each had three extra drinks plus what we had with our meal, but that still wasn't enough.
BEAN	I think that idea of getting three extra drinks is an excellent one. You shouldn't wait until the end of the mission to set those drinks aside. That ought to be something that's planned and set aside. I think maybe three is a marginal amount, particularly if you are going to spend as much time in there as we did. If you are going to spend something like half the time which is all you really need to, then it is probably enough. But having extra drinks along with you even if you don't use them and you land on the water and don't drink all the drinks, it's still a good thing because it allows you to have some good quick water. You don't have to use the

SKYLAB AIR-TO-GROUND VOICE TRANSCRIPTION

323 03 16 09	CC	Skylab, Houston through Vanguard for 9 minutes.
	CDR	Hello, Houston, Skylab. How do you read?
	CC	Read you loud and clear.
	CDR	Okay, Hank. Subject came to mind during the medical conference that I meant to men - mention to you some time ago, and hadn't. We got an awful lot of water or ai - air - gas, entrained in our water. It's almost as bad in the workshop as it is in the command module. It's making it a little tough for us to reconstitute the - the foods. I'm not sure there's much of anything we can do about it. Wonder if you'd have the wizards down there think about it a little bit for us.
	CC	Okay, will do.
323 03 17 09	CC	Skylab, Houston. This is the last pass for the - for the night before your bedtime here. I got a couple of things that I would like to get by you right quick. First for the - for the PLT, the Sudafed is in W-706, in the far right rear can, in the upper level of the can. And tell the PLT to also take a baseline temperature tonight and tomorrow morning, and report tomorrow morning only if there is anything abnormal.
	PLT	Wilco.
	CC	Okay, and a general - general question there for you in regard to the ATM panel there on the top ... in the POWER SYSTEM ALERT light. We tried to do some commanding on that. We wondered if that's cleared itself up?
	SPT	Okay, Hank, I - Hank, I haven't had a chance to get back up there and take a look. I'll do that as soon as I get the first opportunity.
323 03 18 22	CC	Okay, we can get an answer on that tomorrow then. And we are noticing that the package temp on quad A is still going up and - in fact, it's

REFERENCE 3.2

	CC	Okay, we'll do it. And we were watching Ed down here and it looked like he got a lot of good sleep. And we pursued your comments on air at the - in the water from the wardroom table. And looking at comments from the SL-3 crew, they did not have trouble with air in the water. But it appears that the food they reconstituted tended to off-gas and produce some - some air. So you might take a look at where the air is coming from. Is it in the water or is it produced by the food you are rehydrating?
323 12 24 03	PLT	Okay, Story. It sort of seems like the drink nozzle. At times I thought I was getting a pretty steady flow of water, other times it's almost frothy. But I don't want to overemphasize that. But we - we were more or less convinced there was some air entrained in the water, although we did observe that there is not only air in the food packaging, but there could be this out-gassing you are talking about.
	CC	Okay, in rehydrating some of the drinks, you might be able to look at the water there and see if there is any bubbles in it.
323 12 24 37	PLT	There - there is quite a bit of air in - in the drinks, but also when we mixed our salt solution, it - it was almost translucent; it was translucent because of so many small air bubbles. You know it just occurred to me, Story, I'm going to go check all the QDs on the water fittings. It just may be break them and make them again. See what they think about that down there?
323 12 25 23	CC	Bill, we think that water tank 2 is about bottomed out, and we'll be switching you to another water tank. So you might as well stand by on examining the QDs.
	PLT	Okay.
323 12 37 41	CC	Skylab, we're a minute from LOS and about 30 minutes to Texas at 13:06.

END OF TAPE

		wardroom water, they didn't find any gas in the wardroom water system. However, they observed that when they added water to certain reconstitutible food items like veal and spaghetti, there was gas formed as a result of the reconstitution. He suggests that in order to check for where the gas is, you notice whether you get gas when you reconstitute drinks. He said they did not have any gas in the drink reconstitution. Over.
323 17 49 21	CDR	Okay. We've noticed all that same stuff ourselves, but we do definitely have gas in the water because you can feel it in your mouth when you take a drink out of the drink gun.
	SPT	And, Bruce, I also - when we got down here the first day, we're still working out of some of the bags. I used the wardroom table for just plain water, and I got maybe, oh, six or seven drinks out of that. Just plain water and maybe 10 - 10 to 20 percent of it was bubbles.
	CC	Okay. Thank you, Ed. We copy.
	CDR	Bruce, also, when we reconstituted our salt into the liquid sodium - there's lots of bubbles in that, too.
323 17 50 12	CC	Okay. Do you think you're getting any distortion of the volumes of water that you're using or significant one, due to the fact that there's air in it?
	CDR	That's affirmative, Bruce. That's why we've been coming down every day on the evening report with reduction of deltas in the rehydration water. We average a loss of about 1 ounce of water on every drink and something like a half an ounce on all the reconstitutibles.
	CC	Okay. Thank you.
323 17 51 01	CDR	So what it means is, we do a lot of bag swinging up here after we get the thing - get the water in and try to make room to get some more water in.

	CC	Is that generally successful?
	CDR	About 50 percent of the time.
	CC	Okay. Because they tried that on Apollo 10, with the orange juice, and didn't have any notable success.
	CDR	Oh, it works - it works about 50 percent of the time, if you're quick. You can take an 8-ounce juice container and fill it with 8 ounces of water, and then swing it, and about the top inch and a half of it will be a big bubble. If you work real fast you can put a valve in and get rid of about half of that air and then you start getting liquid and you have to swing it again. But, what it does, it makes food reconstitution a real time-consuming event.
	CC	Sounds like it makes it more of a black art than a science, but is Bill where he can listen or talk for just a minute?
	CDR	Yes. He's listening.
323 17 51 47	CC	Okay. With respect to the Coolanol reservicing this afternoon, we got a couple of items here. If you could dig out your SWS Systems Checklist. We're looking at page 9-61 and following. Over.
	CDR	Okay. Stand by.
	CDR	Okay, Bruce. Hit the page again.
	CC	Okay. 9-60 and subsequent.
	CDR	Okay.
323 17 53 00	CC	First item is, as you notice on the Flight Plan, we're asking you to weigh the Coolanol before you do the servicing, and also to weigh it afterwards. This is weighing the container in the A-7 locker. And prior to weighing, we'd like you to remove this - remove as much of the food as is possible. But without removing the RCS tank and its bracketry from the A-7 locker, since we understand it's a

CC Okay, and I've got that. And on the next item that's on the Flight Plan deviations, Jerry, we do have a Vanguard pass coming up about 10 minutes after your scheduled bedtime. And that's about a half an hour from now and I was thinking we could save that and I can give you a call there and you could review today's Flight Plan. And just let us know what you did not get accomplished, and we'll crank that into our planning.

324 03 39 33 CDR Okay, good enough. Now let's see, I owe you some food information now.

CC Okay.

CDR Okay, for day of the year 323, mission day 4, menu Charlie. CDR: no salt packs; deviation is minus one coffee and rehydrate - rehydration water deviation. I mentioned this to Dr. Hordinsky and I think what we ought to have the food people do from now on, is assume that we're going to lose 1/2 ounce of water on every drink that we mix, due to air in the water, because I think it's just a big pain in the neck for us to sit here and recalculate that every night, because - and use the same number. People on the ground can do that.

324 03 40 27 CC Okay, concur.

CDR Okay for the SPT: no salt pack used, no deviations and the same on the rehydratables. PLT: no salt packs used, deviation is minus one coffee and same thing on the rehydration water.

CC Okay.

CDR That's it.

CC Okay, real fine, Jerry. Incidentally, a while ago, on that business about the two-inverter operations, I wanted to give you just a word on that to put your mind at ease. What we've tried to do, it turns out on all three missions, is go to one-inverter operation to save some power, and it turns out that the coolant loop just starts getting too cool. And we should have corrected that in

332 17 45 01 PLT

Non-equipment. Okay, that's item number 3: How effective is non-equipment-assisted verbal communication? I'd say - say when you're on the same level, you have no difficulty communicating. And this is because of the noise level and the way it increases as you go up and down the X-axis of the workshop. So when you're trying to shout to somebody who is separated from you by more than 10 or 15 feet along the X-axis, you find it extremely difficult to communicate. When you are communicating on the same level, say in the X/Z plane, you have no difficulty. Of course, that restricts you to a limited distance there, probably no more than 20 feet anyway. Also, I think probably the shape of the workshop, the fact that it's round, helps a little bit to focus sound and especially when you're communicating on the same level. I would say - I think I've already given the distance - I'd say, oh, 15 to 20 feet. When you're separated by more than 15 to 20 feet along the X-axis, you actually have to shout.

332 17 46 12 PLT

Okay, item number 4: How satisfactory are the food management and dining accomodations? I would say they were satisfactory. I think that's what I would give them. I like the water guns; they're real good. The dispensing system is good. One of the things, the foot restraints, - they have already been picked to pieces; I don't want to cover them. I don't like them too well. They clock your triangles, but they don't unclock them; so when you get out of the foot restraints on the - on the wardroom table, you got to reach down and exert quite a bit of force with your fingers to unclock the triangles so that you can use them in the grid. And this means that - It's a little bit unpleasant, and you sort of tend not to use the triangles in the pedestal around the food preparation table. Foo - Foot restraint is - is essential when you're around the - the wardroom table though, and that's where I usually step back and just use the grid, because I'm a little bit lazy and I don't like to reclock the triangles.

332 17 47 17 PLT

The - How well does the food adhere to the utensils when eating? It adheres quite well; however, you

still get the splash and spatter problem, and in fact, getting all of the food out of the plastic bags and - Once you get it on the utensil, out of the bag, then it's no problem. One of the things that I would like to - that I find is difficult is fixing - is mixing the condiment in. And I find that I spray - I try to really spray it around and mix. Cut a big triangle out of the plastic container, hold it over the food, and spray the condiment in there, whether it's pepper or Tabasco sauce, which are the main condiments I use.

332 17 48 02 PLT

Would a closer tray-to-mouth proximity have improved eating ease? The answer is, for me at least, affirmative; it would, and I find myself eating Japanese style quite often, getting my mouth down very close. And this just - it just minimizes the probability of getting - getting food loose, because you're - you got your mouth open right down next to the food and you can sort of shovel it in.

332 17 48 29 PLT

What unanticipated problems have occurred in performing various activation, housekeeping, or experiment activities to date? Well, I guess they weren't really unanticipated, but movement around and restraining myself has caused me a little bit more of a problem than I thought. I've already mentioned the problem of stowage - temporary restraint and stowing of loose items, particularly when assembling equipment that has multi - a multiplicity of pieces. One of the things that has really caused me more trouble than anything else is the book and accounting on the film. One of the worst tasks I've ever performed is in the film transfer. I don't think it was too well - As far as the bookkeeping part of it, it was excellent. I mean there were no errors. There were no errors, and it was correct. However, as far as being well designed for the human factors and so forth and having some creative planning going into it, the film transfer represents a good example of how not to do it.

hook your shoes on to, whether it would turn out to be triangles in the future or squares or balls or whatever it'd be. I think that much of the environment should be made of that particular material.

SPT How effective is non-equipment-assisted verbal communication throughout the OA? It's okay if you are in the same compartment - that is, if you're, say, in the lower bot - lower storage well of the OWS or the upper compartment or in the MDA or in the command module; but if you're trying to go from any one of those four compartments, it's awfully hard. You can't do it because there is usually too much noise, or there's too much absorption of sound. If you happen to be in the experiment compartment, then you can usually call up to someone above you, but it does take a fair amount volume.

