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SKYLAB EXPERIENCE BULLETIN NO. 12

TEMPORARY EQUIPMENT RESTRAINTS

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No. 12

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February 1975

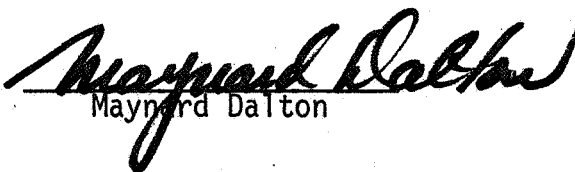
MAN-MACHINE ENGINEERING DATA APPLICATIONS
OF
SKYLAB EXPERIMENTS M487/M516

BULLETIN NO. 12

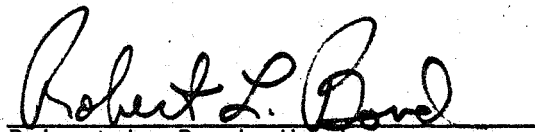
TEMPORARY EQUIPMENT RESTRAINTS

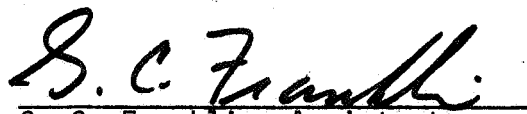
This document is the twelfth in a series of releases which are intended to make available to NASA and contractor personnel those results from the Skylab Man-Machine Engineering Experiments which have design and requirements relevance to current projects and programs. This method of data distribution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

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February 1975

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SUMMARY

Temporary equipment restraints must provide quick and easy attachment and detachment for any item of equipment. These restraints should be available at any location in the spacecraft.

Bungee cords were the most widely accepted restraints on Skylab, with velcro a close second. However, the velcro exhibited some deficiencies that should be resolved before it is used extensively in future vehicles.

Straps were quite useful as was the snap system throughout Skylab. The crewmen were quick to innovate equipment restraints when necessary and desirable.

The entire system of temporary equipment restraints needs to be carefully considered in future spacecraft to ensure that each area or location in the spacecraft is adequately provisioned.

PRE-SKYLAB EXPERIENCE

Velcro proved to be a very effective temporary retention device and was the only thing used in Project Mercury and the Gemini Program for temporary equipment restraint. Patches of velcro hook were bonded to areas on spacecraft bulkheads while the velcro pile was bonded to the various pieces of equipment. The mating of the velcro pile to the velcro hook provided the necessary retention and ease of retrieval as the equipment was used.

However, the nylon velcro used had a high burn rate and a new velcro material was developed. It was less combustible but, unfortunately, was also less effective as a retention device. Additional equipment restraint methods were implemented for the Apollo Program.

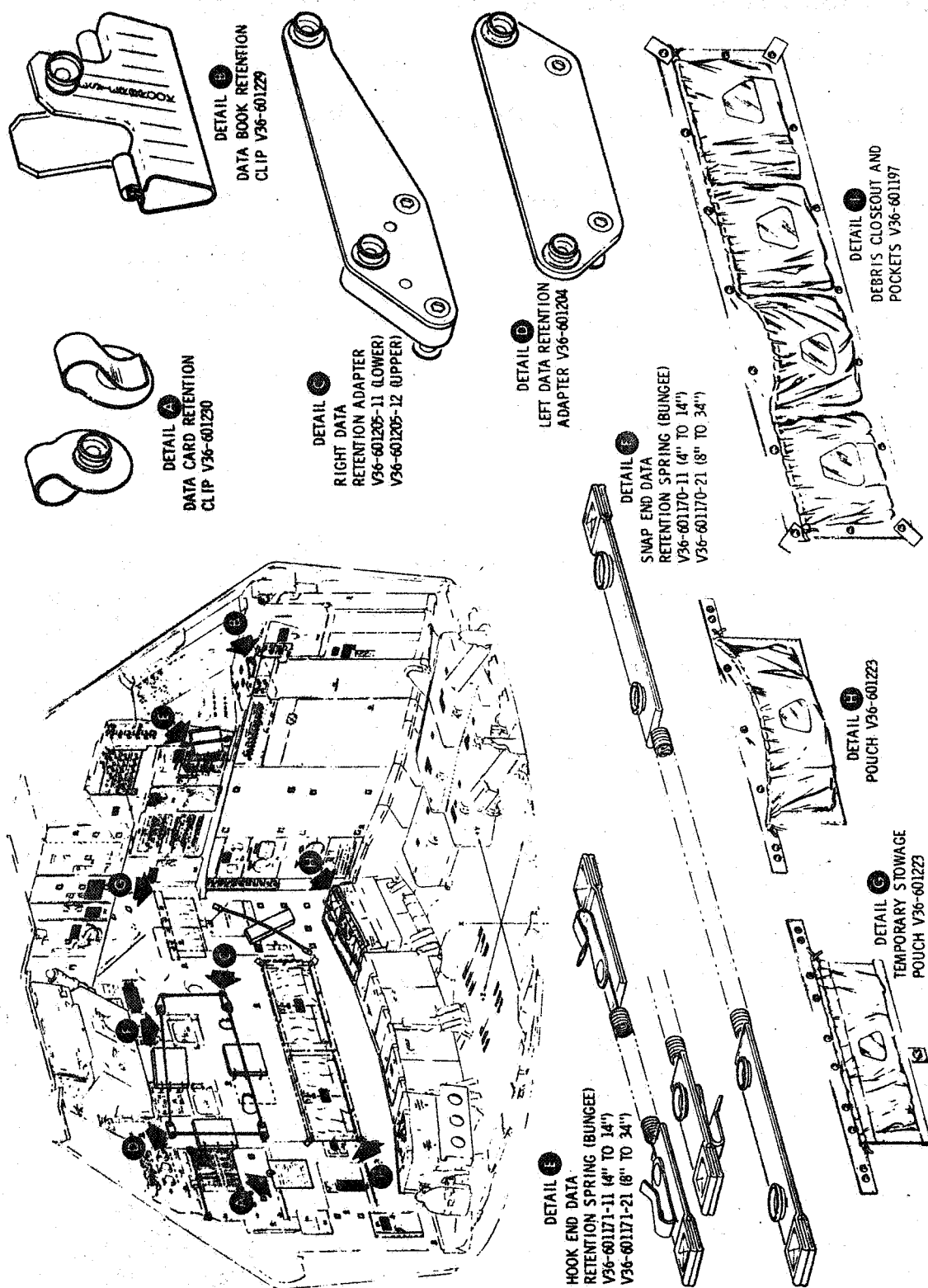
The Apollo Command Module had various equipment restraints for various purposes. The Flight Data Restraint System (commonly called the bungee cords) was a new technique developed for Apollo. Bungee cords are metal "screen door" springs with snaps or hooks provided at each end. They were provided to position and retain the flight data charts, maps, and manuals so the crew could handily review them during the mission. Slightly stretched between mating snaps, they were strategically located within the crew compartment and provided an extremely useful retention device.

The system included both long and short bungees with snap ends and with clip ends, adapter plates, data card clips, food door clips, data book spring clips and temporary stowages as shown on Figure 1.

The short bungees were 10 cm (4 inches) long and could stretch to 35 cm (14 inches) while the long bungees were 20 cm (8 inches) and could stretch to 86 cm (34 inches). Both lengths had a 7.5 cm (3 inch) strip of beta cloth attached to each end. A female snap or a clip and a snap was bonded to each cloth strip which permitted use of the bungee springs with the snap system.

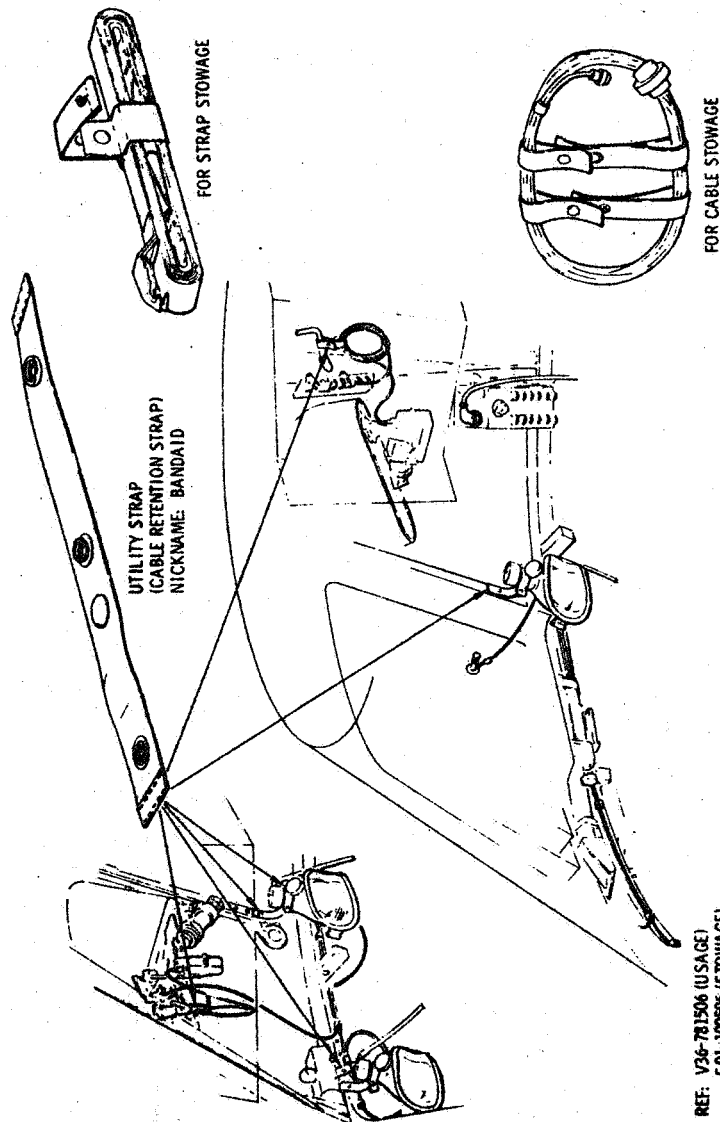
Metal snaps became second to velcro in frequency of use for equipment retention. One side of a snap was mounted to a hard surface within the spacecraft. The other side of the snap was mounted on the various items of equipment. The crewmen could mate the two sides of the snap together to achieve retention of the equipment.

A number of restraint straps, both specific use straps and utility straps, were provided to supplement the limited amount of velcro used within the crew compartment. The utility straps were 32 cm (12.5 in.) long with two studs and two sockets positioned so as to form two loops when snapped. Figure 2 shows the utility straps. The snaps mounted on the straps also permitted them to be used with the snaps in the spacecraft.



APOLLO COMMAND MODULE FLIGHT DATA RESTRAINTS

FIGURE 1



APOLLO COMMAND MODULE UTILITY STRAPS

FIGURE 2

The specific use straps were designed for particular retention tasks within the crew compartment. Some of these straps are illustrated on Figure 3.

Numerous patches of 2.5 cm (1 inch) velcro squares were bonded to the bulkheads and internal structure of the Command Module. As has been described earlier, the velcro hook was bonded to items of equipment. It was used, but not as frequently as on the Mercury and Gemini flights.

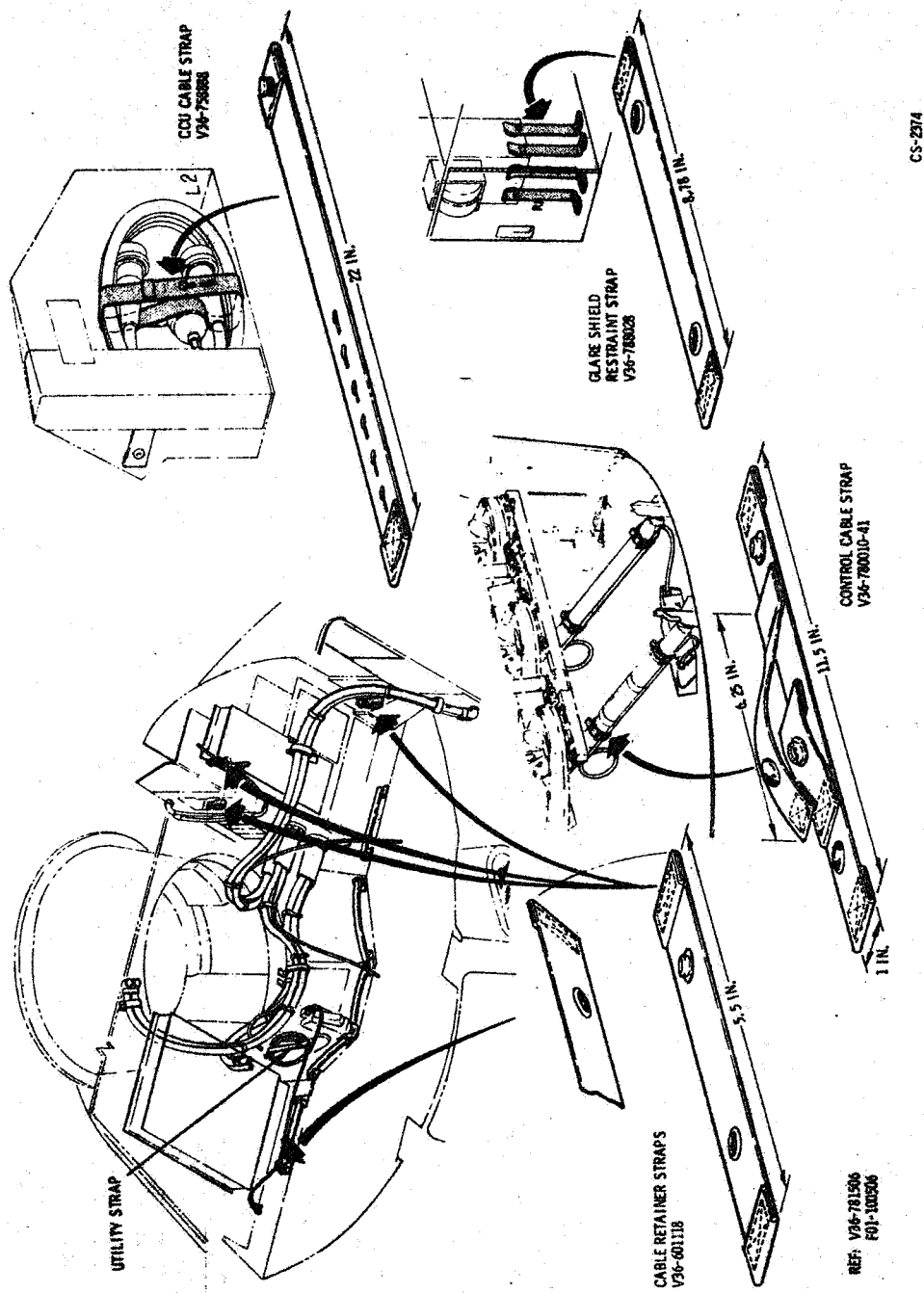
SKYLAB DESIGN

Several types of equipment restraints were utilized on Skylab. They are described in the following paragraphs.

Straps

Three types of beta cloth straps were used to restrain large and small articles to the SWS structure. They were portable and permitted the crewmen to temporarily restrain and/or stow equipment for convenient access while performing work tasks.

The short straps were 30 cm (12.5 inches) long and 2.5 cm (1 inch) wide. The fabric was faced on one side with velcro pile and each end contained velcro hook. Both sides of the straps were fitted with four snap studs and four snap sockets.



APOLLO COMMAND MODULE SPECIFIC USE STRAPS

FIGURE 3

The long straps were 66 cm (26 inches) long and constructed similar to the short straps, but contained four additional snap studs.

Equipment restraints were very long straps, made of Beta fabric. The end of the restraint was fitted with a snap stud and a snap socket to permit the end of the restraint to be securely fastened to a handhold or open grid. The strap was adjustable to 185 cm (73 inches) long and was 2.5 cm (1 inch) wide.

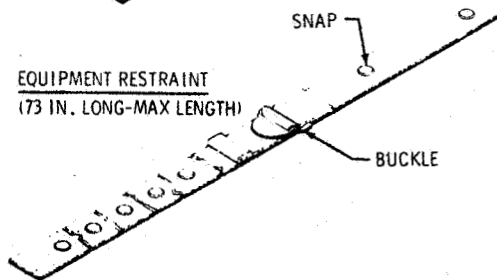
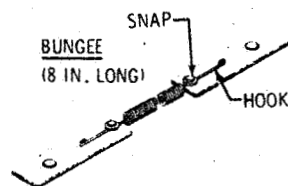
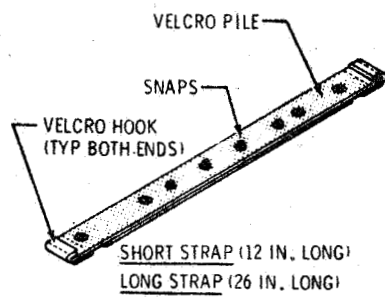
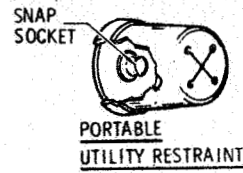
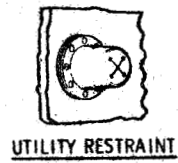
Figures 4 and 5 show the equipment restraints and straps.

Bungees

The bungees were 20 cm (8 inches) long constructed of a coil spring fitted on both ends with a hook. The maximum extension was 30 cm (12 inches). Twenty of them were portable and others were permanently installed in the galley and in the flight data files. Figure 4 and Figure 5 illustrate the bungees.

Utility Restraints

The utility restraint was a fluorocarbon rubber cup, supplied as shown in Figure 4. Some were permanently mounted and others were provided for portable units. The cup contained a cruciform slit into which small flexible items could be inserted for temporary restraint. The permanent restraints were located near the food preparation areas,



SKYLAB TEMPORARY EQUIPMENT RESTRAINTS

FIGURE 4

BUNGEEES



UNIVERSAL
MOUNTS

STRAPS

SKYLAB TEMPORARY RESTRAINTS

FIGURE 5

in the WMC, in the sleep areas, and near items of operational equipment. Six portable restraints were fitted with a snap socket to permit usage in nearly any location in the SWS.

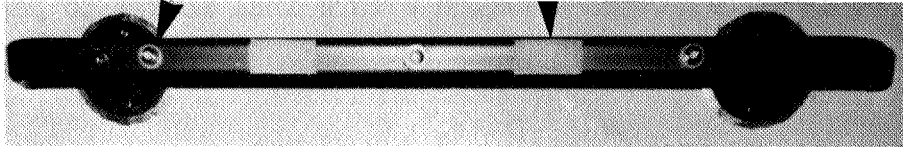
Universal Mount

Twelve universal mounts were onboard to be used as an attachable/detachable portable equipment mount for readily securing equipment to convenient structure.

