

84N 75645

JSC-09538

SKYLAB EXPERIENCE BULLETIN NO. 4

DESIGN CHARACTERISTICS OF THE SLEEP RESTRAINT

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National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER
Houston, Texas

JULY 1974

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July 1974

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

BULLETIN NO. 4

DESIGN CHARACTERISTICS OF THE SLEEP RESTRAINT

This document is the fourth 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 and is intended as an interim measure, to be followed up by a thorough experiment report six to nine months after receipt of all Skylab flight data.

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July 1974

DESIGN CHARACTERISTICS OF THE SLEEP RESTRAINT

SUMMARY

The Skylab sleep restraint was extremely well received by all crewmen and was compared very favorably to the Apollo sleeping bag by those with flight experience in the Apollo Program.

Two minor shortcomings were evident; the body restraint net trapped excessive air around the legs of the user causing a local thermal problem, and some of the crewmen felt that the various pieces of the assembly were poorly labeled (causing some confusion during changeout) and were too complex in design for the simple purpose they served.

Only one major complaint was voiced by a majority of the crewmen. Getting into and out of the sleep restraint through the neckring was inconvenient, awkward, time consuming and potentially hazardous in the event of a real emergency.

The Skylab sleep compartment was discussed in Skylab Experience Bulletin No. 3.

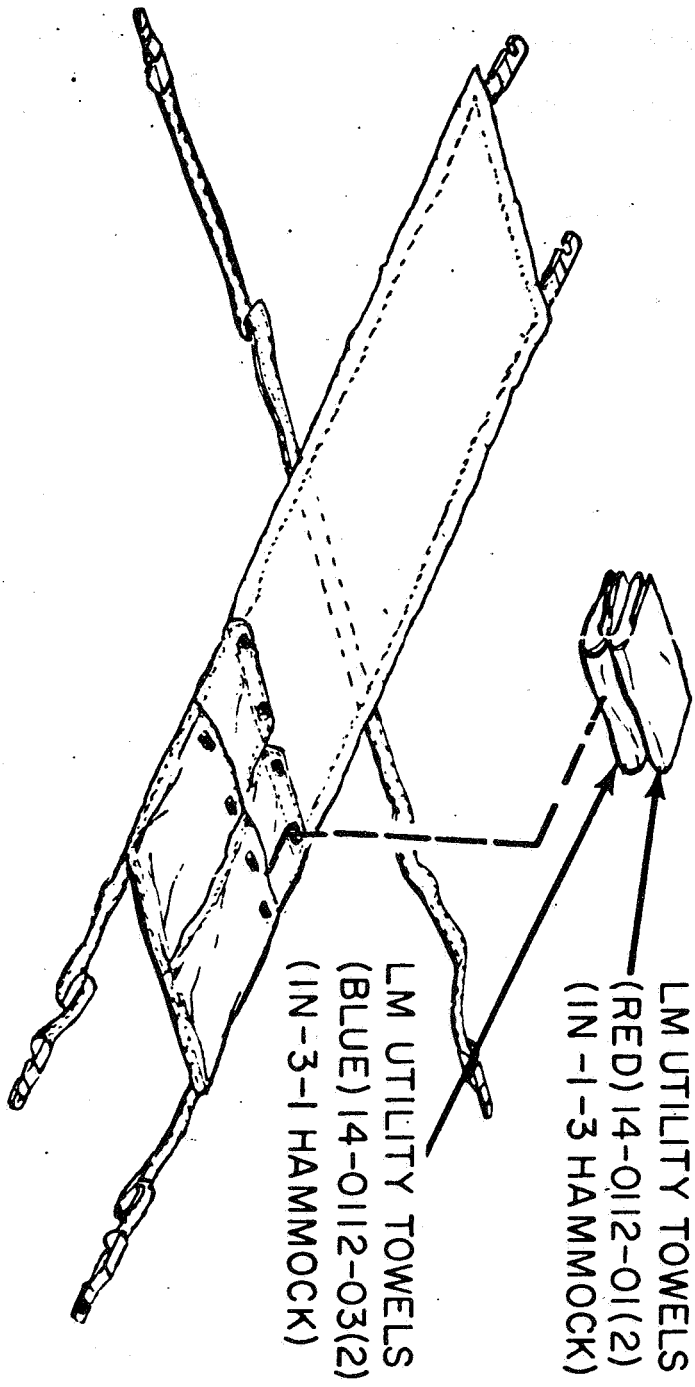
PRE-SKYLAB EXPERIENCE

During the Mercury and Gemini missions, the crewmen slept in their couches, restrained by their couch restraints. Since they wore their space suits constantly and were continually restrained, a sleep restraint was unnecessary for either thermal comfort or retention.

The Apollo Command Module employed a "sleeping bag" sleep restraint to provide warmth and retention for the sleeping crewmen. The bag was 164cm (64 inches) long by approximately 53cm (21 inches) wide and equipped with a longitudinal axis zipper. Each bag had a neck opening and was constructed of perforated Teflon-coated Beta cloth. The material was chosen because it had good abrasion resistance and met the fire-retardation requirements of the Command Module cabin atmosphere.

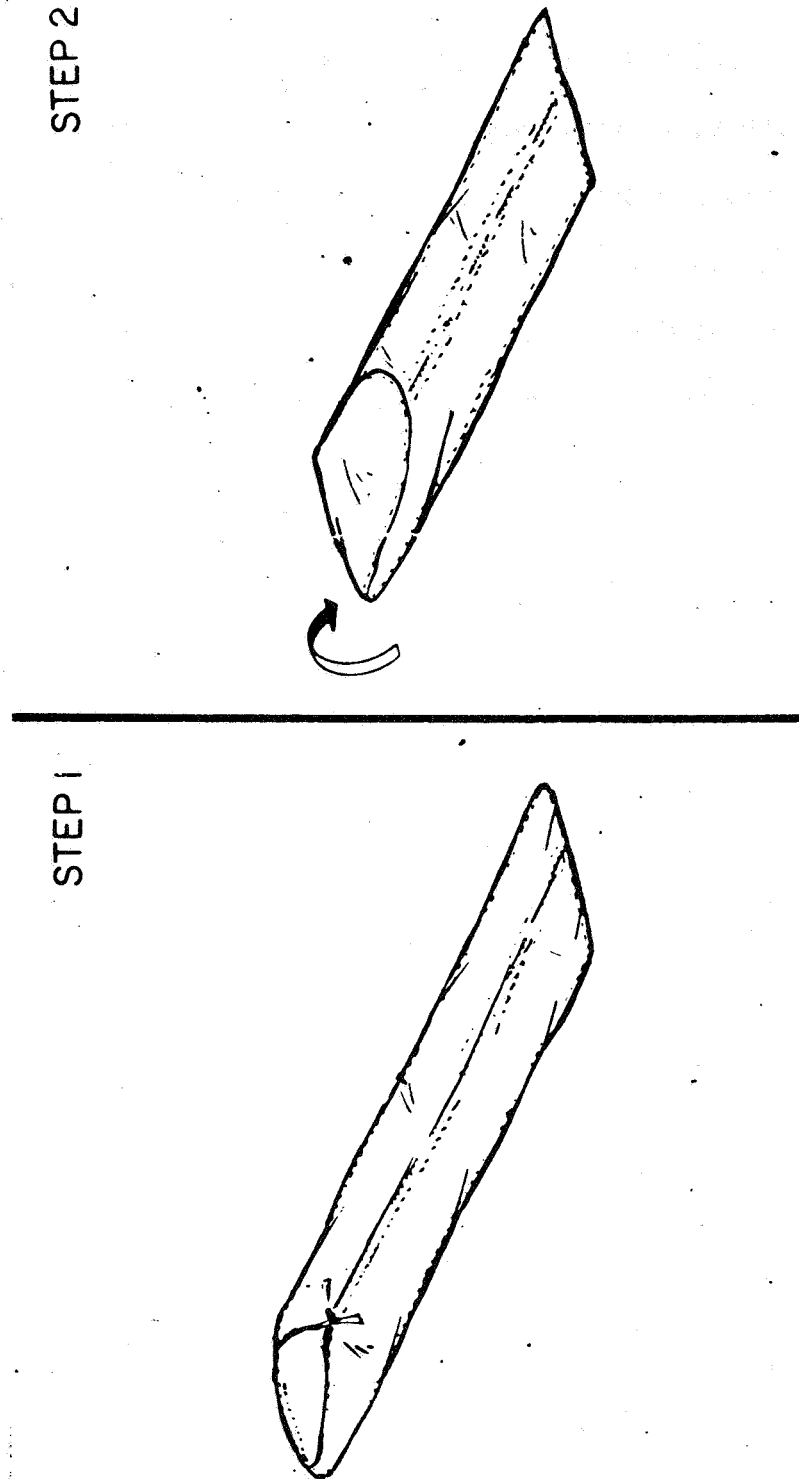
The bags had perforations of 0.15 centimeters (0.060 inch) diameter on 5.1 centimeter (2 inch) centers to provide ventilation for the user. The sleep restraint material was not very absorbant and one crewman later complained that he always felt clammy and cold in the sleep restraint.

The Apollo Lunar Module (LM) employed similar materials for the 1/6-g sleep restraint used by the two crewmen during the LM's lunar surface stay. The restraints, shown in figures 1 & 2, were strung hammock-style within the cabin.