332 23 46 36 SPT How satisfactory have the intercom boxes been for IVA communication? I find that when they are not squealing they're okay; however, the problem with the squeal just makes these things almost obnoxious at times. I think that it's a shame, and I think that they could have been designed better. I don't think there's any reason for - with the technology that we have at our disposal - that we end up with comm boxes that have squeals for three missions. We have come up with an alleged fix for these; however, when we put the fix in, we find they still squeal; maybe not quite as bad as the other guys have had it, but they're still squealing. Every time you press one of those buttons, they squeal, and then you run around for a good 10 - 15 seconds trying to find out which box it is, and then calm it down. Air-to-ground also works the same way. I find it's not such inconvenience, but a real time waster. I think whoever designed that thing just incorporated an awful lot of wasted crew time and a lot of - he created a lot of nonproductivity into the whole mission. Locations are not too bad.

332 23 47 49 SPT How satisfactory are the food management and dining accommodations? They're not too bad. I could find - I could think they could be a little more pleasant in the wardroom. They're - Functionally, they seem to work reasonably well. I don't have any real major complaints right now.

SPT

How well does the food adhere to utensils when eating? I don't find that's any problem as long as you reconstitute it well enough. There are a few things such as sausage which gets a little out of hand, tends to break-up and move away. Would a closer tray-to-mouth proximity have improved the eating ease? No, I don't think so. Not at all. You're - if you have a problem, it's going to be with you regardless of what you do there. You just can't put it up next to your mouth and flop it in.

332 23 48 38 SPT

What unanticipated problems have occurred in performing various activation, housekeeping or experiment activities to date? I think the unanticipated problems are relative to that we did not anticipate we'd be running so darn many medical experiments which we had never seen before. There are some good ideas behind these medical experiments, and the objectives are worthwhile. However, I think the people who are behind them were completely wrong in not exposing these experiments to us early and letting us get some training on them. It took us, as a rough general - just a rough generalization, a factor of 2 longer than what was planned on the Flight Plan to carry out every one of these; by that I mean the - the stereo photos, the IR photos, the limb - volume measurement, the blood pressure - leg blood pressure measurement, and one or two others which don't come to mind right now. They were scheduled an awful lot in those first few days, and it took up a major portion of our time just trying to get those darn things done, and we found that we were usually running far behind the time line and unable to get most of the housekeeping and transfers and other things set up in order to get this place squared away.

332 23 50 06 SPT

The net result is that our first 7 or 8 days up here were not something I'd want to go through again. We were hustling around behind the time line tired and irritated for those - for those - that whole first week. And I think it all boils down to the fact that we throw a lot of experiiments on board at the last minute, dumped them all in at the very beginning of the mission as a very critical type - time period, and expected it all to work and, of course, it didn't.

a man to do up in zero g. It used to be that something like that was never even thought of. It's a relatively complicated task since it really wasn't an Instamatic type loading. But since we're tight on launch weight and volume, we had to just bring the film and not an extra camera.

SPT — So, all and all, we're pretty happy with the way things have been here, and we feel that the next 70 days or so in space will be both quite enjoyable for us and rewarding. And we mean rewarding for the total Skylab program and the country.

333 00 37 02 SPT — Thanks for being with us.

CDR — Here you are.

SPT — May be frogs' legs ...

PLT — ...

PLT — (Laughter)

333 00 38 40 SPT — You will see Dr. Pogue here extracting some salt water - trying to extract some salt water - using the syringe with a bag in which we have brought up salt and mixed with water once we got on board. Apparently, he's done pretty well on this. Many times the salt sticks up, not because it gets too - too wet as it goes on the ground, but because it gets too dry up here and it just dries inside the place where we put the syringe. Notice Dr. Pogue now; he's injecting salt into his filet.

333 00 39 20 SPT — All the techniques of a good surgeon. (Laughter)

END OF TAPE

of the squeal problem. You've probably heard, sometimes during the activation phase, that we were having fits with the squeal problem. Once we put in the antisqueal device in the command module, the - the squeal problem on the air-to-ground loop is pretty much solved. The squeal problem does, however, still exist on occasions for using the intercom boxes for intercom - that is, for IVA commumications. I think the intercom boxes are generally pretty well located. I can't think of any other places that we could locate them other than where they are, right offhand. If I think of anything specific, I'll put that on the chan - on the tape, channel A tape. Nonequipment-assisted verbal communications throughout the workshop is possible. It's - In the workshop area, it's quite easy to communicate with anybody that's within the workshop area. You can talk to anybody in the experiment compartment, the wardroom, the waste management compartment, or the sleep compartments without any great problems at all. The - the waste management compartment, of course, does become a little bit difficult once you close the door and turn on the fan.

333 03 20 44 CDR

The food management and dining accommodations, I think, are pretty well laid out. We have a rather unique problem in that we are staying much longer than was originally planned; so the food is not packed for us in the manner that makes it easy for us to get to - to it in the proper days. We finally had to spend quite a few man-hours, I think about 5 to 6 man-hours, in rearranging all the overage food in a pantry fashion so that it could be easily obtained when we need to come up and fill up a food bag for a high-density day. I would suggest, in the future, for food bags, that we consider going pantry style. I think the pantry style is a - is a good way to go. Design some little hand-foodbags that you can carry with you and go up and just pick your menu out of a pantry, out of cans that are marked and each can holding only one kind of food, with that marked on the front. Possibly you could put some X's or some O's or something on the front of the can - on the top of the can so that when you remove an item, you merely draw an X or write a - put a line in

one of the circles, indicating that one's missing. And that way, the number of open X's or open circles or squares would indicate how many are inside. I would suspect that it would be a good idea to have the food located in such a manner so that it's much like a razor blade dispenser - when you pull one - one can of food out, the next one moves into it's place behind it - and that you don't have two layers deep, that there'd just be one layer all the way to the back.

333 03 22 49 CDR That means food cans about 4 feet long instead of 2 feet long or about 36 inches long rather than 18 inches long. The food adheres to the utensils quite well when you eat; surprisingly so. I think the fo - most of the food is sticky enough so that it's no problem at all to eat. I don't think it would be good to have a closer tray-to-mouth proximity because the food tables are used for - as a working table, as a desk, and I think you need to have it where it is.

333 03 23 29 CDR What unanticipated problems have occurred in performing various activations, housekeeping, or experiment activities to date? Well, I guess the most - the most prevalent unanticipated problem that we have experienced during activation and housekeeping was - Number 1: As much time as we've spent in the workshop trainer at Houston doing mini-sims and finding our way around, we still came up here and we were like one-arm paperhangers and bulls in a china shop trying to find our way around.

333 03 24 11 CDR I'm going to break this off for a moment for a medical conference. I'll be back in about 10 minutes.

TIME SKIP

333 03 34 25 CDR No.

333 03 34 31 CDR Yes. This is the CDR back on - on the recorder again with MO - M487-2, proceeding on. Let's see. We were talking about unanticipated problems, and

time. I find that kind of inconvenient. So I guess the kit itself is very good, but the location is poor.

SPT Towels and washcloths: I guess I'd give those a poor. I think the fire guys really got away with something when they made us go with that kind of material. I don't think it's absorbent enough, and I think it's too hard.

SPT General utility wipes: Okay, those are all right, except they're a little bit hard to get out of the container. I'd give them a very good. Again, we don't have enough of them.

SPT Wet wipes: I think they're too hard to open up; I'd give those an adequate. They're good once you get them open. Biocide wipes: I'd give those a poor. No one wants to go on in and get that biocide all over your hands whenever you want to clean up one simple thing. I think we ought to have a plastic handle on a sponge which has got something - which has got a way of getting biocide into the sponge, and then can be kept at a location where it won't dry out.

338 03 30 40 SPT Utensil wipes: Adequate. Again, tough getting the bag open.

SPT Trash and plenum bags: I'd give those an excellent; I think they work real well.

SPT Urine/fecal bags: I'd give those a very good. Only thing is they do tend to - a little bit hard to roll up and get them all squared away.

338 03 31 06 SPT Wardroom table, eating space: I - I guess I'd give that, oh, an excellent. I think that works pretty well. Thigh restraints: Adequate; they don't really hold you in there. You got to work at it pretty hard; what we really need is a good pair of foot restraints in there. Wardroom light-day - light-duty foot restraints: They're unacceptable. They just - they don't hold your shoes; they're too - way too small and you really can't get your stocking feet in them because you can't hold yourself that well

with your stocking feet ... Food reconstitution - well - We're getting away from the foot restraints.

338 03 31 50 SPT

I'd give the foot restraints an unacceptable. Two reasons: first your triangles always become locked and they still come out. So you're going to have to get in there and try to unlock your foot restraints with your fingers, or try to squeeze them back into those foot restraints to try to get it - to square it away and get it working right again - get it working right to pull your foot out. And secondly, there is only one location. I think we should have just done away with that completely, as we planned to do - planned to do, and just use triangle grid. Let you put your feet wherever you want them. That was really a make-work project there. What we also really need are some lightweight foot restraints that just snap into the triangle grid, so you can put those anywhere you want, because there - I could just go in there in my stocking feet, or with light shoes on and work that way. That, combined with the thigh restraints, would probably be a good system.

338 03 32 52 SPT

Food reconstitution dispenser: Okay, it works pretty well. Little bit hard sometimes in order to get the - I'd give that a, oh, very good. A little bit hard to get the food you're reconstituting out of it at times, but that's no real major problem. What I would like to see is a way of selecting how much you want, as we have, but also a way of letting the little - marker run up and show you how much you are actually getting at any given time, so you can shut it off right when you wanted to. I think the - Also we ought to go up to 8 ounces on that because many of the drinks are over 6 ounces, and it's a two-action move there in order to get it all in there. What I'd like to have then is, going back to the present system, is a way of seeing exactly where the cylinder is; that is, how much is in the cylinder at any given time while it's charging. That way you can cut it off by going from CHARGE to DISPENSE at any moment. I think especially if you had 8 ounces you might just leave it at 8 ounces all the time. It's a lot more bother moving the thing back and forth, and just

	cut it off whenever you wanted it. You had your option.
338 03 34 19 SPT	Water gun: I think the floods of water are - I'd give that an inadequate. I think the floods of water are about a factor of 2 too small. I think you need twice as large. Food tray: Works real well; I'd give them an excellent. Food cans: Oh, I guess I'd give them a very good. Beverage Dispensers: I'd give those a very good. My personal preference is to see something which is all one integral unit on the top so you don't have to put one piece inside another to make it work. Seasoning dispensers: I haven't used them very much, but I guess I'd give it an adequate. Beverage dispensers. I guess I'd give them a very good.
338 03 35 05 SPT	Going back to seasoning dispensers, I've not used them too much at all. I guess I'd give them an adequate, the problem being that many times the seasoning leaks out of it, and it will also run up the side of the dispenser when you try to get a drop out. Eating utensils: I'd give those an adequate; the main reason being there that the ser - spoon is way too small. I've had to use the one from the command module. Sleep restraints: I'd give that an adequate. One of the problems is that it's kind of tough to get in and out of that thing. It's a real struggle every time I work at it. I also don't know what the heck that thing hanging over my head is supposed to do. I would much rather have something you could pull from one side to the other. The thing hanging over my head just really gets in the way, and I'm thinking of cutting it off.
338 03 36 07 SPT	Trash airlock - Okay, sleep restraint I give an adequate. Trash airlock: Commander does all the work there. From what I see, it looks very good except for the possibility of it binding up on you. Vacuum cleaner: I'd give that an adequate. The problem there is that it just doesn't have enough suction. Wardroom table, noneating uses: I find putting the cover back on after every meal is just too much thrashing around, so I never really do it. For that reason I'd give it an inadequate. Okay,

bags are unpleasant to use. I'm talking about contingency fecal bags. The fecal collection bags that we use in the head are - are sort of difficult to use. I wondered if there isn't a little bit easier way of fixing the seal on these, if there were some kind of very simple roll-down. You could put a little, tiny thin sheet of metal across that or have one that you could attach to it, and you roll it down like you're rolling a - a window shade over a roller.

