

SKYLAB 1/3 TECHNICAL CREW DEBRIEFING

PREPARED BY
TRAINING OFFICE
CREW TRAINING AND SIMULATION DIVISION

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O.O IMPORTANT OBSERVATIONS

BEAN

Rather than starting section 1.0 which is called Suiting and Ingress, we'd like to have a new section titled "Important Observations." The reason we'd like to have this section is that we have some points we don't want to bury within this report although we may discuss them again. They will be easy to see right at the front of the report. We may not get all the important ones at the beginning, but at least these are some of them. From time to time throughout the report, we may single out an important point and ask that it be moved up to the front. This will allow anyone, for instance the medical director, to read the important comments plus the ones that apply to his directorate and then he'll have a feel for the important issue and also the details of his particular specialty. This way some of the important things are not lost and can gain some attention and visibility early in the game. I'll start with the first one.

It would be my feeling that one of the things we're going to have to do for the SL-4 crew is come up with some more experiments for them to do. We found in flight that we had excessive time available when we didn't have what we considered good scientific experiments to do. Now we had good scientific experiments but we just didn't have enough to fill

BEAN
(CONT'D)

the time available. We called down several times and said, "Do you have anything else for us to do?" Sometimes there was nothing to do and sometimes there'd be, for example, a BMMD calibration of which each person had done two or three before. So we felt that although it was useful to do another one, it might be more useful to do some things that could be easily a put on the SL-4 mission. Let me give you a couple of examples of simple experiments that might be useful. I noticed prior to flight and subsequent to flight that in the LBNP and the ergometer, there is a - a long blue band perpendicular to which is a number of measuring tapes about 10 inches long. They fit this on your arm or leg and using this device they measure very carefully the circumference of your leg or arm all along its length to determine what changes have been affective. It appeared to me that this device could be carried along on Jerry's flight and used productively the first 10 days and, depending on the rate of change of circumferences, maybe weekly after that. It'd be simple, light, easy to train on, and you could get some data that would be useful; I'm not qualified to know what's useful exactly but here's something that maybe more useful than calibrating the BMMD on Jerry's flight. Another example might be this. There's been some questions about the position of man relaxed in zero g and whether it changes as

BEAN
(CONT'D)

his time progresses in zero g with the idea to understand the muscle-balance situation better than you sometimes can on Earth because of the gravity situation. A very simple experiment might be to take each person in his fully relaxed position, orient him properly, and take a photograph using the flash camera on days 1, 2, and 3 until it looks fairly constant and then take it on a 2-week basis. Then do the same thing when they come back in. This might aid designers of artificial limbs for example and understanding better the loads that are imposed upon the body naturally. These are two simple ideas that could be useful. There must be a significant number of other ones along the same lines that could be taught with a minimum amount of training and it would give useful work to be accomplished in the time available.

GARRIOTT

Let me mention a couple of important topics to precede the general debriefing items. The first one is the ATM film. With the three men going all out, based on our experience on SL-3, we can expose a complete change of ATM film in about 20 days. That's how long it took to make use of our first exchange and we could have done the second exchange in that length of time. Early plans only call for one exchange of film on SL-4 and that has to last anywhere from 60 to 80 days. The thing that I want to point out is one exchange of film for SL-4 is just totally inadequate. For

GARRIOTT
(CONT'D)

the amount of volume and work that it takes to fly extra film for the ATM I think that it would be the greatest mistake that we could make not to fly up the extra film required to give them a second exchange. I do have an exception to that. I would agree that the NRL A and B camera film package used are just too large to fly up a fifth exchange. But certainly for the S054 (doughnut containing the film and extra reel), certainly for the S056, film camera and very probably for the H-alpha for documentation purposes, we should have a fifth exchange of film. It'll be useful for looking at the Sun. In some cases, it'll be useful for looking at either X-ray sources or ultraviolet sources and it will also be useful for looking at the comet observations in December and January. I think this is the primary thing that we should be sure we include in the gear taken up on SL-4 - and if we don't it'll just be great tragedy.

BEAN

I don't know what Jerry's carrying on his mission. If he's carrying any extra clothes, he ought to offload them right now. The clothes necessity compared to getting new ATM film just isn't required. There are so many clothes to wear up there now. It's the same thing maybe for most of the other items with the exception of food. Time should be set aside where our crew went over the equipment that Jerry's planning to take up there and looked at it and said yes or no. For

BEAN
(CONT'D)

example, we recommend that you take this but not that; we have thought about it and the ATM film would be a lot more significant. We suggested some more gray tape. I think that you could survive on the gray tape you have there. It is certainly more important to bring ATM film. We ought to look over the storage list that they have in the command module and at least give them our opinion on the relative importance between ATM film, experiments, and that sort of thing.

GARRIOTT

Let me just make one more comparison. I heard this morning that the mission may be planned for 80 days. I would think that exchanging 5 days of food if it should come down to that for an extra roll of film to make those remaining days more productive would be an extremely good trade-off.

GARRIOTT

If it should come to that, not that it has to, that's the sort of trade-off that, if it were required, should be made.

BEAN

That's right, I agree. There's a lot to be said for staying up there but there's a lot to be said for staying up there and doing something useful.

LOUSMA

I think the other factor here to consider is the psychological attitude. There's nothing more irritating than sitting up there and doing nonproductive work. I think we're going to need to provide opportunities to do productive work if they're

LOUSMA
(CONT'D)

going to stay an extra length of time. That basically means more film, more tape, and more productive experiments. There's nothing more irritating than being there and doing busy work. The comments that Al and Owen have made are not only important in terms of getting something done but also in keeping a good psychological outlook for that length of mission.

GARRIOTT

If you talk more about busy work later Jack, I'll have a couple of things that I thought were busy-work items to add to yours. Everything I think is important to take up relates to handheld photography. We were handicapped with only three Nikon cameras on board. We used two of them for the S063 experiment and the third had color interior film for taking pictures inside. We had no camera body for using exterior fast film. So when it came time to take photographs of the aurora and we had an unparalleled opportunity for that - probably better than anytime in the last few years and probably better than anytime in the next 5 years - we were simply ill equipped to it. But we should had had a fourth Nikon camera body and a good number of additional cassettes of 2485 film. As it turned out, we launched with simply one extra 2485 cassette. It's almost incredible that we would have launched so short supplied with 2485 film and as it then developed I managed to foul up the use of some of the S063 2485 and so the one extra cassette that we had

GARRIOTT
(CONT'D)

was therefore devoted to S063. We should have had one extra Nikon camera body and a minimum of six extra cassettes of 2485 fast film for the photography of such things as aurora and cities at night. We have had a great deal of interest expressed from demographic objectives, from the Governor of Ohio to take some photographs of his state and we simply couldn't do it because we were handicapped by the lack of a camera body and 2485 film.

BEAN

That was a good one. Maybe that Hasselblad that we took in the command module which we used to take several pictures during rendezvous and docking could easily be exchanged, since we didn't use the camera body any way, for a Nikon and use it during the rendezvous and docking. We have loads of pictures of that vehicle during rendezvous and docking. The Nikon takes excellent pictures anyway and then you got a Nikon body you can use. The Hasselblad body we just left in the command module. We never needed it and then we used it on the home so actually we had a camera aboard that we never used except during launch and entry. We could have had a Nikon and used it; plus then load it with this film you are talking of and had essentially done it for no extra weight penalty and got picture of just as good for all practical purposes.