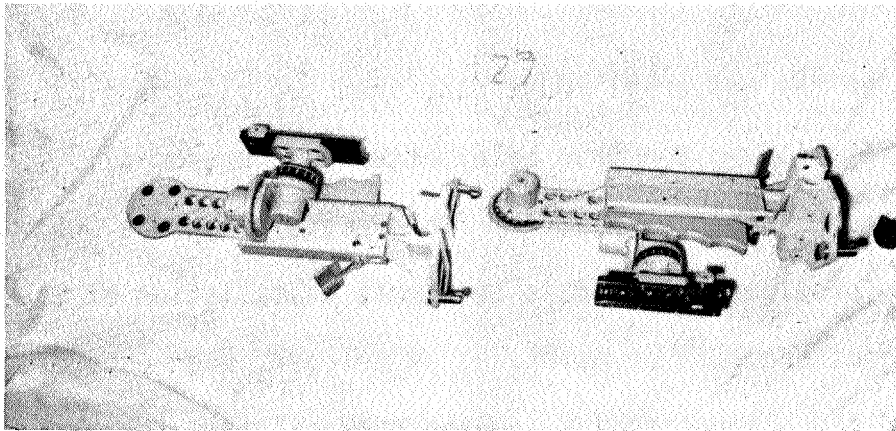
The base of the universal mount contained two alignment pins to permit its installation in the grid hole pattern or in specially located hole patterns such as on the platform foot restraint in the OWS. In addition, jaws were provided at its base to permit installation of the mount on a convenient handrail or handhold. A trigger, when compressed, separated the alignment pins and the handrail jaws for rapid installation and removal of the mount. A mounting adapter on the universal mount provided an easy installation/removal mechanism for the articles of portable equipment. The universal mount swiveled the equipment through all three axes. Three calibrated drums with marking in degrees provided the swivel joints with a reference for desired pointing of the equipment. The mount was to be used with the portable lights, high intensity lights, food trays, motion picture and TV cameras, tool boxes and their drawers, repair kit and its drawers and the IMSS work table. The universal mount is displayed in Figure 5 and Figure 6.

SNAPS (3)

VELCRO (2)



HANDRAIL WITH SNAPS AND VELCRO



UNIVERSAL MOUNT

SKYLAB TEMPORARY EQUIPMENT RESTRAINTS

FIGURE 6

Velcro

Velcro pile was provided in patch form installed on handrails, stowage compartments and structure at many locations throughout Skylab. Also, a supply of velcro hook and pile in patch form with adhesive backing was provided in one of the tool kits for use where needed. Figure 6 shows two velcro patches installed on a handrail.

Snaps

Snap studs were located throughout Skylab on stowage compartment doors, partitions, structure, handrails, etc. and were configured in a standard snap pattern to accommodate all SWS and CSM provisions that contained snap sockets. Three snaps are mounted on a handrail shown in Figure 6.

SKYLAB EXPERIENCE

The Skylab air-to-ground transcripts, post-flight debriefings and in-flight films have been reviewed and the data pertinent to temporary equipment restraints studied carefully. The results are presented in the following paragraphs.

Straps

All three lengths of straps were utilized in many and various ways during the Skylab missions. Not only were they utilized in the

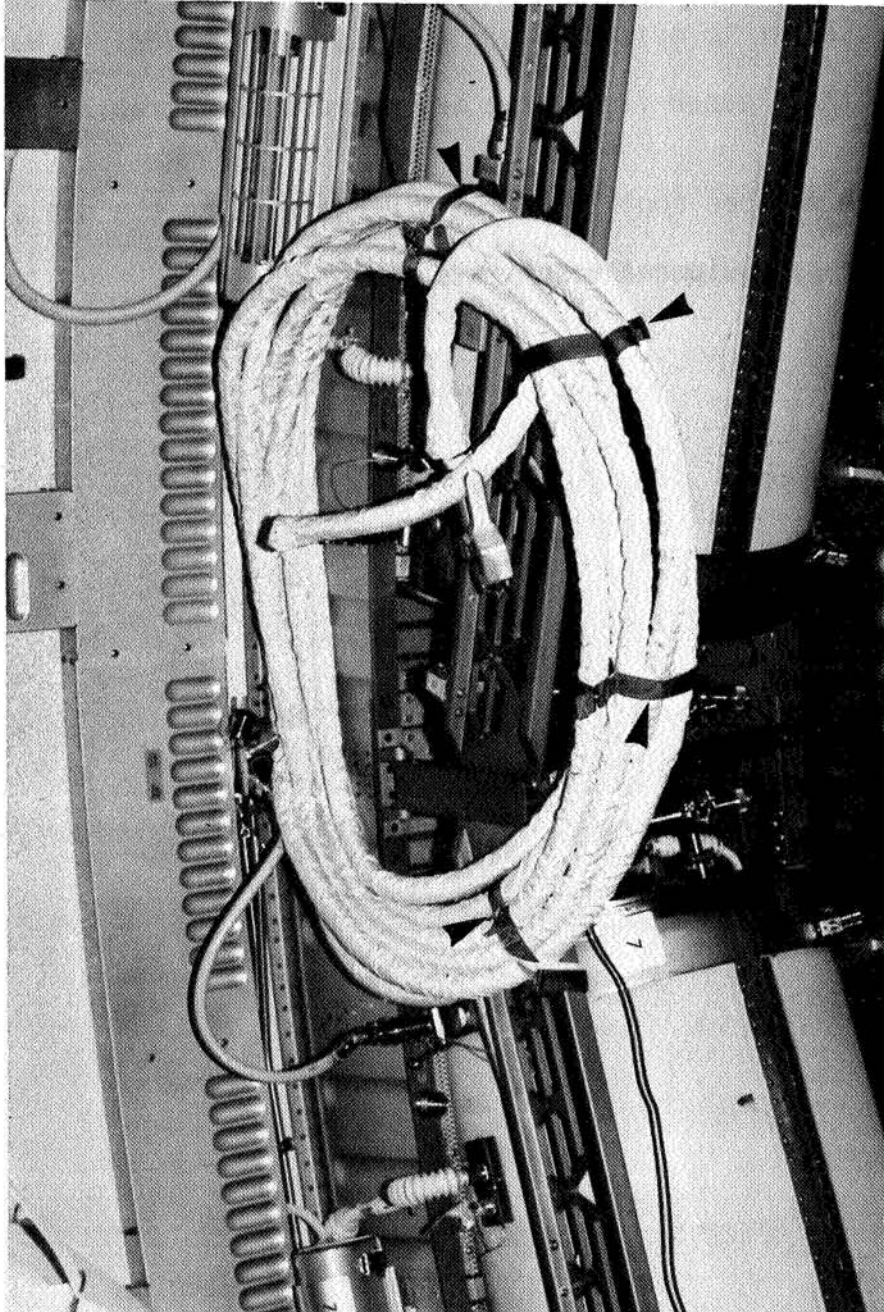
prescribed manner for fastening equipment but was used to rig foot and body restraints where necessary.

The crewmen's response to the straps and their uses appeared to be highly individualistic. Some felt that all the straps were quite good, others felt that they didn't use the straps all that much. Some of the crewmen preferred the longer straps and the equipment restraint straps while others preferred the short straps. However, most of them used the straps as they were intended to be used and had few complaints.

One comment was made that the beta cloth straps were quite difficult to push through the buckles when adjusting their length. It made those straps a bit slower and somewhat inconvenient to use.

Reference 25 also has one crewman's comments on improving the straps. He felt that the strap should be stiffened in the vicinity of the snaps and should have a generous pull tab at each snap. It was felt that these modifications would improve the attaching and detaching of the straps and make them more convenient to use.

Figure 7 shows several of the short straps used to secure a coiled cable, Figure 9 shows a pair of scissors secured by a strap, and Figure 12 shows a strap being used to prevent a power cable attached to one of the cameras from floating free and becoming a potential snag hazard.



SHORT STRAP TEMPORARY EQUIPMENT RESTRAINTS

FIGURE 7

Straps supplied for attaching equipment to the crewman's body were seldom used. The vacuum cleaner had such a strap to permit the user to attach the cleaner to his body during its use. However, it was simpler to let the cleaner float free and not use the strap.

The following references contain comments pertaining to the use of straps as temporary equipment restraints.

<u>Reference</u>	<u>Page</u>
2	2
3	3
4	4
7	7
8	8
11	16
12	18
13	20
14	22
24	46
25	48
29	57
30	61

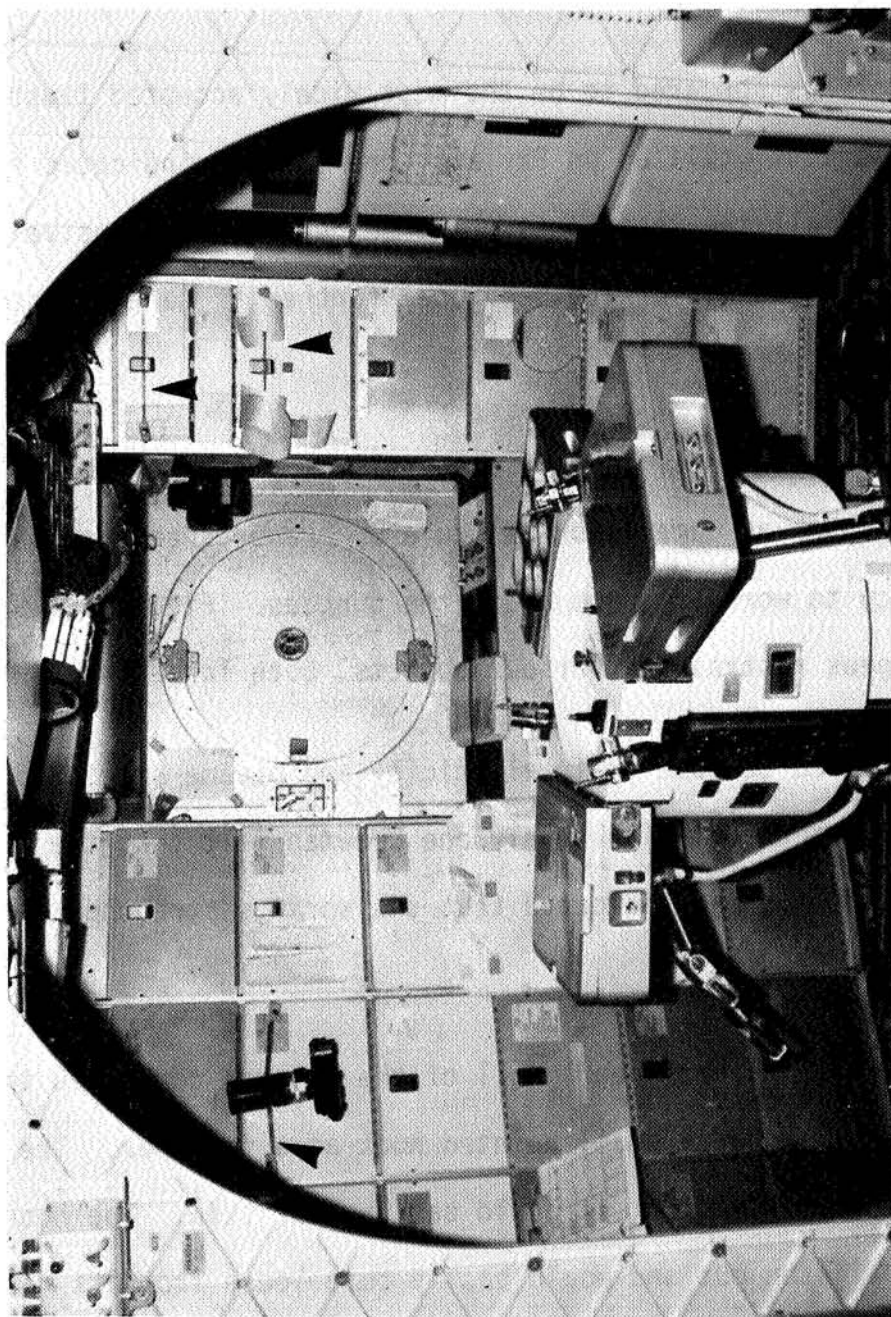
Bungees

The bungee springs appeared to be the most widely accepted temporary equipment restraint utilized on Skylab. One crewman indicated that it was the best of all the restraints. The bungees were extensively used in all locations and would have been used further if more of them had been available.

The bungees were extremely useful, especially for thicker objects with protuberances such as cameras or binoculars. Paper sheets or thin pads had a tendency to work out from under the bungees. Figures 8, 9 and 10 all show bungees restraining various objects, both large and small.

The springs tended to lose their elasticity and became stretched out toward the end of the mission. Only one crewman felt that the bungees were unsatisfactory. He indicated that the springs stretched out too easily and were "lousy".

One general complaint from nearly all of the crewmen concerned the bungee springs that had a small pointed hook as a fastener. The hook was so thin and pointed that it could easily tear skin. The hook tended to straighten out and would easily come loose from its fastening point. However, there was sufficient elasticity left in the spring to catapult the bungee across the workshop. Fortunately no one was hit or hurt by one of these flying objects, but the danger was clearly delineated, and the crewmen were concerned.



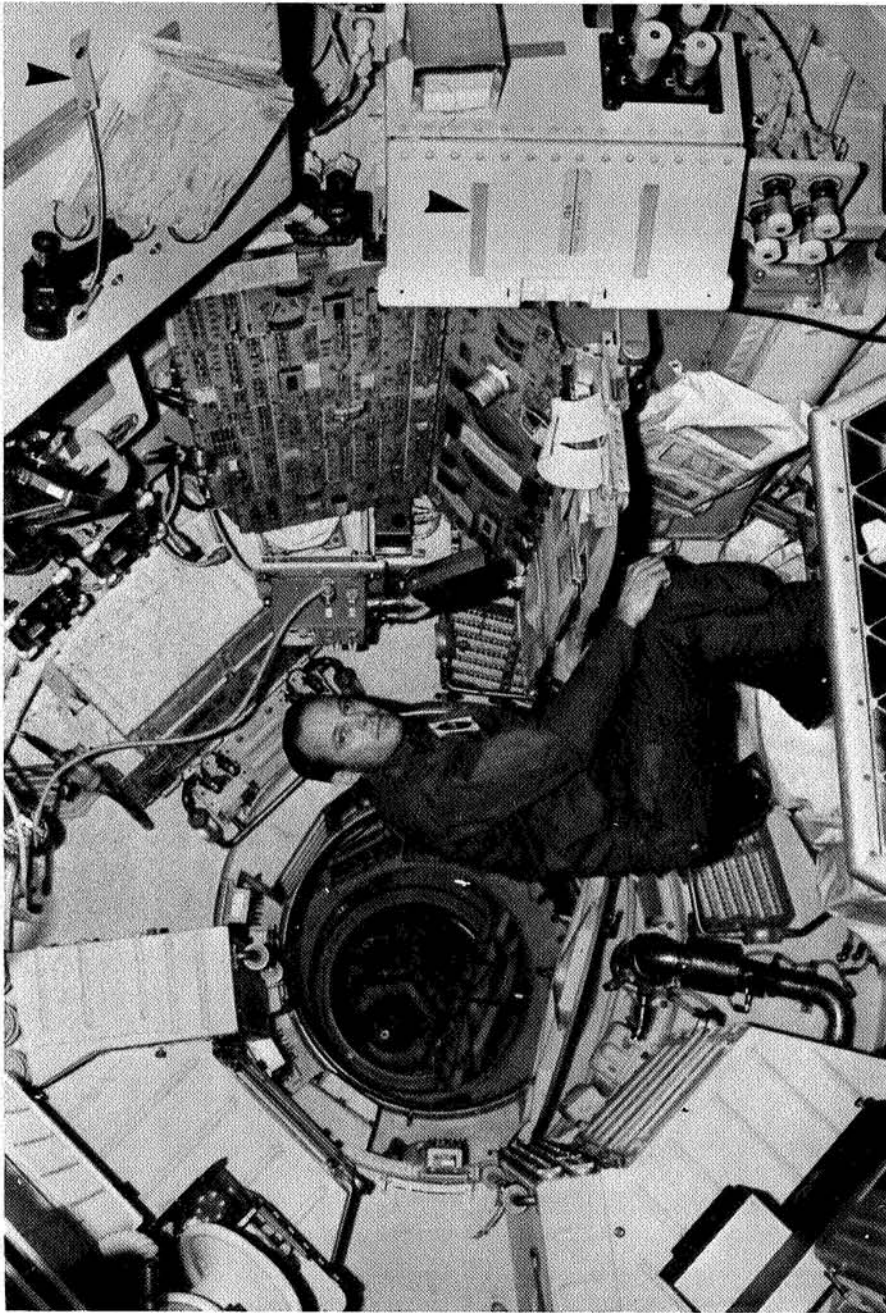
BUNGEE TEMPORARY RESTRAINTS

FIGURE 8



SNAPS AS TEMPORARY RESTRAINTS

FIGURE 9



BUNGEE, VELCRO AND SNAP RESTRAINTS

FIGURE 10

The snaps on the beta cloth ends of some of the bungees were considered superior to the small hooks as fasteners in spite of the cloth and snaps being considered cumbersome and difficult to use. At least the snaps were not dangerous to the user. The small clip of "flat hook" as it was described by some of the crewmen was considered the best fastening device of the three types used on the bungees.

The crewmen recommended that the bungees be permanently installed throughout the spacecraft. Nearly all surfaces should have bungees installed on them to provide immediate temporary restraint at nearly any location in the spacecraft. This would eliminate the crewman having to spend the time required to transfer a bungee from one place to another for use.

Another recommendation presented by one of the crewmen was that the door surfaces under the bungees should be slightly convex rather than flat. The bungees would probably hold paper or thin pads much better with this slight protrusion applying positive retention pressure.

The following references contain comments concerning the bungee restraints.