344 21 53 58 PLT

Because all that sticking and pasting to pull the little green pieces and everything seems to me to be all devoted to making sure you got a good seal up there, and I'm just not sure that you need all that origami - let's see - WMC origami to made sure you got a good seal at the top of the fecal collection. And that's sort of time comsuming. That takes about 5 minutes at least, after you go to the toilet, just folding and pasting - folding the green paper and pasting the elactics together. And I think a simple, old-fashioned - what do you call it? - window-shade-type affair, if it was properly designed, would give you the same effect.

344 21 54 52 PLT

This is the PLT continuing with M487-3 Alfa on page 3-4, food manangment equipment. Wardroom table (eating station): I would classify it as adequate. We need better ways of restraining our utensils. I - I don't like to put them up every time. There's no - there's no reason to put them up in a drawer. It's a pain to put them in that little holder. The holder is unacceptable as, far as I'm concerned, the holder for the tableware. I got the eating utensils up in our private lockers. You put the stuff in there - They're hard to get in. Then they just float out.

344 21 55 27 PLT

I've put rubber bands around my tray, and I hold my stuff down with - with rubber bands. The magnets, eight: Let's see. I would give them a poor. The magnets just aren't strong enough. I'd say - I'd like to be able to throw a knife at this thing and have it hold on to the thing, but we've kicked - By looking out - While looking out the wardroom window, we've kicked our untensils off. And I've got a spoon stuck on the collector right now

upstairs, the diffuser collector. And the wardroom table as an eating station is not bad. It's - I would say that it's adequate. Okay, the thigh restraints, I don't use. I - I use the foot restraints, and I use them out to the side, not on the pedestal, because you got to re-clock your triangle cleat every time you do that. We talked about that before. Wardroom light-duty foot restraints are just like the head - they're unaccepted. The - Yes, unacceptable. They're not - they don't even serve the utility function for which they were designed.

344 21 56 25 PLT

Food reconstitution dispenser: They're a little bit stiff - get more a bit stiff to work at times, but I really can't complain too much about that, other than the fact that in the future - See, we have to reconstitute many, many, many items. In fact, most of them, they require more than, I think, the 6-ounce max limit of these things. I think that a food reconstitution dispenser should fill to a volume equivalent to the max required to the reconstitution of an individual food item. Not if you're trying to fill a contingency water bag, okay; I'm going to give no argument there. I'm not saying that if you don't have a quart of water in, to be able to put a quart of water in there, because that could be un - undesirable. But I think we should be able to charge that thing with enough water to fill the food items which require, say, 8 ounces of water. Water gun is good. I would say that's - in fact, would be given an excellent rating.

344 21 57 23 PLT

The food tray: I mentioned this a ... - a little bit earlier. I don't like - The magnets aren't strong enough. The tray lid, of course, has been bad-mouthed quite justifiably. That's a pretty lousy design, that little latch on there. Let me see if I can think of anything else on the food tray, beacuse there were some comments I want to make on it. The timer, we don't use. We just turn the thing on. It doesn't put out that much heat. You can just turn the heater on, and it's never going to burn anything, for crying out loud. It - it just doesn't put out that much heat. Food cans: They've already been - Let's see. ... food tray is adequate. Making sure of that. Water gun is excellent.

344 21 58 06 PLT

Food cans are adequate. Those have the - They - Some of them have collapsed. We were able to get them out, the overcans, with no problem. That wasn't a concern to me. Because of the - Apparently, they go some - higher than 5 psi in there. Beverage dispenser: The beverage dispensers are - let's see - poor. You get an awful lot of air in them, which is not to say - maybe not the blame to - not the fault of the dispenser, but the valve is not reliably easy to use. And we - Sometimes is very difficult to get the thing lined up between ..., but let's give it an adequate. Seasoning dispensers are adequate but certainly can be improved. I think we - The idea - The salt dispenser is the best step in the right direction. It's highly directional; that is, you can direct it with a great deal of accuracy, place the salt in there, and also it's a spray.

344 21 59 17 PLT

And it has enough velocity that it shoots in there and sticks on the item. The pepper and the hot sauce: Both of those are - We're certainly not happy to have them. I - I - I don't want to bad-mouth them, but I couldn't give it better than an adequate because I think that there is a better way of getting the stuff on the food. Eating utensils: No, they're certainly no - Give her a very good. Sleep restraint: I think that the sleep restraint is - Let me give it an excellent with the qualification that I think that individuals may want to modify that slightly, but I've had no trouble sleeping due to the sleep restraint itself.

344 21 59 57 PLT

Trash airlock: I've had some problems with that, but we - It's functional, and I think that the - the action that pulls the lid down on the trash airlock is not - is not working properly. And we have to stand on it, of course, to get trash airlock closed again. Vacuum cleaners: They serve the purpose for the low - low vacuum requirement here, and I think the - the circuit breaker location on the vacuum cleaner - I - I find myself turning that thing upside down, sideways, and every other direction every time; I never can remember where it is. ... assessed as excellent. It keeps me from bumping the breaker, of course,

but it just seems to me - I don't know why it is, but I personally find myself searching for that circuit breaker every time I get ready to use the vacuum cleaner.

344 22 00 48 PLT

It ought to be located in the same general area as the switch. I'm not saying it ought to be next to it, but that's the only thing that is bothering me about the vacuum cleaner other than that and its weird shape, which is no particular problem. And the - But the one thing about the vacuum cleaner I think was really - is unacceptable is the way that thing stows and some of the - the mounts that were designed. All of them are blind pin locations. You have to - It takes you longer to put the doggone thing into stowage, if you bother to put it into stowage, than to use the vacuum cleaner.

344 22 01 17 PLT

Wardroom table (non-eating uses): Well, we find ourselves not putting the top on the food trays a lot. It certainly would - it - it makes a nice working surface. I would say it was adequate. Tool caddy: Oh, that's - that is unacceptable, the tool caddy is. I used it one time, lost two or three tools, - and I don't know what all else - and I threw it away. I threw it back where I got it and vowed I'd never use it again.

344 22 01 42 PLT

It does not hold the items, and it's got all the little pickiest pockets on it and everything. I think I could - I - I - I don't want to be unduly critical on it because I'm sure that someone had our best interest in mind when he designed it, but that thing is unacceptable for all because it doesn't serve the purpose for which it is designed. Portable fan: We have - there's - there's certainly - Let me give it a very good. They certainly move air, and they seem to be a lot bigger than they would really need to be but from that standpoint. And from the functional standpoint, they're ex - ex - Let's see. I gave them a very good. Okay. ODA kit: I don't know what that is.

344 22 02 25 PLT

Our garments: Garments should not be made of the synthetic material if you plan to wear garments for more than just a little while. Cotton is very nice next to the skin. The - Whatever this - PBI,

344 22 36 05	CDR	It is not too terribly difficult to do, to - to take a whole lot of time, and that's probably a pretty good system. Food management equipment. Wardroom table: I pretty well hit the wardroom table on the last one. I would give it a rating of very good. The foot restraint problem down there - Let's see if there's a foot restraint - Yes, there is a foot restraint. I'll get to that later. Okay, the thigh restraints: I find them to be very good. I found them to be quite helpful and useful, and I use them every meal. The light-duty foot restraints: I guess that means the straps. Those are not too good because you can't really keep your feet in them. SPT used them with the ... on them, but that still doesn't do it.
344 22 37 07	CDR	The other foot restraints, the triangle foot restraints in the wardroom table area, I've already discussed. They're unacceptable. And we have not yet got around to taking one of those platforms up in order to get access to more of the grid restraints, but we will, and we'll give you a report on that whenever we do. The water gun is handy and easy to use. It's ridiculously large, and it takes up a lot of weight. I think from a weight-saving standpoint, they should be redesigned in that to change it. The rating on that would be very good. Okay, the -
	CREW	...
	CDR	Okay, getting on with my report here.
344 22 38 38	CDR	The food trays, I would say, are excellent. They do a very good job. I think the little time-study thing is quite handy. The food cans are very good. I'm afraid - Well, let's say adequate on the ratings of the food cans. Those things are dangerous, really. Sooner or later somebody is going to cut themselves with that, and I think we need to find a different way to put our food up. But those food cans do do the job. They are adequate. It's just that I'm afraid they're dangerous. The beverage dispensers are good. They only problem with the food cans and the beverage dispensers or whatever the food comes in is essentially in the food itself. The food outgasses. It causes bubbles.

344 22 39 32 CDR	We end up ingesting a lot of air, which causes a great deal of flatus and gastric distress, which is very bothersome. And I don't know how we're going to whip that problem. It's not the fault of the food cans or the dispensers. I would say it's the - it's the fault of the - you know, the food. And I don't know how we can pack it so that it does not get - That's - that's a ongoing problem that we're going to have to cope with and solve sometime soon. The beverage dispensers ... any use ... I would say probably 5 or 4 percent of valve failure is in our beverage dispensers. Maybe even that's a high number. The seasoning dispensers are working quite well.
344 22 40 25 CDR	The only thing that Bill and I have indicated that would probably even be nicer would be maybe an eye dropper or something like that would be ... We find that the pepper, being in an oil base, has quite a bit of surface tension. And you can squirt the pepper out of the little - the little nozzle, and it just kind of flows back over the nozzle again and makes a bubble. And then it disappears down over the - the top of the nozzle. Possibly a [sic] eye dropper would give us the same problem. I'm not sure.
344 22 41 04 CDR	We have found ways of getting around it, though. At the pepper dispenser, as - as well as the - the hot sauce dispenser, is - I just - I turn my spoon over so the round side is up, so the neck side is up, and then squirt out a bubble of pepper or hot sauce and quickly get it onto the spoon so it'll adhere to the spoon before it decides to flow back over the - the nozzle. Then I can just turn the spoon over and smear it over the top of my food ... it's evening out quite nicely. The eating utensils: The big spoon is by far the most handy. The fork is used only when we have meat - frozen meat, and it doesn't get much use other than that. The small spoon, in my case, gets very little use. So let me go back. I have - I've broken away from the grading system again.
344 22 42 02 CDR	Food cans. I - I've I gave them a grade of - Let's see. I think I gave them a grade of adequate, and it would have been better except for the danger of it, the sharpness of the thing. The

beverage dispensers also are adequate. Seasoning dispensers are adequate. We need to - need some improvements. Eating utensils, I would say, are very good. I think we could probably leave the little spoon home. I could move in - move on to miscellaneous now. We have sleep restraints. I would grade the sleep restraints as very good. At - Having had to sleep in the command module with no sleep restraint and then getting the next night down here in the workshop in the sleep restraint. I must say that the difference was quite - quite - quite sharp.

344 22 43 04 CDR It was a very strong difference; it was very - it was very pleasant to get into that sleep restraint. I think the best thing we ever did was make those body straps. I think that they've been very fine. I think maybe that in the future, that we don't need to go quite to the extremes of having to get in through a neck ring. I think it would be just as easy to have a sleeping bag sort of thing. If you could zip down and get into it and then zip up, then you wouldn't have to climb into it through a neck ring.

344 22 43 47 CDR I think the flexibility that's been designed into the restraint is very good. The fact that we can have a - either no blanket or a top blanket or a top and bottom blanket is very good. At the present, I have never used a - an overblanket, the top - the bottom blanket. The top blanket has - was on when I got here, and I've kept it on. And the only times that - When I've gotten cold, I found it to be much more convenient to put on a pair of - a half union suit than it would be to put on the lower blanket. And so when the Beta angle gets lower and we start getting cooler, I just put on a half union suit. That keeps my feet warm and the rest of my body stays quite warm.