GARRIOTT Some science demonstrations were done on board. I think SL-4 certainly ought to try to get fish up there again with an improved arrangement for keeping them alive. We have the expertise over in building 37. The same folks who put together that package on brief notice can do it again. We can arrange the temperatures, we can arrange the package in such that they can be - maintained alive and hatched and brought back alive during even a 80-day flight. I'm confident and I think that has sufficient interest to people studying vestibular disturbances as well as the public affairs potential that we certainly ought to crank that experiment up again and do it even better on SL-4.

BEAN Okay, let me talk a minute about the workload that we had inflight. We seem to have two types of workloads. We were working in nice steady workloads and getting the proper sleep, eating on time and getting our exercise from about day 5 down to day 58. While we were doing activation and deactivation, the whole thing was hustle all the time. You ate when you could, you didn't usually get too much exercise, and you tried to get finish just in time to get to bed. Now it seems to me that with the total length mission times that we have right now and the things you have to do in the desire to keep physically fit and mentally going, the most important time is when you first get there. The same way when you

BEAN
(CONT'D)

come home, so that you don't come home feeling the worst you have for the last 50 days so we're going to have to do something about the time line for those two times. In other words, we ought to make sure that for the first 3 or 4 days when the crew gets there, their running on a time line where they can do the three most important things they need to do. They need to be able to do get the meals on time, they need to be able to get their exercise, and they need to get the sleep. And if we get them on a little time line here and then adding in all these other unforeseen things that always arise - the bolts that you want to fit something to the wall just aren't where they're supposed to be or things of that nature that always come up, you're going to run out of extra time. So it appears to me that what needs to be done in this activation time line, for example, is we need to sit down and look at it, pick out what has to be done the first day and there aren't too many things. Either you could go up there and crawl in the thing and turn on the lights and fans and stay for a day or 2 and you would be just as happy. But you need to do that; you need to put in the food, the eating periods. Exact times need to put down for exercise periods. Fit in whatever hours you can elsewhere around them; if it takes you 4 days to activate the machine, I guess it takes you 4 days. There's no reason to unload all that

BEAN
(CONT'D)

equipment instantly. There's no reason, for example, why we unloaded our rate gyros the first day and assembled them and put them on the wall. Ridiculous. We could have waited for 2 weeks to do that. What we should have done instead of that was set time aside to eat exactly on schedule. Now not only must we plan to do it this way but we must have our flight planners on the ground, flight directors, and the crewmembers realize that the most important thing that they can do is keep healthy and happy at that critical time. And make sure that, for example, is their hustling along with a few things that come up like they always do and if it gets much past dinner time, the flight director should remind them to eat. Everybody should settle down to offload the crewmembers so they can eat right on time. And the same thing goes for exercise and going to sleep on time. It is a most important thing the first 3 or 4 days. That's the days that things could get bad. Let me give you an example of coming home. My weight was maintained for about 50 days in that mission; in the last 3 days, I started losing weight and it just went down until we headed home. Simple matter of working hard all day; we couldn't get in our exercises, we were having a tough time getting our meals on time. We need to take a look at the deactivation. Instead of having a 2- or 3-day deactivation, we ought to expand it

BEAN
(CONT'D)

sufficiently so that you can deactivate at the same rate that you normally work. You can eat, you can exercise, you can sleep, and then you get ready to come home the last day. By the way, let me mention something. The last day we had, we stayed up from the time we got up until we finally went to bed on the ship that night. Something over 26 or so hours. That's too doggone long and the main thing is, it's unnecessary. About 5 hours of the things that we did early in the morning, we could have done the night previous. That means something we did the night previous could have been shifted to the day before. There's no reason to try to cram this activation and deactivation all into 1, 2, or 3 small days. We've got to make this mission run along sort of like clockwork, at a steady pace, particularly at the beginning and end so you can acclimate. My personal belief is that half of the problem we had as far as adapting to motion sickness was caused by the fact we were not eating on time, we were not getting to bed on time, and we were not exercising. We were just in a hustle all day long and we got to figure out a way to stop that so that's one important item.

LOUSMA

I'd like to amplify Al's remark on sleeping and so forth. I think that the days I didn't feel good or any days that I wasn't performing well were a direct result of not having enough sleep the night before. I feel that the amount of

LOUSMA
(CONT'D)

sleep you get is very important in your performance, probably more so than it is on the ground. You can miss sleep on the ground and get by much better than you can in space. If you miss your sleep up there, you're not going to perform nearly as well and you're going to be running behind the 8-ball and feeling bad all day long and you're going to making mistakes. It is more important to spend an extra hour and make sure you get to bed on time, so you can do your job better the next day, than it would be to shorten your sleep and try to cram more in because you're going to get a better return for your time by having gone to bed on time. I think that planning your activities right up to bed time is wrong because nobody wants to work through 16 hours a day and suddenly keel over and go to sleep; it just doesn't work that way. Everybody needs a little bit of time to relax and wind down and a chance to look out the window and do a few of his own personal things. I think you ought to do is plan an extra hour over and above what you need to sleep, get more presleep activity, and let a guy have a chance to wind down and get ready for bed because there's just no way to stop working suddenly and go to sleep.

As far as the activation is concerned, I think we had too long a day there. Much too long. We should have a normal working day and we ought to go to bed at the right time. I think

LOUSMA
(CONT'D)

we all would have felt better and we would probably have gotten the whole activation done more smoothly and quickly had we had a normal working day. This essentially amplifies Al's remarks. On the deactivation, here again I think what we should have done was to have gotten all the activation done in the workshop and gone to bed. The first thing we do in the morning, when we get up, is to close the door and undock. That would significantly shorten the time line. I think that we would have performed better on the medical test. I think that we would have felt better for the medical test had we done it this way. I don't think there's any big rush. I think there's going to be a lot more productive work done if we try to have normal work hours, normal work days and then go ahead and do your medical test or whatever is necessary. But this ideal of staying up extra hours to do some last-minute thing. It only hurts you and bites you in the long run and it is more of a hindrance than a help.

BEAN

Earth observation: We had a number of what was called hand-held photographs that we did out the window; we did have some out the wardroom and some out the STS windows. I think we were ill prepared to do these tasks. Not the actual photography because we knew how to operate the camera. But we were ill prepared knowing exactly what was wanted by the ground. For example, they would request a photograph and

BEAN
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at the same time want to know various pieces of information about the site that we were passing over. We knew that we were not able to take the picture and answer all the questions each time. Moreover, we also knew that finding these locations when it was cloudy was a bit difficult. We knew that a lot of these observations that we made just by eye were not the sort of thing that would advance any state of anybody's art because we knew some of the questions were much better answered and the answers were already known on the ground. It appeared to us that this whole experiment needed to be thought through much more clearly as to what we want to try to accomplish with hand photographs and particularly manned observation of the Earth from orbit. Now we all believe that he's got a great role up there. But we got to find out exactly what that role is in a scientific manner instead of trying to ask the same questions that really have him fulfilling a role that's better filled by someone flying over in an airplane or an unmanned satellite or just some guy walking out in a plowed field and looking. So the whole just, to sum it up, I'd say Jerry needs to devote considerable time to understanding what he is going to try to accomplish by this experiment which may be one of the most productive ones. And then not only what he's going to try to accomplish but how is he going to do it. I didn't feel

BEAN
(CONT'D)

that we were doing it. I felt that we were sort of shot-gunning the problem as opposed to zeroing in on it and trying to go on a step-by-step approach where you find your target and zero in on it. We just trying to answer all sort of questions. I'm not sure that as a result of what we did we actually zeroed in on exactly what improved the understanding of what a man can do in orbit. But I do think it's extremely important for the SL-4 crew to to do this sort of thing.