LUNAR MODULE HAMMOCK

FIGURE 1



LUNAR MODULE SLEEPING BAG

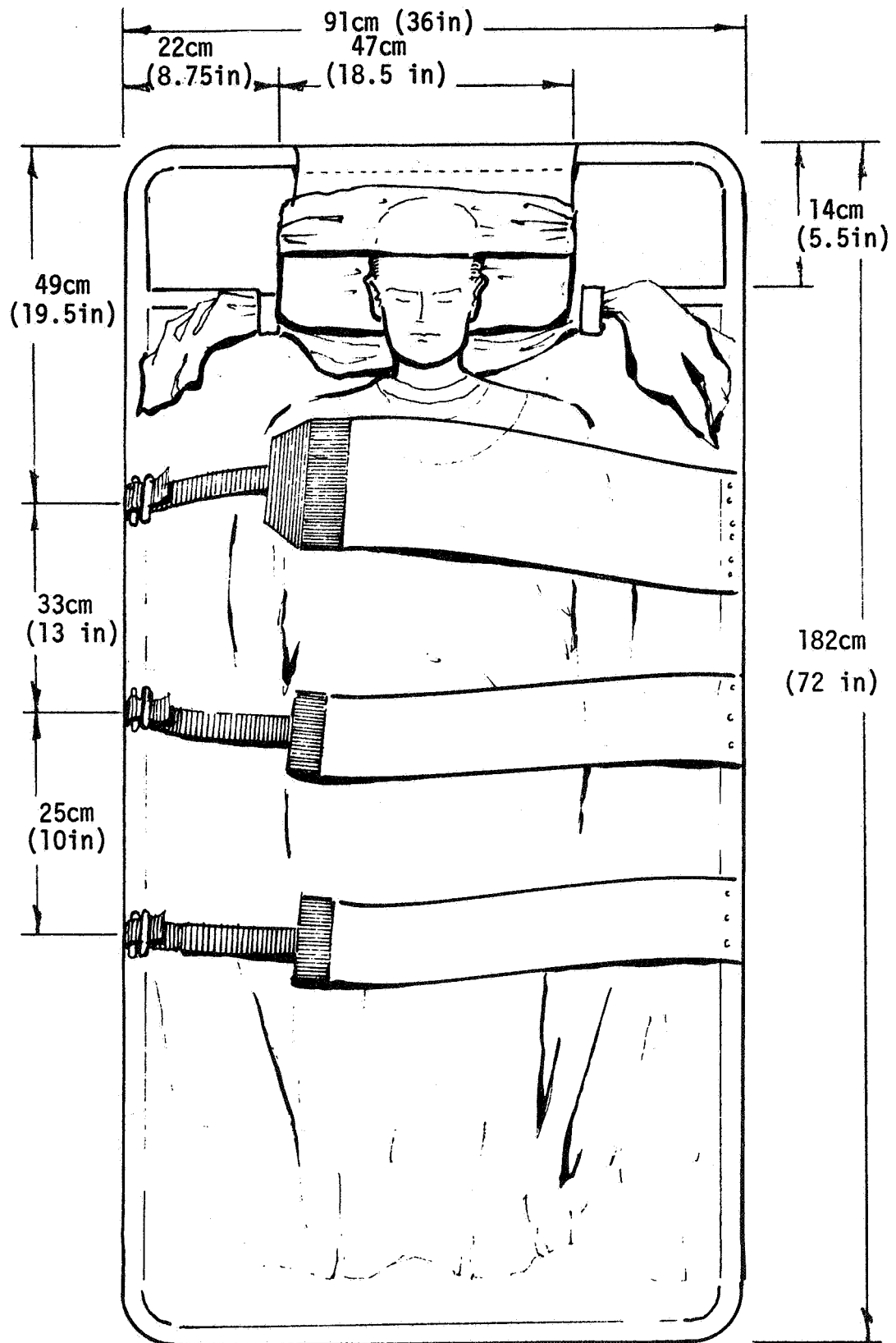
FIGURE 2

SKYLAB DESIGN

The Skylab sleep restraint provided thermal comfort and positive body restraint for the sleeping crewman. It was attached to a support assembly which was mounted vertically in each of the individual sleep areas. The support assembly had 10 mil thick, perforated armalon fabric mounted on a metal frame which was 91cm (36 inches) wide by 182cm (72 inches) high. The fabric provided firm body and head support for the sleeping crewman. Figure 3 indicates the overall dimensions of the sleep restraint assembly.

The sleep restraint itself was a PBI netting attached to the support assembly. The netting material was selected to provide ventilation. It had arm slits to provide the crewman with arm freedom and a neck hole for his head. The neck hole was large enough to serve as an entrance and exit into the sleep restraint. Figures 4 and 5 show the sleep restraint being used. A PBI overblanket was attached at the foot of the sleep restraint and could be zipped up as far as the crewman desired. It provided additional thermal comfort as desired. Figure 6 shows the overblanket zipped up to the users's waist.

The support assembly had a head rest with removeable pillows to give the user adjustable head support. It also had an adjustable, elastic strap to provide positive restraint for the crewman's head. Three adjustable, elastic straps were attached



SKYLAB SLEEP RESTRAINT

FIGURE 3



SKYLAB SLEEP RESTRAINT NETTING

FIGURE 4



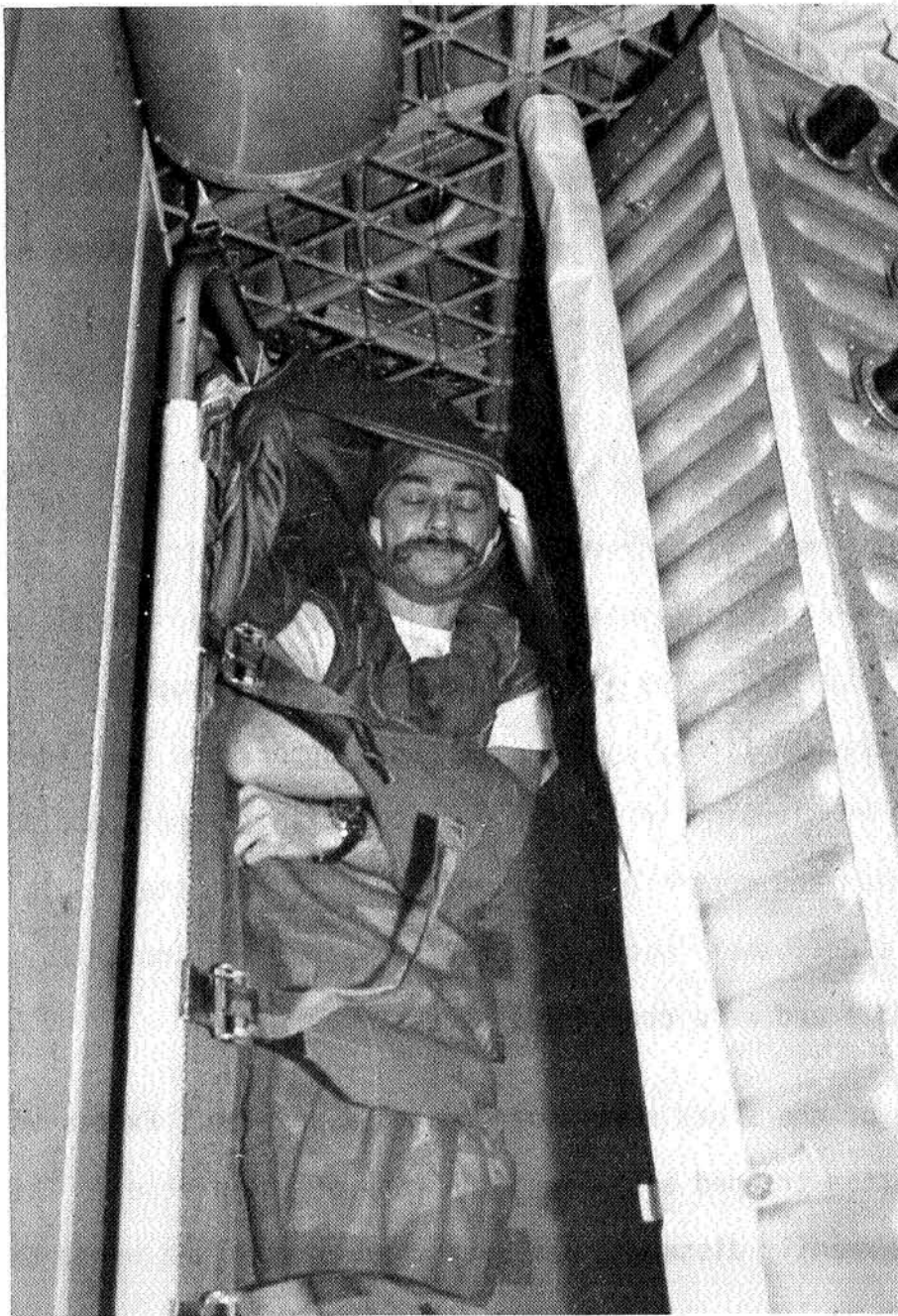
SKYLAB SLEEP RESTRAINT NETTING

FIGURE 5



SKYLAB RESTRAINT THERMAL COVER

FIGURE 6



SLEEP RESTRAINT BODY STRAPS

FIGURE 7

to support the assembly, providing the crewman with positive full body restraint. Figure 7 shows a crewman employing the full array of straps available in his sleep restraint.

SKYLAB EXPERIENCE

The Skylab air-to-ground transcripts and post-flight debriefings have been compiled and analyzed along with in-flight movies and still photos to ascertain the design adequacy of the Skylab sleep restraint.

General

In general, the Skylab crewmen liked the sleep restraint. It was compared very favorably with the Apollo sleeping bag and sleeping without restraints. The strap arrangement, when properly adjusted, held the crewmen firmly against the back support and gave them the sensation of sleeping in a bed. They could shift their bodies to any position and most of the crewmen reported that they could sleep on their sides, their back, or their stomach. The arm slits were very useable and were considered necessary.

The shape of the sleep restraint created a problem. Excess volume at the bottom trapped air around the legs of the sleeper. This air would not readily dissipate and when the workshop was warm, the excess air would become uncomfortably warm. When the workshop was cooler, there would be too much air to warm readily. One crewman solved the problem by using safety pins to reconfigure the netting and reduce the volume.