344 22 44 38 CDR In the very hot weather, I leave the top blanket rolled up and put it under my head rest, and I sleep in the nude. And I found - find it to be quite comfortable. So I found essentially that I've had no use for the - the large overblanket, the bottom blanket I've been calling it, and that I find that by just either rolling up or leaving

347 15 05 13 CDR — I think I did you a disservice, Karl, in that I started the exposure on Kohouteck too early. I'm finally looking over the remarks in my pad, and I should have waited until exactly 03:40. Okay.

347 15 05 43 CDR — MARK. 4 sec - 4 minutes have gone by. CARRIAGE is in RETRACT. And let's see. It's now 06, and I'll go ahead and get the mirror retracted and the door closed. Setting ROTATION and TILT to zero. I'm so used to being so far behind on this S019, that I - I should not have gone ahead and started the exposure early because - I hope I didn't overexpose the film and degrade your Kohouteck information by showing you some airglow first. My ROTATION and TILT are both zeros. I'm going to retract the mirror; retracted and locked. Going to close the wind - or the SAL door; closed and locked.

347 15 07 30 CDR — Okay, this is the CDR terminating S019 operations.

347 15 12 36 PLT — Comes PLT, GMT of 15:15, with the M487-2 Bravo. Number 1 - this is on page 2-3 of the Eval. Checklist - How adaptable are the various compartments to multi-uses beyond their prime design function? Example: Does each sleep compartment double for off-duty reading, et cetera? I find that in the case of the sleep compartment - Of course, we don't have time to do much reading. The flight planners see to that. But in any event, the sleep compartment does afford a lot of stowage during the day. I find the straps across the sleep restraint very useful for restraint if I'm handling bulky items, such as urine bags, trach resupply modules, that sort of thing. The towel holders, I use every one of them for holding clothes, socks, watches, et cetera.

347 15 17 50 PLT — As far as the wardroom doubling beyond their prime design function - Of course, the wardroom is our prime viewing area because we're getting ... and it's very convenient to look over and see where you are. And I think that we're probably getting an awful lot of good handheld photos and visual observation by virtue of the fact that the window is located in the wardroom; so I think that probably the wardroom is making a prime contribution

to the visual-observation sciences, which, of course, wasn't its designed function. We also find the wardroom walls very convenient for posting items for general crew reference. Wall space is at a preminum, and we find - In fact, I find myself using the doors of all the lockers for stowage also, which makes it inconvenient to get into the locker, and in one case, the tableware - the eating utensils stowage, I find undesirable in their design; so I just line my utensils out on my tray, using the magnets, which are only marginal in their effectiveness, but at least they still work.

347 15 19 07 PLT

The wardroom table is not very convenient to use because of the fact that a lot of time we have food heating in the area. And the trays - When you take the trays out, the puddings all come out, and so you're - and also, it just - it doesn't seem to be convenient to put the tops on the trays a lot because of the latches, because of the fact that you take the bottom tray out, the puddings come out of their drawer. Experiment compartment: It's sort of useful. It's got such a fairly good volume, and you're able to move around it quite well; so I do a lot of - just sort of childish experimentation with small objects, such as balls, and that sort of thing.

347 15 19 52 PLT

And I use it in zero g for play and the elementary experimentation because it does have a close ceiling and you can move around and catch things, whereas the forward compartment has such a large volume, it's pretty difficult to do anything when your slips away. The head is not useful for about anything else because of the floor in there. And also, it's not intended for anything else, and it's not used for anything else. It's very difficult to restrain yourself in the head because of things we've already mentioned.

347 15 20 28 PLT

Forward compartment: I don't - can't think of anything other than the prime design function; that is, as - it's got a large volume and housing stowage and supplies and providing the scientific airlocks for the corollary experiments. Also, there's volume for the corollary experiments. I can't think of anything else. Airlock's not

useful for anything other than going through. MDA is use - It's worse than useless because of the lack of restraints in it. And how good has the sleep restraint been for sleeping? It's excellent. Andything useful for anything other than sleeping - I've already mentioned the fact it's a good interim stowage place; very good.

347 15 21 15 PLT

What non-eating uses have been found for the wardroom table? Okay. Again, I think the utensils should have a good stowage position; the location, on the tray itself or in it. I find the stowage in the locker is very inconvenient to use and unsatisfactory from my standpoint. It takes a lot of - It's a lot of trouble to get them in there when the restraint is unsatisfactory. It doesn't hold up too well.

347 15 21 44 PLT

Would a design modification of the table and its associated restraints be desirable for any and all uses? Well, I wouldn't want the people that designed this table to do anything else. I think that it's such a lousy job of design and the foot restraints are so poorly designed that I wouldn't want to have - have those same people work on that thing, because all they'd do is just make a bigger and better white elephant. Although the idea is sound, I'm afraid the implementation would be very bad if the same people were permitted to work on it.

347 15 22 14 PLT

What sanitation problems have developed, and how have you dealt with them? Urine spills, I guess. I have been - I've had about two urine spills, and both of them were my fault, mainly because of the peculiar way we're ... processing our urine bags ... if you leave them out. We have to - to evacuate them, put them ... chloride, and so forth. And I've saved up old clothes for that purpose; mopped up with the old clothes. Defecation for me has not been a problem. It could be. Again, you - The prob - The way you deal with them is give us time, and that time is at a premium. I think that anything can be cleaned up if you're given enough time. Of course, it's unpleasant and - It hasn't been that big of a problem for us. Food spill in the - in the wardroom has been

a problem in that the bags have been - I've had a lot of trouble with spilling the drink bags - Or the flatus bags is probably a better name for them because that's where I think all the flatus is generated in talking our drink - drink bags.

347 15 23 24 PLT

I think that that's another problem, too. We generate so much flatus, we have to pass so much gas, that you're laundry marking your shorts all the time. And that, I think, probably sounds a bit flippant, but I think it's an - it is a problem. And I don't want to pass over the flatus problem lightly because I think passing gas 500 times a day is not a good way to go.

347 15 23 48 PLT

What is the most disconcerting personal hygiene problem you have encountered? I think I just mentioned it - Passing gas about every 5 minutes. And I don't mean just a nice little pooh; I mean really passing a big blast of gas (laughter). It's just not a nice thing. It - it offends people around you, and the only redeeming feature is that everybody else is passing the same amount of gas. It's a good thing we got some charcoal canisters taking the stuff out.

347 15 24 16 PLT

How effective and efficient are the cleanup procedures and hardware? The - We don't have a very good way of cleaning up. It's just swab and mop, and we use our own personal towels. The - the tissues are at a premium, and I don't want to - I find myself very reluctant to use gobs of tissues to clean up. I made one obser - observation that leds to the aft compartment; that is, we have grid structures about 6 to 8 inches above the plenum wall, the bottom of the workshop, which is a closed bulkhead. Now this bulkhead is about 16 inches below the grid, and it gets an awful lot of food spills. And yet there's not a good way to reach through there and clean it up. You can reach your hand through there, but you - you're just very confined. And you can scratch - cut your wrist fairly easily if you try to do any vigorous scrubbing. So I think in the future we should have removable grids if we have the same arrangement we have, with an area below which can be contaiminated by food and drink particles drifting around ... and splashing around.

347 15 25 26 PLT

How much of a time-line imposition are cleanup chores? I'd say anything that you do is a time-line imposition, because cleanup obviously - What I do is, I try using my utensil wipes on my utensils. And then I try to use the utensil wipe to clean up a small area every day before - after I get through eating before I throw the utensil wipe away. That way, I get a little bit cleaned every day, but the grid above the food preparation table is pretty soiled - pretty well soiled with small drops of food. By the way, the bag - the - the - the food bags that had to be cut across the top, they're in - some of them are in cans. The - These are very poor bags. And the Apollo bags are very, very bad for flipping particles of liquid out. And I think that we're maybe directing ourselves at the wrong problem here; and rather than cleanup, to prevention. Now of course there are always going to be spills, but rather than, say, forcusing your attention on giving us more cleanup time, a better designed bag is probably - It would go a long way toward minimizing a lot of those food spills. I can't overemphasize the poor properties of those cut-across bags. They call them pull-open bags - That - I - the ones that you have to use the big spoon in - and they have caused an awful lot of food spills.

347 15 26 53 PLT

How adequate is the ATM chair? I have not used it, and I won't - I won't comment on it. Do you use the shoes/grid with it? Is the toe bar useful? Oh - Okay, no comment on that.

347 15 27 13 PLT

How comfortable are your garments in terms of fit, warmth, and don/doff ease? Fit: I lost a lot of weight. I can't complain about the fit because they fit me when I was about 15 pounds heavier. Warmth: No problem. Don and doffing: Well, that's a good question. The jacket has the sweat-shirt-type insert at the sleeve. I find it difficult to get the jacket on and off with a wristwatch on, particularly if you have to use the - the passive radiation dosimeter on the watchband. I finally took the PRD and - the passive radiation dosimeter off the watchband because it - it was

most prominent, and it has a sort of a - what may be an associated, or may not be, streamer which is slightly clockwise from that. Then the two others, I think Ed has described as very fine streamers around the 9:30 to 10:00 or 10:00 to 10:30 positions, are two distinct ones. The one closet to the 9:00 position seems to be thickening a little bit, the bell ... The XUV activity associated with the limb activity on the east limb is about the same as it was previously. I saw no other items significant - of significance, and that's about it.

347 22 23 45 PLT — PLT out.

347 22 25 52 CDR — This is the CDR again picking up at 22:26 again with the M487-2B crew debriefing. Question number 2: How adequate was the sleep restraint - has the sleep restraint been for sleeping? Has it been useful for anything other than sleeping? if so, what? Yes, it's been quite adequate for sleeping and gotten some good rest. It's, as I mentioned in my last debriefing, it - After having spent one night in the command module with no sleep restraints, it was an extremely welcome change. And I found it to be quite comfortable and got quite used to it. I can't imagine it being useful for much of anything other than sleeping, and I haven't tried anything else. Question 3: What noneating uses have been found for the wardroom table? Well, I mentioned that up in 1. The fact that - -

347 22 26 52 CC — ...

347 22 26 58 CDR — - - as I mentioned before, it - it could be used for paperwork and things like that, if you want to put down the center cover and cover your tray and put springs on and magnets and get on with - with that. It's - Would a design modification of the table and its associated restraints be desirable for any or all uses? To that, the answer is yes. First modification I would make would be to change the water dispensers and design them so they deliver more than just 6 ounces of water. I think probably the largest water requirement we have is 8 ounces for some of the drinks. And I think that that's probably what the water dispenser ought

to - ought to dispense, about 8 ounces. In fact, it seemed to me it might be just kind of handy to have it dispense 10 ounces.

347 22 28 01 CDR The - The floor, the restraint floor. We still haven't gotten around to raising - removing part of the floor there. But on my very first debriefing, which was, I believe, 487-1B, I pretty well told you how I feel about the foot restraints that are in there now. They should very - would very definitely - if I had - You know, if I was designing a new table, I would certainly modify the foot restraint design greatly.

CDR I think that there are probably some pretty snappy ways you could redesign the table for paperwork for the - the things like checklist changes and - and the like. We have never tried playing cards yet, which might be interesting. We keep thinking about - well, one of these days we ought to give it a whirl. But our problem is we don't seem to be able to find enough leisure time where we can just maybe want to sit down and play a little cards. Okay. Question number 4: What sanitation problems have developed, and how have you dealt with them? No serious sanitation problems have developed at all.

347 22 29 24 CDR The only area that could be a problem, if - if you don't keep up with your housekeeping and everything, could be the - the trash locker and the waste management compartment - and the waste management compartment in general.

CDR But I think that our housekeeping tasks that we have which have us water washing and biocide washing the - the head and the wardroom area on - on a frequent basis pretty well takes care of that problem for us. Around the food area, sanitation is not much of a problem, again, if you just stay with it. I think probably the - the biggest problem we have is - has been a rash of - of faulty valves particularly in the drinks.