LOUSMA

I think they're going to have to have more detail maps also. If you want to ask about details on the ground, you got to have maps with sufficient detail to answer the questions. We don't have those on board. If you want to look for cities, for coast lines, or something like a few rivers, you're okay. If you want to ask for greater detail, you're going to have to have better detail on maps than you got and you're going to have to carry them along with you.

GARRIOTT

That's a good point. I can give several good specific examples. For example, we were trying to photograph various points of interest in Spain. It's a devil of a job just to find Madrid. Madrid covers the largest area of any place there, but it's not very obvious from the 270 miles. I think we had some trouble because we didn't have a good map. We had crystal-clear weather for a half a dozen days and

GARRIOTT
(CONT'D)

yet we only saw Madrid once or twice, we think. The same thing was true of many of the cities in Germany as we talked several times passing over that country. Even some of the cities in Italy which is very clear there, just what part of the boot the city is located on. We had trouble identifying because we lacked the map for it. I think that's a real good point. We could run a much better job had we had detailed, properly designed maps; and by properly designed, I'm talking about maps which show the things we see from orbit. The things that you see are large land protuberances the water, large lakes, or really large mountain systems. We need the kind of maps which show these features to bring home and to draw our attention to the proper location of the things we want as targets. A lot of work could be done to make the time a little bit more productive from that standpoint.

BEAN

On those maps, what they need to do is pick out several places on the Earth, not so much where you are going to be looking with EREP, because then you don't have time to perform these experiments, but places like Africa, or South America. Generally when you pass over, you're not at an EREP mode but rather doing other experiments. You have time to look out and have these certain areas to pick places that are generally clear like the west coast of South America

BEAN
(CONT'D)

before the Andes. Then have several different type of maps on board of the same plane. Try to use these several different types to observe the plains at Nazca or something like that. We never did figure out exactly where it was although.

GARRIOTT

You've got some pictures of the divides or of some there nearby.

BEAN

That's right. But you never knew from the maps exactly what point the plains of Nazca should be. It's not on any of the maps. That's one of the problems that have to be solved. Let me mention something else. They need some additional tools up there to do the job. They need some better binoculars. The stabilized binoculars are good. The little handheld binoculars are good. But we ought to see what we think is the most powerful set of binoculars or telescopes that a guy could use from the window without some sort of image motion compensation. Maybe even - say he probably can't use something this good. Take it up there and try it. Let's don't launch another mission with just what we got there now. Let's take up something with a little more power maybe even too much so that we can at least find the limits and let them observe the Earth with greater magnification and see what they can see using that technique. They need something

BEAN
(CONT'D)

they can mount on these windows to set at certain angles so that you don't have to hunt around for small islands. They can give you time and a set of angles. You look through there and it says at certain times the little island you're hunting for is going to be there right in the sight. That'll save you having to look around so much and allow you to photograph the exact little angle, allow you photograph the plains of Nazca exactly instead of the general area where it is.

Another thing that needs to be done is come up with a little device that allows you to look out the window and estimate distances, diameters and angles, so that when you're looking down at a storm, you won't have to say - well, it looks to me like the diameter of the storm is - Instead you can say 178 miles, you may be wrong plus or minus 10 miles but you won't be wrong 50 or 100 miles. We need some devices like the Army uses when they're out in the field trying to tell someone how big a bunker is or how far away it is. We need some handheld devices that simplify observation from orbit so that man really can do the jobs up there.

Some of the jobs that I thought man could or was going to be able to do from orbit, I don't think now he can do. Some of the questions we were asked up there that I thought we

BEAN
(CONT'D)

could answer you never can answer unless we get some new tools. It just can't be done. But there are probably many many more that we can that we haven't ever addressed at the moment. We get some different tools up there, we might be able to think up what those are.

LCUSMA

If you only had a window you could use them from, you'd be in great shape.

1.0 SUITING AND INGRESS

LOUSMA I thought it went smoothly. I have no complaints about the way it was done. I thought it was a professional job. I know they've done it many times and prospered by their experience.

LOUSMA Same comments about life support equipment, PGA connections, suit circuit check, ingress, and cabin close-out.

2.0 STATUS CHECKS AND COUNTDOWN

BEAN There are several different sounds that occur when they
 pressurize the vehicle or systems, but none which I think is
 significant to the guys operating it.

LOUSMA You can feel some vibration, some motion, and a little bit
 of swaying. I think that's all been recorded before.

3.0 POWERED FLIGHT

BEAN SLB ignition: Noticeable. The lights go out just like they do in the simulator. The vibration is very noticeable, surprisingly.

BEAN Lift-off: The vibrations were strong and seemed to last a little bit longer before lift-off than I'd imagined from watching the lights go out and then seeing the lift-off lights in the simulator. I felt like it stayed on the pad a little bit longer than I had imagined it would. When it came off, it felt very good. It felt like you were moving out and moving out very fast.

GARRIOTT I thought it was easy to tell when the launch arms were released. My description would be of an old model A that you rev up and then release the clutch. It just took off going and you could feel it rumble with just about the same vibration of a model A engine. There was just about the acceleration of a good model A.

LOUSMA Lift-off was three or four very distinct, rapid, hard vibrations, enough to rattle my head in a helmet or almost enough to rattle my teeth, which gradually died out to something less right at lift-off.

LOUSMA
(CONT'D)

I would imagine that would be the hold arm letting go and this big thing straining to get away from the ground and a lot of transverse acceleration or vibration up and down the vehicle. The vibrations died out to a more steady state that was almost gone about the time we cleared the tower.

BEAN

1/V lights: No comments on the launch vehicle lights.

Max q: Noisy. I definitely noticed the increase in noise coming up to max q. I also noticed the vehicle seemed to get a little bit touchier then. Instead of being quite as stable as it was, it seemed to hunt a little bit more. It could be the CDR's imagination as he stood there and watched it, but it seemed to move around a little bit more.

LOUSMA

I felt during the first stage boost things moved faster than I had anticipated. Like your first solo in an afterburner airplane like the F-11 where suddenly you're off the ground and the gear and the flaps are just coming up, and you're a little late. Kind of like sitting on a motorcycle that you've just revved up too fast and going a little faster than you really wanted to. That's the kind of feeling I had in the first stage. Things were happening a little bit faster than I had expected.

LOUSMA The second stage was different. It seemed to be a soft ride. It went along there rather slowly and at the same speed as I had anticipated it would from the simulator.

BEAN SIB/SIVB separation: It didn't have the accordian like feel that the Saturn V did. It was a nice, noisy, smooth sep and powerup of the second stage.