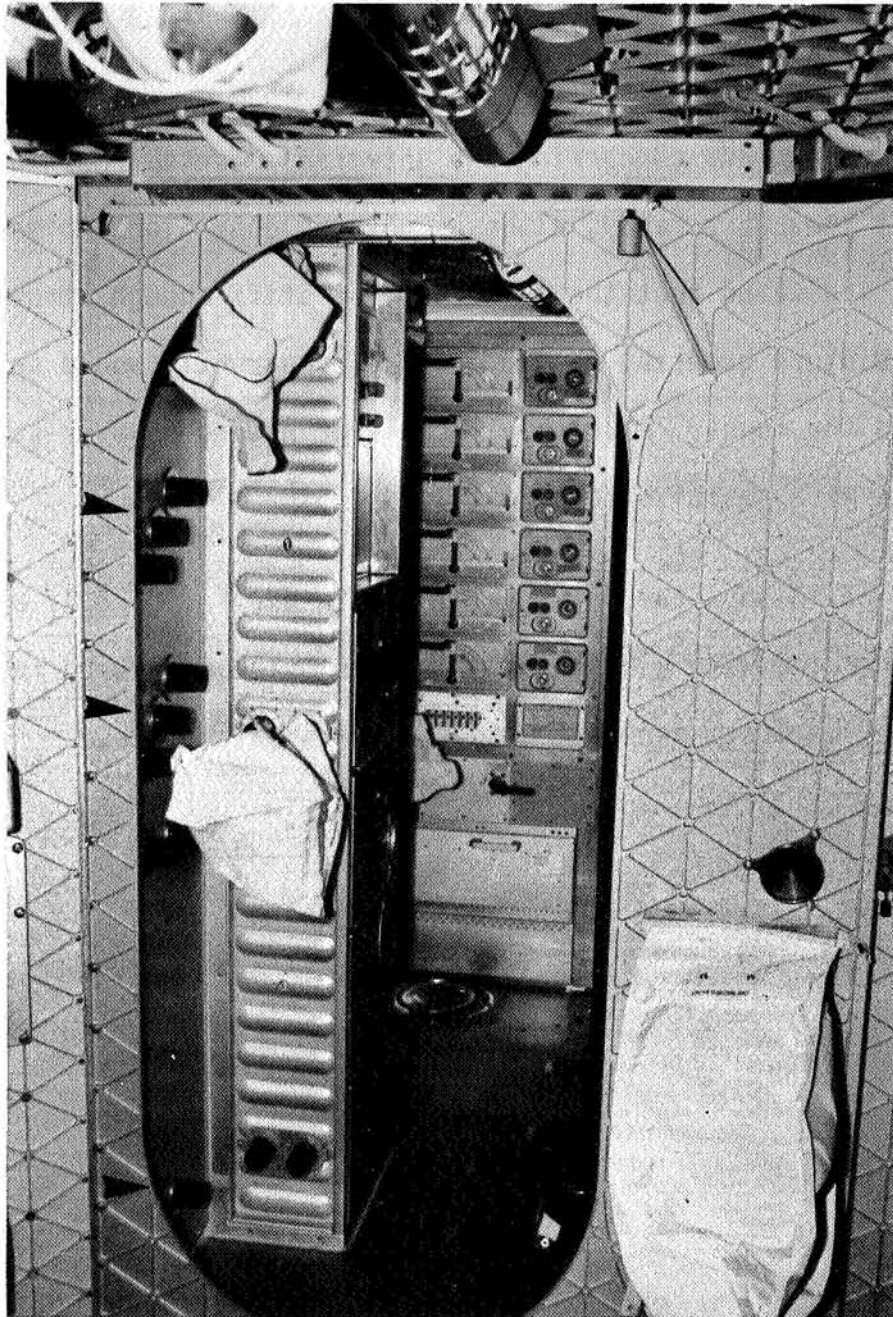
<u>Reference</u>	<u>Page</u>
2	2
3	3
4	4

<u>Reference</u>	<u>Page</u>
10	14
11	16
12	18
13	20
14	22
22	42
23	45
25	47
26	50

Utility Restraints

These devices were apparently used primarily in the waste management compartment to hold towels and washcloths, and in the sleep compartments to restrain clothing. Figure 11 and many of the TV and movie films show the utility restraints being utilized for that purpose. Only one crew comment concerns these restraints and then somewhat indirectly.

<u>Reference</u>	<u>Page</u>
5	5



RUBBER CUP RESTRAINTS IN WMC

FIGURE 11

Universal Mounts

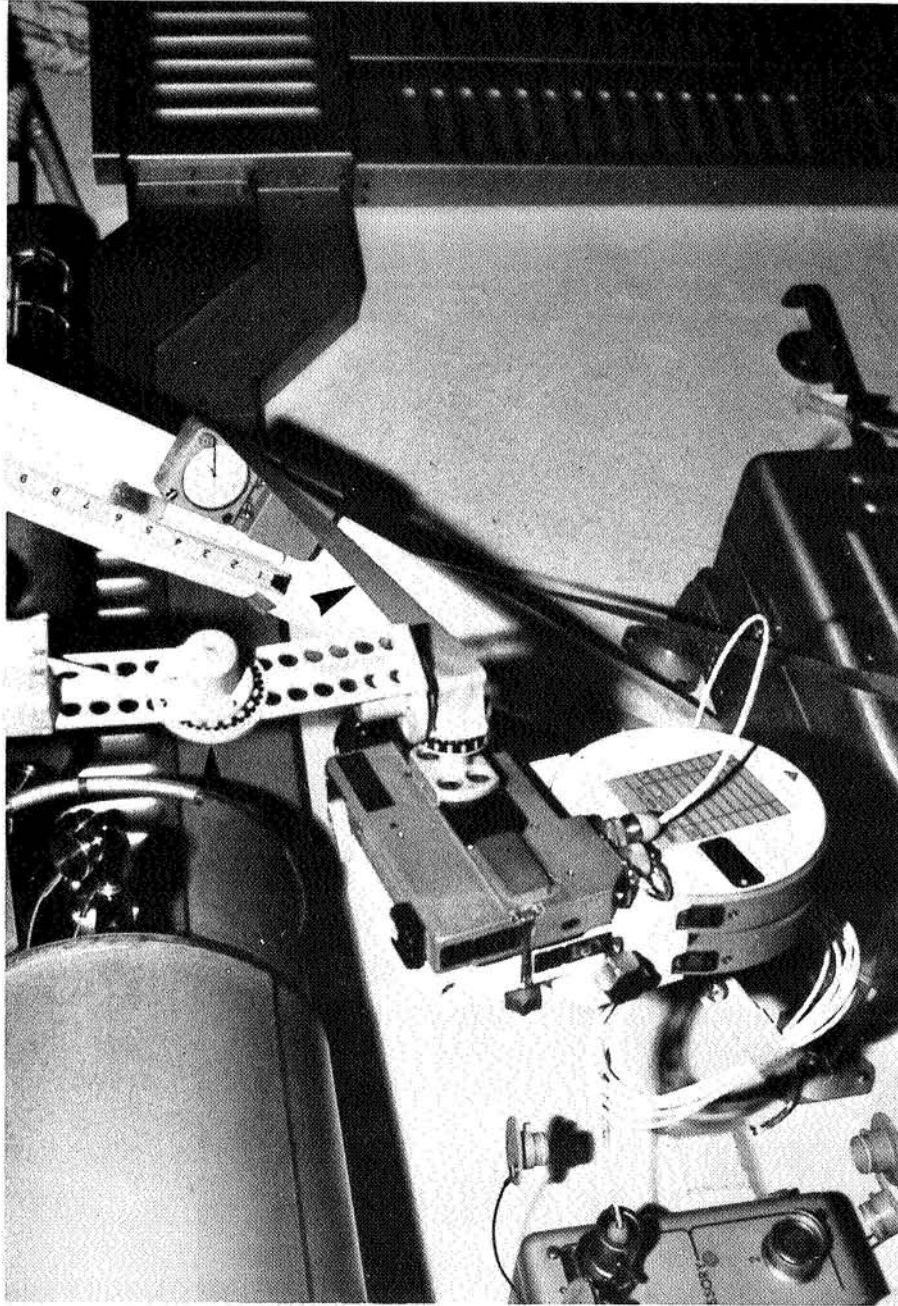
Few comments were made concerning the universal mounts. Most of the crewmen felt they were handy, although not too convenient to use. One crewman indicated that the mount was not stiff enough structurally. The motion picture cameras, when operating, apparently would set up a vibration in the mount. Also, the lock-lever needed an over-center type of lock with positive feel to it.

Figures 12 and 13 show the universal mount in use. Figure 12 shows the mount steadied with a strip of gray tape. The following references have the crew comments pertaining to the universal mounts.

<u>Reference</u>	<u>Page</u>
2	2
4	4
11	15
12	19
13	20
24	46
25	48

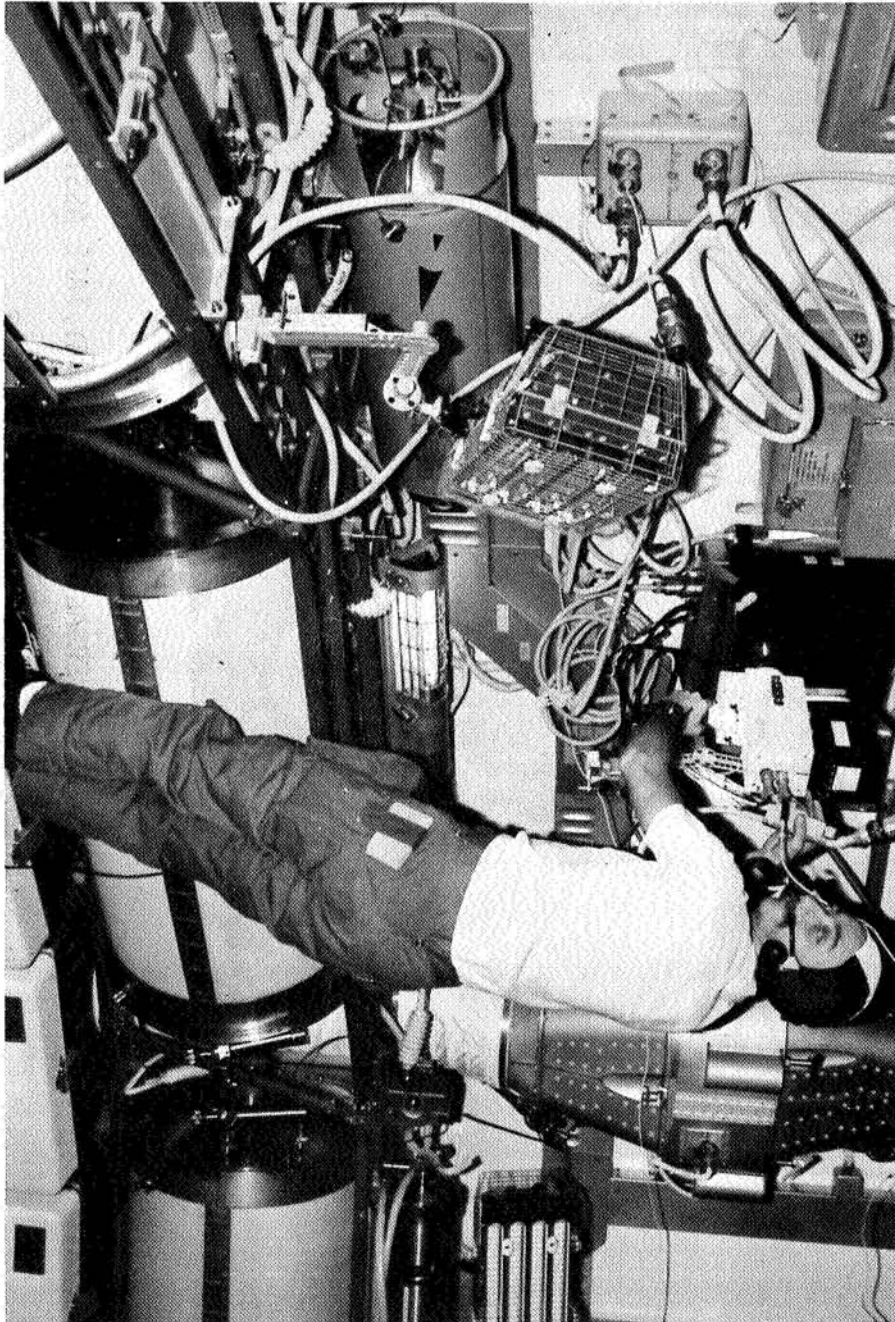
Velcro

The velcro hook and pile material used on Skylab was quite controversial. The crew comments ranged from "velcro is lousy, terrible, miserable



UNIVERSAL MOUNT WITH GRAY TAPE ASSISTANCE

FIGURE 12



UNIVERSAL MOUNT IN USE

FIGURE 13

stuff" to "those velcro squares turned out to be one of the finest things we have brought up". Probably all of the comments were correct.

As has been pointed out in the Pre-Skylab Experience, the velcro used on Skylab was not as good as the original nylon velcro used on the Mercury and Gemini Programs. However, it was the best available that would meet the safety requirements. The comments of the first Skylab crew pertained to this type of velcro.

The second Skylab crew took a fresh supply of velcro patches with adhesive on the back to use where needed. Their comments indicated that it was much better than the velcro existing from the previous mission. However, they also indicated that the velcro hook and pile stuck together with greater force than the adhesive would stick to the bulkheads. The adhesive would pull loose before the velcro would release.

The third Skylab crew had similar comments. The velcro patches were used very frequently, but didn't stick to the bulkhead too well. Figure 10 shows two velcro strips fastened to a stowage locker door.

In summary, it can be said that good velcro hook and pile has the necessary attributes of a good temporary equipment restraint. It is easy and quick to use, both when restraining and when retrieving objects. Apparently, however, the adhering qualities of the hook and pile are quite material dependent. The method used to retain the

velcro to the spacecraft bulkheads and to the various items to be restrained must provide more holding power than the velcro hook and pile. The adhesive utilized for this purpose apparently lost its holding quality with time and became quite a nuisance to the crewmen.

The following references contain comments pertaining to velcro equipment restraints.

<u>Reference</u>	<u>Page</u>
1	1
2	2
5	5
7	8
9	13
10	14
15	24
16	25
26	50
28	56

Snaps

Surprisingly, the Skylab crewmen had few comments concerning the snap equipment restraints. They were used frequently as tie-downs for the bungees as well as for trash bags and some of the crewmen commented that "there are never too many snaps".

A common complaint concerning the snaps was that some type of counter-
ing force was required when trying to snap an object into the snaps.
The crewmen apparently would push themselves away when trying to snap
items to the male snaps on the bulkhead. The large double clipboards
were apparently quite difficult to install on the snaps and one crew-
man commented that these clipboards came off the snaps quite easily.

Figure 9 shows a snap pattern not being used and snaps holding bungees
in position.

The following references contain comments concerning the snap systems.

<u>Reference</u>	<u>Page</u>
2	2
3	3
22	42
25	48
26	52

General Equipment Restraints

The one lament that runs throughout all three crew's comments was the
scarcity of adequate temporary equipment restraints. Three areas,
the MDA, the waste management compartment, and the area around the
dome lockers were specifically mentioned as having too few equipment
restraints. The interior of the refrigerator was also specifically

mentioned as having insufficient restraints to hold all the items that were stored in it.

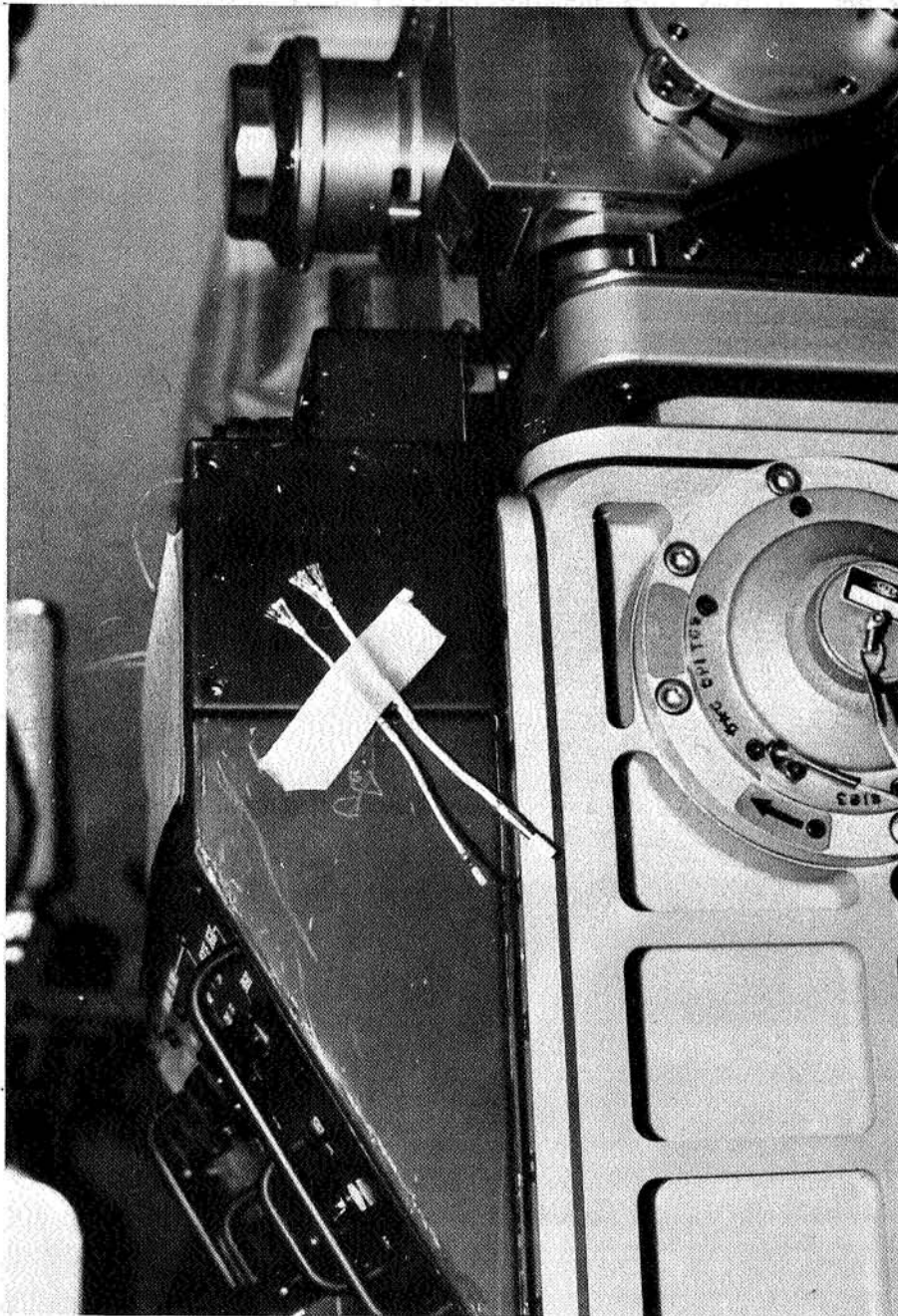
The following references address the problem of inadequate restraints.