Some of the crewmen felt that the sleep restraint was too complex and difficult to use properly. One comment was "it looked like it was designed by a committee". Several of the crewmen modified the restraint to suit themselves by trimming away excess netting with scissors.

Part of the dissatisfaction with the complexity was due to the packaging and labeling of the various pieces. The procedures for installing the sleep restraint specified each piece by name but the pieces were labeled with serial numbers rather than nomenclatures. Unless one was quite familiar with the equipment, it was difficult to identify each item. The packaging was labeled as to location, but not by specific item. This caused a certain amount of unpacking and repacking of items to find the specific item desired.

The following references contain general comments about the sleep restraint:

<u>Reference</u>	<u>Appendix Page Number</u>
1	1
2	2
3	3
6	8
7	11
8	19
9	21
10	23

<u>Reference</u>	<u>Appendix Page Number</u>
11	24
12	26
16	32
18	34
21	38
22	39
23	43

Head Rest and Pillows

The use of the pillow and head rest varied with each individual. Only one crewman felt that it was in the way and didn't use it. Others utilized it in various ways. Figure 6 shows a pillow in use. The following references contain comments about the pillows:

<u>Reference</u>	<u>Appendix Page Number</u>
2	2
4	5
5	6
10	23
11	24
12	26
17	33
20	37

Restraining Straps

The Skylab crewmen all used the body restraining straps and liked them very much. The most frequent comment was "it makes you feel like you are laying on something". The elasticity was apparently very good and the adjustability permitted each individual to vary the pressure to suit himself. Three crewmen would have liked at least one more strap, while one would have liked a full body sheet of stretchable fabric instead of the straps. The use of the head restraint varied with each individual. Some crewmen used it all the time, some of the crewmen used it part of the time, and some of the crewmen used it not at all. Figure 7 shows all the restraints being used. One of the crewman reported that the restraint straps served as an excellent temporary restraint for holding bulky items removed from the storage locker in the sleep compartment.

The following references pertain to the restraint straps.

<u>Reference</u>	<u>Appendix Page Number</u>
2	2
3	3
6	8
7	11
8	19
9	21

<u>Reference</u>	<u>Appendix Page Number</u>
10	23
11	24
12	26
13	28
15	31
18	34
19	36

Blankets

The use of the blanket combinations available varied with the individual crewman and the temperature of the spacecraft. Generally, the crewmen used only the "thin blanket" or the net. When the spacecraft cooled down sufficiently, some of them would use the additional blanket, at least partially. One crewman didn't use it, he merely put on long underwear when the temperature warranted it.

There seemed to be some confusion as to nomenclature. Few crewmen used the same terminology when referring to the blankets. There was even a bit of confusion on how to install the over blanket. One crewman used safety pins to hold the blanket in place.

The following references contain comments concerning the blankets.

<u>Reference</u>	<u>Appendix Page Number</u>
4	5
5	6
6	8
10	23
11	24
12	26
18	34
20	37

Neckring

The only controversial portion of the sleep restraint was the entrance and exit through the neckring. Five crewmen voiced the complaint that it was too difficult to get in or out of the sleep restraint. One crewman even enlarged the ring with scissors. Apparently, the hole was nearly always large enough but the proximity of the ceiling made it extremely awkward and difficult to negotiate. Figure 8 shows a crewman getting into the sleep restraint. The following references address the problem of the neckring.

<u>References</u>	<u>Appendix Page Number</u>
7	11
17	33
18	34
22	39



CREWMAN ENTERING THE SLEEP RESTRAINT

FIGURE 8

CONCLUSIONS/RECOMMENDATIONS

1. Retain the favorable characteristics of the Skylab sleep restraint:

Adjustable, flexible restraint straps

Arm slits

Adjustable/removeable pillows

Adjustable thermal protection

2. Improve the shape of the sleep restraint to reduce excessive trapped air.
3. Consider the installation, proximity of ceiling and walls, and ease of use when designing entrance into and exit from the sleep restraint.

RAW DATA APPENDIX

<u>REFERENCE</u>	<u>SOURCE</u>	<u>PAGE</u>
1	SL-1/2 Dump Tape 151-09, Page 4	1
2	SL-1/2 Dump Tape 154-06, Page 7	2
3	SL-1/2 Dump Tape 160-01, Page 1 & 2	3
4	SL-1/2 Dump Tape 167-04, Page 1	5
5	SL-1/2 Dump Tape 167-04, Page 3 & 4	6
6	SL-1/2 Technical Debriefing, Page 18-5, 6 & 7	8
7	SL-1/2 M-487 Debriefing, Page 4, 5 6, 7, 8, 9, 10, 11 & 12	11
8	SL-1/3 Dump Tape 222-01, Page 4 & 5	19
9	SL-1/3 Dump Tape 222-01, Page 20 & 21	21
10	SL-1/3 Dump Tape 223-08, Page 9	23
11	SL-1/3 Dump Tape 239-01, Page 5 & 6	24
12	SL-1/3 Dump Tape 239-01, Page 19 & 20	26
13	SL-1/3 Air-to-Ground Tape MC-2122/3	28
14	SL-1/3 Corollory Debriefing, Page 10 & 11	29
15	SL-1/3 Corollory Debriefing, Page 29	31
16	SL-1/4 Dump Tape 321-03, Page 17	32
17	SL-1/4 Dump Tape 338-02, Page 12	33
18	SL-1/4 Dump Tape 344-06, Page 30 & 31	34
19	SL-1/4 Dump Tape 347-05, Page 4	36
20	SL-1/4 Dump Tape 347-09, Page 3	37

<u>REFERENCE</u>	<u>SOURCE</u>	<u>PAGE</u>
21	SL-1/4 Dump Tape 365-10, Page 15	38
22	SL-1/4 Technical Debriefing, Page 5-22, 23, 24 & 25	39
23	SL-1/4 Technical Debriefing, Page 7-6, 7	43

SkyLab Dump Tape 151-09
Time: 1831 to 2011
Date: 5/31/73
Page 4 of 6

19 24 16 PLT

It's fairly difficult to press down on it especially a juice bag which is pulling and unpleating. It's accordion style at the same time. I think we need some sort of small finger hole right around those water dispensers. Water gun works and is easy to use. It takes about 3 shots of water before you get chilled water but that's alright. The fruit J is worked out fine. The beverage dispenser are too small. The accordion dispenser that you put in there for each accordion container we put in there seems to be around 1.05 times as door is designed. The doors need to be about 10 percent bigger than they are. They're hard to open - hard to close - hard to get drinks in and out of. The Cheesing dispenser works find. The eating utensils have worked find. It is a necessity that they be held magnetically and the teaspoon I think is too small. I brought my large spoon down out of the

command module. The swing is called the sleep restraint is extremely useful. Once and all and very good I think. It is quote - Y - unquote in any position you want. Your back, your side, on your stomach, as many covers as you want. It's all been quite nice. Trans air lock - is all right. Right now the opening seals in the lid are in very good shape. Plus it takes a pretty heave. You have to lie down astraddle of it and really muscle and twist down on it in order to release the interlock so you can get the lid lock up over where two people have to use it. We have also taken to - taken our urine bags and folded them double and wrapped them in 5 or 6 turns of gray tape. It was because we had a slight palpitation the first night in and we dumped some urine bags from the command module and evidently they had quite a bit of air in them than these urine bags have had. But we've put it in - put the urine bags in, dumped the air lock, tried to push it out with the ejector and it would only move - it hardly

Dump Tape 154-06

Time: 16:23:21 to 17:46

6-3-73

Page 7 of 8

Putting them on ... except that ... the little nozzle's flopping around and ... really not too satisfactory. The water had air in it. There's no doubt about it that every one of the drink's full of air bubbles and ... caution if you have air bubbles ... drink it right ... air bubbles ... Yes, the salt sprays out okay, if you like liquid salt (Yawn) and it's better than no salt at all. They're a kind of a pain in the neck. You ... pull open, and I prefer cutting because when you pull them open there's no telling which way they're going to spray. When they're cut open they spray fairly uniformly ... The utensils are fine, although I find that I can use both a bigger fork and bigger spoon ... Skylab-sized knife, for, and spoon set.

16 48 16 CDR

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

16 49 55 CDR

Vacuum - vacuum cleaner I have not as yet used. And the wardroom table one might say we collect there in flight and work there right on our log books and so forth ... and I think the wardroom table is excellent. That ends the M487-3 Alfa debriefing.

Skylab Dump Tape 160-01
 Time: 01:03 to 02:16
 6-9-73
 Page 1 of 7

01 04 45 PLT ... JOP 12, ... block 11, the reading on
 dector 3 when we tweaked it up was 9000 as
 opposed to ... of less than 1000.

01 35 44 SPT Tape recorder, the SPT, with another comment
 on ATM operation. The active region 31 which
 is - was quite ... in H-alpha also turned out
 to be rather bright and prominent and ... XUV
 either we ... and we have is very clearly ...
 it looks as if it's a flare, and it's gone.
 So this makes me think that flare has ...
 if you can ... in XUV.

01 43 27 PLT Hello, B channel, this is the PLT with ...
 for the night. I'll send you a ... report ...
 75, Bread, was one of the two slices was
 eaten. For lunch meal 65, corn was deleted
 and potato salad was ... All I did was eat.
 All the snacks were eaten, except item 62,
 coffee. Total Delta water was plus 1.0,
 optional salt, zero. That's it.

2B

CREW ...

SPT Okay. ... How adaptable are the various
 compartments for ... uses beyond their design
 functions, e. g., does the sleep compartment
 double for off-duty reading, et cetera.

CDR Yes. Frankly, we haven't - our schedules
 been such that we really haven't used the
 bedroom ...

SPT Oh, I - -

CDR Yes.

SPT As a bedroom ... functions very nicely.

CDR Yes. Yes, I understand that and - -

CREW ... hining in that ...