347 22 30 20 CDR It seems to be pretty much concentrated in the drinks that we brought up. It appears that - that those drinks were not - not too well evacuated, and it looks like some of the crystals or something

got into the valves. But anyway, we - Bill has particularly had trouble with those - those valves. There's been a lot of spillage. And that spillage, when it gets up into the grating area, is - is almost impossible to get out because none of us have small enough hands to get in between the - in the grating and work very easily. I can get in there but I can't do much, once I get my hand in there. Waste management has been no great problem.

347 22 31 10 CDR I'm beginning to get into question 5, so let's go to that. What's the most disconcerting personal hygiene problem you've encountered? Well, I had a urine bag break on me. It wasn't so terribly disconcerting as it was just a great big pain in the neck. I had to pull the drawer out and - and go in with rags and things and - and clean out the drawer. Luckily, we had the foresight to begin saving soft cloths like towels and T-shirts that weren't too dirty, and we put them in a rag bag that we have got established outside the 131 area, M131. And when this spill occurred, we had some nice absorbent rags to soak it up with, and then we just threw them away. The fecal containment system has been no problem at all for me. I think I mentioned before that I was very pleasantly surprised at how well it worked. And so I've had no hygiene problem there at all.

347 22 32 16 CDR It takes a long time to wash yourself. I've found that it takes about 20 minutes for an entire body wash, and you kind of hate to spend that kind of time. But after a heavy workout, you just need it; it; so if you have an hour and a half exercise, PT period, you're going to spend 20 or so minutes of that cleaning yourself up, getting yourself squared away again.

347 22 32 42 CDR Question number 6. How effective and efficient are the cleanup procedures and the hardware? How much of a time line imposition are cleanup chores? When programmed, there are no time line imposition; and I'm assuming that's what you mean. I think the procedures we've got for cleanup are - are pretty good. I think we could use some better some sort of a better system then running around dabbing with - with biocide wipes. I never have understood why we have shied away from aerosol

things; maybe it's flamability. I'm not sure just exactly what it is, but it seems to me that are some aerosol products that are nonflammable that would be excellent for cleaning the place down. Disinfectants: Lysol, Mr. Clean, Pinesol - you know, some of those things where I think you could probably clean a lot better if you could squirt it with a spray of some kind; let it sit and bubble for a minute and then wipe it off. It would be a whole lot better than going after it with a biociade and then following that up 10 minutes later with a wet sloppy cloth of some kind.

347 22 34 00 CDR We've definitely found that following a biocide wipe with a wet wipe is ridiculous. What you got to follow it with is a wash - wet wash cloth or towel. It's not so much in the area procedures, but scraping the re - the freezer is - is no easy chore because we don't have any of the right kind of tools for scraping. What we're using is a - a K-bar to which are - are fastened our extra maps. It's in the tools - tool box; and that's really not a very efficient way. I think that a regular old fashioned ice scraper or putty knife would have been a whole lot better, and we could have - we could scrape the ice from the - from the freezer in a lot less time than we are doing it in right now.

CDR Cleanup of the - of the food disposal area, the place where the six can - over cans be placed, and we put our - our dirty cans and things in there. That place does not lend itself too well for cleaning, because there's too many nooks and crannies around the cover. I think next time we design something like that we ought to design the tops so that they're nice and flat and easy to clean and there aren't too many hooks and nooks and things like that to - to tear up your wipes and - and everything and make it difficult for you to clean.

347 22 35 31 CDR Let's go on down to question number 7. How adequate is the ATM chair? We have not used the ATM chair, and none of us is of a mind to try to use it. I think, just in deference to - to you folks, we probably ought to get up there and stick it in and - and run on ATM pass with it. But

TIME SKIP

352 19 13 00 SPT — SPT at 19:14 for M171. Start of the run of M092 with the PLT as subject. It started at 19:10.

352 19 13 13 SPT — SPT out.

352 19 15 40 CDR — This is - this is the CDR at 19:15 Zulu with a note to the food people. Yesterday in my evening status report I forgot that there was a little bit of variation in my water usage. It was occasioned by one of those blankety-blank food - Apollo spoon packages splitting. The - What it - Actually, it didn't split. It wa - it was mainly caused by the little check valve that's where the nozzle goes into the bag - you know, on the side of the bag. There's a little hole with a flapper on it, and apparently, that flapper stuck closed and would not allow the water to go in with the food. And the pressure from the dispenser finally split the side of the tube going to the bag, and we lost that water. And I ended up having to open the bag and put the water in with my water gun.

352 19 16 46 CDR — I've already repressed what the food was, so I can't think of that. But anyway, I do remember that it was 3-1/2 ounces of water. So if you really want to get - get the details correct, subtract 3-1/2 ounces from my water gun reading, and apply that toward food reconstitution. And the 3-1/2 that the table tried to put in the bag just kind of went all over the workshop. So chalk up 3-1/2 ounces for the workshop.

352 19 17 14 CDR — CDR out.

END OF TAPE

356 16 47 51 SPT — SPT out.

356 16 54 49 CDR — This is the CDR at 16:55 Zulu with M487-3 Bravo, using subject eval guide number 2. We'll use the habitability parameters. Okay, first off is the wardroom. But before I start on that, let me slip a few parameters your way on what I think of the food bags - the food containers, not the cans.

356 16 55 19 CDR — As I look back over 487-3 Alfa, I see we talked about the water gun and the food constitution - reconstitution dispenser and the cans and all that stuff, but we never really talked about the - the food bags or food containers themselves. And I should have talked about them at that time, and I want to take this opportunity to do it. The - the bags in the cans that have the nozzle at the very top, have them coming to a peak at the top with a nozzle on top, I have found by far to be the most convenient to use.

356 16 55 58 CDR — You can add your water and mix, and then when you're ready to - You just hold it by the nozzle on top and stick your knife in around the side and essentially cut the whole top cone away and leave - leave an inch or so of it attached and then fold it back, and it serves as a little flat top thing. You can pull - pull the top back out of the way, put your spoon in your food and get what you want, and then le - set the flat top back down again. Works out very nicely.

356 16 56 33 CDR — The spoon bowls, as far as I'm concerned, are lousy. I would give them a rating of lousy on your scale, which is somewhat below poor. But the - the problem with those darn spoon bowls, particularly with the sloppy food like the soups and the potatoes - I mean the chicken and gravy and corn and some of those things, is that the funny little disk-type seal that bends inside aways never holds.

356 16 57 13 CDR — You put hot water in there, and those seals just open right up and let all that food move right up against the top of the bag. And then when you try to cut that top strip off with a pair of scissors, you - you succeed in slopping the scissors

all up with food. And as soon as you manip - manipulate the bag the slightest bit, trying to get your fingers in the loops or trying to get anything else, squirt! Out comes the - a squirt of food that seems to get siphoned out through that slot at the top, and it goes lurching off into the workshop somewhere. And you're - you're catching them.

356 16 57 48 CDR

If you are unfortunate enough to let the top of the bag slip while you're trying to get your finger in the loops, and it snaps back, that pumps a big glob of food off into the - into the area somewhere, too.

356 16 58 01 CDR

Generally, I find that food packs - It sounded like a neat idea on the ground when the food would stay away from the slot that you're trying to open with you/ fingers - you know, with the finger that you stick through the loop. But up here in zero g, when the food moves - every time you manipulate that slot or move it just a little bit, it pumps food up to the slot for some reason. And then all you got to do is - is pump it a little bit or let it slip or something like that, and you got a big glob of food propelled off away from the bag.

356 16 58 36 CDR

It's not all that handy to be able to close it and open and all that stuff. Really, the nozzle-type bag that I was mentioning at first, with a nozzle on top that you can cut, really seems to be a little bit better. You can take that bag by the nozzle and swing it fairly gently, force all the food down to the bottom, and it all sticks together. Then you can put it back in the can you got it out of and carefully cut it with a knife until you got your flap, and you food seems to stay pretty well in one place.

356 16 59 08 CDR

The Apollo food kit - food bag are every bit as bad as the food bags you got stuffed down in the - in the can; they're just, I think, more trouble than they're worth. And I would prefer to do without them. I would rather try to manage with the nozzle-at-the-top type. Cereal is another problem - the Rice Krispies, corn flakes, and those.

When you get the milk in there and shake it up, it just kind of goes all over the place when you try to use this food bag the way it was designed.

356 16 57 42 CDR — We've had a couple of failures in the water-input nozzle into the food bags - that is, the ones that are in the cans; you know, where you've got the nozzle going into the side into a little flapper valve. That little flapper valve has stuck on us twice now. And you put that on the reconstitution nozzle and try to pump water into it. And if that flapper valve doesn't open up and let that water in, you've had the stroke, because in just a second or so later, your seam, the - the junction between the nozzle and the bag is going to split and you're going to have water going all over the place. And then you have no choice but to open the top of the food bag and reconstitute your food from the top using your drink gun, and that is a very messy business.

356 17 00 32 CDR — So all in all, that should just about do it on the - the food bags. I really don't like the food bags at all. I much prefer the other types. Okay, let's get on with subjective evaluation guide number 2. Wardroom table - eating station.

356 17 01 09 CDR — Okay, you're interested in the general arrangement and orientation of the compartment. I would say that the arrangement and orientation of the compartment is - is excellent or very good. The table is - is well located relative to the lockers, and each man, within his arm's reach, has got light available to him plus his locker with his ut - utensils in it. And the fact that it's oriented with a - a window that looks out toward the Earth, I think, is very, very good. And all in all, I think the - the arrangement is excellent.

356 17 02 02 CDR — The volume of the compartment is - is very good, I'd say. There's plenty of room - in fact, about all you need - and I don't think there's anything to be said about that. Ceiling-to-floor proximity is excellent. Everything's within comfortable reach. You can reach ... some of these took place ... wardroom table. You see that I was able to lock my feet into the ceiling and push against

we hit about 2 minutes. I wanted to get back on Sun center and get everything tied up for the powerdown. And the coronagraph looks - The corona is fairly interesting on the west limb, and it has the one helmet streamer on the equator on the east limb.

361 03 33 21 PLT — On the west limb it looks like there's about - oh, very, very fine but very distinct - that is, narrow streamers at about 2:30 and 2 o'clock and maybe 2:30, 2:45, 3 o'clock. That's two of them. And then there's sort of a grouping - more or less a wide - more - more widened helmet streamer down around 4 o'clock. Quite a lot of activity in the corona on the west limb. The active region zero zero there, I couldn't tell much about it. I think that you can probably see as much as I can in H-alpha. The - There does seem to be an awful lot of activity on the limb, however, and think you got the 55 data on that.

361 03 34 04 PLT — PLT out.

TIME SKIP

361 04 17 29 SPT — SPT at 04:17; M487-3B. Wardroom: General arangement's pretty good. I think the volume on the compartment could be slightly larger, although I think it's fairly adequate. Again, on the arrangement, I find that the SPT - to get to the food or to the place for stowage of used cans or to the can crusher or to the food freezer - has to crawl over the CDR or the PLT. And I think, from that standpoint, the arrangement of the room could be a little bit better. I think it ought to be worked out so that all three have accessibility to the items required during a meal as well as immediately before and immediately after.

361 04 18 35 SPT — Ceiling to floor proximity: I think that's pretty good. I think the height is good, and I think we ought to keep triangles on the - or some way of stabilizing yourself on both ceiling and floor as well as on the walls as much as possible. Trash collection provision: They're adequate. Stowage volume and ex - access: I would like to keep in

the wardroom those things which are used - to be used in the wardroom, like most of the food. For example, down here we have to go on up and try to pull most of the food out of the - the lockers and frequently a small amount down here and especially now that we're working, where third day we have to go shopping and find all of the overage food. We've gradually moved it all down here, but we've had things like ED experiments to showers to flies to clothing modules. Just everything has ended up in here instead of - Just a haven for anything they can't fit elsewhere.