<u>Reference</u>	<u>Page</u>
2	2
5	5
10	14
14	22
20	32
22	43
26	51
27	54
29	58
30	61

One expedient utilized extensively by the crewmen as a temporary restraint was the gray tape. Numerous comments were made concerning its efficiency and the first two crews recommended highly that more tape be brought up by the following crews.

Figures 12, 14 and 15 all show gray tape being used as an equipment restraint.

The following references contain comments concerning the use of gray tape.



USE OF GRAY TAPE AS A RESTRAINT

FIGURE 14



GRAY TAPE USED AS RESTRAINT

FIGURE 15

<u>Reference</u>	<u>Page</u>
7	8
18	28
19	29
20	33
28	56

Another expedient utilized by the crewmen was the set of magnets originally supplied in the Off-Duty Activities Kit. The crewmen found that the magnets worked quite well as paper hold-downs when used on the proper surfaces. They kept teleprinter sheets held down and, if used in pairs, kept the teleprinter paper from curling up. They were limited as to the places they could be used; there were not too many iron or steel surfaces in the Skylab. Also, they were limited as to the number of sheets of paper that they could hold.

The following references contain the crew comments pertaining to the use of the magnets.

<u>Reference</u>	<u>Page</u>
17	26
19	29
20	35
21	37

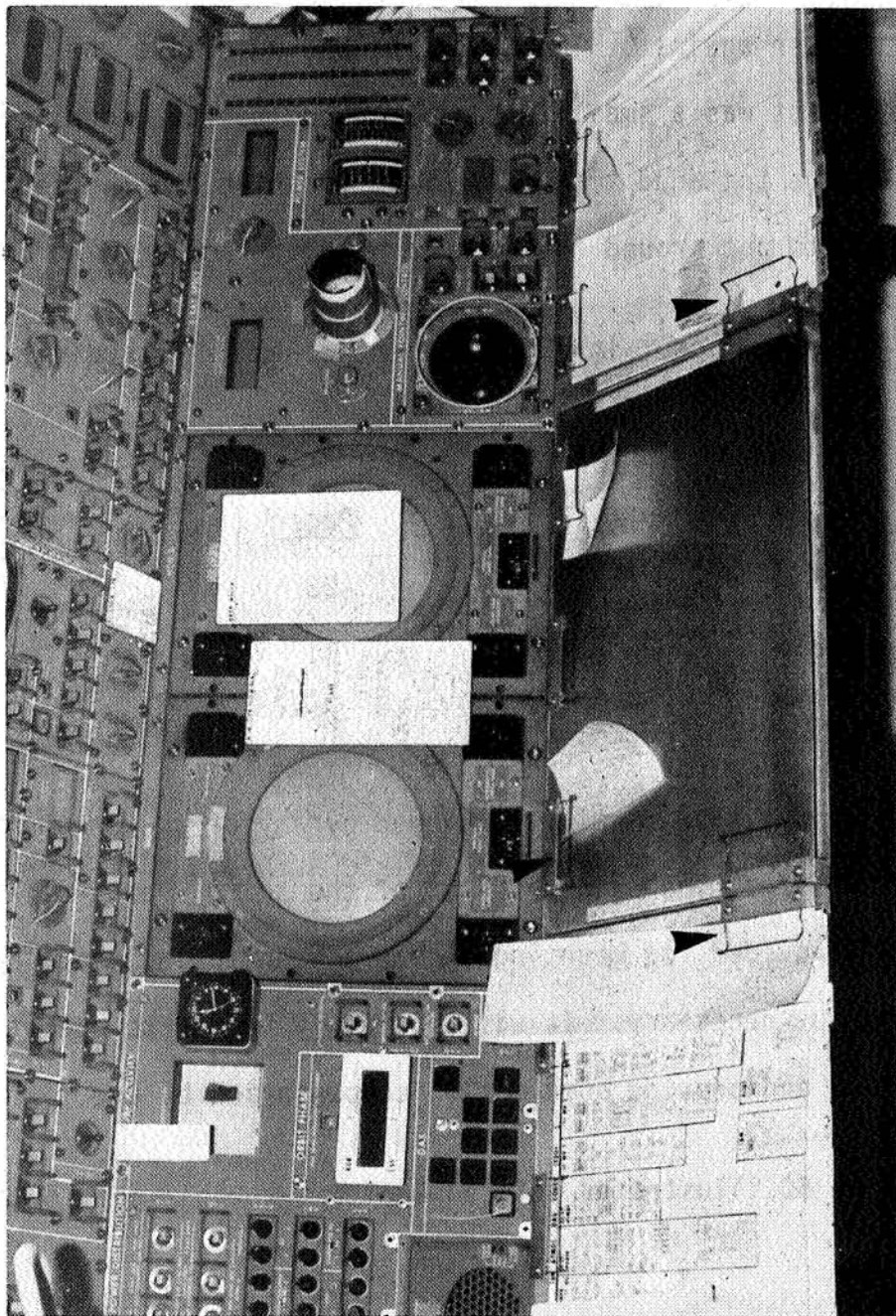
One equipment restraint that required a bit of learning on the part of the crew was the checklist holder at the VTS in the MDA. It was a double clipboard that was to provide a restraint for the required checklist data for the crewmen that were operating the VTS. The first crew reported that it would not hold the entire Flight Book and did not permit rapid page changing during use. The next crew found that if they used only the pages that were needed for that day's operation the clipboard worked quite well.

The following references contain the comments pertaining to the double clipboard.

<u>Reference</u>	<u>Page</u>
3	3
6	6
20	34

One equipment restraint that received good comments from the crew was the paper clips on the ATM panel work surface. The crewmen reported that although they were concerned that the clips would wear out and lose their capability, they had very little problem with this restraint. Figure 16 illustrates these clips. Reference 7, page 9 gives the crew comments.

One item that caused some problems was the tendency of checklists or flight data books to open automatically. They would spread themselves



PAPER HOLDERS AT ATM PANEL

FIGURE 16

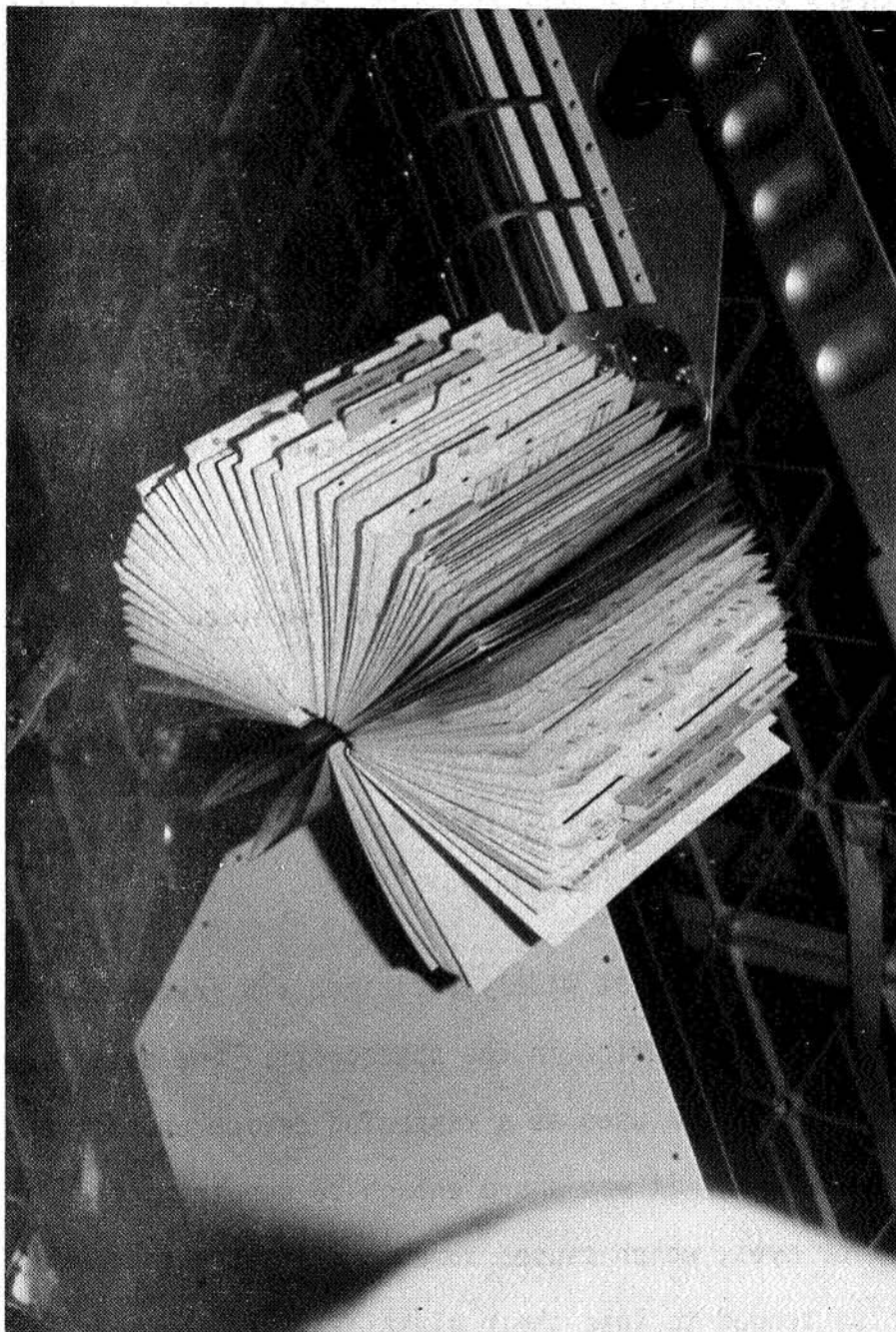
open as shown on Figure 17 and push themselves away from any surface they happened to push against. Two things helped alleviate the situation. The first was a small lanyard attached to the checklists to permit them to be fastened to a convenient location and the second was a rubber band to put around the book to hold it from pushing open.

The following references contain the pertinent comments regarding this problem.

<u>Reference</u>	<u>Page</u>
18	28
20	31
24	46

Only one restraint was specifically mentioned by any of the crewmen as being not necessary. The science pilot of the third crew indicated that the bracket provided for mounting a camera when taking photographs of the earth was not necessary. It was apparently better to operate the camera by hand and provide some motion compensation by eye.

Reference 30, page 60 illustrates this comment.



AN UNRESTRAINED CHECKLIST IN ZERO G

FIGURE 17

CONCLUSIONS AND RECOMMENDATIONS

In general, temporary equipment restraints must provide for the quick and easy attachment of any item of equipment and hold it against inadvertant release. The restraint must also permit quick and easy retrieval of the equipment when the crewman needs it. Temporary restraints may be both permanently installed and portable, but must provide adequate restraint at any desired location.

The various Skylab equipment restraints are discussed in the following paragraphs.

1. The straps were utilized quite frequently and received few adverse comments. One minor problem was noted with the adjustable equipment restraint strap. The strap webbing was difficult to push through the adjustment buckles making the use of the straps slower than should have been necessary.
2. The bungee cords were the most widely acclaimed and frequently used equipment restraint device in the spacecraft. One potential problem was the small hook used as a fastening device at each end of some of the bungees. It was sharp enough to penetrate the crewmen's skin or eyes, which caused some concern to the crewmen. The bungees also tended to lose their elasticity with extended use.

3. The utility restraints were used primarily to hold towels and washcloths for drying in the WMC and served that purpose quite well. They also provided for temporary clothing stowage in the sleep compartments.
4. The universal mounts were handy but not too convenient to use. Some of the crewmen felt that the mounts should have had more structural rigidity, and a positive, over-center type of locking lever.
5. The velcro, when made of the proper material, was extremely handy and useful. It must, however, adhere to the bulkheads and equipment with greater force than that between the velcro hook and pile.
6. The snaps were used for restraint quite extensively and were well received by the crewmen. The one problem that arose from their use was that the crewmen occasionally pushed themselves away from the snap when trying to engage it. An immediately available counteracting restraint should be supplied for the crewman's use at the snap restraint.
7. The crewmen were nearly unanimous in their desire for more temporary equipment restraints being available throughout the spacecraft. The MDA and the WMC were identified as being particularly lacking in equipment restraints.

8. Several innovative equipment restraints were utilized by the crewmen.

- a. Gray tape was used extensively as a temporary restraint for tools and items of equipment.
- b. The magnets from the off-duty activities kit provided adequate, though specialized restraint for sheets of paper.
- c. Rubber bands proved to be an excellent device to hold flight manuals and checklists from inadvertant opening in zero-g.
- d. The clips on the ATM control console table held paperwork down quite adequately.

RAW DATA APPENDIX

<u>REFERENCE</u>	<u>SOURCE</u>	<u>PAGE</u>
1	SL-2 Dump Tape 148-09	1
2	SL-2 Dump Tape 151-09	2
3	SL-2 Dump Tape 154-03	3
4	SL-2 Dump Tape 154-06	4
5	SL-2 Dump Tape 155-12	5
6	SL-2 Dump Tape 160-04	6
7	SL-2 Technical Debriefing, JSC-08053	7
8	SL-2 Systems Debriefing	12
9	SL-3 TAG Tape 220-06	13
10	SL-3 Dump Tape 222-01	14
11	SL-3 Dump Tape 223-06	15
12	SL-3 Dump Tape 223-08	18
13	SL-3 Dump Tape 227-02	20
14	SL-3 Dump Tape 232-05	22
15	SL-3 Dump Tape 250-06	24
16	SL-3 Dump Tape 251-04	25
17	SL-3 TAG Tape 259-02	26
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Dump Tape 148-09

Time: 12:38:53 to 13:50:06

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12 38 53 SPT

Okay, B channel, this is the SPT on the M110 blood letting exercise. The serial numbers are as follows: for the CDR, his ASP is 153; his vial 006; the SPT, ASP 148, vial 004; the PLT, ASP 165, vial 011. ... procedure, the major problem so far is that one of the ASPs didn't take a good vacuum. It was the SPT's ASP that was the last one used, and only about half the blood went into it. I had to draw on myself, again, using a freshly sucked down ASP, and that worked fine. I recommend that from now on, and the way we're going to do it, is that I will put the ASP, unaspered, a couple of minutes before the draw. Leave it there, and take it off just in time to receive the blood. That way we'll be sure we have a fresh vacuum and no leakage, and then we don't have to do it twice.

... the general comment is that there are an awful lot of loose pieces, and the IBCS kit itself will not stay closed, will not stay down on the table; won't stay together at all because the material is so stiff. And the Velcro, there is a lot of it, but none of it holds. It's lousy stuff.

PLT

Okay, B channel. Just had an accident with an instant breakfast. There was a lot of air in the container before reconstitution, and there was quite a bit of instant breakfast powder leaking out the top before reconstitution. On reconstitution, it wouldn't accept 6 ounces of water because there was too much air in it. And consequently, the water leaked out around the nozzle.

CDR

Darn!

PLT

In general, if you put less than the specified amount of fluid in, and don't get too much air in the water, and hold your finger over the nozzle while you're shaking it, you do better.

13 23 12 SPT

TAPE RECORDER, for urine sampling, if you'll pass on to the - Whoever's configured to that. Get this thing out to record. The first day's sample on the sample bags are logged as day 145. The second day's sample, which is the day they were collected, is logged as day 146. The third day's sample was logged when they were sampled. So, that picks up today with day 148. Therefore, on the sample bags, day 147 is missing.

Final

Dump Tape 151-09

Time: 18:33:24 to 20:04:08

Page 2 of 5

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

Final

Dump Tape 154-03

Time: 13:44:09 to 14:18:19

Page 3 of 7

various locations can be selected either forward or aft, of the - of the pedals to try and find the right axis along which to exert the force. The big difficulty here is that we didn't think, when we put all the extra junk in the experiment compartment, how handy those triangles were going to be.

13 51 23 SPT

And on the right-hand side of the bicycle there is virtually no open grid work or holes between triangles to put things in. The shower is much too close to the bicycle. Okay, portable equipment, these three: The straps are extremely useful. The short straps, I haven't used too much. They are really too short to tie things to. But the long straps and the equipment straps are extremely useful. I have right now, the entertainment tape recorder strapped to the radio noise burst monitor here - monitor here at the ATM panel. Bungees we find very useful, particularly down in the wardroom and so on for temporary restraint of cameras and checklists. Smaller things than that, such as pads, the bungees are not adequate for me, because they - the pads slip out and makes it too flat or too smooth. But anything that's got hooks on it, like a camera, works out very well under a bungee.

13 52 29 SPT

The - One item of equipment that is a pain in the neck, and it's not useful at all, are the large clipboards that snap in the standard snap pattern. Everytime you touch one of those things, they come flying off. On the other hand, it's a major operation to get them back on the snap. And we just made a bad mistake by assuming that we could snap something to a flat wall, especially something with any standoff, such as these clipboards have, and then exert any force against it.

The ATM seat is very useful, although you don't really sit in it, obviously. You have to push the seat belt down pretty tight ah - if you want your back to be supported. I find it useful because it gives you a body-centered restraint from which you can work against. You can reach the whole ATM panel,

Final

Dump Tape 154-06

Time: 16:23:21 to 17:44:38

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we have not used them. Portable equipment restraints - used no tethers, but we have used bungees quite extensively. We do use the universal mounts. We find them quite easy to use, and find them very handy. They work well on the camera. They work well on the portable fan and the TV. There are no big complaints or anything about the universal mounts. I think we can do a better job on bungees. I - I don't know exactly how. Fireproof straps - the fireproof strap has a lot to be desired. It doesn't work its way through buckles well, and is not very strong. And springs have a tendency to get permanently stretched - and the same bunch - the same strap type of material on either end of them makes them cumbersome to operate, although we do use them. I rate these spring bungees as adequate and I rate the tiedown strap as poor. I commented a little earlier

on the ATM seat/backrest restraint. I rate that as very good. Some of the improvements the SPT did, we have found that we would tilt it a little bit differently than you would expect it. In evaluating it at one g and - it does turn out that it probably would be nice if it were padded with some softer material; however, it's possible if you worked the back and seat pad arrangement out a little bit differently, you wouldn't quite get the same pressure points that you get. With that point ... I find it very good. From this - the sense of having to work the ATM panel being locked in at just my feet ... this chair, I have to rate the chair excellent. I think we would have got very tired, very rapidly, using our toes just to lock in to the ATM and to work the ATM.

SPT Hi, Paul.

PLT Hi, Joe.