BEAN LET and BPC jettison: The LET and BPC jettison went well. Sounded just like the simulator. Went bang and it was gone.

LOUSMA I made a special note to watch it go. It went in a hurry. It seemed to go below us as it went.

BEAN SECO: The technique we finally developed so we wouldn't have to do a manual shutdown for the overspeed was a good one. You notice the g's on the g meter starting to drop before you notice the yellow light coming on, showing you the number one engine shutdown. If you're trying to shut it off to prevent an overspeed, you get a little more clue that it has shut down, as you approach the velocity you're looking for by watching the g meter. As the g meter starts down, you know you have a shutdown. Seconds later, the yellow light comes on. Owen was counting out the velocity. Just when he

BEAN
(CONT'D)

got to the right velocity, I noticed the g was coming down even though the little yellow light was not on. So I recommend that for SECO, you watch the g meter even more closely than you watch the engine 1 light.

BEAN Communications: Good.

BEAN Controls and displays: Dandy.

BEAN Pogo: I didn't notice any pogo. Did anyone?

LOUSMA I thought it was a comfortable ride.

BEAN Separation from S-IVB: Sep, turnaround, and stationkeeping were quite simple.

LOUSMA During that period, I had to get the camera out and take some photographs of the S-IVB. I remember one particular sensation that's kind of interesting here after we separated. We were heads down and we had made a pitch up towards the Earth to look for the S-IVB. I had the distinct feeling that we were diving into the ground, doing a split S. Maybe with the forward motion, orbital motion plus the pitch rate, it made me feel like we were diving right into the ground.

BEAN I remember that. We talked about it a little bit. It did feel that way.

LOUSMA There was no problem at all getting the camera out and the helmets and gloves out from behind the head. You just loosen the straps, pulled around and got it. It was much easier than it ever was in the simulator. It's not a problem to do that. Taking pictures - no problems. I was impressed with the sharp lines of demarcation of the SIVB. It looked like an animation to me. I never did notice the format of the S230; I believe that was the number within the IU. It may have deployed after we had changed our attitude to press on with the rendezvous.

BEAN Essentially all went well. The SIVB was stationary. As far as we could tell, the panels deployed properly. It's hard to get a relative distance, tell how far you are away. And the fact that the SIVB was so stationary that you could fly around it was kind of mystifying. I thought it was a good thing to do. It gave me some practice at stationkeeping that is needed later on as you finally get up to the workshop. It allows you to check out your thrusters. I don't know whether they plan to do that for SL-4, but if they do, it could be an advantage to the crew to do it. I think it teaches you something.

4.0 RENDEZVOUS AND DOCKING

BEAN

Rendezvous and orientation: I thought that our rendezvous time line was easy to follow and pretty straightforward.

NC 1 burn: A comment about all the burns. The engine, when ignited, really kicked us in the pants. Perhaps it was because we weren't fully strapped in but it was a surprise to me, even for a short burn, to feel the hard bump when it lit. I guess that's par for the course. It always seemed to me like it fired up about a second after the time was zero. You'd reach time zero and nothing happened. Then about a second later it'd kick. You always had a feeling that it didn't start. Just about the time you'd think it didn't start, it started. It was just consistent.

VHF powerup: Didn't we power up the VHF out of range? They wanted us to do it earlier. I seem to remember they asked us to. We were in solar inertial. The vehicle was in solar inertial and they wanted us to check it.

LOUSMA

When we did power it up and started using it for range, taking marks around it, it worked as advertised.

BEAN

Sextant marks: We had some sextant problems. But I can't remember what they were. One time the sextant was drifting

BEAN
(CONT'D)

or something, or didn't go to the target, but I can't remember exactly what it was. The ground thought the reason was because we went to optics zero. It was some problem that we should have been aware of but we weren't. I can't remember what it was. We either went out of the problem or into the program and didn't zero it. We need to have somebody look up exactly what it was, because it should happen that way but it didn't do it that way in the simulator.

GARRIOTT

Aside from that it didn't drive normally; it didn't jettison normally. It couldn't be steered manually. Part of the problem was, I remember now, that in manual, it didn't track at the right speed or something like that.

BEAN

One other thing I thought about the optics. The optics drive about the same as they do in the simulator, medium and high. But in low, in the spacecraft, they drove about one-third of the low speed of the simulator. In low, I thought it was not even tracking. I looked down and said, "Yes, it is." Then I tried the other two and they seemed low also but the low seemed much slower than the low in the simulator.

BEAN

One other thing about the NC 1 burn - We flunked the horizon check because, out in front of us, the thing that I took for the horizon was really the terminator. The terminator is not in our simulator. During the burn time, you're going to see

BEAN
(CONT'D)

the terminator and the horizon will be out ahead of it somewhere. You're going to have to get your cockpit lights down and look for a dark horizon. It's hard to tell from orbital altitude exactly whether or not you're looking at the horizon or a terminator as it moves across the Earth, unless of course it is right below you. Particularly if it's right in front of you, the difference between the horizon and terminator, 10 or 15 degrees is going to be tough to tell.

GARRIOTT

I doubt you would have made that mistake at reentry. After a few days, you learn to work with it.

BEAN

They called us up and told us not to make that mistake. I thought was smart. It ought to be pointed out on the onboard data.

GARRIOTT

I thought the ground had made a mistake. They didn't intend to have a dark horizon. They really thought it was a light horizon and there was a slip up.

BEAN

The onboard data should say, terminator here 15 degrees, horizon 10 degrees or whatever it is. Then you can do them both or either.

LOUSMA

Backup charts: The backup charts worked just like in the simulator. Solutions were within the limits to the solution

LOUSMA
(CONT'D)

we actually burned. I don't know the numbers now, but we did record them. I recall, the errors were consistently similar to what we'd seen in simulations. We didn't burn them but they did verify the solution.

BEAN

One thing that might be worth mentioning here is somewhere in this area, and I don't recall where, is when we had our quad B problem. This was the first note that we had a quad B problem, although I didn't psych it out at the time. I looked at the attitude and we're off about 25 degrees in yaw. I said, "Wonder what we're doing over here" and I flew it back to zero. I couldn't understand at the time why we were off in yaw because I didn't think we had done anything to maneuver it over there. I just wrote it up as maybe an accidental bump of the hand controller. I was looking out the window some time later and noticed some sparklers go by. I watched those for a while. Then Jack said "There is something going by the window." That's when we started to think about it. I can't remember whether we figured it out or the ground said we had a quad B problem and suggested that we turn it off. Do you remember, Jack?

LOUSMA

I remember a lot of sparklies at sunrise or sunset going from -X to +X past my window and reported them. The ground told us to turn off the proper quad. I noticed the gradual

LCUSMA
(CONT'D)

diminishing of sparklies going by. Later on they had us turn it on again and there they went again. That confirmed the problem. I noticed one time during this period that a chunk of ice which had the same shape and marks on it as I remember the thruster having. Maybe that was the thruster. That piece of ice was shaped just like the thruster bell.