361 04 19 49 SPT

And I don't think that's right. We ought to put things in here which are strictly used for the food. You ought to have to have the pantry right down here. Temporary equipment restraints: Well, we don't use equipment as such. For ourselves, we've ripped out the - the bottom plates, and that's probably one of the best things we've ever done. Now we have some good footholds on the floor, and now it's mucn easier to work and eat. Personnel mobility aids: There are none. Personnel restraint devices: Well, I just discussed that one. Thermal comfort: That's good. Noise level: That's great; no problem. Illumination: That's adequate. Okay, in the head, WMC: I say it's too small and cramped. General arrangement: Functionally, it's good; it works well.

361 04 20 57 SPT

Volume of the compartment: As I said, it's too small. Ceiling-to-floor proximity: No problem. Ingress/egress provisions: Again, it's too hard. If two guys want to be in there at the same time, they're really crawling all over each other. That's part of the accessibility. Trash collection provisions are adequate. Stowage volume and access: That's no good; pretty poor. I think it would be much easier if we had more - make the thing larger and put some more lockers around there where we could store more towels, more washclothes, urine disposal bags. Each guy have his own cupboard for - for his own personal belongings. I think that's way under - under supplied and really just a token gesture for things related to personal items - your Dopp kit and anything else you'd like

you've got to hold that cottonpicking button down on the tape recorder the whole time. So I mean, obviously, I can't do that. I guess I could tape it down, but that seems a little bit extreme. That - that whole idea of recreation there - I get more kick out of looking out the window and having time to look out the window than - having good optical equipment. I would say a good set of gyro-stabilized binoculars would be excellent. These that we have, they - the inner pupilar - inner ocular adjustment isn't narrow enough for my eyes, so the gyro-stabilized binoculars have a sort of a design deficiency in that respect. I'd like to emphasize that, because I can't imagine why they'd design them that way. But I think gyro-stabilized binoculars would really be great, if they were good ones. And I don't consider the ones that we have satisfactory.

365 21 48 53 PLT In terms of your zero-g living and working experience during this mission - Oh, by the way, on that recreation thing, I think cameras and a certain amount of dedicated film for recreation purposes would be great. A lot of times we see things we'd like to take a picture of but we're sort of reluctant to do it because it's sort of a "gee whiz" picture, you know? But it'd be nicer, you know, to have that for your own - or at least have it available to get a copy of.

PLT I'm not saying we have our own film, but have film that - that's available for - you know, just go ahead and take whatever you want to. We really have that now but it - we still feel that it was such a strong sense of responsibility to make sure that there's some kind of good data in the picture that we take.

365 21 49 32 PLT In terms of your zero-g living - Oh, another thing for recreation. I think we definitely ought to have something to eat of a pleasure nature. This food experiment we got on this thing is - I think, is highly detrimental to morale as far as the recreation and feeling good sort of thing, in the sense that it does not provide what I call pleasure food. Now I'm a big candy eater myself.

Another guy might like to eat peanuts. I like peanuts too, but I mean he might like something else. I think that we've really missed the boat on this flight by not putting on some pleasure food like candy bars or whatever a guy likes. They - they - they - we were - had a very strict control over what we could eat and perhaps there were very good - at least they say there's a very good reason for this. I have no reason to question it. I think that the metabolic analysis has to be done, but I think that you - if you continue this, that you really take away something that can provide a lot - a lot of pleasure and at least relief - temporary relief in relieving mental pressure and that sort of thing for a person, and that is eat what you want to. They have - you know, have lots of sort of snack type things that you eat when a person like them.

365 21 50 44 PLT — In terms of your zero-g living and working experiences during this mission, what specific habitability improvements would you recommend for the next Skylab crew; for future programs? In terms of zero-g living and working experiences during this mission, what specific habitability - habitability improvements would you recommend for the next Skylab crew? Okay, I have to think about that for a minute.

365 21 51 08 PLT — One of the big problems is hygiene and washing. I would like to be able to stick my hands into an autoclave of some kind and wash them without having water - you know, really wash them down, without having water fly all over everything. The same thing with my face. The razors aren't very good. The - that windup razor is - is useless as far as I'm concerned. Jerry can use it, but I can't. The habitability - I think that the food is part of habitability, and I've already mentioned that in the previous question. The - the restraints make it a - the lack of restraints have made it sort of difficult to - to move around in here. Working experience - what specific habitability improvements would you recommend for the next Skylab crew; for future programs?

PLT I think I was not available for that discussion that you're talking about. At - at the time the discussion took place, I think that I was more less over hiding in a corner.

CDR Bruce, I think I can answer that. I think that, essentially, we felt we didn't want to bother the ground with it. We didn't want to worry the ground with it. We decided the next morning that was a bum decision. However, we'd already done it. It was too late to take it back, and so that's the way it went. As far as I'm concerned, that matter's finished.

CC Roger on that. Back to Ed. Some earlier Skylab crewmen have reported brief periods of irritation with one another. Has there been any sign of this on your flight? Over.

002 19 22 14 SPT No, I don't think so, Bruce. I think all three of us have been pretty much up against the same things and we're cooperating in trying to get the best out of the mission and in beating those various obstacles that we've come up against. So, I think we've hung together pretty well, and I think we're all pretty proud of that fact.

CC Roger; we got about 52 seconds to LOS here. Next station contact in 4-1/2 minutes through Madrid, at 19:27 Zulu. Let me throw one more out as we go over the hill, to you, for all three of you. Aside from your families, what do you miss most about being away from the Earth? Over.

002 19 22 56 PLT I think good food, and the ability to eat any time you want to. I - I miss that more than anything.

SPT I think what I miss is going right back to Jerry's point, the ability to recoup at the end of the day and to be able to analyze where you're going the next day. And to be able to take a really fresh creative approach to things you're doing.

CDR I think essentially, that's what I miss the most too. I miss the opportunity to just sit down and - and relax. And, of course, with my family at home, well, I can come home and just take it

game is contribution. And that's what I've been working for and that's what we're doing right now, and that's why we're working so hard. And to actually be here and finally doing it, that to me is very rewarding. And I think that's going to fill a very large part in my life and I'm just happy to be here and doing it.

002 19 32 00 CDR For my own part I feel somewhat the same way that Bill does. And that is that people in our line of work, very technical-type work, are inclined to move along with your blinders on. You - you begin to get so involved with the details of what you're doing, the details of your life, that I think that you forget to look around you and see what's really going on outside. And I think that this mission is going to do me a lot of good in that I think it's going to increase my awareness, my awareness of what - what else is going on besides what I'm doing. And I think that in itself is going to be the - the major effect on my inner self.

CC Okay, thank you, crew of Skylab 4. We've got little less than 2-1/2 minutes left and four questions remaining. For Bill, what recommendations would you make to those who are designing space stations for long-duration future missions? Over.

002 19 33 05 PLT I think that they ought to get people who have flown in on the very early design stages. That's my recommendation right there. Otherwise I'd have to read, more or less, speak out a whole book.

CC Roger that. And I guess we'll get a lot of that out of the postmission debriefings. Over to Ed, how are the high-density food bars working out?

002 19 33 28 SPT I like the food bars. They're pretty good. Unfortunately, we were not able to carry up a - a full complement of things to go with them on that particular day. So we end up always feeling a little bit hungry even though we get all of the - the nutriments and calories and so forth that we need that day. So, it's - We just feel a little extra hungry that day; but food bars are great.

007 23 20 50 CDR

Now the way you could do that would be with a blower, like a hair dryer, and you'd just have a warm air blower. Then once you get most of the water cleaned up with a good suction system, which requires better suction than we have and also a better head, you could go ahead and dry the area and come out of the shower dry and clean and not freeze yourself to death trying to get your clothes on. That's one of the big problems right now. You just absolutely freeze when you put that shower down and head for clothing. You've got to float over several updrafts, and those updrafts are mighty, mighty cold when you're without clothes and wet - completely wet.

007 23 21 34 CDR

Okay. The next area is in the food area. I've about done a 180 on my opinion of the - of the food table. I said a little while ago that I thought the food table height was just fine. But after another month of hunching over the table to eat, I've decided that it's not such a hot deal after all; that really the food table ought to be about chest high, and that's about where you would work, too, if you wanted to use it for a desk. You're standing up anyway. We solved the problem of foot restraints by taking up the floors - you know, the base of the pedestals, and it greatly improved the foot restraint situation. And so, I think in the area of the table, it should be raised.

007 23 22 26 CDR

In the - Let's see. In the waste collection area, I just have no quarrel with the fecal collector. I think for a zero-g system that is very well devised and - and well done. I think the only thing that grates more than anything else is the time required. Stand by just a minute. I'll be right back. I've got to do something here.

007 23 23 20 CDR

Okay, CDR back up again. I think the biggest single problem with the fecal collection system as a habitability problem is the fact that it just takes so much time. It takes you 5 minutes to - get rid of your waste and it takes you another 15 to 20 minutes to process it and get it put where it belongs. And I think we need to work some - some areas there to find a way to more quickly process fecal waste and - and get rid of it. The urine

PLT That's affirmative.

CC Okay. In going back over some of the dump tapes, we saw your comment about leaving the food tray heaters on all the time. And I guess we'd like to help understand that a little - that situation a little bit better from a power and from a thermal standpoint. Would - that is affirmative, you have been turning them on rather than working with the timers - is that correct?

PLT Now, I don't remember making any statement to that effect. I do use that - I usually come down and do that when I can think of it, but it's not left on all the time. No.

CC Okay, this was in a - I believe in a 480 - when you were talking about M487 that you were sort of talking about - you know - things about the vehicle. And you mentioned something about that. Can you tall us normally how you do - do use the timers then on the food trays in general?

014 00 39 52 PLT Well, when we have the time and set it up, we use them just like they were designed. When you don't you just come down and put it in - you know - like if you're a little short on - you don't do it far enough in advance, you just turn the thing on and if it gets warm enough fine. But then you go ahead and eat it the way it is.

CC Okay, fine. We have been worrying about the vehicle's going - we're running into one of these high beta cases, and we've been trying to think of ways to sorta keep it cool. And, of course, any power, like the heaters and so forth, does add a little bit thermally to the vehicle. So that was the reason that we were interested.

PLT I think I know the comment you're referring to was how we use the timers. I said most of the time that I just turned the - the food to - on manually and left it on, but what I meant was I - I was usually short-timing it.

014 00 40 43 CC Yes, right. Okay. If - in looking at it, it initially gave us the impression that perhaps you were just, you know, turning them on and keeping

it - like at breakfast, leaving it on all throughout until lunch. But understand the situation now. This one, perhaps, we can probably find out a little bit better down here, but I interpret from that comment that you're not - that on your - the number of cavities that you're leaving on are just the ones that are applicable for the meals. And I assume that's probably on the average of about two per person.

PLT Well - yes, it varies. I would say most of the time I have all three of mine on say for a minimum of about 15 minutes. That's just when you're keeping the food warm while I'm eating it, and I think the other people are doing the same. Now when we're de - when we're thawing out food, of course, that takes about a hour and a half to 2 hours.

CC Roger. Okay, got you.

014 00 41 41 CC Okay, that really runs over that question. There's one other item I guess that - if you end up doing that EREP tape change for us tonight. We had Jer scheduled for it tomorrow. And one item we might suggest him putting in where we had him scheduled for that is to do a documentary photo 22 prep to help Ed out since he's going to be trying to do the ETC prep and the DT22 all done there together in the morning.

PLT Okay, he heard that. Sounds like a good way to go.

CC Okay, and also from the photo status report we did not get the impression that the photos were taken of ED61 today by Ed. If - if he has not done that, we would appreciate if we could get some this evening.

SPT Crip, those were taken this morning.

CC Okay.

014 00 43 04 PLT Okay, Crip, I'm going to check the number on that because the number I gave you was the same one I gave you a couple of days ago.