PLT We got to talk - -

16 41 31 CDR At this time, as of yet, I have not had an opportunity to evaluate the conical shoe cleats

Final

Dump Tape 155-12

Time: 22:15:45 to 22:52:28

Page 9 of 11

see ... The place that really ... is having your hands full of ... obvious, no problems ... But it gets very hard to make yourself ...

SPT	Very good point. I think that the next generation should come up with some clever ... pieces of gear with - put away places. Whether they be ... little boxes with ... openings or quadruple rubber clamps like we have where you just push them on with ...
PLT	They're not in the - I don't need the dang things - They're - We're - -
CDR	Not another clamp! I got them.
PLT	We've got snaps of (laughter) Velcro. We've got snaps of Velcro all over the vehicle, and we don't have enough.

22 48 15 SPT How effective are the various tools used thus far; in particular, what tools are well suited and what tools are poorly suited for use in zero g?

CDR Well, the - a tool is poorly suited when you have to put about six or eight pieces together to get the tool to work. You know, but again, I was pleasantly surprised to get the tools ... You got ...

PLT You've got something to hang onto.

CDR You've got something to hang onto ...

SPT What - what significant improvisation (procedural; equipment arrangement or modifications, etc.) have you accomplished as a result of adapting to living and working in zero g?

CDR ...

SPT Yes, the major one that came up today is doing away with all - We wound up doing away with all the restraints for the bicycle ergometer.

22 49 26 PLT We had that thing in 16 different arrangements and configurations, none of which worked very well, and we finally wound up - Joe tried it yesterday and the day before and I got my shot at it today. And the

Final

Dump Tape 160-04

Time: 13:05:50 to 14:15:01

Page 1 of 2

13 05 52 PLT

Hello, tape recorder. I'm a little bit late with the first 20-minute report; it's been an hour. But, another requirement, and Charlie 7 presently reads 36, 3 6 degrees. That's all for now.

13 11 02 PLT

Hello, tape recorder; for the EREP people on the VTS. I put the new magazine on the DAC this morning. On camera checkout, I'd let it advance for 10 seconds, turn the camera OFF, at which time we'd get in that old thing of the camera continuing to run. Not take pictures, just the motor - the motor in the camera continued to run. It did this three times. What I did then was take the magazine off, put it back on, and now it works normally. It - it'll take up one or two frames after you finish taking it, and then it functions normally just like the other one did. End of message.

13 21 15 CDR

Hello, tape recorder. On the SL91, meter reading Charlie 7 is reading 38 percent at 13:21 Zulu.

13 24 56 PLT

Hello, tape recorder. Friendly tape recorder, pass this on to the friendly EREP people, if you would, please. This double clipboard that we use on the VTS is unsatisfactory when trying to use the whole Flight Book. Now maybe using the whole Flight Book on it is unsatisfactory. I - I think I'll try working on something, but while we are up here, you guys ought to be working on something on the ground, too. Because what you do, is - you got to pull the whole book loose from - from the clip and then flip pages and then get it hooked back under. And that big, thick book is hard to hook under those little clipheads, since the clips are made to take a large book, they are quite stiff. All in all, it's - it's not a very good arrangement. So work on something and we'll work on something up here. End of message.

SPT

B channel, this is the SPT at 13:25 with today's solar observations. More for practice than anything else cause you guys can see H-Alpha on the ground. Active region 31 appears to have a good arced filament system inbetween it's two Sun spots. And it's by far the brightest plages now visible on the Sun. The white light display on the XUV SLIT clearly shows the large leader spot and the smaller follower spot. It looked on H-Alpha as though the follower

CONRAD That's mine.

WEITZ Yes, I know. But at least it has the changes in it.

CONRAD While he's looking for that, I have one general comment. It seemed to me that, later on in the mission, we found out that there were some blocks in the Activation Checklist that just went down the crack. They were minor things, but they caused us some perturbations of the time line later on, simply because we didn't get to them. Such things as high-intensity lights, portable lights, and some of that other minor stuff that weren't activations.

WEITZ Items in the workshop. I never got to my photo prep, and that hung you up later on. We cancelled the M516, and I never did prep for that. The SOP/SOMA transfer was a nothing. I don't remember if I strapped it to my leg with one strap or if I just held it by one hand. I think I held it. It wasn't worth the bother of unhooking the strap the way it's tied around your leg. I think I just held it in one hand. The aft lock entry was done per checklist. Since the OWS hatch apparently leaked, the write-in said inspect it for damage. As I reported at the time, I couldn't see anything wrong with it.

CONRAD CSM caution and warning went per checklist, and CM O₂ configuration went per checklist.

KERWIN
(CONT'D)

splayed-out group of white dots at the top. You could see each individual filament; as it swept down, you'd see two or three other individual filaments laid out. They were never the same ones from sweep to sweep. We got used to considering it as noise in the system. When a flare happened, then you'd see another group of white spots that would be there on every scan. It was very definite. I would consider that a very useful flare-location device, but not useful for any other purpose. I never noticed any coronal activity on the X-ray image.

The shield was fine. It's still on there. The Velcro didn't work, so I just taped it down with gray tape. It's probably required, too. You wind up leaving a window or two open up there because you want to see out from time to time. When something is coming in the window and bouncing off the mol sieve, it's very bright near the ATM console.

Practically none of the Velcro in the whole spacecraft worked. In zero g, Velcro is lousy, terrible, miserable stuff. You had to take the shield up and curve it around and then bend the little feet. There's a little memory in the cardboard that tends to unbend the feet. You plank it down there, and it just floats away, so we taped it.

For the rest of the SO54 mod operation, controls and displays were quite nominal except for the doors and the READY and the

KERWIN
CONT'D)

ATM operations boards and ATM chair. I thought the ATM boards were super good. We very quickly got a place for everything, and we used the center board for the JOP Summary Sheets exclusively and that's all. I guess the only thing about the center board that I would have changed is that I felt that those little wire clip things were going to weaken as the mission went on. You would lift them up a little bit to get the paper in and out because if you just tried to jam the paper in, it would just crumple up. I was worried about them getting so weak they would not hold a piece of paper in them, and you would wind up losing your ATM schedule. It didn't happen to us. The clips that are on the two end boards. Now this is the way we ran it. The boards with the clips were on the sides, and the ones without the clips were in the middle. The clips were great because you could stick the log or checklist or something under them. I would have had a couple more of those on those side boards, rather than having any of the smaller ones. I realize that the virtue of the smaller ones is that they don't obscure the type on your summary sheets as much, but I like them better because they were easier to use. The center board was used for the JOP Summary Sheets. On the left-hand board, on the outboard side, we kept a stack of teleprinter messages referring to ATM

KERWIN
(CONT'D)

system operations; those frequent gyro updates that we got and the computer switchover pads what gyro drifts to set first if the computer switched to backup because you might go out of control if you didn't get the right drifts in - Messages of that kind. We would windup with four or five of them stacked under there at all times. We used the big clip for that. Then on the inboard side of that, we had the ATM schedule. On the right-hand board, on the inboard side or on the left-hand side, we had the SAP. On the middle, we had the star tracker pad and the maneuver pads, if any; the Z-LV maneuvers, primarily. On the outboard side I kept the ATM Log. So everything had its place. I even marked the things - where we put them - so everyone would see them up there. That generally worked out very well indeed.

WEITZ

I used the ATM Log as scratch paper, because I wanted scratch paper sometimes. And that was the only place available.

KERWIN

If I had a change to make to the ATM Log, I would have fewer circles preprinted, so you would have more free room to draw and make notes on. But that's a minor thing. We wound up just writing through the circles frequently, as you will see when you look at the log.

KERWIN
(CONT'D)

Concerning the clips on the board of a given wire clip, one side would be flush with the tray and the other side wouldn't. and you had to learn to slip your pads under the side that was flush; otherwise it wouldn't hold.

KERWIN

The ATM chair. We finally arrived at a compromise setting for the chair that was acceptable for both Pete and me, with Paul kind of in the middle. I wound up not strapping myself in the chair all the time. You don't really sit at the ATM like you do in one g. Sometimes it was pleasant to strap your waist in and cinch it up nice and tight and stay that way for a while. It certainly gave you good reach and a nice stable point. But your muscles would get tired if you stayed that way all the time. It is not like sitting in a chair, where you move around a lot and cross your legs and keep your muscles loose. So sometimes we would be that way. Sometimes you would use the chair simply as a backbrace and you wouldn't use the belt at all. You would slide in, let your thighs ride up against the bottom of the tray, and your backside against the top of the back of the chair and work that way. And sometimes I would work hanging onto the back of the chair with one hand and my body floating straight out perpendicular to the ATM console, operating it that way. You moved around a lot.

CDR What did you use when you cleaned the big screen?

SPT Crevice tool

PLT No, it wasn't the crevice tool. The crevice tool is that little narrow. You used the one thats flared on the end.

SPT long tool that is thin and flat at the end. Is that the crevice tool?

SPEAKER Yes, narrow and kind of cut off

PLT Whats the name of it? Whats the one that looks like the thing in this Hoover?

SPEAKER surface tool. Thats a surface tool

SPT Surface tool, I'm sorry, thats the one I used.

SPEAKER That fans out at the end

SPT Yeah, fans out. Thats right, ok.

PLT You're a lousey describer thats all. (chuckle)

PLT Really doesn't matter, they all work well. I used the crevice tool for something one time, I forgot what, and it fit.

SPEAKER I think we heard mention that you used it on the screens, solenoid vent valve screens that you had used the crevice tool during that operation.

SPEAKER Did you use brush burns?

PLT No, never did . Did you?

SPEAKER How about its performance as far as holding it in your hand or using the bady strap and holding it on the side?

SPT I never strapped it to my body---

PLT I didn't either

SPT Only really held it in my hand except for moving it from place and then you just let go. Leave it float and use the hose and the tool.

TAG Tape 220-06/T-141
Page 3 of 7 /963

train us. And there some differences that make the whole thing worthwhile.

CC

Okay. Sounds good. And if we could get you to stay off the DAS in case anybody's in that area for a little while, we're going to enable C&G auto reset per our new criteria.

220 13 46 03 CDR

Crip, got another suggestion for Jerry Carr, Bill Pogue, and Ed Gibson, is - you know these two rings - one ring of female Velcro squares and one ring of male Velcro squares - those have turned out to be one of the finest things we've brought up. And, I'd suggest that they bring up double that amount. It doesn't weigh anything, and they sure are handy.

CC

Okay. We'll make that recommendation, also.

CDR

Okay.

220 13 50 56 CC

Skylab, we're about 15 seconds from LOS. And we'll have you again at Guam at 13:55. And, Jack, I'll try to get a good answer for you on your restowing your film back in the film locker there.

220 13 51 10 PLT

Okay. Thank you, Crip.

220 13 55 13 CC

Skylab, Houston. We're AOS through Guam for 9 minutes.

CDR

Okay. We're having our rapid DELTA-P drill, in case you've got that on the caution and warning there.

CC

Okeydoke. And we copy that, we think you're going through that mol sieve malf, is that correct?

CDR

Jack was changing out the solids trap.

CC

Okay. We still copy.

CC

And, Jack, if you've got a moment, I'll go through that film, door stuff with you.

635

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.

Final Dump Tape 223-06/D-161
Time: 223:19:17 to 223:20:35
Page 1 of 15

223 19 17 00 CDR

Hello, hello.

223 19 19 19 CDR

This is the CDR and recording some information on 487-3A for the PIs. You know I had to stop recording several hours ago to do an EREP pass. I'd like to give some ratings to some of the things I have not, although I have discussed them. Let me go back. The OWS fireman's pole; I'd give an excellent. The OWS dome and wall handrails, I'd give poor to adequate. STS handrails, I'd give adequate. MDA handrails, poor to adequate. Triangular shoe grids and cleats, probably adequate, but as I have discussed, there could be easier ways of using them. Conical shoe cleats, I have not evaluated.

223 19 20 04 CDR

Water tank foot ploy - platform, I give very good and it would go up to excellent if it were somehow portable. The concept of using your knees is an excellent one. Portable equipment restraints - port, no, portable PGA foot restraints - I would give them an excellent except for one thing. The astropin method of keeping them there is very poor, so I'd have to give them a very good. There's no need for a complex pin like that. It could be a simple clip pin. It could be a sliding lever. It could be almost anything. To go to something as wild as the astropin just to hold something to the grid is - or anywhere else defeats the purpose. It's too difficult to operate and understand and there is just no desire on the part of the crewmember to fool with it all the time. Portable - P - portable handholds, never used them on the wall. I don't think they could be used. As I suggested where - our handholds should be mainly in traffic areas because it always ... traffic areas have solid walls and bolt them toward the ... toward the - except these portable restraint. They look like they might be useful in some areas but I have not used them yet, so I could not say.

223 19 21 40 CDR

Okay, next one is the portable equipment restraints, tethers, bungees, universal mounts. The universal mount is an excellent device, needs to perhaps be a little stiffer at the - angle, so that when you

adjust it, it stays adjusted. The bungees and tethers - the best bungees are these spring ones or maybe that's what you're calling bungees, but these spring ones with the snaps on them. The ones with the hooks on it are a little bit dangerous. I recommend having at all times these bungees and hooks and maybe permanently affixing them to all doors, because it appears that that's where we end up using almost all the bungees - carrying them over to the doors and snapping them on. Now the thing that I worry about those hooks is they're rather sharp. Looks like if you got one small and just the right way, you could take your eye with it. That sure wouldn't be a good idea. So there ought to be a way to affix them to doors and holds without making them quite so sharp. I think they - Some of the ones up in the command module have blunter hooks and certainly acceptable. We use those here. Suggest that we have those on every spacecraft; they are extremely useful.

223 19 22 48 CDR

Tethers, short tethers are a little bit small for any job, but - okay. I - I - By the way, I'd give the bungees an excellent. I give them an excellent to very good. Tethers I give - and restraints, I give a very good, very good. The - the short strap is a little short. If the short strap were about 2 inches longer, it would do all the things - almost all the things that you generally have to have done. Of course you would still have the requirement, some 25 percent of the straps to be long strap, and maybe some additional 10 or 15 percent of the total straps to be those big tiedown - long tiedown straps. Those are excellent, those are a - I'd give those very good. I'd give them excellent except they're hard to slide and hard to adjust. Now when you are adjusting them, they - Oft times, the snaps pop off. I'd recommend in cases of those devices where you're going to be trying to strap down loads and put loads on them, that you use - fold a snap pad - snap fasteners just in the right direction, so that when you take up tension, you don't always pull them off. It tends to diminish somewhat the advantage of those fixed straps.

223 19 24 07 CDR

The tethers, the wrist tethers are good. The wrist tethers are good. The only disadvantage that I can - by the way, I give them a very good - is the way they sometimes - sometimes difficult to get them off your wrist to work them. They're so difficult, in fact, that you tend to once you have it off your wrist to leave it floating free and this could be - a dangerous situation in EVA and certainly gives you an additional - or blinds and hooks and things going around in front of your eye which you know, gives you added trouble when you're trying to - in you're rather clumsy glove and suit work on an EVA problem. How we can do it, I don't know. Maybe they should be somehow fixed so they can be wrapped once around the wrist and then snapped rather simply. But I don't have any answer for that.

223 19 24 57 CDR

ATM seat backrest restraint. Personally, I'd give it a poor. Mostly, not because of the chair itself, because the chair seems okay. It's the fact that when attached to the foot restraint there, the thing wobbles all over and makes noise and just doesn't seem stable enough. Somehow when you attach your foot to the same grid, you don't mind to flop around. I assume that your legs accept it, but when you attach the chair to it, and it flops back and forth by 3 or 4 or 5 degrees, at least in my case, it's very troublesome. I would suggest that this sort of thing would be good if it had more adjustments back and forth and then tilt as it does and particularly so it's affixed to a rather solid foundation. The seat itself is solid. Its attachment to the floor structure of the ATM is good. It's just that the ATM floor structure's rather loose.

223 19 25 57 CDR

Waste management hygiene equipment. Fecal collection equipment - I would have to give a good to that. The reason is - let's - let's talk off this thing just about as ... First of all, it takes time to work. It seems to me there must be a better way to get rid of waste material with putting a bag on, taking a bag off, weighing it, and all that. Now I realize that if those requirements had not come with this design of

Final Dump Tape 223-08/D-163
Page 3 of 13

frequently have to reach down and twist them around to line them up so they'll go in the next time.

223 23 14 26 PLT

But the triangle shoe cleats are great and I haven't used the conical shoe cleats at all. I haven't tried them. I might mention that one place you really need some handholds is right around the film vault. There's nothing there to hang on to. That film vault is just a big square object and you just can't grab on. You don't have any triangular shoes on and you're pretty much out of luck in that film-vault area. Frequently go up there with our socks on late at night and put cameras away early in the morning, before you get your triangle shoes on, and it's a real unhandy place to be without handholds or - or foot restraints.

223 23 15 13 PLT

Portable PGA foot restraints - correction - ATM foot platform is very good. I use it all the time when I'm at the ATM, but don't use the chair. And I always have myself anchored by one foot at the ATM.

223 23 15 31 PLT

Portable PGA foot restraints are - I tried forgetting this. I'd rate them excellent. The extra little pins that were put in there to keep the feet in there, the PGAs down there by themselves were a very good position. And the portable foot restraints worked very well in suiting up, and they also worked very well on the EVA the other day when we carried a set outdoors to put up the sail.

223 23 16 03 PLT

Portable handholds. I haven't used any of them yet. Portable equipment restraints, tethers, bungees, universal mounts and so forth I would rate them as adequate to very good. The tethers - they're really not used very much except for the tether that we strap onto the arm of the suit to use for EVA. Be nice if there was a way to fasten the EVA tether down to your arm with some sort of elastic or something. One wasn't any use because otherwise it flops around and catches on things. The bungees we've got, we've used them all. We've got them all over. I don't like the ones with the sharp hooks on them because there's

a good possibility that they could get loose and zap you in the eye. I like the ones that come in the command module much better. The ones that were with the workshop are - could be dangerous type of bungee. And I am always very cautious when I use them. I prefer not to be around them. We've got them mounted all over, particularly on the front of the lockers in the wardroom to hold down anything - checklist, maps, camera, flight plan, food bundles, extra drinks, that is. Just anything that you might want to hold down. My suggestion there is the next time we go around we ought to build some bungees right in a lot of places like that so we can hold things down without having to get portable bungees. Obviously we're going to need them, so we ought to have them built right on the doors. Universal mounts are - the only thing I don't like about universal mounts is that the blocking - lock and lever is not over center. It should be further over center.