CREW ...

SPT (Laughter)

Skylab Dump Tape 160-01

Time: 01:03 to 02:16

Date: 6-9-73

Page 2 of 7

CDR I don't think we have much of an answer to the question. I - I don't think we have ... - -

CREW The answer is - -

CDR - - the compartments for anything other than what they were designed to be

CREW That's right, we can't answer it.

SPT How adequate are the sleep restraints for sleeping. Is it useful for anything other than sleeping? If so what?

PLT ...

CDR ...

02 06 50 PLT I think it's been very good for sleeping, I like the soft elastic restraints, and I wish there was one more of them. The only other thing that I know of that we'd use them for, is when we grab one cover, over the LCG last night, ready to pick up more ... the wall.

SPT Yes. I like the restraints, it's excellent, it really is.

CDR Yes, I do too, I like it better than sleeping in the Apollo bag, I find that I sleep with all four positions that I normally sleep in on the ground. I start out with what you call, my back, and roll over on my right side, and sleep with my right side to the back of the bag for awhile, and then roll all the way over on my stomach, until my stomach's at the back of the bag, and then sleep on my left side which is exactly what I wanted to be able to do. Plus I can assume a more comfortable position in there, for relaxation, ... than the one that you assume when you're in zero-g you relax. You can move your legs, ... your back, or do something with it, and - and it will stay there, because of the straps, and I find that much more comfortable, than ... in the bag.

Skylab Dump Tape 167-04

Time: 1105 to 1150

Date: 6-16-73

Page 1 of 4

487-3C

11 24 51 FLT

Hello, friendly tape recorder, it's the FLT with the 47-3, this day, evaluating the frequency of use. Okay, starting with the jacket. Used it almost daily. You got to keep in mind, we're in a little of nominal situation although basically nominal, that is with IDA heaters on. There was a span of about 2 or 3 days ago which - the middle of which, was about 3 days ago. The span of 2 or 3 days, the middle of which was about 3 days ago. ... the IDA was warm enough that the jacket was not required. However, there was before that, and as it is now, we're - have the IDA heaters off in order to help keep the workshop temperatures down. Therefore, it is warm in the workshop and chilly in the IDA and a jacket is an extremely useful item. The IV boots, I prefer them - much prefer them to the triangle shoes and wear them everyday at every opportunity, but I do not require the triangle shoes. The IV gloves, I have only worn one time and that was on our initial entry into the hot, hot workshop when we were handling the extensions on the sail. I have not used them since. The bump

hat has not been out of it's locker. The pillow on the sleep restraint - sometimes I used it and sometimes I don't, I haven't really decided. Blankets, I have not used at all. The light baffle I have not put up, since I have not been sleeping in my sleep compartment, same with the private curtain. Penlight is used almost everyday and carried at all times. Scissors is used everyday, is kept at the meal table and was used - mostly, almost exclusively, is used for opening food packages and also for trimming the teleprinter messages. The tool caddy was used during activation. I found it fairly handy at the time, it has not been used since. I don't miss it. The portable fan, we have used the portable fan. It goes along with the - my time estimates on when the IDA heaters were on. When the workshop was

Skylab Dump Tape 167-04

Time: 1105 to 1150

Date: 6-16-73

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put it back. The Energym, we have used on and off not very much. I wanted to try to set it up to do what is called to Energym and exer-jeanic people to think four, which basically is started at squat, and pulls through, and winds up erect as it were. We have seen on some surface, the arms extended fully overhead, there is not enough line. We don't have the right kind of handle on it and we - the biggest drawback is not enough line on the Energym, therefore, it has not been used very much. The binoculars we have used at almost every opportunity. We did carry up an extra set in our command module so we could look at the workshop and we have used both sets. We have been using two sets at the same time. And the off-duty windows, the only thing I can say about that is, there are not enough of them looking in the right direction and they are not large enough. The wardroom window is nice and large, however, now we are at high beta angle it's looking out at the southern horizon. We cannot see below us out of that window anymore and besides that window has a big ice spot in it now, as you are probably aware. And we need - we ought to have bigger and more - more windows like the wardroom window in the workshop. STS windows are - they're very good, however they are obstructed very much by external structures to the vehicle. That's all, thank you.

11 33 22 SPT

Friendly tape recorder, this is the SPT with M487-3 subjective evaluation of the following items for frequency of ^{use} use. The jacket is used daily, every other day, depending on how long I'm spending in the 'DA, the cold part of the vehicle. It's not on all the time and I wouldn't be without it. I use the IV boots very seldom. I haven't used them for 2 weeks. Use the triangle shoes all the time. The IV gloves, I haven't even found. The bump hat, don't know where it is. Use the pillow all the time, however, I do not very often use the little knit thing that flips over your head. I've evaluated it, I haven't

Skylab Dump Tape 167-04

Time: 1105 to 1150

Date: 6-16-73

Page 4 of 4

decided whether it's useful or not. Use the - the thin blanket all the time, the one you crawl in through the neck of, all the time except the first 4 or 5 days when it was too hot to use. I have not used the other blanket except the bottom blanket I tipped up a couple feet on one occasion when it got down to 72. I have not used the light baffle, use the privacy curtain every night. Use the penlight daily, not very frequently and for long periods of time. For instance, to go to the bathroom at night, in the earlier morning looking at the PRD's to read them, you need a good light and earlier in the mission when we were conserving light I used the penlight frequently. Use the scissors daily for eating, for M133. The tool caddy I used during activation have not used since, probably will use during deactivation. The portable fan, we're using the one portable fan because of our thermal problem. Other than that, they're not required. The tape player, one of them is in the wardroom, one has been strapped up near the ATM, use both of those. Have never used the headset, have never used the microphone, have never used the playing cards. I read a little every night before bed, as is my habit. Have never used the hand exerciser. We use the balls for fun about once a week. The dart set was tried once, doesn't work. The Energym I don't use. The binoculars are used every day for looking out the window and we use all the windows at every opportunity. And that's the end of evaluation.

11 37 04 SPT

B channel, SPT, let me finish my EDC1. ... Photographs were taken, and they are on the same roll that the previous ones were. Namely, color interior number 23, which however, failed to rewind in the camera. I took it in - in my bedroom and made myself a little darkroom out of a bag and I wrapped it in mular tape and I hope that those pictures will come out okay. I took the final picture, number 15, on the new roll, color interior 31. The ones that showed growth were 7 and 9 as previously only they're bigger - they have scalloped edges and a dark center. They're multicolored and 13, and 14, and 15 which are very light colored, very tiny colonies no numerous in number. And that's the end of the report.

END OF TAPE

CONRAD
(CONT'D)

that anybody moving around, as Joe says, is going to wake somebody else up. It is really quiet in there. One other thing. When we shut off all our lights and closed the workshop window and the windows up in the MDA, that was real night in the vehicle. It was good and black in there.

The other comment is, if you get up in the middle of night to go to the head in that configuration, be careful, because you have no sensation of movement and you can slam into things or get lost. You don't realize that your body is pitching or anything else until you start moving around the vehicle. And the next thing you know you're in the wardroom against the wall instead of the head. It's really weird. It's also weird for the other guy who wakes up and this white apparition is sliding by his sleep compartment in the night, very quietly.

I personally thought the sleep restraint worked very well. Surprisingly enough, it turned out that my geometry was such that as I was lying on my back and I pulled the three restraints in to straighten my body out, that pulled my head against the pillow. Completely relaxed, there was just a slight pressure, with my neck muscles barely pulling my head onto the pillow, and I really had the sensation I was sleeping on a bed on the ground with my head comfortably against the pillow. Then I found that there were ways that I could turn sideways in the sleep restraint and, by getting one shoulder a little bit past

CONRAD
(CONT)

the 90, that also would do the same thing to my head. It would make it logically rest on the pillow, and I never used the overhead thing to hold my head on there. This is strictly an individual thing.

KERWIN

I used it sometimes and sometimes I didn't. I thought that if I had to redesign it, I would make it even lighter and even more elastic at the bottom, so that it was a very gentle restraint. I would have put one more elastic band in the middle. Those were of a nice elasticity. You could tighten them or loosen them just the way you wanted them.

WEITZ

All in all, I thought the sleep restraint was excellent.

CONRAD

Well, let me comment on one other phenomenon. I don't know if the other guys noticed it or not. I slept most of the time with just the net, until we got down to the 72-degree area for about 3 nights, and then I slept with a blanket partially up. But you have no convection. And the net would trap the air around your feet. I noticed this especially in the lower extremities. And then your body would heat that air up. And even though you didn't have a blanket over you, because there is no convection, you had this warm air ball around your legs. It was really weird. If you got hot, all you did was stir your legs, which would move the air out of

CONRAD
(CONT'D)

there, and then you'd reheat new air. But the air doesn't move. It doesn't circulate if it's not in the path of some blower air that's going through there. We had different thoughts about arranging the little duct in the bottom, which blew air up past your bed. I had mine off the wall, because if it blew it on my feet, I got too cold. But I could very definitely tell there was no convection there.

WEITZ

I'm a little more warmblooded than you. For about 3 days there, I used the outer blanket, but only about up to the knees, just enough to keep my lower legs and feet warm. I never got under the net, because it was uncomfortable. I got too warm. Halfway through, I modified it with the scissors by cutting the net off and throwing it away. There was only a 3 day period that I anything. I just slept with my shorts and a pair of socks on. That net is really warm.

CONRAD

The Swiss Army knife was very handy. It would float out of the knife pocket, unless it was restrained. I never restrained mine; I carried it in a zipper pocket. You guys keep it in a knife pocket with a tether ring restraint on it.

KERWIN

I cut a little hole in my pants to slip the big ring through and clipped the knife on. I thought the clothing was real good.