BEAN

I remember Jack saying that. We went through the procedures and changed around our DAP. It was here the ground noted where we had our DAP and we talked about it and we followed the procedures. The one thing we didn't do, and we should look back to see if the procedure is correct or we didn't execute them right, when you follow the procedures as pointed out in mal procedures, you end up fixing the problem so that you can attitude maneuver real good, but then you can't translate. You can translate fore and aft but you disable the quad that allows you to translate up and down. And it seems to me that nobody on the ground ever told me to reactivate those two until prior to TPI when I started thinking about it myself. I decided we had better activate a couple of thrusters that were deactivated in order to get anything up and down. It appears to me that if we hadn't done that the rendezvous would have really been a mess. We should look back and see if we really are setting ourselves up in the malfunction procedure so we don't have up and down

BEAN
(CONT'D)

translation for a failure like that and look at the other failures also. In other words, do we not also fix the attitude problem and at the same time keep the maximum amount of translation capability? I called the ground and told them I did such and such, what'd you think? They said okay. We need to get our onboard charts so they put you in the right configuration.

LOUSMA

I should correct something I said earlier about the backup charts. I think they confirmed the solution except when we got the midcourse solution. I had some fairly good size numbers - around 6 to 9 feet/second. Six to 9 feet a second for solution and it did confirm the solution in the CMC. I don't know which is right. We burned the CMC. We did not use the backup chart solution. The back up chart did not coincide with CMC. I think it was on one of the midcourse burners.

GARRIOTT

The second one.

BEAN

I agree with Jack. That's one of the biggest questions I have from this flight is why did we get an 8 foot/second midcourse correction on a second midcourse? I don't understand how we got that. It seems to me I put that in and then just a few seconds later, I took it out because we had to start braking. So I'm convinced that something happened in

BEAN
(CONT'D)

those midcourse maneuvers that made them not come out like the simulator. Like I say, I never say any midcourse corrections like that. We burned everything that came up. We had a good TPI. When that 8 foot/second midcourse came up, I could hardly believe it. I don't think I had much of a choice except to burn it.

LOUSMA

I had a first midcourse of a zero X and a minus 9, which could have been up Z. The second midcourse was nominal around plus 3-1/2 and a minus 2-1/2. The first midcourse was the one we didn't believe.

BEAN

The midcourses didn't work right and the TPI was good. I'm still puzzled over that.

BEAN

Final phase and prebraking: I like everything about the flight except the braking. I wasn't happy with the braking. I felt it was a noncontrolled operation even though we had one quad out. There were no problems in other quads, but with one quad out you had problems with the other quads. If you made up and down corrections, which you had to do once in a while that resulted in some other inputs. I don't know what they were exactly. The whole point is I didn't fully appreciate the problem of having one quad out and the braking phase. I think we should rectify that so that Jerry fully understands it before he goes. His onboard data should say

BEAN
(CONT'D)

that if this quad is out, expect the following phenomena to occur. I knew what was going on but I felt that it was not a precise operation like the rest of the rendezvous had been. I personally wasn't particularly happy with the braking. If Owen hadn't been there and kept saying I had to brake some more, it really would have been difficult. I kept answering that I had already put in enough braking and he would say that I had not. I believe he was right. I want to read the data that showed what we did exactly and then try to understand it. I felt that it was a nonprecise operation and I didn't like it.

LOUSMA

Let me say one more thing about the backup charts. We had enough VHF ranging to get an NSR solution, TPI, and both midcourse solutions and they're recorded in the book for those people that want to look at it.

BEAN

Stationkeeping: I thought that stationkeeping was more different than I thought with one quad out. I think a lot of that was the fact that I didn't appreciate what effect the thrusters had on the vehicle itself, particularly around the parasol. You don't have to be too close to that vehicle before the thrusters start impinging and moving around the parasol. When they start doing that, your only recourse is to thrust away, which impinges it even more. You're caught in a situation where, when you know you are too close, the

BEAN maneuver that rectifies being too close gives you more problems. I would suggest that there be no flyaround on the SL-4 mission. I don't think there's a big advantage to doing it. All you do is spray the vehicle down and take a few pictures which is nice. The main thing is, you don't know you have a problem of being too close until you're too close and then you can't get out of it easily, because getting out of it gives you more of the same problems.

GARRIOTT That's even more true with the ATM doors open.

BEAN That's right. I don't think we should have done it. I didn't do it very well, either. Even when I was doing it well, I would get caught. You can't float anywhere. You can't float when you get away from it, but you're standing there close and you want to back out but you don't back out naturally.

LOUSMA The whole operation was for television. We had the right positions and the right attitudes to get good TV pictures except that the TV wasn't working right. We could only get half a picture out of it. We tried to keep the workshop in that half of the picture which was good. I thought Al put the workshop and the Earth in the right perspective to get the television as planned prior to the flight. The rest of the flyaround was compromised by the fact that the

LOUSMA
(CONT'D)

thrusters weren't all working. I think what you said about another flyaround for SL-4 is correct. I don't think you should do it because you are going to mess something up.

BEAN

That's right. You're liable to break those twin-pole sunshades out there and then you have a huge problem. I looked down there and I was worried that we were going to break that parasol. It was whipping around and I kept saying I've got to back out of here. Every time I gave a little bit of a backout, it whipped more.

GARRIOTT

Did you see the parasol flapping on TV? Do you know?

LOUSMA

I think so.

BEAN

Could you see it down here? Did you watch it?

SLAYTON

No.

GARRIOTT

I thought an accurate description is the way a big flag would look in about a 20-knot wind.

BEAN

That's about right.

GARRIOTT

It flopped about like that and you were probably out about 100 feet at that time.

BEAN

I wanted to be a few hundred. I wanted to get back. I wouldn't do that any more. That's not a good thing.

LOUSMA OWS photos: We took them.

BEAN Docking: Docking I though was straightforward. It takes a little time to get into position. The docking angles were beautiful. Just slid right on in. You've got to get into position a little further out than on the simulator. You've got these ATM wings and things out pretty far, so you've got to get in a pretty good position and then slide on in. It was easy docking. After docking, I tried to get a good alignment before I went harddock by using the translator in the roll. It looked to me like I had gotten a pretty good one. Look to me like I got a pretty good alignment although, when we locked up, it moved us around a little bit. I didn't feel that was extensive and looked okay.

BEAN Docking latch verification: We had about two or three latches, I don't recall now, but it's all on the records, that were not made. Everything had fired but they were not touching. So when we went out there and checked them, they had gone down and I left them just like that for the whole flight. I did not want to get into any latch problem.

Hatch integrity check: Great. Everything worked fine for us.



5.0 WORKSHOP ACTIVATION AND CSM POWERDOWN

LOUSMA Make various observations on what we should have done and all this stuff. We should have gone to bed and made an hour working day out of it.

BEAN That's right. And right in the middle of it should be the primary thing, eating on time. I don't know if you need exercise that first day, but you certainly you need to eat. Also quit work an hour before time to go to bed.

LOUSMA I did feel that we wanted to accomplish a sufficient activation to be able to use the sleep compartment and head and the wardroom eating facilities. You can sleep one night in the command module. If you're go to the workshop, you've got to activate the caution/warning and ventilation to make everybody happy. I think the smart thing would have been to just sleep in the command module and eat in there at night without even opening the door. There's no reason to even go in there. I think the most important thing is to get to bed on time. Then the next day, you're fresh and you're going to get the job done more efficiently than by staying up all night working on it.

BEAN You work towards getting those things done, but when the time comes to eat, you quit whatever you're doing right then.