223 23 18 12 PLT

ATM seat/backrest restraint, I haven't used. I don't think anybody has except for maybe right at first. We find it just as convenient to strap - or to fix ourselves at the ATM with our feet. So, we're not using the ATM seat/backrest restraint.

223 23 18 28 PLT

Waste management/hygiene equipment is the next subject. Fecal collection equipment; I rate that very good to excellent. The only drawback to the fecal collection business is that it's too much of a nuisance to fill a new bag. There should be a better way of fastening a bag on there - a lot quicker. It takes you about 30 seconds to relieve yourself fecalwise and about 10 minutes to take care of all the logging and putting the thing in the heater and taking the one in there out, securing that and then putting a new fecal collection bag in.

223 23 19 12 PLT

Urine collection equipment works very well, also. Don't - Haven't had any spills; blowers all work good. It's a - just a great system. It's no fuss, no muss. There's some way we could save time in taking samples and changing bags and so forth, that'd be a plus for that system but as it is, it's pretty good.

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Time: 227:02:09 to 227:03:28
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227 02 09 14 SPT

Okay, back to this discussion on mobility aids. Dome and wall handrails, I never use them. STS handrails, I don't use them very often - take it back; STS handrails are used more. That's our principal means of locomotion back through there, and I think they're very useful in that area. And the same thing is true for the MDA. Shoe cleats, triangular, those are basically what we all use. I wear two triangular shoes all the time and find it the most convenient thing. I've not even tried putting on the conical cleats yet. I may get around to it, but I haven't done so yet. Water tank foot platform I find useful. I've used it on a number of occasions on getting in and out of dome lockers or up around there for the TV work and so forth. The ATM foot platform I always use. The portable PGA foot restraints we use for the suit donning stuff, and we use them to tie down our suits for the drying interval. And so they're handy to have, and of course they were indispensable on the EVA. Portable handholds. As far as I know, we've never used them.

227 02 10 27 SPT

Stand by.

PLT

Okay.

CC

One minute from LOS.

PLT

19. Okay ...

227 02 15 05 SPT

Okay, back on the M487 portable handholds, never use them. Tethers, bungees, universal mounts: universal mounts we do use. We have barely enough, might not even hurt to have another one or two, but they are used quite often. We used them today, for example, for S063 camera which is sort of an unscheduled use. Tethers and bungees - I think we need more of those things around here of various kinds - need to spend some time just thinking about just what they ought to be. But we need these things that'll strap across the front of our lockers in the wardroom. And the ones that are on there with these little wires are sort of dangerous - potentially dangerous as they don't stay well or anything else.

227 02 15 48 SPT

We ought to have things that are permanently mounted there and designed into it and planned to be used, and snap rings too. So those bungees in there are very useful; the ones we've got are only half adequate.

227 02 16 02 SPT

ATM seat/backrest restraint - tried it once and threw it away. It works a lot better to just put your feet in the triangles and stay there. That dadburn chair does nothing but annoy you. You try to sit down in that thing and you feel like you have to be strapped tight to it. You strap yourself tight to it and then you can't reach the panel where you want to; it's nothing but an encumbrance. Pardon me, Pete, but (laughter) we'd be better off without it. And let's see, waste management and hygiene. Fecal collection equipment, inadequate, but better I'm sure, than a - than a bag would be by itself. In fact, once you get used to it, it's not too bad. But there are probably some design improvements that could be made. Have to talk about those at some other time.

227 02 16 48 SPT

Hand washer - if we have one onboard I don't know where it is. I know what you're talking about, though; it's the one that's supposed to be a hand washer; the only trouble is that you can't use it to hand wash. You put your hands in there, you try to pretend you're hand washing and you splatter water all over the compartment so all it amounts to really is a place to dampen your wash rags and towels, and the whole concept of the hand washer needs to be re-thought through because the one we've got is not one at all.

227 02 17 13 SPT

That lap strap is essential for the use of the fecal collector. I wouldn't want to try it without. The orientation is such that you do need to grab hold of the handhold to keep from what you would call floating up in one g, but it's toward the overhead of the compartment. The handhold is a necessary aid when using the fecal collector, but the strap is absolutely essential. WMC hand washer handrail - well, shucks, I don't know. Hadn't thought that much - leave it there if you

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for the stuff that we take out EVA. Be nice to have a place to put it instead of hooking on to everything so it's in the way of your feet, kicking it around and dangling on tethers, and getting wrapped up in your legs and your umbilical and wrapping itself around other articles that are also fastened to the tether. It's a big rat's nest in there during EVA, as far as stowage is concerned.

232 15 08 47 PLT

Temporary equipment restraints. We should've had more spring bungees and we shouldn't have had those sharp wires on them because those are eye catchers. We found that with time and use that those bungees, those little wire hooks - the ones from the command module are real good, but the ones that were built with the workshop, they're starting to stretch out. And every once in a while they get loose and go snapping across the room and we're lucky so far we haven't put out somebody's eye. And on some occasions we've hit people with them, and if they hit them in the eye, we would have been in trouble. They're tending to come loose sometimes because the hooks are getting bent and straightened out like straightened-out fish hooks.

232 15 09 27 PLT

And we should have had those springs built on the doors without having to improvise and - and hook them on there as an afterthought. We should have had some kind of little stowage bungee or a stretching device attached to every - every locker. Every place there's a flat place, we should have had something there to stow things underneath.

232 15 10 02 PLT

The other temporary equipment restraints, we use the short straps quite a bit. The long straps, we seem to use them, too, although the short straps are nicer. But it looks to me like the favorite is the spring bungee. And we yanked them all out of the command module and yanked them all out of the workshop. They're all fastened somewhere and we still don't have enough of them. So that's something that we ought to, next time around, provide more of.

232 15 10 32 PLT

Temporary equipment restraints in the MDA are essentially nonexistent. Whenever you go up

there and try to fasten something down, there's just no place to put it. Now you got to take springs up there and hook it under everything. The question is not enough equipment restraints up there for temporary use. Temporary equipment restraints in the airlock are nonexistent. We discussed that already. We need something other than tethers dangling all over. Now I've got to go and work on the ATM and I'll come back and finish this later.

232 15 11 06 PLT

So this is the temporary end of this message, and I'll be talking to you later, Robert.

END OF MESSAGE

250 14 57 52 PLT

So, basically, the tools have been doing the job, and it's just - They're not the kind of tools I'd buy if I were going to pick some out, because they just don't fit together that well. But they do the job here.

PLT

Repair kit. The items in the repair kit - not all of them been used. Some have. One item in the kit that ... is the - the Velcro, stickyback Velcro, Velcro. And this was a complaint we had before launch on this Velcro. When we did the C 2F2 on. Somehow it didn't get fixed.

250 14 58 29 PLT

The stickyback Velcro, the problem is that the - the glue that holds the Velcro to the stickyback has less strength than the Velcro to the Velcro. So when you use one of these pieces of Velcro and stick one side of it on the wall and the other side on a card or whatever you want to stick to the wall and then say, take the card off the Velcro why, instead of the Velcro coming loose, the stickyback comes loose. What you got is a real neat piece of backing tape left on the locker and you got all your Velcro on your card or vice versa. So that stuff doesn't work good.

250 14 59 09 PLT

The S190 maintenance kit: Fortunately we haven't had to use that very much. The items that we have used have done the job all right. But it's only been minor things like - Oh, well, we haven't used the wrenches. We haven't had to replace much equipment. The items that came up in the special kit with S192 work satisfactorily.

250 14 59 45 PLT

Just a ... gauge and I can't remember what else.

END OF TAPE

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251 02 55 53 CDR

Now one of the drawers that's pretty good is - is the pliers drawers. You go in there and you can find every kind of plier you need. The lubricant - We got more lubricant than you can shake a stick at. Knives - Those are good. We carry those around, but we need a sharpening stone badly. My mistake of not bring a sharpening stone was gross. A thing called experiment handle mixed in with the cutter pliers, along with the Phillips offset and the crescent wrench and a bunch of snaps - ridiculous. We ought to have supplies in one drawer and then wrenches in one and special handles in another. One whole drawer's got some spare space. And we ought to have a lot of spares of these things that we use a lot. We use a crescent wrenches - I mean Allen wrenches. Those need spares. The vice we got's so-so. Don't have a workbench. That's one of the bad things.

251 02 56 43 CDR

We've got to invent for the next space station - we've got to invent a place that - that you can do work at to fix your books and all that and then another place with good lighting and some special rigs to keep screws and all that stuff. A workbench where we float up and put down this equipment we work on. Everything's going to - and that - along that line could be improved. Let's talk about the repair kit. Repair kit is okay. We don't use it much because we just don't have much to repair. There's blister patches in there. We never use them. We never use the flat patches; the Velcro strips, we use.

251 02 57 15 CDR

Now the Velcro in here isn't worth a darn. We need to get more Velcro like we brought up with us - those little squares and those have been really superb. The little nuts and bolts we brought up here fit great, but we ended up bringing up nonstainless-steel ones. We ought to bring up the best bolts and nuts we got. I like the variety that you have and the ability that whenever you have something - do it. We need an area where we could put things that we find floating by, or loose ones, and put them in an organized fashion instead of just throwing them in and hoping we can find them at some late date. Because you'll - you'll see a screw float by and you'll

TAG Tape 259-02/T-613
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259 02 42 57 CDR That's a new one on us.

CC What - what we're trying to do there is get the leg-band cal data on the recorder.

CDR We're trying to remember which switch has the CAL to AUTO on it.

CDR We never throw it. You want us to start using that one, huh?

CC That's affirmative.

259 02 43 30 CDR What happened to the same old way of putting on both recorders, like we do for everything else?

259 02 43 43 CDR Why don't we go into hold on this one, and let you think it over tonight. And we'll be glad to do it in AUTO, but it's different than anything else we've done, and so I'm suspicious of it, just on that grounds alone. Not that we don't want to, but something's funny.

CC Okay, I - Biomed's discussing it. We don't have time to talk it over and get it up to you tonight, Al. We will do that. We'll take the suggestion and get you a final answer on it tomorrow. A couple of quick questions, here, before we sign off. For our M518 planning, can you comment on how long it takes for the - for - to do the termination in ops. In other words, is it still taking approximately 9 minutes for the chamber to vent to 10₋₃ torr?

PLT Yes, it takes about that long. And it doesn't take very long to do the ops and the termination. About the amount of time you've allowed for, is about right.

CC Okay; we copy.

259 02 44 46 CC

And we've noticed on the tape once that you've commented on the lack of handhold - holddown restraints for use at the wardroom table when making changes to the checklists. Now in the entertainment kit over there, there's some magnetic card deck and card handholders

that - you might be able to fashion in some form to - to hold those checklists down. We wondered if you'd tried those or thought of trying them.

PLT We haven't thought of them, but we will. And if we can't use them for that, the big O. can probably think up a science demonstration (Chuckle).

CC Roger; we copy. And we're just about to go LOS. We'll say goodnight to you, now, and give you a call in the morning.

PLT Okay. Thank you, Hank. And thank you and your team for all your good work today.

CDR And how about, Hank, not calling us tomorrow morning until we put 10,000 on the DAS. Is that okay?

CC Okay, we'll do it that.

CDR Okay, that'll let Jack get up and do his ATM while the rest of us snooze.

259 02 45 49 PLT Nothing has changed ...

END OF TAPE

and grab something else and - and get it, why that's - it's very convenient.

PLT

For example, if you want to mount a new lens on a camera, you got to go get it out of the drawer. You've got the camera in your hands. You got to operate the drawer. You got to hold yourself ... somehow. So you can't - you haven't got enough hands. You just let go of the camera, open the drawer, get the lens out, and then go grab the camera and put it on.

259 14 12 43 PLT

So that's one logistic management technique, I guess you might say. Another technique is to find a little piece of tape or take one out of your pocket and stick it to the wall or on a handrail or somewhere and then stick it to the object you want to keep there. All it takes is just a little bit of - of tape to - to just very lightly fasten to it, to hold it in place. So I've used that frequently.

259 14 13 08 PLT

And we've discussed the other techniques of using strings and stuff like that before, but some of the simpler and more straightforward devices include tape or just suspending it in midair. Okay, question 4.

259 14 13 38 PLT

Have we found that we could accomplish maintenance tasks ... pretty well where they are? Yes, we have been able to do that. Other items that we've had to fix, like the tape recorder and so forth, - why, we've found that it's been very convenient to suspend them or to say, go up to the food locker and, using a couple of springs, stabilize it there or, using the top of the waste bins or the - on the waste management compartment, to Velcro something to that and work on it.

259 14 14 10 PLT

And one thing that we have had difficulty with is checklist changes and - and holding the book down and all that. Books up here like to spread out in their normal open position, and when they do, they push against whatever they're resting on. And then they tend to float away, and they also tend to want to just open to - to - They just spread open like a fan, and you lose your place very easily unless you got a rubberband around it.

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Time: 259:15:19 to 259:17:32
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259 15 19 13 CDR

This is the CDR with some information from EREP - for EREP. We've reached time 2, in other words 20 minutes, since the 192 has been on. I'm in MODE, CHECK; and I'm going to record D-6 at this time. D-6 is 57 percent, 57 percent. CDR out. That's information for EREP. We'll be back in a few moments.

259 15 23 21 CDR

Information for Ted Guillory. Ted, suggest - We tried those magnetic devices out on the tape with the top of the food trays and they work real good. I'd recommend that we come up with a - first of all, as you know, you're going to have - Maybe you don't know. We're just about out of the tape you sent up. And, also, it's bad tape; too hard. Next mission, how about sending up some regular Scotch frosted tape instead of this tough stuff we've got. It's too hard to cut. Also, you might look at modifying that serrated edge and put a regular Scotch one on. This one - the teeth are too big, and it just - it just - it just is ridiculous to have to use something like this when the one on the market is so much better.

259 15 24 05 CDR

The metal holder is good with one exception. We need to get one with a - a magnet as part of it, so on one side we'd have Velcro, the other side we'd have a magnet. That way you could Velcro it to the wall where you need to; and magnetic the part to the top of the table. That would be good. Now even a better way would somehow be to get a little fastener on the bottom so when you put it on your - top of your food tray and wanted to use it to update checklists and things, then you wouldn't have to hold it in your other hand. You can do a one-handed operation. And I think that could be done simply by putting some sort of fixture that would interface with the holders on the side of the box - or on the side of the food tray. Those little indents there on the side of the tray or one that would interface somehow with the universal - the abbreviated universal mount that's on the top there on the side of the food tray.

259 15 24 56 CDR

So those sorts of things, I believe, would - would facilitate the work. Now the one that works really good is that little blue one that you lay on its side and stick things under it. I sure wish we - That principle could be used to - to great advantage up here. We just have to think about how we might want to use them. Now maybe use a couple of them that keeps your thing rolled out - your teleprinter paper would tend to curl up, roll out; but we're going to start using those more. CDR out. That goes to Ted Guillory.

259 15 25 38 CDR

Another note to Ted Guillory. Maybe if we took those magnetic ones and made the other kind, not the blue ones, and made the distance between them the same size as the book, somehow they would be more useful. CDR out.

259 15 27 57 CDR

CDR with information for EREP. I just checked D-6 again and it's still at 58 percent, 57 - 58 percent. It's har - hard to tell. Okay, we're at 10 minutes. We're going on RECORD. Let's check all monitor readings for you while we wait. Okay. Here we go. Let's go ahead and do the ones this time. A-1, 51 percent; A-2, 59 percent and GO; A-3, 86 percent and GO; A-4 - correction, A-4, 71 percent and GO; A-5, 66 and GO; A-6, zero. Actually it's a little bit below zero and GO. And that's it for that one. Let's go back to A-1 and stay there. B-1, 54 percent, GO, I guess. 2, 46 percent - correction, 56 percent, GO; B-3, 76 percent, GO; B-4, 71 percent, GO; B-5, 74 percent, GO; B-6, 50 percent, GO; B-7, 31 percent, GO; B-8, 1 percent, GO; B-9, 58 percent and GO. C: C-1, zero; C-2, 44 percent, GO; C-3, 88 percent, and that's GO; C-4, 71 percent, GO; C-5, 82 percent, GO; C-6, 46 percent, GO; C - C-7, 51 percent and GO; D-2, 86 percent, GO; D-3, 84 percent, GO; D-5, 72 percent, GO. That was D-4, gentlemen, I said that wrong. D-4, 72 percent and GO; D-5, 14 percent and GO; D-6, 58 percent and GO; D-7, 10 percent and GO. Let me read you the ones again you like. D-7, 31; C-8, about 1; C-7, 52; D-6, 58; and we're there. Give you C-1, if I didn't give it to you before; it was zero. Okay, we've completed that.

GARRIOTT I never adjusted mine the whole flight.

BEAN That explains a lot of things. (Laughter).

LOUSMA I took them like they were.

BEAN He couldn't find his shoes the whole time. Forgot where they were.

BEAN I think you should launch with a rubberband they can put around their Activation Checklist. They should have a little string with the connector that connects your Activation Checklist to your pants. I lost more time in activation with losing that book than just about anything. It's because you can't do things with both hands and hold the book and keep it open to the right page all at the same time. At deactivation, I noticed that we all had our books clamped to us some way with a rubberband around them to the right page. Then we could do the job and the book was always trailing behind us and we could read it.

GARRIOTT That's the way Jack and I did it in training.

BEAN Is that how you guys did it? Thank's for telling me.

LOUSMA Another thing you need to do is to get a timer and a roll of gray tape and put them in your pocket.

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.

BEAN

Same thing for the ones in the food compartment. I think they can live with them. I wish that the first time they corrected them, they would have made them big enough so that you could put both your triangle-shoed foot and your non-triangle-shoed foot in. We made an inflight modification only to mine because I was the only one that cared. The other two are not modified. It is certainly useable - not nice, but acceptable.

Digital multimeter: Good addition. We used it a lot. It's easy to read. It has good batteries. I would suggest that you keep it off between uses. It's a good addition to the toolkit and we probably should have had it initially in the toolkit.

LOUSMA

The only problem is that, when you take the little pins out of the probes, there is no place to put them. The little screwdriver that goes with it floats around. It's going to get lost one of these days. You have to tape it down. There is no good place to put it.

Shoe repair kit (toe): It seemed to do the job. It protected the toes anyway. It is a little bit difficult to line up the holes and get the screws back in, but after working at it awhile, you can do it.

BEAN
(CONT'D)

then put it back in. If that can't be fixed, putting the vacuum on that window every couple of weeks is not unduly prohibitive or time consuming. It should be done to keep the wardroom window in pretty good shape.