KERWIN-

A couple other things here. I don't subscribe to the zero-g mixing theory either, because if you sniff something through your nose you create an air passage and convection through there. We all had this feeling of fullness in the head and to me that says there are changed circulatory paths that may have something to do with it. Also, I think that this diet is a rather bland diet to begin with.

MACHELL-

Okey, getting back to the prepared questions. As a result of your Skylab experience, do you have any habitability design suggestions to offer to the Shuttle Orbiter flight deck and crew quarters areas?

CONRAD-

Yeah. I think we have a fair number of those. One that come to my mind right off the bat is that the sleeping quarters ought to be very soundproof and capable of being darkened completely. I think we all enjoyed the bed more than we thought we would, but I think there are improvements that can be made in the arrangement that holds you to the bed. I don't know whether you can do it but I probably would prefer to not have straps. I think Al Bean and I were the ones who originally conjured up that bed and my original idea on that was to have a light stretchable fabric that would apply to your whole body rather than going to straps -- and

obviously the problem we got into right away was that any of that stuff that was available was highly flammable. I think it would make it more comfortable if you had it spread out over your whole body rather than having the strap arrangement.

KERWIN-

That might work.

VOICE-

The other day you described pressure points on your body at various places when you were in the sleep restraint. Would you want this sheet to apply equal pressure everywhere over your body or just to apply more in some places?

CONRAD-

Thats a very good point and I feel that if you could work it out you would probably want to vary it. The reason is because mainly if you have a piece of cloth and you bulge it out one place you are going to get tension somewhere else. If you turn sideways, your shoulders are obviously sticking up a lot so its not a simple thing to do to get away from the straps, but the concept is the more you can make you think you are laying in one-g the more you are going to be comfortable in it.

KERWIN-

In one-g the side you lay on gets the most pressure but up there its the side that sticks up the most that gets the pressure. I would have liked one or two more straps. A sheet would have taken

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care of that. Then I would have liked the option to tack the sheet closer to me at the torso points, because it would keep your arms from flapping around.

WEITZ-

I didn't like crawling in and out of it. the few times I used the net I didn't like crawling in and out of that little hole.

KERWIN-

I kept trying to crawl through the arm hole.

JOHNSON-

One of the TV shots of Pete getting out of it looked rather awkward.

CONRAD-

In my particular case the opening was fine, the awkwardness is because the ceiling is in close proximity.

WEITZ-

I'm not sure how well Jack Lousma is going to sleep in there - you are really encroaching on his height limit. Well, Joe is nearly as tall as Jack.

KERWIN-

I'm as tall as Jack is although I'm not as muscular and the only time it bothered me was when I had the M133 sleep cap on -- and that extra inch did it, the top of the preamp scraped the ceiling when I turned my head.

CONRAD-

When I got down to where my feet were touching the floor my head wasn't on the pillow.

KERWIN-

I agree with Pete that the sound is very important. If you can't structurally mask the sound because of weight considerations you might want to consider masking it with white noise.

JOHNSON-

The orientation is very important to us. We had speculated that some people might find it uncomfortable to sleep vertical with respect to other orientations and I believe Paul made some comments on that. This sampling is very poor, but nevertheless its a data point and at the moment we would tend to try to avoid that arrangement in the Shuttle. It has a lot to do with the architecture in the spacecraft, whether that is a real effect or not.

WEITZ-

I eluded to that as contributing to my leaving the sleep compartment, but I think that was before I really learned how to use the sleep restraint. What I would up doing was taking about two of the pillow inserts out because lying on my back my head was like this. [BENT FORWARD IN A CHIN DOWN MANNER] and that contributed to the illusion of hanging from the wall. But when I moved back in I didn't have any problems at all sleeping. Even when I was sleeping in the forward area I would wake up on my side and things weren't where I expected them to be and that didn't bother me at all.

KERWIN-

The solutions are all visual and you structurally might do some clever things with the sleep compartment to make it appear horizontal rather than vertical.

CONRAD-

Thats OK if you can do it but I don't think its necessary. I'm going to go back to sleeping in the Apollo sleeping bag. I've got two reasons why I didn't like that (1) I don't like the free floating position from a muscular point of view, although on a long duration flight I'm not sure but what one may adapt to that -- (2) I'm on the cold end of the spectrum and even in Houston on a summer night I wear a tee shirt and prefer sleeping with a blanket because I really power down. I tended to get cold in the Apollo bag because the Apollo clothes were clammy because they didn't absorb at all. That kind of material tended to float away from you, it tended to take its own shape and you floated inside the clothes and inside the bag and I was always cold in Apollo, thats what I liked about Skylab --- it did two things (1) it straightened out my body -- and I don't attribute that affect to not just having gravity there - but thats not bad. I don't want the body straightened out because it makes me think I'm sleeping on the ground - I want to distinguish that very clearly I'm perfectly happy to float up there - its muscular. And the other thing (2) is that I like to have something around me when I'm sleeping. Even before air conditioning I was one of these

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guys that couldn't sleep without at least a sheet over me. I can't sleep in the open air because my heart rate goes down in the low 40^s and my metabolism powers down and I get cold. So I never had any of these illusions, I don't care which way you stick the bed up there. That doesn't make any difference anyhow.

KERWIN-

I was thinking about how you arrange the locker openings and the lettering and so forth.

CONRAD-

Frankly, before I went to sleep I liked the illusion of hanging because I don't like lying in bed reading flat on my back and I was now on my back hanging on the wall and it seemed much more natural because I would hang there and read my pocket book and listen to music on the ear-phones and it seemed, much more natural to be hanging on the wall doing that, it made me think I was sitting up and reading.

BOND-

Paul, why did you move back into the sleep compartment after you had been gone awhile?

WEITZ-

Because it started getting hotter up forward, I'm at the opposite end from Pete, I'm very warm, apparently. When they were still sleeping in the command module and I was sleeping in the MDA in the sleeping bag on nights [!]203 I found it very comfortable there even though the air temperature was in the order of 60 or the high 50^s.

I moved out of the sleep compartment because of a combination of heat and not being familiar with the sleep restraint and that air blast coming from the vent in the floor. Anyway, it got hot in the forward area once we got to the high beta angle and I could feel the walls radiating at me and it was uncomfortable even though I was just laying there. By that time I had cut the netting off, I didn't use the netting anymore after that and it got uncomfortable because when you turn over, which all of us did, I think, you get all tangled up in the netting - like the tangles you used to get in these washing machines when they first came out -- so I took the scissors and flat cut that off. Laying on the bare bones sleep restraint in my ^{SKWIES} ~~seintes~~ and I was too warm, so I moved back into the sleep compartment.

CONRAD-

I managed to sort out sleeping. I used to fold my arms inside the bag and I could ^{do} 360° in there but I was always kind of aware of when I was doing it and I was keeping the bag sorted out. If you go to the stretch sheet approach the guy won't have that problem, he can sleep with his arms in or out.

KERWIN-

Still put the arm holes in though, they are very useful.

CONRAD-

Yes.

CONRAD-

Am I the only one that used the blanket?

WEITZ-

The outer blanket?

CONRAD-

YES.

KERWIN-

I pulled it up about my knees once.

WEITZ-

About the time we bottomed out on the temperature curve in the workshop I used it to the extent ... that I pulled it up to mid thigh, for about two nights. I used it mostly as a lower limb restraint.

CONRAD-

The first time I used it I found out that because you don't have the convection boy does it really trap the heat. I had it up all the way and I had to take it back down to where it was about across my thighs and bulged it out. You collect body heat in there and it just gets hotter and hotter and you have to stir your legs to get it out. Whoever thought up putting the netting in there, I don't know if they thought of it for that reason but thats what made the netting work perfectly because in effect its almost a blanket.

MACHELL-

Let me ask you another general question about the sleeping area. Do you advocate or like the idea of individual sleep compartments, does this seem like a good idea or even a necessity for future programs or would you prefer a more open hospital ward or bunkroom type arrangement?

WEITZ-

You definitely don't want the bunkroom type arrange-

wetpacks are real losers. I think there are, uh, some other things that are well designed in the spacecraft. I think the general, uh, wardroom, uh, eating arrangement, uh, the way that the food is reconstituted, and so forth, and the table in the center works very well, and the water gun works good. I have no complaint about the way the food gets heated, the tray. I think that's good. And the layout of the pantry is also good. And it's a super idea to have the freezer in the pantry there because the frozen food is kind of the highlight of the day. I think another great design is the, uh, uh, the wastemanagement system. It's, uh, essentially a no mess operation. And, uh, the only thing that takes a little time - It takes 30 seconds to have a bowel movement and about 10 to 15 more minutes to log all the data and, uh, snap the, uh, new bag in place. So that, uh, installation of the new bag could be designed in a more efficient manner. One of the systems that does bug me on the spacecraft is the video tape recorder. Any time you want to video tape something you have to go and turn on the recorder that, uh, you have to go and turn on the recorder which is way up in the MDA. So that, uh, when you've got various scenes that you want to take down in the workshop, you've got to work from clear up in the MDA to get them on the tape. And when you want to turn them off, you've got to go back up there and turn them off. There ought to be a switch down here somewhere where you can - down in the wardroom area where you could uh, turn the video tape recorder off.

Uh, Al, do you have any comments? Oh, by the way, the sleeping bags are really good. I, uh, enjoy sleeping in the - uh, in the sleeping bag. It's uh, I think the design, uh, is very good, particularly with the, uh, is very good,

the, uh, elastic straps. It kind of makes you feel like you're, uh, uh, laying against something and, uh, I, uh, sometimes sleep on my side or on my back or stomach and it's kind of like at home. It's, uh, very comfortable and convenient sleep. The temperature's just right, also.