BEAN
(CONT'D)

You go back to the command module, if you haven't activated it somewhere else, and you eat. You work along, and when the time comes to go to bed, that's it. You stop; and if you didn't get the sleep compartments activated, you just go back and sleep in the command module. If you did, that's great. But you don't stretch anything out or hustle and try to get moved in so doggone fast.

BEAN Pressurize Tunnel: no comments.

BEAN Remove hatch: Nothing.

BEAN MDA hatch opening: Nothing.

BEAN MDA lights: Nothing.

BEAN MDA visual inspection: Nothing.

BEAN MDA vent: We didn't do that. Some of those were already done.

BEAN CB and switch panels: Okay.

BEAN S190 window protector installation: Okay. Speaker, intercomm relocation: That wasn't for us. Umbilical connection. Caution and warning activation. CSM switch communication switch configuration. ATM control and display panel.

LOUSMA I think one of the things that makes all this a no comment is the fact that we had a good checklist. When we turned it on, it worked.

BEAN ATM foot restraint.

LOUSMA All we ever used were shoes, except for a couple of trials.

BEAN Here's the way I would do this if I had to do it again. I'd float in the workshop and, before I did anything else, get out my triangle shoes. I'd put them on and try putting them in the grids and adjusting them. Before Jerry goes, he needs to get a a 10-minute briefing on how to adjust those grids on his triangle shoes. Here's the way you do it. You tighten those things up as tight as you can get them all the little screws, and then you back, them off two turns each, or something and that gets them all about the same - the three little screws. Then you put them in to where you can barely work them with your hands, your fingers, at that time, you're pretty doggone close. But then you always operate with the three screws. If they're too tight, you loosen each of them a quarter of a turn or something. You should practice that and that should be one of the first things he does. He floats down and he gets his triangle shoes on and he adjusts them just right, to whatever he thinks he likes.

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.

BEAN

That's right. That should be the first thing you do. You go get your timer, you go get your gray tape, you go get your triangle shoes, and you just look over the vehicle for a few minutes. The minute you get in the vehicle, there should be about 2 hours when you don't do any work, when you go get all this stuff and you just float around in there and see what's going on. Then you try out your triangle shoes. You learn to hold on with one foot and instead of trying to learn three jobs, you should learn to just float around in there and work for a few minutes. You need a little relaxation period. When we first got out on the Moon, we had 5 minutes set aside to gain our balance and I think it was really worthwhile. We weren't trying to do things while we gained our balance. We just gained it. And you need time in there to get your gear in your pocket and try to see where you are. I remember for the first week coming into the MDA, I'd get in there and I wouldn't know where anything was. And after that, you get to where when you came in there and rolled to a certain direction, it was sort of like it is in the simulator. Then you knew where everything was. I can't think of the number of times I went in there and didn't know where I was. And really if you just spent a little time - -

LOUSMA

You guys learn better than I did. I needed a week. (Laughter).

BEAN I know it; that's what was so funny. There needs to be time. You don't want to go right into work. You want to go get orientated a little bit. I think that would also help you in preventing motion sickness because it keeps you from spinning around so much looking for things. You could go somewhere and be more organized, less head motion, less body motion. Try to learn which one you want to operate. Learn to get orientated in those things relative to the ATM. I noticed after we'd been in there a while, we'd go in and rotate to where the ATM panel was. That's the way we always worked in there. That didn't happen at first.

GARRIOTT It's a little off the subject, but it does seem like in every compartment, there were several areas with one reference direction that you'd get. I'm the MDA, it was the ATM panel.

BEAN That's one of the things that it was best for. I think these are the sorts of things that would help you; if you did them first and kind of got orientated and then go off.

BEAN O_2/N_2 activation. AM forward hatch.

LOUSMA I don't remember anything unusual about any of those.

BEAN AM lock entry. Don SOP: Down at the workshop, I put the Mast on. Am aft entry.

BEAN OWS entry: Circulation Fans. OWS vents. Visual inspection.
Configure/verify OWS systems.

LOUSMA I was at the workshop. I had to take the maps down there
and look around. Owen was supposed to watch me. I think
the only thing we can say about the workshop is that I thought
that the crew left it in good shape for us.

BEAN It was tidy. You figure you verified the OWS systems. Tool
kit. Gas interchange duct. RCS trim burn: We didn't do that.
Urine samples: Several.

LOUSMA Who made them? Did I make them?

GARRIOTT I think you must have, didn't you?

LOUSMA I don't remember. Maybe we each did our own. I don't remember
what we did about them any more.

GARRIOTT We had to have taken the UCTA down and then hung them up.

LOUSMA Then transferred them into a bag or something.

GARRIOTT Yes. I think that's what we did and we each did our own. I
think we got out the special adapter. There's an adapter for
the UCTA to the urine bag, sample bag.

GARRICOTT Transfer IMSS: No big deal. But one little item they've got to work out in their plans is the thing that we worked out a couple of days before launch and had to work out in flight. That is, to get the contents of the IMSS out and figure out some way to conveniently clip it to the back of the cooler and then take the thermal insulating cylinder and go stir it up. We did it somewhere else and left it out that way so we had room in our cooler. That was not in our procedures. We did talk to the people responsible for it here at the center before launch and Dr. Cal Ferguson over in building 37 is the man to talk with. You should make sure that those procedures are written in there properly so you won't have to do it in that last minute manner.

LOUSMA Right. In other words, you should never do as we did and have the IMSS in the cooler, because it just clobbers up the whole thing and you can't do anything else with the cooler. All you have in there is a bunch of insulation keeping it cool.

BEAN You should do that and you should figure out before you go; even if it means taking up some epoxy or something to get those cans at the back of the cooler and stabilize them instead of floating around.

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

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

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

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

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

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

GARRIOTT Correct. I see on the air duct.

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

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

BEAN It's a good thing to watch. Caution and Warning Check: I think caution and warning check is okay to do, but I wouldn't give it a high priority. We certainly did it too frequently during the mission.

LOUSMA I think we did that often enough to prove it works. There's a high probability that it's going to work when Jerry does it.

BEAN Maybe what we need to do is sit down with Jerry on his activation list, like we're going to do with stowage, to give him a feel for what he might do on his activation and which of these things we've done in order to be canned and put to some other day or put down on a shopping list at the end. Like repositioning the ATM foot restraints; you can wait awhile to fool with that. The same thing with the SOP and the caution/warning check. You can skip that until day 10.

BEAN Configure the wardroom. Activation of water system.

LOUSMA That went off pretty much as in the book except for one thing. It takes a lot more time than I expected because you can't permit the pressure of the waste tank to rise above the certain number and you get there awful quick when you're activating the system. So you have to do a lot of cycling and waiting so you ought to allow lot more time for activating that

LOUSMA
(CONT'D) water system, if you want to make sure the pressure doesn't rise above a certain amount.

BEAN That's one of the reasons you need that timer, too. That you mentioned you want to get.

BEAN CSM condensation blanket: No remarks.

LOUSMA As soon as you put on the condensate blanket, it seems to swell up. As soon as it gets a little warm, it protrudes into the envelope of the CSM. It kind of broke loose from its Velcro moorings. I noticed that it expanded out into the CSM, it didn't remain nice and flat against the bulkhead.