LOUSMA

The next one is the flight data file board restraint (double clip board tethers). That little tether seemed to work well to stabilize the clipboard on the wall. We had another little device on the clipboard by the EREP VTS, which was designed to hold your book open. We never used that. We found the best technique was to take the pages, pictures, and maps out of the book and use them by clipping them to the board. We took only the ones we wanted to use. There is no time to flip from one page to another anyway.

BEAN

SUS loop heater assembly: We didn't do anything with it. Skip it.

LOUSMA

TV closeup lens: We got that out a few times. Paul used it the most. I find it hard to get within focal range, so it took me a lot of setup time.

GARRIOTT

You know what range it normally sets at. It only takes a couple of minutes. You need to know where to find it. It is over in that TV locker to the right-hand side of the wardroom window by the M509 bottles, to the right of the film vault.

BEAN
(CONT'D)

changing that he needs to have a way to keep the Scotch tape in position; he needs to use the Scotch tape with one hand, he needs some place to keep his pen in position, he needs a way to keep the book in position, and also keep the change sheets in position. Those changes come up on teleprinter paper so when you receive them, they're long rolls of paper and something has to hold them down so you can read them, cut them, and then paste them. You're doing a lot of that work and we need to come up with some sort of desk adapter. A thing to your set that would make it like a desk. That's one of the shortcomings of Skylab - no desk. Another shortcoming of Skylab is there is no work bench to put the equipment on with the right lighting and the right holders for screws and the like so that you can do some work on electronics and other equipment without having to makeshift a desk.

LOUSMA

Did you mention that we use the magnets that were in the entertainment kit?

BEAN

We used some of the magnets in the entertainment kit to improve the handling of these pieces of paper and they work somewhat. I don't think that's the final answer, but it's sure better than doing without. I was glad that the ground thought of that. The one's that I found the best were the little blue ones that lay down flat. I assume that were made for cards.

BEAN
(CONT'D)

When they were lying flat on a table, you could slip some of those cards and changes right under them and they held the cards pretty tight.

LOUSMA

EREP Checklist: We always used the cue cards for operations. The only time we referred to the checklist book was when we were doing special operations or for some special technical data.

19.3 CHARTS AND MAPS

LOUSMA

We do all the logging we should do and we probably are doing too much. One thing you can scratch off the evening report is the film log for the drawer A configuration. You can figure that out from what you've done with the 16-millimeter film which appears just above it.

BEAN

If they want drawer A configuration, the ground can make a special request and you can give it to them.

BEAN

Flight data file configuration controls: It's not a bad one. We talked about the changes a few minutes ago. I would say that we completely addressed that configuration control. One thing that's different is you do have a number of changes to a lot of different books, and it's important to understand with the ground before you go, which books you are going to use and for what. For example, if you're using S019 operations, you're

INTRODUCTION

QUERY

We have a large number of individual corollary and scientific experiments and individual representatives for the experiment will conduct the questioning. We have prepared questions which you have before you. There are copies of the M487 and M516 questions. The Marshall people have consolidated all of their questions into a list also.

M487, HABITABILITY - CREW QUARTERS AND M516, CREW ACTIVITIES

QUERY

The first portion concerns crew quarters, crew activities, and experiments which are integrated with the questions.

QUERY

A1, one of the remarks that was made many times during the mission concerned the inability to find a place to tie down your checklist when you had to make numerous checklist changes. One of the suggestions that was voiced up to you was that you use the playing card holders out of the ODAE kit. Did you use those and if you did, how did they work?

BEAN

We did, and they were effective. The ones which I thought were better were those that had the little blue part on it that laid flat on the table, under which we could slide and secure the checklist. I used two of those in a row because

BEAN
(CONT'D)

the teleprinter messages were always curled, which made them difficult to read. I put two of these card holders together and placed the teleprinter sheet under them. I slid it up as I worked along making the changes, and that was helpful. We tried using the double magnets that have a piece of white between them, on the books, and they worked fairly well.

GARRIOTT

Flight magnets?

BEAN

Yes, like the ones you used.

GARRIOTT

They make a very useful demonstration too.

BEAN

They're good magnets; they have a lot of pep. Those things worked fair but they weren't long enough to be used with the book. You would have to have one the length of the width of the book if you wanted to hold it down. As it was, we had one on each side of an open book and it might work or it might not, depending on how big the book was. At any rate, those are good things. The problem came up if you used them on the little food table, which wasn't very big. You had more things than the area would allow. I've seen what Jerry's taking up. The mount for the scotch tape is different and would allow you to use that with one hand. With some of those springs we had, it might be useful.

GARRIOTT

What about that little ATM trays? Do you think that design, with clips and the magnets, would have been helpful?

BEAN

Yes. You need something like that. I wouldn't carry it up for this mission. But, originally conceived, they should have a special table for that.

QUERY

As for downstream design, do you have any specific recommendations for the construction of a table that will be useful?

BEAN

What you need in future design is a table that's a combination table for making changes and a work table, and with good lighting. There was bad lighting for cutting, reading and all that in most of areas of the SWS. The lighting wasn't adequate. You should have special lighting in areas where you have to work on springs, clips, and all that business; and in places where you can tie down checklists for corrections, or a battery to check it out like we did frequently on 509, or of the VTRs to check it out.

QUERY

When you were up on the upper experiment deck in the OWS, did you find that the lights coming through from below when you were looking down gave you any difficulty at all?

GARRIOTT

We had problems with the TV frequently. We would have to turn them off for that. I don't remember any visual problems.

BEAN

On inventing these zero g desks, you can invent that on Earth simply. Provide something that would work and could be used vertically. Make sure that you have enough clips and springs to do the work vertically. If it works in that position, it would do the same thing horizontally or any other way at zero g. But if you can't do the work on this thing vertically, you can't do it in zero g.

QUERY

Do you have any comments on the preferred angle of orientation on the work table in zero g? Was the flat work table in the wardroom at the right angle?

BEAN

It was not good because you have to have your feet restrained somewhere. It's very much like it would be here. If it's a flat surface, you would want something that is comfortable relative to your feet.

QUERY

Like a drawing table?

BEAN

Yes, like a drawing table.

GARRIOTT

It's the same orientation that you would use here. You must have your feet restrained. Our ATM boards happen to do that.

BEAN

They were low enough and could be useful for work. The food tables weren't that low, therefore, you ended up bending over the top looking down.

TAPE 3, SIDE 1

CDR O.K. Even if it moved all the way open? So what?

PLT It might close it even

SPEAKER I can get you the numbers that the guys have come up with, if you want.

SPT Well, there's really no point in getting the numbers for me. I guess, at this point. I asked a rhetorical question. My point is, I think, it was just really no point in any sorts of constraints. Things like strapping the SOP's down.

SPEAKER We were told that's the docking loads.

SPT We just waste fifteen minutes of crew time up there on every flight because the SOP's have to be strapped under this big two inch metal strap.

CDR If you took the SOP and floated it in the middle of the chamber, not tied down at all, and docked, it probably wouldn't move. And even if it did, so what. We're over -----

SPEAKER I sure the SOP's would be the latch loads. That's probably just the docking loads.

CDR That's when you're docking on either one. Either one. If you just set it on top of the ATM panel, it couldn't bust anything. There are things we got to somehow get a grip on in this shuttle thing, Dick, because it makes you build something twice as big and hairy and strong.

SPEAKER And expensive.

CDR And expensive, and just -----

PLT Everybody argues about it ---

SPEAKER We wouldn't have anything to keep things interesting really.

SPEAKER Temporary stowage location. Where you had temporary stowage bags, for example, things like that. Were they the layouts reasonable, or did you want them other places, or did you have ones that you just never used, someplace that you'd like to have special temporary stowage location.

CDR Owens' idea of putting, you know these springs we always had on doors, in the front so you could shove things under them. He indicated, Owen mentioned one day, he said, you know we ought to build doors, almost every door in the spacecraft ought to have a spring on it or in it or somewhere. So all the flat surfaces have an ability to receive something you want to set down for a few minutes. That ought to just be part of a door. Couldn't agree with him more. So as far as, that would be one temporary stowage scheme that would not bother anybody, would add some weight to the spacecraft, but it would sure be all over the place, useful. It might solve almost all your temporary stowage problems just with one simple device.

SPEAKER You talking about bungee type springs?

CDR Yes

SPEAKER Screendoor things?

CDR Yeah- on every _____ much the same as we can put any thing down here on a horizontal surface and forget it. So we don't need hardly any restraints in this room. All we got to do is set something down. Put a spring on every horizontal surface in that spacecraft, you don't need much else. You can always stick it under the spring. Or if you don't want to, you can carry it down and throw it into a locker. And then you eliminate all of these problems. We could find, you know, we could get a special holder that would hold this here, and that one there, we can always lay it down horizontal. With these springs all over the place, you've got built in restraints. Simple, straight forward and fits everything.

SPT We ended up with two or three of these apiece in the wardroom, but we didn't have enough springs or time to go putting them around everywhere.

CDR Lot of places don't have places, like those big lockers in the MDA. Film lockers had snaps on it, we tended to put springs up there. They were always useful. We never had too many springs around.

PLT That's right.

SPT Another place that we could have used one, in fact I guess we took it up, but the next fellow ought to plan to put it right back, is a trash bag, just to the right of the ATM foot restraint. Between that and the film vault there, I've forgotten what the number is but there's no place to put any trash in the whole MDA. Maybe you carry up a can of apricots and want to throw the can away, or a piece of chewing gum and want to throw the paper away, or yesterday's teleprinter pad; there's not a single place to throw it. Now there was a TSB up there, but

SPEAKER

In the FTS, -----

CDR

One other thing about, let me go to this temporary stowage thing one second. A lot of times its difficult to determine prior to flight exactly when you want this temporary stowage business. I think if you ended up having a spring on every horizontal surface, you'd have it ninety percent whipped. O.K. But there are other things that are going to come up. For example, we very much wanted to have a way to restrain our food in the chiller. Because we had three or four drinks, plus maybe our peaches and one butterscotch pudding and all that sort of thing. It was all floating, free in there, plus we had the IMSS in there. In all, it was a big fiasco in there. Same thing inside our spice locker, cause we had not foreseen that we'd have spices. Same thing in our own personal lockers. You couldn't predict what you'd have in there. But we had nothing that would give us the ability to put restraints in these places realistically. For example, the thing that had been daydreamed up was a round piece of metal like this with a snap on it. You would take that round piece of metal that had adhesive on it and stick it to the wall and then stick something to that snap. Great idea. It would sometimes work outside if you had the right surface. But, for example, it wouldn't work inside the chiller at all. It was too cold. You'd put one there and three days later it would come lose.

SPEAKER

Condensation would break the seal.

CDR

Yeah, so somehow we need, in future applications, the ability to get snaps on in positions on flat surfaces with an adhesive that really works. Even if we have to take up two bottle adhesives. I mean, I can get that and do it in my house, I can do it on the side of my car if I want, but we just could never do it to the spacecraft. Those things just didn't hack it. That would be extremely desireable. Those springs and the ability to put these little snaps, if you would put two of the, you'd have a spring in position, or you could leave the snap and put a clip, like we had, those different clips. I think you'd have this stowage problem whipped very easily.

SPEAKER

A1, there were two snaps inside that chiller on the left side ---

CDR

We used them. We needed more. Those were great.

SPEAKER

O.K.

PLT

Just like that -----.

SPEAKER Rib cages?

CDR Yeah, we needed about five rib cages to do the job.

SPEAKER O.K. You had more quantity than we envisioned, then.

CDR That's right, and I think that we can't always envision--If we could have put three more in there, just like that,-- we did it a couple of times, they'd last three or four days and then float out -- we would of had it made. But we just couldn't get them in there. We thought "I'll bet Frigidaire has got some tape; we could have taped them in there; they probably have some glue, you could stick it on one of these and it would stay forever. Cause they must have that application, they do it every week on their equipment.

SPEAKER In the STS, did you notice any change at all in the forces required to open or close the STS window covers?

PLT Seems like they were always hard, but they're hard enough so that you never noticed any difference.

SPEAKER Uniformly hard (Chuckle)

DR They were unsatisfactorily hard all the time would be my comment.

SPT That's a good way to bust your knuckles because whenever your hand slips, it runs into a metal bulkhead. The other thing, actually a little dangerous, I think, is that you can't plant your feet to counteract the torque, and you got to always be careful that as you crank up here, your feet ain't wagging down here into the rate gyro pack or the ATM panel or something else. I always thought that was in addition to the inconvenience, was a potentially dangerous thing involved with opening and closing those windows.

PLT Might kick the SPT.

SPT He's up opening the windows (chuckle).

SPEAKER Under EVA, yesterday, Jack, you were talking about when you were stowing ----- portion about how the mosite was holding up you mentioned two containers that were just----- 505 was the water sampling and then you mentioned the 131. Is that the M-131 experiment stowage container? You're not talking about a -----

PLT Yeah, I don't think it was because of the mosite in them, though. Because there wasn't any mosite in the water container at all. The fact that --- Somebody brought up mosite with the idea that I thought of getting hard to close containers. And I just thought of those two others, but it was not a mosite problem.

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You can tighten it as tight as you can with the channel-lock pliers, and in about a day, they're loose again. So, there needs to be a - a better method of keeping the triangle from moving.

333 23 53 40 PLT

Second unrelated point, but still I - in the way of restraints, is that - again the drawers and the poor design of the drawers that we have. In the food compartment, the pudding drawer is completely inadequate. The puddings are always floating out of their restraints and getting upended when you pull the tray out to put on top of the food preparation table or the trays to heat food. The puddings all come floating out. The tray is required to restrain the puddings in the tray there - that is reserved for pudding.

333 23 54 16 PLT

Another point is - I mentioned yesterday in the M487 about the difficulty in restraining the pieces of paper - managing the pieces of paper. One of the things that we - we found that would be - of course, clips are very nice, but once they're off of the counter bungees, it's very useful. However, when you're using the bungee, you almost have to have a convex curved surface, so that the bun - bungee or rubber band or whatever it is, is stretched across a slightly curved surface. Or else the friction is lost, and we've lost - temporarily lost a lot of pads this way, by putting the paper under the spring, and the paper will float free. If the spring's stretched across a flat surface it tends to not hold the paper as well as if it were stretched across a curved surface, is something to bear in mind any time you're designing a surface for writing.

333 23 55 06 PLT

PLT out.

END OF TAPE

SPT ATM foot platform: I'd call that adequate. What I'd like to do is to have that foot-pad moved down a lot more than it is. We find ourselves really hunching up over the panel, trying to get our heads in the same position they were in one g. And we can't move that thing down any more. Useful to have much more, greater range to travel on. Portable PGA foot restraints: Okay, very useful. I give them an excellent.

338 03 23 03 SPT Portable handholds; specify where and how used. I guess - I guess the problem is - they're probably adequate, but the problem is, for me, I don't have time to run one - run one up and then try to figure out where to put it. I'm interested in getting the job done and I sure don't have time to construct things in order to do it. If I used footpads many many times, I might do that, but I have not run into that situation yet.

SPT Portable equipment restraints, tethers, bungees, universal mounts, et cetera: Okay, most of that - heck, let's go at it. Tethers: I've - I've not used any inside except for the small lanyards that we put on our checklists, and I'd say those are very good. The bungees are - If you're talking about the spring ones, they're lousy. They - they stretch out too easily, and I give those a poor.

338 03 24 05 SPT Universal mounts: I guess for the job they're going to do, they're very good. ATM seat/back rest restraints: I haven't tried it. I have the feeling it would be very much - way too confining. When I'm working on the ATM, I have material mounted all around there. And I swing my body completely back, to the right side, to the left side, straight up, in order to get to the material which I have posted for cue cards and one thing or another. Sitting in that chair would really tie me down. So that's why I haven't even attempted - I may drag it out one of these days when I get a chance.

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It puts the Ground into a full-scale panic to even touch those things. So I guess I'd say that poor to adequate would be the rating I would give the handrails. And as far as the MDA and STS as a working area, as far as restraints are concerned, I'd say it's unacceptable. Real shortcomings all over the place, and the MDA is just a lousy place to work.

344 21 41 22 PLT

Triangular shoe cleats/grid: I would say very good to excellent. Conical shoe cleats/grid: I've not used yet. I want to get around to using those; I'm going to try to fit up my second pair of shoes with conical cleats and try them out. Water tank foot platform is excellent for working dome lockers. It's no - not much good for working water tanks. I'd say it's poor for working water tanks because of the crouching action that has to take place. By the way, a crouching action is very difficult in zero g; so if you design a foot restraint where there's - this posture requires a crouching action, then you're not helping us at all. In fact, it's a great hindrance to have to go into a crouch because you have to hold your abdomen very stiff and your leg muscles very stiff and you're at a constraint strain even putting on shoes. When you bend down to put on your shoes - If you bend down, it's difficult; if you pull one leg up at a time, it's not too bad to lace shoes.

344 21 42 22 PLT

Portable M512/479 foot platform: Not applicable except for its EREP purposes. So - And that's very good except it's very limited. It's only good for the C&D panel, and that's about it. The rest of the thrashing about for the C&D and the VTS operator is done without foot restraints and is difficult. The ATM foot platform is good. Portable PGA foot restraints: I did get to use them the time - Because I was - I had to use my PGA foot restraints for the EVA - foot restraints for the

SL93 maintenance. Portable handholds: Not used. Portable equipment restraints - tethers, bungees, universal mounts, et cetera: Tethers and bungees, in general, are - are - are very nice to use; however, the ones with the little, fine wire hooks on them are really bad. They - The wire comes out

from under the rivets, and you've just lost it. And not only that, but when that happens, you've got a nice wire fish hook there thrashing about that could really snag you. That's a really bad design. I'd consider that worse than unacceptable; downright dangerous.

344 21 43 27 PLT

Also, all of our snaps - Every place that we have snaps, there ought to be stiffeners where the snap is located. I'm talking about where it's located on the strap, and a bungee falls into that category.

344 21 43 39 PLT

There ought to be a stiffener, and ought to be an inch and a half or 2-inch pull tab on those. The pull tabs we have are not long enough; they're about a quarter-inch to a half-inch long in many places. And I don't know what it is, but if it's just a tip, enough there to tease you; it's not enough to help. And it needs to be stiff so you can get some levering action with it. Just a little, tiny quarter-inch picky asinine extension on there is not good enough. It does not serve the purpose for pulling that snap off. And if you have - have a stiff portion of the fabric on which the snap is located, it also helps you when you put the snap on. And by the way, when attaching snaps to a position, it's a very difficult operation in zero g unless you have an opposition pull point to offset the pushing force required to put a snap into position. That holds true with snaps regardless whether they're on bungees or equipment bags or these clipboards we have. If - There's a major effort to put one of these aluminum clipboards onto a position because of those two snaps.