222 02 12 25 CDR

Uh, one of the things I think is good in here, ... , is, uh, the general - the general, use of colors and, uh materials. We've noticed that the - the workshop stays extremely clean. About the only thing that gets dirty is that a ... opening sometimes causes spirts. For example, any of the ..., it'll expand the gas slightly, and then when you place the membrane in the top, food will fly out. Now food flies out when you're eating it sometimes, but mostly the, uh, former rather than the latter. But that'll get on the walls, but this material is fairly easy to clean. And it just doesn't seem to ruse. It doesn't seem to collect dirt. There doesn't seem to be much in the way of housecleaning to be done other than the ... from the food spots. I guess. And then, uh, uh, cleaning the screens you have uh, from the fans that blow the air around. Now those turned out to be pretty easy to clean because they're all conveniently located and I think that's been a very good sign. If we're careful, the only fans we use have the right diameter screens on them and also have easy access to cleaning because it looks like everything we're going to - picked up there, particularly if you have a good airflow. Now Jack indicated that he thought the temperature was okay. Well, I felt that I - it had been a little warm. It's been up in the 80's. My personal feeling is that we'd like to have

Dump Tape 222-01
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we had the stuff nearly ... And that really makes it much better for us. Space food ... and we're certainly available ... makes it much more palatable. ...

222 02 38 55 PLT

What significant improvisations (procedural, equipment arrangements or modifications) have you accomplished as a result of adpting to living and working in zero g?

222 02 39 07 CDR

Well, I made a significant improvement, I think, in our sleeping quarters. The air is at the bottom. I've taken my sleeping bag and mounted it upside down, and I sleep that way, and it does definitely improve the flow of air. It doesn't come from the top of you and flow down past you, instead of coming up from your feet into your nose, into your mouth. I found it is effective for the dryness in my nose, it made it much more moist and I found I was able to sleep better just because I was closest to the air vents and was able to control it. It made it easy to lean out and touch the vents and move them around. I think that that's a significant improvement. Another one is the - the bedclothes themselves behave a little more like Earth. They're a little big baggy down at the toes, makes them a little bit more Earthlike. And the strap that holds us in, they're excellent. Particularly the one around the head. ... to add so I doubled it under itself and also ... the headband arrangement. It has now a really - a rather poor ... and come out with it sort of belted ... to it and I sometimes think - I think that ... come out with a better ...

Dump Tape 222-01
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and connector belt. ... with
modifications significant ... it
comes to a number of spacepads.
... as we all pointed out ...
better operation ...

PLT ...

PLT Yeah.

222 02 40 56 CDR Okay, we got too many jacks, power
cables and TV power cables strung around
the workshop. We got - and we
got to have - we got to have those
things built into the wiring
someplace so that they could reflect
directly in the way they reflected
other appliances and things. ...
the wire around it ... want to do that
or a tape recorder or a TV camera
or a blower. Looking around the
workshop ... 6 foot, 12 foot cable
... after the workshop had already
been configured ... There was no
way to think of everything and you
want flexibility, so need to make sure
the cords themselves have some sort
of adhering quality. I don't
mean - sticky - I mean every so often
on the cord is a little plug that
sticks in the hole on the triangular
grid or some sort of little clip
hook that snaps front that you could
lean above the - hook on, that way
you could keep these cords flush.
Right now you have to go get the
equipment strap and hang them up ...

222 02 42 27 PLT One last question. How satisfactory
have the various environmental
elements of habitability been in
providing a suitable habitat.
Lighting, we just checked. Noises,
we checked. Temperature, humidity,
and airflow, we discussed all of
those. Think we feel that - that

use the command module spoon, and that's the tablespoon size, and then you have the mess half-way up the spoon; but you don't have your hands in it. So, I give the wetpacks a complete unsatisfactory and needs a little redesign. Also, the food doesn't reconstitute as well in this because there is so much empty volume, that frequently you get in there and there's the clots of some reconstituted food, particularly like cream corn.

223 23 31 02 PLT

Sleep restraints I like very well. I give it a excellent to very good. I sleep with the - only with the bedding. I guess you call it the upper blanket. I use the head restraint and I use three cushions and the head restraint. The head restraints stay on all night. I guess I don't move around too much. I don't have it on tight, just loose, loose enough to feel like I've got something from there. I think I'm going to start using the bottom blanket a little bit because it's getting a little cooler in the workshop. And I noticed that in the morning, I wake up a little chilled. I use the upper strap across the body. I've loosened the bottom one. And when I sleep in the sleep restraint, why I feel a slight pressure. I've got the strap loosened all the way out, but I feel a light pressure and I nearly sleep on my side. Sometimes, I start to sleep on my stomach or on my back. I can close my eyes and imagine myself in any position I want to, and position doesn't really matter much. First, I - the first few days of the flight I woke up with the feeling as though I was laying on my back, but I don't necessarily do that any more. And orientation is no problem whatsoever. Stand by 1 on the - this 487. I'll be back.

but - uh - doing head work. Uh - there's no way to fasten yourself down. And - uh - you don't want to go in there any more often than you have to for that reason. Otherwise, it's a

PLT

nice clean place to operate. Uh - it's - uh - not a messy place. It's quite adequate to the job we've got to do there except for fastening yourself down somewhere. Sleep restraints. The sleep restraint is - uh - very adequate for - uh - for sleeping and that's all. You couldn't do anything else there. I - uh - don't have any - uh - qualms about sleeping in the attitude you put it in. I sleep very well in the vertical position. Uh - I sleep all night - very hard. I don't wake up. I can always sleep pretty well when I get to bed. I sleep with - uh - only the netting over me. I don't hardly ever pull - pull the blanket up except sometimes in the morning when it gets cold, why - uh - I might pull it up and - uh - and - uh - doze off another half hour before getting up. But - uh - I use - uh - the two upper - uh - straps - uh - a fully loosed. The bottom strap I've taken loose. I like to have them there because they make me - uh stay against the back of the bed and - uh - and - uh - stay in pretty good position although I doubt that I'd have any - uh - trouble sleeping if I was drifting

around. I use the head restraints - uh

- the - uh - restraints deal sometimes and sometimes I don't. I use only two cushions as opposed to four. I only had two. Four's too many. Two's about right. Uh - sometimes I sleep on my stomach; sometimes I sleep on my back.

Sometimes I wake up in the morning and feel like I'm laying horizontal in the bed.
Other times I don't. I feel like I'm in some random attitude.
Uh - all in all - uh - works pretty good for sleeping, and I like it. Uh - when I sleep on my side, sometimes I put the metal strap under my rump and - uh - throw one leg up - uh - like you'd sleep on your side at home. And - uh - so - sleep-wise, it's a pretty good restraint.

239 01 48 31 PLT

What noneating uses have been found for the wardroom table? Would a design modification of the table and it's associated restraints be desirable for any or all uses? Well, we do a lot of checklist changes at the wardroom table and - uh - what we need there is something to hold the books down something you could hold the book down with and write on it the same time. And hold - uh - something else in the other hand so that - we need something to - uh - hold things down with on the wardroom table for that. One other thing, while I'm thinking about it, about the wardroom tabletop, I think that's the most miserable latch that's ever been designed in the history of mankind or before. That darn latch - uh - half the time doesn't latch up and the other half of the time it uh - uh shoves right on through, and you have to get a knife under there to break it loose. I think that's a dumb design and it ought to be changed. Next one. Well, I guess it's too late for that but - uh - I can't how such a neat ... could have such a crummy designed hatch on it. Otherwise - uh - it works pretty good. We tend to complain

anything, but - No, you do the medical work in the wardroom. Looking out the window in the wardroom is useful. Wardroom needs to be bigger.

PLT

... I don't think ...

239 02 17 26 CDR

Okay. How adequate are the sleep restraints? Excellent. Sleep restraints need more bungs. Needs a softer pillow, it needs a softer cover to hold your head to the pillow. Other than that I think it's real good.

239 02 17 38 CDR

One of the nicest things about it is the ability of it to be moved to different places rather simply and to be usable in those other places, just in case the temperatures, good. I slept up in the MDA about 4 or 5 nights because I thought it was much cooler there. Now that it has cooled off down here this is certainly satisfactory. Another disadvantage, I think, is you cannot put on - you can put only one blanket on your bung. I certainly have two, but I had to use safety pins. Another disadvantage is there's so much billowing down near the feet because your body heat won't keep it warm. So we'll - so we'll be able to - also put some pins in there to decrease the volume. That turns out to be real fine. ... you think about it. Perhaps at the foot. ... you can see probably as much - more than anyone else, that's just one of the things we

overlooked. You wanted plenty of foot room - toe room - you didn't realize it would also - -

239 02 18 45 CDR

What non-eating uses have been found for the wardroom table? We use it ... Would a design modification of the table and its associated restraints be desirable? Definitely. You need restraints on top of the table to hold different items when you're working on books and checklists.

239 02 19 02 CDR

The foot restraints are too small to house the triangle shoes. The ones - uh - the leg restraints are good and the thigh restraints are excellent with one exception. The little bars - the four little bars that come out and fit against the front and back of the thighs should be wider, so they can provide some leverage points. As they are, they're small and you tend to flop around in them - in the shoes, you see. They can be large enough to slip in and they can be nice and tight fit. You could move around.

239 02 19 36 CDR

What sanitation problems have developed and how have you dealt with them? I think everything is ... fecal ... allow you to have ... contact ... trash every day. Touch it with your fingers and then the whole thing is ... germ catching ... should be improved. ... now that we've got one behind each person. It makes it nice. Changing them - uh - every 3 or 4 days is certainly adequate.

SL 111 MC-2122/3
TIME: 15:01 CDT 51/20:01 GMT
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Reference 13

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MCC No, that's on the MS.

SPT Oh yeah. Way up on the MS. Before you'd mentioned lower thresholds on the OGI. While my impression had been either the same or a little bit higher, but I guess you've got all the data to look at down there.

MCC And on the M133, Owen, you're showing decreased stages in 3 and 4, and you're spending increased amounts in stage 2. Could you make any comments on subjective quality of your sleep? I know in the Evening Status Report you've been showing good sleep every night.