BEAN You wouldn't recommend doing anything about it other than just observing it.

LOUSMA No, I don't think so. As I remember now, I believe the condensation blanket had an odor, too.

BEAN The one on the right side of the command module?

LOUSMA Yes. At first, it had the characteristic blue odor that we smelled in the CSM one time during the chamber run. It seemed that early in the mission the CSM had that same smell and that it was coming from that blanket.

BEAN Transfer SOP: Nominal.

BEAN Food transfer: Pretty straightforward.

BEAN Configure food preparation area.

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

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

GARRIOTT It's an awful inconvenient thing; the inconvenience more than the palatability because it takes so much longer and it is messier. It takes time.

BEAN It's like eating camping out instead of sitting down to eat. You're really need to have all things going for you right at the first.

GARRIOTT Four weeks later, we could have handled it easily.

BEAN We could have eaten that stuff and it never would have bothered us, but right then we needed a couple of steaks. It seems to me that they should take a look at the food they have onboard, too; and maybe give them some extra good food right there the first few days; make sure that each night they have a filet. Now we know where there's some spare filets right now. And they can go up and get those out and consume them. There's some level between what we're doing now and what could be done to ease the transition, the transition over to good food and then come back later and eat that stuff.

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

take the things you need for the next week. Instead of just taking them all in and putting them in the places where they go and then living in there. Now it appears to me, when you get to the command module, and this doesn't haven't to be day 1, 2, or 3. Whenever you get ready to make CSM transfers, to take and move all those things that you're going to have in the CSM and you're going to use in the OWS and just go ahead and put them in stowage in the right place. Let's take the power packs for example. We've got room in the lockers where the power packs fit right now. Yet we kept the power packs in the CSM all the different time. What it does for you is, everytime you go to the CSM and open up a locker, you got a bunch of things in there that you wonder if you're going to throw them away. Are they going to stay there forever or are you going to move it over 10 days from now. Whereas, if you just move it in and put it in, it's in position.

LOUSMA

Suppose you can't find it when you go to that locker and find a pile of junk in there and it all comes floating out, or it's all bound up with something or the other. This is a good way to lose things and it's a time waster.

BEAN

You wouldn't do that if you were moving into your house. You'd go and move them in, even if you didn't have room. You'd stack them in the corner. You just get everything out of your pickup. This way you have everything all over there. You should just go ahead and get the gear and put it away as best you can. There is plenty of room there. They have plenty of storage space. And then everafter that, have the command module arranged so that when you use up the EREP film, you're already got your little snaps mounted in locker 9, you go put them in their place. Same thing with these other items. Don't stash stuff all over the workshop all the time. When you finish using it, and the Flight Plan should call out if it isn't something that's radiation sensitive, when you finish using it, it should say, move it over and place it in A-8. Then you have things, either in the workshop where they are going to be used, or being used, or you have them in the command module when they're finished being used and you're ready to come home. And you don't have them just stashed all over the place.

BEAN

CSM quiescent mode switches: Pretty straightforward.

BEAN Configure WMC: No comments.

BEAN Activate film vault.

LOUSMA It just takes a long time to make sure everything gets in the right place but if you just follow the checklist everything is straightforward.

BEAN Activate Vacuum Cleaner: The vacuum cleaner is activated.

LOUSMA It's got a new bag in it. I put it in there myself.

GARRIOTT Medical activations: This is an area in which I was very uncertain as to what was supposed to be done. I don't think that it was listed properly in the Activation Checklist. Maybe I'm wrong. But I don't think that it was, because SL-2 stuff was scattered all over. I got messages 2 or 3 weeks later that had me moving stuff around; cleaning out SL-2 stuff, putting it in cans; putting it in lockers. Then I had to go through and do a inventory of stuff and I can't imagine how the medical situation got in what I think is sort of a mixed up position that we found it in. I think a review should be made of just what the medical activation status is. What needs to be done, if anything, to modify for SL-4, and get that properly inserted in the Activation Checklist.

BEAN

I would second that. I would say 3 days out of 7, plus every other nightly medical conference, wanted to know the quantity of syringes in some can somewhere. And Owen spent all sorts of time trying to find syringes, or cotton balls and it just was a gross waste of time. Owen's right. There needs to be a review of what is where, and once this is decided SL-4 shouldn't every day be trying to locate and count the number of expendibles. The whole control of those expendibles was the worst of anything we dealt with. If we'd handled the film or the food the same way that that medical equipment was handled, we would have never done anything that other than trying to find the food. There was so many inventories over so few items. Another thing that seemed to be a problem with that is that it is scattered all over in cans. You take a group of medical supplies and things and put them in a can and stick this in a locker. Then you take another group and put them somewhere else, such as the cooler. Then you move those in the cooler. It's almost by rote and also by can number. So intuitively, for example we come to Owen and request a Seconol tonight because it's near deactivation and we want to get a good night's sleep. He couldn't put his hand on the Seconol because it had been moved weeks before, but nobody knew where, because somebody from the ground had directed Owen to move the pills from drawer A to

BEAN
(CONT'D)

box B. We just couldn't put our finger on things and this is not the way to operate.

GARRIOTT

MO74 activation and calibration.

BEAN

We didn't do that.

GARRIOTT

ML72 activation. The BMMD was turned on.

BEAN

Relocate condensate hold tank: SL-4 needs to make sure that before they launch they understand all the different hoses because all of them have the same name. I recommend that they bring up a piece of paper that can be affixed to the top of the holding tank. And on that piece of paper should be a picture - -

GARRIOTT

A plumbing diagram.

BEAN

A plumbing diagram is nice, but mostly I think you need a picture of all these different fittings so that when somebody says go find the wardroom purge setting, you know whether you're you're looking for something 8 inches long or 2 inches long, because there are many different fittings and adapters and alot of the names are almost the same. It's hard to find them. You can't remember them all and it's hard to try and find them. If you had a picture that you showed you, for example, that the ones that you were hunting had a male fitting at one end and a female at the other, and it was

BEAN
(CONT'D)

4 inches long, you could hustle around and find it a lot quicker than you can any other way. So I recommend that a picture of the things be made and put up on the tank. Also on that piece of paper, it should tell where it's located. In other words, that particular one might be located in locker 288 in the dome part of 288. So it should have a picture of it, the name of it, where it's located and then a little description of how it's used. In that way, you can operate with this water system much more satisfactorily. Condensate plate welding. We didn't need it. We wetted them per the instructions. They were sopping wet when we got there. There's no reason to believe that they're not going to be as just sopping wet for SL-4 and there should be a way to figure out not to wet those plates but go ahead and crank up the system and see if it holds. Our guess is that it's going to hold. I might mention that the little device that checks whether or not the condensate plates are holding water was modified in flight, so that we could look at some of the other pressures in the condensate and vacuum system. It's still in that condition, in a kluged arrangement. It's still hanging right where it was on the fitting in the MDA in it's stowage condition. However, it has the water plate sep wetting system attached to it.

BEAN

M168 container. Replace solids traps assembly: Simple.

LOUSMA Only trick is to make sure that you try to get the little lid closed before the fan stops running because the debris does come out of the screen and starts floating around.

BEAN In other words, you turn off the fan and then unscrew it and close the lid before the fan winds down.

LOUSMA Right.