344 21 44 35 PLT

You feel like you've put in 75 pounds of push boards just to put the doggone thing into position. You've got to anchor yourself, one arm and two feet, to get that clipboard attached to a surface where you have the snap arrangement that's accepted. Universal mount, I don't think is very good. Generally speaking, I'd say poor to adequate on a universal mount. I don't like the non-privacy blocking mirror. That's the mirror with those block locks. If - If the place where you're hooking

the universal restraint - on a handhold, I'm talking about now - is a grand platform, it works fine except for the oscillation dynamics of the handhold in using for cameras and so forth. The DAC will - will stimulate a vibration in the universal handhold; however, it sets [sic] there and shakes back and forth in resonance with the shutter motion of the DAJ. But when you're trying to use the - the clamp mode of the universal restraint, I would say that there is not enough flexibility in there to allow for fine tolerance or - or to - say, to allow for - for a general manufacturing tolerance to the handholds.

344 21 45 42 PLT

The handhold - The lock is not very good. When you push it down to lock, it may or may not. Sometimes you get a nice, over-centered flex, about - and that's about one out of 100 times, when you pass it through a - one of these oblong handholds. The bungee is better, generally speaking. Are very, very nice pieces of equipment to have around, if we just had better ways of sticking them on things - attaching. ATM seat/backrest restraint, we have not used.

344 21 46 11 PLT

Fecal collection equipment: As far as the collection equipment, functionally, it is, I would say, very good. Urine collection equipment: I would say poor to adequate, maybe because of the difficulty in inserting the urine drawer and in removing it. One of the things I don't like about the urine collection equipment is the hole that was cut in through the pressure plate with this green thing with a spring leaf arrangement on - the four-leaf arrangement. The hole's in the wrong position for reaching in there and pulling the little tab. We have to do this every morning. And every morning I have to fiddle around and reach in there and almost cut my finger trying to pull that tab out.

344 21 46 51 PLT

The square hole was positioned incorrectly. Also, have - Every morning I have great difficulty pushing the collection - the thing that holds the urine bag - pushing that back into position and getting the Teflon thing over the separator inlet fitting and then pushing the thing on.

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the floor and - and hold a screw while Ed was busy working underneath. Ingress and egress positions are - are very good; are excellent in the wardroom. There's lots of room and no problem getting in and out.

356 17 02 52 CDR

Trash collection provision is - is excellent. Each man has a trash bag within arms reach of his eating station. Stowage volume and access is excellent. There's lots of room. And as more and more clothing is being used up and lockers are being emptied out, we're moving more and more bulk volume food, overage food down into the lockers near the tables so we don't have to spend as much time transferring from the wardroom up to the food lockers in the forward compartments.

356 17 03 27 CDR

Access is very good in all these stowage areas, these lockers in the wardroom. Temporary equipment restraints: We make extensive use of the bungees in the doors, and we make extensive use of Velcro. And they're all very good. I think the best temporary equipment restraint is the bungee with the flap. I don't want to call it a hook. It's really a hook, but it's long and - and flat, pinched. I like - I like that better than the sharp wire or the other type of hook; just about a 3/16-inch wide piece of metal bent into a hook.

356 17 04 09 CDR

Personal mobility aids: Now that we've got the - Well, I don't know what you mean by a personal mobility aid. I don't think there are any. The personal restraint devices: I think the thigh restraints are okay but not necessary. I would say that removal of the floor plates has greatly improved the ease with which we can harbor ourselves to eat our dinner and do whatever we want to do. Thermal comfort: It's very comfortable down in the wardroom. It's one of the more comfortable rooms in the whole spacecraft. Noise level is very low in the wardroom, as it is in the entire OWS, unless you've got the ATM/EREP cooling loop running. And then the dome takes the noise as it comes down the airlock and serves as a great big megaphone and - and sends it down to us slightly amplified.

356 17 05 11 CDR

Illumination in the wardroom is excellent. Waste management compartment: General arrangement and orientation in the compartment - I guess I have no complaints. I'd call that very good. Volume of the compartment: I think that's very good; it's quite adequate for the use.

356 17 05 33 CDR

Ceiling-to-floor proximity is adequate. Ingress, egress provisions adequate; no problems there at all. Trash collection provisions: There's one trash bag in there, and it's located in a good position. I can't really complain about that.

Temporary equipment restraints: Those are minimal. Again, we've moved in a - a bungee and put it over the - the top door in the top locker over there above the SMMD, and that's where we put urine bags and things. Usually the first guy in the waste compartment gets out all three urine bags and all three sampling bags and puts them under the bungees available for the other guys to use, and it avoids having to open and close the locker down at the bottom, near the floor so many times.

356 17 06 30 CDR

We use Velcro to restrain pencils and things like that. Personal mobility aids: None. Personal restraint devices: I've already discussed what I think of the restraint devices in the - in the waste management compartment. They're terrible. Somehow we needed to have an open grill in there.

356 17 06 56 CDR

You just - You're in there trying to clean up after defecation, or you're trying to urinate or comb your hair or do anything in there, and you just ricochet off the wall like a BB in a tin can. You've just no place to anchor yourself down. Those restraints that are in there are completely unsatisfactory. The fecal collector: Once you anchor yourself down on that rascal - I got no complaints about restraint devices there. I use the lap strap, and there's just no problem. I put my feet in the foot restraint area that's back behind the urine drawers, and it all works very nicely. It's once you get off that thing and start the cleanup process when it begins to get exasperating.

356 17 07 43 CDR Thermal comfort in the head is fine. Noise level is okay; it's a little bit noisy with the separators going, but it's not uncomfortable at all. Illumination is quite adequate; more than - more than adequate. Sleep compartments, general arrangement:

356 17 08 02 CDR They're fine for sleeping. There's not much of a place to go hide and be by yourself unless you're going to get into your bed, because there's no place to anchor yourself or really put yourself unless you're in bed. The volume of the compartment is just about right for that use.

356 17 08 19 CDR The ceiling-to-floor proximity is okay. Ingress, egress provisions: They're good. The doors are very good. And the light - the light-blocking devices: The fact that you got the Velcro doors and the - the light attenuators in the ceiling, are all very good.

356 17 08 40 CDR Trash collection provision: No problem. In - I think well located and - and no problem there. Stowage volume and access: Well, I've already discussed that earlier. I think we're a little light on personal item stowage volume. I think a little Ben-Franklin-type desk top or something for the second from the top, a locker, would have been very nice because you could lay in bed and - and reach that and write or read or something like that. That would have been very nice.

356 17 09 17 CDR I would have been nice if that locker was - was provisioned with ways to restrain small articles that you would want to keep in there, personal articles. Temporary equipment restraints: Again, we're in wide use of snaps, Velcro, and - and springs, bungees in order to anchor your personal equipment down. Personal mobility aid: None.

356 17 09 43 CDR Personal restraint devices: None other than the bed. I have already talked about the bed. I think it is a step in the right direction; it's a very good piece of gear. Don't know how you would improve it off-hand except possibly rather than body straps, you might want to use something like a big body sheet, much like the sheet that's over

the front of the SMMD. That sort of thing might be kind of nice. I don't know, but it will - would merit looking into.

356 17 10 18 CDR

Thermal comfort in sleep compartment I think is good. There's lots of air moving through there, and you can adjust your bed - your bedding to keep you at the right comfort level. Noise level is excellent. It's very quiet in there; the walls pretty well da - and the door pretty well damp out the noise, as well as does the light attenuators. Illumination is fine. One light in there is more than adequate. Experiment compartment, general arrangement and orientation: I think that's fine. The chair's kind of off in the corner and out of the way, where I would really put it.

356 17 10 59 CDR

I have no complaint about the arrangement and orientation of that compartment. The volume is about right. Ceiling-to floor proximity is fine. Ingress, egress provisions are more than adequate.

356 17 11 13 CDR

Trash collection provisions: I think there is where we fall short in the experiment compartment. There really aren't any good places for trash. I think we need a trash stowage area over around M131 area and something over, say, between the bicycles and the BMMD.

356 17 11 40 CDR

Stowage volume and access: No problems there.

Temporary equipment restraints: Again - again, in this area we use mostly Velcro, not many - many springs. Personal mobility aids: None.

Personal restraint devices: Well, the floor grid is the primary device, and that's excellent. Most of the other restraint devices that you got or mobility aids are just grabbing grabbing - grabbing hold of things like the handles on the BMMD or the handlebars that are on the bike or something like that.

356 17 12 12 CDR

Thermal comfort is fine; no - noise level is fine; illumination is excellent. Trash airlock: Problem here for the operator of the trash airlock; there is no really good way of anchoring yourself or restraining yourself while you're trying to use the trash airlock. You pull on the handle - open

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up with food spills. This is a problem. We've spattered the window up. Of course, there's the window cover, but we occasionally do take that out. And we have to have the - out the window - and we have to have it - the window cover over it. Food spills are a major concern when you start locating anything in an area where you're eating.

356 19 13 46 PLT

Temporary equipment restraints: Again, the same thing. We did not have enough there. Personal - personnel mobility aids: Well, with the ceiling-floor proximity we have, it's no big problem. We do find it difficult to go over the wardroom table. We usually find ourselves going around one-g fashion, because there's not quite enough space between the top of the wardroom table and the ceiling to get over without pinging something on the table, knocking somebody's utensils off their tray, or if they're - happen to be out, or just in general getting in their way and kicking them in the head. Personnel restraint devices: Well, we've already kicked that one to death. We finally removed the pedestal, and that was just a - a bad scene all the way around as far as design is concerned, as far as I'm personally concerned in evaluating it.

356 19 14 31 PLT

Let's see. The - the fire restraint is useless. The pu - the natural posture of an individual is almost with legs straightened out, and when - in - trying to design a table to make you assume a one-g eating at-the-table posture is really out to lunch, that is not the way to go. I would rather eat up, like a sack - snack bar, where you're standing up and eating. And somebody's already mentioned the eating Japanese style, and I think that's the - that's the way to go. You need the tray close to your head, and you need room for your legs to almost straighten out. Otherwise, you got a perpetual tension in your abdomen, trying to hold yourself in. Thermal comfort: No problem. Noise level: No - Well, it's really not that bad. Illumination is no problem.

356 19 15 11 PLT

WMC, general arrangement and orientation: I've already beat that one to death, too. I don't

356 19 17 40 PLT

Stowage volume and access: Well, we got enough urine bags and all that and so forth. Temporary equipment restraints: No, I - I - well, equip - equipment restraints - Yes, I think that we - it would be nice to have more. There are - are none in there. In fact, I just did an M46 - not an M47, a housekeeping task where I changed out a fine filter, and it said stow it. The - the - replacement filter - Well, there ain't no place to stow it; so we don't have enough equipment restraints and clips. We'd like to write down the weight - the - of the feces and the urine. Of course, we have a place to write down the - the weight of the urine when we weigh that. But when we do the SMD of the feces, we have the bag's in the weighing device - And it would be a - nice to have a place to write down things. Every place that you work, there ought to be a good crew restraints, and there ought to be good places to write, and there ought to be equipment restraints because you're - always got your hands full; put stuff under your arms, between your legs, and in your teeth, trying to hold on to all this garbage when you try to do all these asinine tasks that people ask - ask you to do in these areas. And I - I - that is a bit flippant, because most of those are important things; it is nice to record that data. But we don't have places - we don't have provisions for it. There is one spring clip there someone thought fully provided in the WMC. But I - it's a very, very stiff spring, and we've had cards under it - permanent cards under it already for - for logging the weight of the urine, telling us which ... the urine management.

356 19 19 10 PLT

Personnel mobility aids: Well, I - there weren't very many. Restraint devices are cu - totally unsatisfactory in the WMC. We're already commented on that. Thermal comfort's okay. Noise level is okay, and illumination is okay.

356 19 19 23 PLT

Sleep compartment, general arrangements: Okay. Volume of the compartment, fine. I don't think that it needs to be a lot bigger than that. Ceiling-floor proximity is okay. Ingress, egress: Ed has a little trouble getting in and out of his bunk because of the way his bunk is provided, but

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SPT

Okay, tool kit number 2: the lacing, the wire, I've used time and time again. Found that to be exceptionally useful. The 2-inch tape we found to be exceptionally useful and wish we had more of them. We went through it. Velcro, if we had good velcro, it'd be all right. This Velcro doesn't stick. That - The male and female don't stick and the glue that's on the back of the Velcro is poor. Net result is you should have put a couple of wads of bubble gum in here, and they would have worked just as well. That Veclo is - is lousy. We ought to get the good Velcro and quit piddle - picking around with this stuff. It's just - We've had it on the spacecraft for a long time.

025 16 11 54 SPT

It just doesn't do the job and it's more a problem than it's worth.

SPT

You put it on something; you expect it to do the job and it doesn't. Then you got to find another way of doing it. That way you lose a couple of cue cards, or you lose whatever you happen to be tying down. I think it's time we just came up with a good Velcro and used it. We've got to either make it fireproof or relax some of the constraints. What we're using now is just not worth it, not doing the job. 1-inch red tape:

Never have had to use very much of that. A couple of occasions, two 1/4 inches; tape, not too much. Scissors: We've got them all - all the scissors from all the tool kits in the wardroom now. We use those for the - the meals. They work a lot better on the food packages than the other ones we have, which because they're a lot easier to use; don't require much force in cutting those, so that we don't need those especially strong ones that we carry around in our pockets.

025 16 13 04 SPT

Needle-nosed pliers and pin straighteners: I have used both of those and great. Slip-joint pliers, used those. Connector, channel lock - Channel lock, used that. Or connector pliers, I'm sorry; I've used that. Channel lock, I have not. Vise grips, I've used on occasion, sometimes as a handhold. And I think all those things are worthwhile. Keep them in there. Lubricant: I've

POGUE none for the VTS operator. The one for the material processing
(CONT'D) facility I didn't use on the M518 sequence.

CARR For 487 I used the one triangle in the upper left-hand corner,
because that was the closest one. It was poorly placed for the
furnace work.

GIBSON I always wished that the ATM foot restraint were lower. We
all found that we were hunched over when we started operating
the ATM. We got a little better as we got used to having a
higher head position relative to the panel but we always
seemed too high on the panel. I would much rather have that
thing gone down about 6 to 10 inches.

POGUE You tend to get a cramp in your abdomen from tensing, because
all the work stations were set up for normal one-g work. Your
body tends to hold itself erect, and even slightly arching the
back, so you are always held away from your workstation. I

thought the aids around the MDA and STS were very poor. It was
very difficult to do some of the tasks which were required. In
fact I put up long straps, and ended up tying my ankles to
single handholds, in order to have a good stable body position
for doing some of the early work in the Coolanol servicing
loop in particular and for some of the EREP instruments'
calibrations.

CARR
(CONT'D)

base plate inside the cutter crimper got caught, or if the skin of the bag worked its way over the sharp corner of the base plate, the system might leak. We were so short of sample bags that we could not throw a bag away and get a new one; we had to repair it. You have probably noticed that a few of the bags have gray tape on them covering leaks.

POGUE

The urine system has serious hygiene implications. Urine spills are not only messy; they're potentially a health hazard. The drawers were all way back in an inaccessible area. It's true that you could remove the entire drawer and get back in there but it still was difficult. Lighting was not provided for proper inspection of that area. The lighting, which was all in the ceiling of the head, was inadequate for proper inspection of the urine drawers, which were at floor level. The system design was also rather inefficient. The connectors were all hidden well back in there; however, during training I had learned to mate and unmate the connectors by feel. One grounding strap on the urine drawer kept breaking off, even in normal removal and reinstallation. Another inadequacy of the urine system was the lack of a provision for securing items during the process of sampling and changing out the urine bags. Although retaining devices are necessary for proficient management, there were very few of them throughout the workshop. No thought had been

POGUE
(CONT'D)

given to the human engineering of the operation. When the procedures were written, it was assumed that the individual would somehow, between his legs and between his fingers, under his armpit, or wherever, hold all these loose pieces of equipment that had to be managed during a normal, day-to-day processing of the systems. Urine receptacles and bags and all kinds of pieces would frequently get loose and float into the experiment area.

POGUE

Any part of a system that comes into direct contact with urine bags should have some kind of quick disconnect and an easy access for cleaning. The big base plate that received the urine bag for measuring total volume was actually bolted into the waste management fixture, and could not be quickly removed for cleaning underneath. Now, any time you're handling a urine bag, you're going to have urine leakage. I'm not talking about urine spill; I'm talking about the normal oozing of fluid from supposedly leak-proof fittings. You had to put the urine drawers into position on that big metal plate by putting the urine boot itself into a recessed area on the base plate. Almost every time you applied pressure to it, a few drops of urine, sometimes as much as half a cup, would leak into the area. It was not easy to clean those; I actually took a pencil and worked tissue down around the cracks of that thing when I got leaks. That's no

CARR Yeah. The bracket was too floppy, too flexible. It would've been better if we'd just - if you're going to have that bracket, to design it to fit into the two holes that hold that big piece of bridge structure that goes across for S063.

QUERY For S063; right.

CARR And you could have had just sort of a lighter bridge with a camera hanging down there with some sort of a ball joint so that you could move the camera.

QUERY Uh-huh.

GIBSON But a bracket doesn't seem to make sense in taking pictures going over the ground. It only makes sense if you're taking pictures of something fixed inertially in space, when the spacecraft is fixed and you're taking a picture of a star or a comet. But taking pictures of the ground, you - you're best off following it with your eye and getting image motion compensation.

QUERY Well, you did a beautiful job because they're much better. The other pictures, the only reason they put that bracket on originally was to - to try to help some of this body motion you get in the pictures as well as being able to tell you, "Hey, at a certain position you're going to be able to see something come up in 2 minutes."

POGUE

Because it - Boy, it was really giving me fits. I had my legs strapped to handholds and everything to get the right force.

QUERY

That's probably why you commented on the lack of restraint in the airlock module and having to tie yourself to the airlock ... - -

POGUE

Yes, I remember pausing quite a few times to reflect on that.

MS

(Laughter)

QUERY

Because we - nobody else has commented about the lack of restraint in the airlock.

MS

(Laughter)

QUERY

We forgot about that Coolanol servicing.

CARR

Tools in general, I can - I'll just - we made a lot of comments in the tech debriefing on what we thought we should have had in the way of tools. We asked for a soldering iron a long time ago and didn't get it - a soldering gun.

POGUE

Files.