SPT Just that. I'm really impressed with how well you can sleep up here. I think that I'm getting about the same amount of sleep that I did on the ground, 7 hours or so, and you can probably tell the total down there even better than I can subjectively. But the quality, I'm really pleased with. Last night I slept right through until Jack woke up, and then I went back to sleep and dozed another half hour after he got up. And the night before it was about 7 hours straight without waking up. And I - I'm really impressed with how pleasant it is to sleep here. I find that I want to sort of restrain myself. I've always been sleeping under those straps, and with that much restraint, why, it feels very comfortable, very normal, and very sound.

MCC Okay, good. In general, on postflight predictions, we think you're doing a lot better than the SL-11 crew, and as far all our numbers go, the M092 and the M171 and that sort of thing. And we're very optimistic about how you're going to do when you get home.

SPT Well, so are we, Story, and we're sort of planning on the - the protocol on the ground to conform with that.

CC Yes sir, and after you get on the water, you might just stay in the couches a short while and get your inner ear used to the one g.

SPT Right. We - at least don't anticipate any readjustment similar to the adjustment from one g to zero. I assume that - that you don't either.

MCC No sir. And we're 1 minute to LOS. We'll pick you up over Hawaii about 13 minutes at 20:22. This will probably be the last med science conference since you'll be in deactivation on next Sunday. But the biomed science people do wish to thank you very much for your expertise in the conduct of their experiments, your extreme responsiveness, and to your inflight observations and comments, and for all the additional data that you got us running extra experiments and your instrumented PT.

QUERY How widespread were the effects of the ergometer on your ability to hear each other or to hear communications?

GARRIOTT Very pronounced.

BEAN But it was the guy that was on it. If you were upstairs and he was ergometering, it didn't bother you. But if he was on it, you always had to go around in front of him and talk to him, or he didn't hear too well.

GARRIOTT That Mark I makes a lot of noise too. If there's somebody pulling on the Mark I, it's even difficult for someone in the wardroom to hear the squawk box. You have to go within 3 feet of it to be able to hear the ground clearly, if somebody is pulling on that Mark I exerciser.

LOUSMA It really does raise the general noise level many decibels.

BEAN Does riding the bike or pulling the Mark I have a significant effect on the running of an experiment such as S019? Karl has suggested that it be prohibited during S019, but that does interfere quite a bit with normal ops.

QUERY Al, when you reoriented your sleeping bag, did it leave you with any residual problems such as lighting or the availability of the squawkbox in your compartment?

0

BEAN

Yes, it did. Therefore, Owen or Jack had to answer the squawkbox, and I just used a utility light.

QUERY

You mentioned at one point that you had to sew up your sleeping bag and use some safety pins on it; what happened to it?

BEAN

One of the disadvantages of the design was that there was excess material on the end, creating a large volume of air around the feet. In order to be warmer, I used safety pins to make the bag fit more closely and thus decreased the amount of total air to be heated while I slept.

QUERY

How did you rig that bag for sleeping in the MDA those two nights?

BEAN

I tied it down rigidly with four pieces of line.

QUERY

In one of the M487 debriefings, Jack commented that he did his morning shower-shaving-tooth brushing exercise just like he did at home, but Owen, you said that you couldn't find a good place to brush your teeth. Why?

GARRIOTT

I didn't spend as much time on that as Jack did. I never used toothpaste because it could not be ingested, and it was time consuming to find a place to spit it out. As a result, whenever there was a convenient time during the

QUERY

Not even during the evening in the sleep restraint?

BEAN

We all used the straps and tended to straighten ourselves out a little bit and put ourselves under a little bit of pressure. Very comfortable.

LOUSMA

I did not like the lower strap fastened. I had the upper two straps fully extended. If I had the lower strap fastened, it felt like it was holding me straighter than I wanted to be, so I took the lower strap off.

QUERY

And you kept the upper two tight?

LOUSMA

Not tight, just as loose as they would get.

QUERY

Al, you had commented at one time during one of the M487 inflight debriefings that many of the personalized things had been overkilled in the Skylab's design. Yet in some areas, you were forced to live with a lot less human engineering than you would like to have had. What was wrong with Skylab from those design points of view and what changes might we make in downstream designs?

BEAN

We should come up with a standard strap with a screw on it that could be put around any box and tied like a seal strap. All these boxes could be designed for inflight and taken like they are. For launch load, you put one, two,

Dump Tape 321-03
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SPT You know last night I kind of slept just like this. Kind of floating.

CDR Yeah.

SPT Out and back and forth ... between the hatch and the chair. The couch-chair.

CDR How did you sleep?

SPT Pretty well. Until I - I guess I woke-up - be darned if I know. I think I remember it was two or three hours before we were supposed to be getting up here. Now I kind of half-awake ... stay around. ... Then after the last half-hour, I was looking out the telescope. I kept, - I slept - I must have got fifty percent efficiency out of that sleep. I think I would sleep for half hour, three quarters of an hour and then wake for 5 to 10 minutes, then back again.

CDR I dropped-off well there in the beginning. I think those beds are going to be nice for a big belly dance on them. Because that's sure what made me sleep better last night is when I grabbed a couple of cargo straps and strapped myself in under the locker. Then I felt like I was being pushed up against something and I slept a longer stretch of the time.

321 12 59 30 CREW ...

CDR How about your audio tone? Okay, we're not reading you at all. We're not reading you on intercom at all. Are you hearing us? ... Now, try.

321 12 59 56 PLT Oh, yeah, it's on.

CDR Okay.

dispenser when you try to get a drop out. Eating utensils, I'd give those an adequate. The main reason being there that the ... spoon is way too small. I've had to use the one from the command module. Sleep restraints; I'd give that an adequate. One of the problems is that it's kind of tough to get in and out of that thing. It's a real struggle every time I work at it. I also don't know what the heck that thing hanging over my head is suppose to do. I would much rather have something you could pull from one side to the other. The thing hanging over my head just really gets in the way and I'm thinking of cutting it off. Trash airlock - okay, sleep restraint I give an adequate. Trash airlock

commander does all the work there, so I'd say it looks very good. Except for the possibility of it binding up on you. Vacuum cleaner, I'd give that an adequate. The problem there is that it just doesn't have enough suction. Wardroom table, noneating uses. I find putting the cover back on after every meal is just too much thrashing around, so I never really do it. That means I'd give it an adequate. Okay, it is adequate. Tool caddy; I'd give it a poor just from the general concept - maybe if I ever had the occasion to use more than four or five tools, I'll go ahead and use it, but I find it just as easy now to tuck the tools in my pocket and go. Portable fan: I'd give that an excellent. It works real well because sitting over there by the bike, it cools us off real well. ODAE kit.

338 03 37 19 SPT

What the heck is a ODAE kit? I give that a question mark. Garments: I'd give those an adequate. Problem there is that I just get tired of this

Dump Tape 344-06
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nozzle. Then I can just turn the spoon over and smear it over the top of my food and it ... to be ... out quite nicely. The eating utensils. The big spoon is by far the most handy. The fork is used only when we have meat - frozen meat. And it doesn't get much use other than that. The small spoon in my case gets very little use. So let me go back. I have - I've broken away from the grading system again.

344 22 42 03 CDR

Food cans," - I've -" I gave them a grade of, let's see, I think I gave a grade of adequate. And it would have been better except for the danger of it, sharpness of the thing. The beverage dispensers also are adequate. Seasoning dispensers are adequate. We need - need some pepper ... Eating utensils I would say are very good. I think we could probably leave the little spoon home. I could move in - move on to miscellaneous

now. We have sleep restraints. I would grade the sleep restraints as very good. At - Having had to sleep in the command module with no sleep restraint and then getting the next night down in the workshop in the sleep restraint I must say that the difference was quite - quite - quite sharp. It was a very strong difference; it was very - it was very pleasant to get into that sleep restraint. I think the best thing we ever did was make those body straps. I think that they've been very fine. I think maybe that in the future that we don't need to go quite to the extremes of having to get in through a neck ring. I think it would be just as easy to have a sleeping bag sort of thing. If you could zip down and get in to it,

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344 22 43 47 CDR

then zip up, then you wouldn't have to climb into it through a neck ring.

I think the flexibility that's been designed into the restraint is very good. The fact that we can have a - either no blanket or a top blanket or a top and bottom blanket is very good. At the present I have never used a - an over blanket, the top - the bottom blanket. The top blanket has - was on when I got here and " 've kept it on, and the only times that when I've gotten cold I found it to be much more convenient to put on a pair of - a half union suit, that it would be to put on the lower blanket. And so when the Beta angle gets lower and we start getting cooler, I just put on a half union suit. That keeps my feet warm and the rest of my body stays quite warm. In the very hot weather I leave the top blanket rolled up and put it under my head rack and I sleep in the nude and I found - find it to be quite comfortable. So I found that simply that I've had no use for the - the large over blanket, the bottom blanket I've been calling it. And that I find that by just either rolling up or leaving the top blanket down and changing what I sleep in, the clothing I sleep in, that I'm quite - quite comfortable in the sleep restraint. I think the head restraint has been a good idea. I've made quite a - quite a use of that. And it helps quite a bit.

344 22 45 25 CDR

The trash airlock. The trash airlock has been very good. " think I would give it a rating of - I'd give it a rating of very good. Works quite well. Thank heavens we made

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Page 4 of 10

347 15 12 36 PLT

The PLT in ... at 15:15 with the M487-2 Bravo. Number 1 - this is on page 2-3 of the Eval. Checklist - How adaptable are the various compartments to multi-uses beyond their prime design function?

(Example, does each sleep compartment double for off-duty reading, et cetera)? I find that in the case of the sleep compartment; of course, we don't have time to do much reading. The flight planners see to that. But in any event, the sleep compartment does afford a lot of stowage during the day; I find the straps across the sleep restraint very useful for ... handling bulky items, such as urine bags, ... supply modules, that sort of thing. The towel holders, I use every one of them for holding clothes, socks, watches, et cetera. As far as the wardroom doubling beyond their prime design function; of course, the wardroom is our prime viewing area because we're getting ...