POGUE In order not to leave the impression that I thought that that water system was the greatest thing since peanut butter, I was addressing my flattering remarks to the procedures people who worked on the water activation procedure, I think the water system itself had a lot of things about it that were undesirable. One thing, which was not peculiar to the water system, is hiding panels. It seemed to be a favorite game of the designers. There were two panels which were hidden. One in the waste management compartment, 851 or something like that, was down inside another panel. You had to open a door which was inside another panel. The same thing was true in the wardroom water dump. There's a panel number hidden underneath the pedestal. The food preparation table also had a highly undesirable panel number feature to incorporate in it. The panel number is not visible. Also, all those hoses and so forth that we were threshing around in the forward comparment did not seem to have straps and snaps designed for them. They had enormous flexibility, but it was confusing to work with them.

CARR WMC/Sleep Compartment Disinfecting: It was clean. I went ahead and did it because I figured there could be something growing there that we couldn't see. Again, everything was just super clean. We went ahead and did all of these things because we felt they had to be done, but we didn't feel that they were quite as critical as we might have believed earlier.

CARR (CONT'D) found myself in a position of having to update the FDF on a catch-as-catch-can basis. I don't think we got trapped using bad data, bad FDF as a result of that.

CARR Weigh food residue. We never weighed a particle of food. We ate it all. And the SMMD in the wardroom, as far as we were concerned, was an on-board spare. When the one in the waste management compartment failed, I wish there had been a simple way we could have transferred that one from the wardroom into the waste management compartment. But we ended up bringing our fecal bags into the wardroom to weight them; our apologies to the micro people for that, but there was no better way to do it.

CARR Plenum bag stowage. Bill, I guess that was yours. We didn't have a plenum bag to stow as I remember.

POGUE No, we waited. It wasn't until about 3 or 4 weeks into the mission I guess, that I took any bags down there. I took two or three bags down, and there was just no problem at all. The system had those little wires strung around there and I just moved around until I found a place to put them and snapped them in. It was super simple.

CARR The plenum bag that we found there only had one or two items in in, and it was sometime before we gathered enough items to fill it to make plenum bag stowage a requirement.

CARR M151: It seemed as though whenever M151 was assigned to an experiment, no extra time was allowed to set up the lens, film, camera, and cables. You must realize that by the end of the mission, we were down to three operating cameras, consequently, a camera was not always readily available. At the beginning M151 took a lot of time because of the jams and hangups we had. We facetiously suggested getting some 151 of 151. I think it would have been interesting to look at the time and motion involved in the M151 experiment itself and see just how long it took us to gather up all of the equipment and put it together. We didn't mind doing it, but in the beginning we were short-changed on time.

GIBSON There was a problem when I was trying to do an ETC prep; something was always breaking. On the fourth try I finally got a successful ETC prep on 151. But I really appreciated Rudy's presence at our training sessions. He made sure we understood what was to be done.

CARR There was no doubt in my mind about what was desired on M151 in any particular case.

CARR Food Preps: We did not prepare the food as it was anticipated we would. It was too inconvenient. At the end of each meal,

CARR (CONT'D)	we were expected to prep the following one. We just never got around to doing that. We took each one as it came, and if the food didn't rehydrate well, we ate it anyway.
GIBSON	During the first 28 days, we did not have time for a long preparation.
CARR	Some of the containers precluded an advance prep. Some of the extra food we brought up would not fit into a heat port, so we could not rehydrate it early.
GIBSON	The only item I did ahead of time was the strawberries. I reconstituted them with hot water, let them set out for a couple of hours, and then tossed them into the chiller for a for a couple of hours. At the end of the day I would put them on some ice cream. That was my reward for the day.
CARR	Eat periods: It didn't matter to us whether we all ate together or whether we staggered our eat periods. I agree with Al Bean that it is important to try to eat about the same time of day every day. Shifting the eat periods around to accommodate the schedule is a bad idea. The flight planners did a fairly good job of keeping our eat periods pretty well stabilized.

CARR	Food freezing was fine. It was perfectly reasonable.
POGUE	Except for the cleaning of it. Something must be done about that.
CARR	The defrosting of the freezers was really a bother. We seemed to have a large area there that looked like a seal problem between the two freezers in the wardroom area. Ice was building up between the two and setting up an airflow path that seemed to snowball the whole thing. Once that ice built up, and got an airflow path going, then the ice buildup began to accelerate and we had a problem. You knew that when the freezer doors were beginning to get hard to open, it was time for scraping.
POGUE	Not only was it hard to remove the ice and the frost but the little inner door made it impossible to really do the best job of cleaning. The need for cleaning obviously had not taken into consideration.
CARR	I'm not sure what good the inner door provided, or what the function of that door was. It didn't appear to be too necessary.

POGUE | We didn't have a tool either. We had to make do with tools to clean that frost and ice off. Any future freezer should have the proper kind of tool for cleaning and also the freezer should be designed to minimize that buildup.

CARR | The stowage efficency of the freezers was very low. A different kind of packaging system probably could have gotten us 50 percent more frozen food into the Workshop; that's an important increase because the frozen food was by far the most enjoyable food we had and I very strongly recommend that, we move more toward frozen foods. Steak, lobster and ice cream were extremely pleasant things for us as were the stablized foods. They were much more enjoyable than the rehydratables.

GIBSON | That was a good point. Concerning the packaging, by putting cubes or squares or rectangles or cross-sections, we could have gained about 50 percent more food than what we had in there.

CARR | Food, Urine and Water Chilling: We had moisture buildup in the chiller which we had to wipe out occasionally. We put a lot of tin cans in the chiller with the IMSS equipment and those cans rusted; got corrosion on them. We've already mentioned that as being somewhat of a concern to us. We probably ought to use different can material. If you need a

CARR (CONT'D)	chiller for IMSS equipment there should be a separate IMSS chiller. The food chiller should be left strictly for the food.
GIBSON	We had so many things mixed in there, from penicillin to cans to heat sinks and all those should have been in a different chiller.
CARR	There was no restraint system inside the chiller, either. You just had to open the door and put stuff in and try to keep all the other stuff from floating out. When you wanted to get in there to get something, you had to pick what you were looking for from among all the other floating objects while trying to keep the others in, so you need some sort of a restraint system in there.

12.4 Crew Systems

CARR Restraints and Mobility Aids: We should temper debriefing of this whole area of Crew Systems with the fact that we've already given extensive debriefing on M487 on these very things.

CARR Mobile aids in the MDA, relative to the workshop, would have the rating of about 4.

POGUE Handholds and footholds in the MDA were too few and far between for my way of thinking, in some places nonexistent. ATM was good and the EREP and C&D panels were good. There were

GIBSON (CONT'D) will be very flexible. Something like that would have helped our film stowage, all the personal stowage, and every small item that you cannot predict ahead of time what it's configuration will be.

CARR I broached the subject for stowage for crew quarters in the M487 area. I proposed that at least one locker with a lot of pigeon holes be designed for personal use. The door of this locker should be hinged so that it opens downward creating a Ben Franklin-type disk, and it should be at an elevation that makes it compatible for reading or writing even if a crewman is hanging in the rack. Inside the locker there should be soft stowage provisions for things like pens, pencils, and any other small personel items you might want to store. I think that's definitely a requirement in a system like that.

Regarding stowage in general, I thought the stowage in the whole spacecraft, generally, was good. We have already pointed out some very definite problem areas. The most glaring example of a stowage problem was the film vault. That's been thoroughly kicked and I don't think there is any need to jump into that one any more. As we used equipment, particularly in the wardroom areas, stowage lockers opened up and we found them to be very handy for stowing items. Once we got into the free-wheeling food system where we had to select a lot of things

14.0 INFLIGHT EXPERIMENTS

14.1 Medical Experiments

CARR

M071 - Mineral Balance: That includes food as well as food intake, urine and feces collection. We ought to talk about M071 and M073 together. I hope by now the ground has an idea of what goes on up there and that future missions do not have to go into the detailed testing that we've had to go through in order to completely measure the balance in and out. It's time-consuming and unnatural. The more naturalness we can get in our life at zero g the better. A wider range of menu choices should be made available. In the future we need to make allowances for changes in taste; if you're going to be up there for long periods of time, you need to have considerably more than six menu choices. You should have a rather substantial pantry available, so when you get tired of eating certain foods you can just set them aside and eat others. If somebody is trying to keep a balance on you, all you have to do is report. You shouldn't feel that you have to avoid certain kinds of foods just because they mess up somebody's experiment. I think the crew should be free to eat any food they want when they want to eat it. If it's required that they report it, that's no big thing. The freedom to eat in pretty much the same manner as you eat on the ground is a very strong requirement for the future.

CARR (CONT'D) Preflight Baseline Data: That area was laid out pretty well. There were many people supporting us gathering sample bottles. It was designed to be of a minimal impact to us and we're grateful that it was done that way.

Menu Deviations: It was reasonably well thought out. We did not object too much to the evening status report in flight. I hope future food systems and medical testing with metabolic balance can be performed in a manner more conducive to the normal daily regimen.

GIBSON I second that. I think from here on we're going to be sending up specialists. You may want to have people who are medical test subjects, but certainly the whole crew should not have to undergo this time-consuming exercise pre, post, and inflight.

POGUE I thought we missed a good opportunity to find out just exactly what foods a crew would prefer.

GIBSON We put some restrictions on ourselves with this experiment in the amount of different types of minerals one can take. For example, a high salt intake a couple of days before you come down to increase your blood volume would help in terms of cardiovascular effects when you get into one g. We never had a chance to really explore that one. In trying to get back to preflight values of hemoglobin. There's nothing we can take

GIBSON (CONT'D) now because of the requirements of this experiment. I agree that it's a worthwhile thing to be doing, but in the future we cannot have every body in the crew living under these restrictions.

CARR M074 - Specimen Mass Measurement: We never measured a specimen of food the whole time we were up there except one time when we had to take a picture of a crewman putting a can with some food in it in the SMMD. We just ate it all. If we didn't want to eat it all, we didn't start on it. The measurement of fecal matter presented a design problem in the SMMD; the bags were so large that you had to essentially force them under the blanket in the SMMD. The system failed and we found ourselves, the last couple of weeks, in a mode where we had to carry the bags into the wardroom to measure them. That was not an optimum situation at all. We did not have the time to fool around with the system and try to change equipment so that we could get our weighing done in the head.

Calibrations: The cal weights were lost, so we didn't do all the calibration work that should have been done. It's a mystery to us where those weights went. It was graphically demonstrated to us that that system is very sensitive to vehicle motion. If we were in a gravity gradient dump, there was no sense in weighing anything; you might as well wait.

CARR Feces and Urine Collection: I think we've covered that already.

CARR Bathing: We've adequately covered that. The shower is neat and a nice thing to have but the next generation of showers should be something less time consuming.

POGUE The vacuum head was no good.

CARR Yes, that was the biggest single thing. It just didn't have enough suction.

POGUE The shape was poorly designed.

CARR Washing: The full body wash was a time consuming thing but it was feasible. We have discussed the possibility of a canister for hand washing.

CARR Food and Water: The iodized water was not as unpleasant as I had anticipated; I found it to be palatable. I'm glad that we didn't have to suffer through the clorine problems that were experienced in the Apollo program.

CARR Food: We all agree that the food was good. There were areas where it could be improved. The frozen food was best and the thermostabilized food next best. We would certainly suggest that for extended missions, the rehydratable should be minimized. The food system was more than adequately covered in the debriefing.

CARR (CONT'D) Water dispensing was very well covered. As for containers, the spoonbowl was a disliked item and the conical pack was one of the more liked of the items.

GIBSON In order to increase the quality of food by including more frozen food on board, we should package three or four frozen foods in the same container, so they could be heated up together. This would miminize container space and volume for each individual item, frozen TV dinner style. If you know that you want mashed potatoes with your meat and peas, you could put it all in one big package, and heat it all together. This would simplify packaging and serving.