347 15 18 01 PLT

It's ver conveneint to look over and see where you are and I think that we'll probably be in an awful lot of good handheld photos and visual observation by virtue of the fact that in the wardroom. So I think that probably the wardroom is making a prime contribution to the visual observation sciences which, of course wasn't its signed function. We also find the wardroom wall very convenient for posting items for general crew reference. Our wall space is at a premium, but we find - in fact, I find myself using the doors of all the lockers for stowage also, which makes it inconvenient to ger into the lockers and in one case the tableware, the eating utensils stowage I find undesireable in theirdesign, so I just line my utensils

Dump Tape 347-09
Page 3 of 4

those things are situated; not off in a corner, but just kind of sticking bare naked right out in the center of everything makes it a little bit hard to use that area as you would like. The MDA: we use the 190 window for photography again. But other than that, that's primarily the design functions of - one of the whole problems with the MDA is there's no footholds or handholds - shouldn't say none, but next to none.

347 18 47 34 SPT

Other than the EREP foot - triangular shoe platform and the one for the ATM, you've got very little to grab onto in there. Airlock; no that's just a place to go through.

347 18 47 49 SPT

How adequate has the sleep restraint been for sleeping? Has it been useful for anything other than sleeping? Well I can hang in there and read sometimes. I think it's perfectly adequate for sleeping. The one thing that I find gets in my way is that top cover which comes down, which is - who knows what you're supposed to do with it. It's always either in my face, or I tuck it in, or I can't get my arms out if I want something. The thing is just a general nuisance. I think they should have made that thing so you could zip it on or off or at least so you could have arm - arm holes through it if you wanted to use them. I don't use the upper blanket, the top blanket, we don't have it on there, just the netting. And that seems perfectly sufficient. I think one of these nights I'm going to try sleeping without it, that is without the outside of that; just floating free. I think that can be done, and maybe there'll be an advantage to it. So far, I've not been able to afford the the chance of losing a good night's sleep for - for the experiment.

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is - that could just as easily be 1 inch high letters in duct or 2 inch high letters in duct and a great big number 2, about 3 or 4 inches high. I mean, why penalize us by - by putting small numerals on this so that we have trouble seeing from a - not trouble seeing them from distance; I can read them 10 feet away - but you have to look in order to find them. Now on pieces of hardware around, I'm looking all the way across to 505 and I could see it all - 20 feet across on the - from the other side of the workshop which is the water purification. But there is no earthly reason why that 505 shouldn't be great big numbers and just jump right out at me.

365 21 55 09 PLT

We - I find it difficult to - to locate some - locate items around here. And as far as I'm concerned that is a

habitability problem. And, also, while I'm thinking about it, the sleep restraints don't have nomenclature on them.

365 21 55 21 PLT

The outer blanket and the inner blanket and all that stuff. All they have are serial numbers on them. The water system parts are the same way. This is all part of habitability in that it - has to do with finding things and identifying them as a certain item in question. And serial numbers are great, but doggone, don't stop there. Give us the working nomenclature on it too.

Another thing that is bad about habitability is the fire sensors. The fire sensor control panel has a number on it and the fire sensor itself has a number on it. And they're the same number; but this morning we had a fire alarm while I was on the ergometer and it took me 2 or 3 minutes to find the cotton-picking sensor associated with that panel.

CARR (CONT'D) going to learn to hate that job. And sure enough, I was right.

I know Bill did not relish the times he was assigned it. I was assigned it a couple of times, but I don't think Ed was.

POGUE I finally figured out a good system, but I didn't like to do it.

CARR It was a time user and nobody wants to spend good time up there fooling around inserting boric acid pills in the urine bags.

POGUE That's right. You had about 10 little tablets to push down in there, and a lot of times, they'd bounce right back up through the hole. One point I'd like to make on that is that anytime you're fooling with a urine system, there is always the potential of the O-ring seal coming out without your knowledge. I sweated that out everytime I finished those bags. I always tried to doublecheck them, but I don't think we ought to, as a rule, fool around with the urine system, because you have the potential for a big leak.

CARR Okay. Sleep Compartment Activation: We slept in the sleep compartment that night. Do you have any comments on that?

GIBSON Yes, that whole sleeping bag - the number of blankets, the under blanket, the top blanket, and the cover - that whole thing. Maybe I had not been trained to use it; I think that was part of the problem. To me that whole thing was so complicated, much.

GIBSON
(CONT'D)

more so than it really needed to be. We had arm holes and head holes, straps, snaps, zippers, and flaps that came out the top; to me it was overdesigned. At the end of the mission I wanted to replace mine, but I could not find a top blanket. I finally just took anything I could fit on there and cut it off at the top and hopped in; it worked great. All you really needed was a blanket which would go across you, and three straps. Climbing in and out of that thing mystified me everytime I did it. I asked myself why I was going through all that. I had probably not trained for it; that's probably why it took me so long to find everything. They were not well labelled. Even though the location where they were supposed to be was labelled, there were two or three things inside - like a headrest, a top blanket, a bottom blanket. One other thing which I've forgotten: the individual items were not labelled and I could not recognize them from the outside. So when you took the paper off and unrolled them, to find out what you were looking at you had to roll it all back up if it wasn't right, which it usually was not.

CARE

As I remember now, Ed did the whole sleep compartment activation, because I did not. Those guys fixed my bed for me; I think it was because I was busy picking up other items. As far as sleep compartment and the sleeping bar was concerned, I found it to be a pretty nice system. I used the armholes, and found those

CARR
(CONT'D)

to be nice, but again it could have been simpler. Compared with the night when we slept underneath couches or on couches in between suit bags, that first night's rest in the sleep compartment in our sleeping bags was a very welcome thing as far as I was concerned, and as I remember, I got a good night's sleep the first night.

GIBSON

I think the idea of being restrained is a good way to go in order to get a good night's sleep. I just thought the complexity of all the folding material was a little greater than need be. But I guess the problem we had to please everybody and each guy wanted something else incorporated. As a result it looked like it was designed by a committee.

CARR

The whole idea was flexibility, meaning, you had to have lots of different flaps and things.

GIBSON

What I didn't like was having to struggle through the neckhole every morning, in and out.

CARR

I guess I didn't have the feeling that getting in and out of that neckhole was too conducive to an emergency situation. A couple of times we had an alarm go off. As a result, there was a lot of struggling and banging and thumping going on while getting out of that thing. It's too bad we didn't have a system that you could whip out of a hot situation.

POGUE

I took my scissors and cut the neckring hole on my second one. The first one was okay, but they seemed to vary in tightness and size. The one thing I'd like to mention about the sleep compartment itself is that you should be able to adjust the airflow from your sleep position. A couple of times I got airflow noise. I then got out of my bag and checked it, then went back to the bag. I'd get rid of the noise but then there wasn't enough airflow. It would be nice if you could just adjust that from your sleep bag. Other than that, I like the straps very well. I think you have to have those straps in order to give you the semi one-g feel in bed. I kept mine real tight.

GIBSON

I might mention that I tried a couple of nights just sleeping out there in the dome, just drifting around without being restrained at all. I found that I was able to doze, but could never really sleep soundly. I would just slowly mash into a wall and slowly come off it and 5 minutes later I'd hit something else and eventually, like everything else, I would end up on the diffuser screen. I found that I could not really get a good night's sleep even after I'd become accustomed to zero g. So I think the straps are a good idea.

POGUE

Mol Sieve Activation: There was no problem on this. It was just a matter of timing it - coming back at the right time in order to get the next step. I used my portable timer, and the procedure was just as it was written.

POGUE
(CONT'D)

was very pleasantly surprised when I saw those photographs of the undocking. Even the picture of that filthy window 4 turned out reasonably good.

I would consider the DAC/transporter problem as a major mission anomaly. The efficacy of those pieces of equipment in taking documentary photos on space flights is totally unsatisfactory. We had such problems as film breakage and end-of-film light that didn't come on when they were supposed to or did come on when they weren't supposed to. I blamed myself for a couple of anomalies that I now know were the fault of the transporter/DAC combination. Three times that transporter shoved film back into the supply reel. We'd do well to consider an alternative to the DAC and transport combinations.

I think the SMMD curtain in the head failed because the fecal bags were too large for the SMMD. That rubberized curtain always stretched when the fecal bag was put in there. Thus it eventually just pulled out and failed.

Concerning the BMMD: After the last M172 calibration, one had to be very careful when releasing the cocking handle or the BMMD would be released at the same time. I think that was caused by a cable run which could be fixed very easily.

The sleep equipment was very poorly labeled. The items were all called out in the procedures by names such as overblanket and

POGUE
(CONT'D)

underblanket, but the stowed items were marked by serial numbers rather than by nomenclature. You can't identify those articles just by shape and size unless you're very familiar with them.

I consider it a major anomaly to have equipment on board that leaks. I refer to the educational capillary experiment (ED72), which had a major leak of water and oil. I believe the leakage occurred early in flight, because the cardboard and other items were stained with dry, crusted water when I took them out. A major leak like that in the wardroom compartment is almost inexcusable.

GIBSON One morning when I opened my urine drawer, a big ball of urine, about 2 inches in diameter, popped out and started floating up towards me. I cannot figure out where it came from, why it was there, anything about it. It was a one-time anomaly.

Window contamination was a major mission problem. I'm not sure whether the people on the ground appreciate the fact that all the brown on the vehicle is not due to solar UV changing the paint. Some of it is actually a coating, an example of which you can see on the command module windows. Before we splashed down, it was uniform. But after water hit it, it wrinkled and peeled off in flakes. I'm sure some of the large pieces of it