POGUE Garments and Personal Gear: All zippers should have little pull tabs on them. I believe in the kangaroo pouch for a shirt, rather than the little pocket on the chest because it works its way up to your shoulder. We don't have enough places to stow flashlights, pencils, scissors, or tools.

CARR Let me give you a word of caution. Bill says he likes the kangaroo pouch on the shirt. That doesn't mean that the shirts for the next mission should all have kangaroo pouches. The plea is for flexibility. If one guy likes kangaroo pouches, great. Give them to him. If another guy doesn't want kangaroo pouches, don't saddle him with them just because the crew of SL-4 said they like that type pocket.

POGUE The point is we should not be adverse to trying new things.

CARR Right. But on the other hand, we don't want to saddle every one with the same thing.

GIBSON One thing I have never seen anybody use was the strips across the top which were snapped to hold comm cables. I found those things were always open, or in the way. We never used the comm cable holders in zero g, and I would eliminate them from future spacecraft.

CARR Personal Gear: It was great to always have scissors with you and I wish we'd had a better pocket to put them in. The Swiss army knife was an extremely valuable tool to all of us. It had enough flexibility that we used it on just about all of the appliances, at one time or another. That is a good piece of gear to have with you at all times, and should be properly stowed on the clothing.

CARR I want to mention the food arrangement. Ed had to climb over the table to reach his food. I had the best position: next to the window and the food. Bill had a good position, but the food was not accessible from all positions at the table.

CARR Medical Briefings and Exams: The medical briefing itself, I thought, was a rather empty formality - that closed TV thing we did. I thought that was a rather empty formality that really wasn't too terribly necessary.

CARR Eating Habits and Amount of Food Consumption for F-5 to 5-0: We were on a food thing and everything was pretty well rigidized on that.

23.2 Flight

CARR Appetite and Food Preference: Appetite inflight versus 3 weeks preflight. At the beginning of the mission, our appetites were diminished, but it didn't take long for them to get pretty much up to normal compared with preflight. But, by the middle of the mission until the end, our appetites seemed to increase beyond preflight levels.

POGUE Yes, mine was on the increase throughout there towards the end.

CARR Difference notable in food taste inflight versus preflight - I did not notice the big difference that a lot of people have noticed. I thought most of the food tasted the same inflight as preflight.

GIBSON I felt the same also. I was looking for that taste difference but it never showed up.

POGUE | I noticed a change, but then I had more nasal congestions than you did.

GIBSON | I personally felt I wanted food with more spice and I felt that before flight, inflight, and after flight.

CARR | Yes, I think that was just in general the blandness of the food. Change in food preferences as the flight progressed - I would say it didn't make any difference whether we were up there or down here. I think that if we'd been right in one g and locked up that long, the change in preference would have been about the same.

GIBSON | Now that we've been down for over 2 weeks, I feel the same food preferences that I did inflight. I liked what I ate up there and I just liked the same thing.

CARR | Turkey and gravy gives you that same queesy feeling.

GIBSON | That's right. I still don't want to have chili and go stand on my head anymore.

GIBSON | Size of food portion and meal portions - I guess that I would say my eating habits outside of this tend to be that I eat a lot of one thing and not much of anything else in any given time. I found it kind of hard to just have a little smattering of three or four things in a meal.

POGUE | Eating is a highly personal and subjective thing and you're going to get all kinds of different answers. I just didn't like the food; that's all there was to it.

GIBSON | Well, the hardest part of that whole program was that you couldn't eat what you wanted when you wanted, even though you might end up eating the same quantity of food throughout flight. You didn't have any flexibility.

CARR | Most acceptable foods - I think we can speak in generalities here. One, the frozen food was most acceptable; two, the thermostabilized food with the exception of the turkey and gravy was second best. The thermaostabilized fruits were delicious and when chilled they were really great. We really liked those. Of course, the last priority was the dehydrated foods.

GIBSON | I liked the peaches and pears and the pineapple when you popped them into the freezer until they got a little slushy. Then they were great.

CARR | Food Preparation and Consumption: Problems with rehydration (mixing, gas) - We had gas in the water. I don't care what anybody says, it was gas. After we worked the gas out of the water (I guess it was about 10 or 15 days), the only gas problem we had was the gas that was generated by the food itself when you added the water to it. Foods that did that were the potatoes and the barbeque veal to a small degree.

GIBSON I tell you, when you put hot water in potatoes and shake it, you ended up with a very tight drum. A couple of times, we did get an explosion and it was no fun to clean up. Potatoes were not too bad, but some of the others were terrible.

CARR Coffee and tea were both gaseous; I guess it was because they both had aromatics in them; as soon as you release those aromatics, you have a bubbling mixture that you had to do something with or you ended up drinking a lot of gas which was immediately evident to you and the people around you. Rehydration in general - we did not give the rehydration the time that it required. Most of the time if we rehydrated the food and ate it immediately whether it was prerehydrated or not. Sometimes your corn was a little crunchy or your veal was a tad crunchy or you found little pocket of powdered sauce in the spaghetti or veal that didn't get fully rehydrated. We just ate it anyway because we did not have time to fool with rehydrating early and putting it in the tray.

POGUE We couldn't do it because of the gas problem you mention early anyway. You put it in there and the food tray top would pop off.

CARR For future rehydration it looks to me like you probably ought to give up on this nicety of rehydration and let it sit for

CARR (CONT'D)	half hour or 2 hours or something like that. You better start figuring right now if you are going to rehydrate food, it had better be instantly rehydratable in 5 or 7 minutes, then ready to eat.
POGUE	Either that or buy off on more time on your schedule for doing all this. You need to go down and rehydrate the food 45 minutes prior to lunch time and this flight would not let you do that.
CARR	Food temperture - The cold water was cold; the hot water was hot; the heaters maintained the heat if you could get it to the well in time.
GIBSON	I thought the temperature of the hot water was just great for the hot food.
CARR	I thought the cold was about right too. Effect of water flavor and gas content - Water flavor didn't effect the food as far as I know. The gas content was a real bother the first part of the mission. We somehow got rid of that gas. I don't know where it came from. I don't think it had anything to do with the quality of the water. During activation, it was in there and it had to work out before we could get into a stable water situation. Use of the spoon-bowl package - I think we adequately documented the fact that we don't like that thing and we don't recommend that it be used for any further flights. The conical

CARR (CONT'D)

pack is by far the superior. What you should do is tailor your food for the use of that package. Use of spoons - For the most part, I found them a little too small. I used the big spoon. Opening of cans - We consider those cans to be rather dangerous. For the next generation of cans, we should find something better. None of us cut ourselves but the potential was there. I had half a dozen tab failures. Consumption from cans - I have no objections.

Food Waste Stowage: Function of germicidal tablet pouch - We never used them. We had them in the CM, but I think they are more trouble than they are worth. Undesirable odors - We did get some odors in the food-disposal area and we had some smell there. We already talked about how we needed to keep that area clean.

Fecal Container: I think we already adequately debriefed that. Urine system has been adequately debriefed.

Water: Chlorine taste and odor - I was not impressed by it. We only used the CM water 1 day and I didn't notice any problem. Iodine taste and odor - no problem. The gas-water separator was removed from the CM. Intensity of thirst during mission - That was no different than here.

QUERY Was the food system a mix of about half thermostabilized and half rehydratables?

GIBSON Yes.

QUERY Did you find any particular preference in the preparation time required or the difficulty of eating between thermostabilized foods and the rehydratables?

GIBSON Most of the thermostabilized were pretty good. I think we prefer them over the rehydratables. There are a couple of the rehydratables which we all have personal preferences for, but in general, the thermostablilzed were pretty good. We'd like to have more frozen if we could.

CARR We really enjoyed the canned fruit. The thermostabilized we disliked the most was the turkey and gravy because it had a lot of preservative flavor to it. The frozen food was best because you could have meat and good meat juice that tasted like meat juice and had no preservatives. The ice cream was a wonderful treat for us. We would hoard our strawberries, if we had them that day and put them with the ice cream and really enjoy it. Our order of preference was frozen, thermostabilized, and then rehydratables last.

GIBSON We were told that the reason that we didn't have more frozen was the volume available, but when we looked at

GIBSON (CONT'D) the packaging, we could see that the space available could have been used more efficiently by packing it in squares and cubes.

QUERY The round cans are not very economical.

GIBSON You could package things together.

QUERY Did you find the general concept of trays, open dishes, knives, and forks to be a good thing?

GIBSON Yes. With the silverware I would have liked to have seen more and stronger magnetic restraints underneath the table. You always ended up with them all bunched up in one little location.

POGUE If you just touched them, they would fly off.

CARR The food in the can, with the can open, was no problem at all, unless you were working with the thin soups or with the cereals that you added the milk to, like corn flakes and rice crispies. They were so thin that they were difficult to work with. We even found the fruit with the syrup was no great problem, although you had to be a little more careful. The beef with the thin juice on it was manageable if you were careful. It was a lot more

CARR (CONT'D)

pleasant to have your food open and to be able to eat from it, rather than having to open and close a lot of containers.

GIBSON

We found that the table was a little bit low, as he said, but it was still preferable to be able to get everything organized, opened up, and proceed into the meal the same as you would down here. However, sometimes I preferred to pick up one can at a time, rather than trying to eat it out of a tray. Another general ground rule in the design of containers which interface with fluids is to avoid elastic materials. By elastic, I mean the very thin membrane over the filet that when cut would cause fluid spill. Containers with elasticity, when interfaced with liquids, tend to pump out food particles and liquid if not handled very carefully. The spoon bowls containing soup are an example of this.

CARR

We had a quality control problem in that the little loop that your finger went through would break off; it would separate right at the weld or whatever you call it in plastics.

QUERY

Let's examine a few comments concerning garments to see if you think they are reasonable assumptions. The two-piece garments ought to be baselined as a standard zero g wearing apparel because of the convenience of waste management and

CARR (CONT'D) get four or five of them into a trash urine disposal bag and dump it without any problem.

CARR Trash bags were beautiful. They held only that amount of trash which would dump easily at the trash airlock. We had no problems with the trash bags whatsoever.

Food Trash Disposal (overcans): We would remove those from the wells and place a herringbone around the outside of the can because that was the best way to dispose of the herringbone. Then we would slide the cans into the trash bags and dump them. When we had a full waste food compartment area in which the cans needed to be changed out, we would get trash bags and empty them. We needed some place to put the overcans as soon as we got them out of the wells. It was very difficult to find a place to anchor an overcan while waiting for a trash bag in which to put it. When we reached a point where we had to change the overcans in the food disposal wells, we would grab a trash bag from the lockers in the wardroom or the trash locker in the waste compartment and insert the trash cans into that through the membrane area. Fitting a large overcan into a trash bag was difficult if there were a lot of trash in the bag. We found that the best way to do it was to dump the trash cans first, then try to manage separate overcans.

QUERY — Jack, did you use the can crusher as a routine device? If so, how did it work?

LOUSMA — Sometimes we used it routinely and other times we just forgot about it. I got to the point that I thought it took just as much room to store a flat can in its plastic bag as it did to put the plastic bag inside the can and stuff it down in it. I tried crushing it with the plastic insert in there, hoping it would crush the whole thing, but the plastic bag just popped out and left the can. They always crushed in a circle so you could put them into the waste overcans. But I don't know how much volume it saved. Also, we crushed only dry cans. Food cans without a plastic bag inside made a mess in the crusher.

BEAN — The garbage arrangement is not comapct enough for Shuttle. The cans do not all lie flat in the overcan; rather, they get jammmed, reducing available space in the overcan to approximately one-third of what it might be. The garbage operation was the least thought - through of all the human factors. We spent too many man-hours on the garbage.

QUERY — You had mentioned, Al, that you needed to wash as well as vacuum the screens at the done air-mixing chamber.

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