BEAN Wet condensate plates: What kind of condensate plate we talked about.

BEAN Launch restraints removal: They don't have any. Do you want to say anything about the fan blowing on the rate gyros, Jack?

LOUSMA We hooked up the fan as per instruction, and it was blowing on the rate gyros. It was verified to be on, pointed, and strapped on in the proper way. It sure is in the way for everything else you want to do around the ATM. And it was in the way for the EVA and if you can, you probably want to get it out of there.

BEAN In fact, if they are thinking about leaving that put up all the time, it's not acceptable. What you should do is have them give you a modified outlet on that blower duct that's near by. I suspect they are not planning to leave it up. You can put on a modified outlet that turns the air around and

BEAN T003 activation: A snap.

BEAN Trash disposal: My recommendation is that you select one person to dispose of the trash because there's a lot of feel about breaking the trash airlock. I don't think you want to send three guys through the system of learning when it's nearly jammed, or partially jammed, or something's too tight. I think the rule is this. You tend to only put two urine bags in a urine bag. You tend to be careful about the amount you put in. Tend to err on the small side. We've got all sorts of trash bags up there. We don't have too many urine bags, and we don't have too many disposal bags. So you tend to try to use the trash bags which are the ones with the little rubber grommet. Try to use them as much as you can. Take up some more spares of the others. You can make those trash bags work. But mainly the thing to do is that after you depress the trash airlock, don't push too hard on the handle that shoves it out. In other words, push on it kind of easy and if the thing just doesn't start shoving out immediately, don't push on it anymore. But close the eyelid, repress the can and take something out of the bag. Because it should slide out of there easily. The way you're going to get in trouble is if you have something that doesn't slide out of there very easily, and you're just trying to slide it out because you're convinced it ought to slide out. It's not

always possible to determine when one of these things are going to stick. You've got a bag that looks loose and then you depress it, and it's jammed in there tight. And then later on, you have some you think are tight and they just shoot out of there. So it takes a lot of trash disposal experience to get the hang of it. That's why I recommend just letting one guy do it because if that trash airlock ever jams, it's going to be the worst day you've every had. You must have that thing.

BEAN Checkout of the ATM.

GARRIOTT Went pretty smootly. No problems. There are some things on the panel now that the checklist is going to have to reflect. Such things as the Sync Gen switch can only be in one position. You have to avoid turning on the TV bus. We've just got to make sure that the Activation Checklist really conforms to the way that the panel looks and that the crew is familiar with all the "funny's" associated with the panel.

BEAN The switches that we're not supposed to operate any more, would you recommend they leave the tape on there, or they take some guards to put on?

GARRIOTT I think the tape is satisfactory. I thought that was a pretty good guard myself. The way we attached the tape across the

GARRIOTT
(CONT'D)

switch. There is one across the sync gen switch and from time to time we had various other switches taped. The timing switch is also taped. I believe those are the only two that we have tape on right now. We have tape on H-alpha switch.

BEAN We can put tape on the simulator for practice.

BEAN EREP Check out.

LOUSMA EREP checkout: Went per the checklist. No problem. Everybody's acquainted with the S192 alinement and so forth. We followed the empty tape reels up at the head of the EREP panel, the little circular container, and that's where we left them. That's where SL-4 will find them. It's configured for tape record 2 operation at the moment. Both tape recorders are empty and cleaned as best we could and they will want to take up plenty of extra swabs for cleaning tape recorders in the future.

BEAN M092/M171.

GARRIOTT The activation went okay. I would suggest a serious look at the tolerances permitted on the MA calibrations. The calibration is set such that you will always fail the tolerance test and have to go back to the checklist to recalibrate, everytime. If the tolerances were expanded, you might still be able to have them within satisfactory limits and save quite

GARRIOTE
(CONT'D)

a bit of crew time. I hope SL-4 is planning on using cue cards and not the checklist, because the cue cards will save a lot of time.

BEAN

M110.

GARRIOTE

On the M110 stuff, everything is set up very nicely there. I thought the checklist was well organized and all the equipment is right where it should be. I don't think SL-4 will have any problem with it.

BEAN

The thing that helped you the most was getting it all out the night before so that when we got up in the morning, we were ready to go. Otherwise, we got way behind.

GARRIOTE

It saves you about 15 minutes to do that. It's not only 15 minutes of the SPT's time, it's 15 minutes of the other two guys time as well. Everybody is in a hurry to eat breakfast and you can't eat breakfast until you get the blood draw. It really slows things down if you don't take advantage of that.

LOUSMA

Then you have an M092 in 1 hour.

BEAN

Did you also mention the fact that when you got ready to use that vacuum system, that the needle had rusted and it is reasonable to assume that their needle is rusted too?

GARRIOTT That's a good point. Down on the ASPER, the device that mates between the vacuum line and your ASP, the needle had been rusty. The procedures, as near as I can tell, doesn't say anything about replacing that. I replaced it and there are more needles in the little M110 kit. I will try to show SL-4 its location and how to change it, if necessary.

BEAN Probably should be changed out to begin with. Then they can start out with a fresh one that should last them.

GARRIOTT Actually I changed it a couple of weeks before the end of our mission in hopes that it would last well for SL-4.

BEAN Good.

BEAN M133 activation.

GARRIOTT I don't think they will have M133.

BEAN S009.

LOUSMA We did not activate S009 or use it. I was trained to replace the motor in it and I was not programed to use it.

BEAN M151 and 516: No comments.

LOUSMA No activation of that.

BEAN Relocate Food Containers: We didn't have to do that.

BEAN Wardroom Window activation. Nothing there.

BEAN Activate portable fan. We didn't do that.

BEAN Configure shower area: We didn't do it.

BEAN Spare condensate module: We used the spare condensate module when we were wetting the water sep plates. And that was a lot of extra work thrown on the middle of activation which tended to cause our activation to slip behind something fantastic. My recommendation is that we try to minimize any extra things out of the activation the first couple of days and after SL-4 is moved in, and then if have any special events that they would like to have done such as troubleshoot the condensate system, then try to take part of those activities.



6.0 TYPICAL ON-ORBIT DAY

BEAN Postsleep Activities: I think we should dismantle all those postsleep activities that we had that are entitled postsleep activities for M110 and postsleep activities for EREP and all that other business and just have one postsleep activities which you do every day. If it turns out you have to do an early EREP on M110, you - the SPT for example preparing for M110 gets his gear out the night before and just gets ready and it just takes him a little longer in postsleep activities. Now, in that case SL-4 will have to be alert that there is 110 and usually along with that is the blood and the urine sample evaluation and an additional time allocation should be provided for that.

GARRIOTT For M110, the time was always too short. That may be because I work a little slowly. I think on the next flight, they will probably be doing hemoglobin and specific gravities, as we did after about the second blood draw. It took about 2-1/2 hours to go through M110 and hemoglobin plus urine. Now don't forget that the SPT has to eat some breakfast on the end of that as well, but he hasn't had any breakfast up to the end of that activity. It's just going to take that amount of time. Proper allowance needs to be provided in the time line.

GARRIOTT An additional 15 to 20 minutes should be provided the night before, to get the gear out, because that'll just shorten the amount of time that the other two fellows have to wait for breakfast. Then, you can hurry along, waste minimum time on the morning of the 110 draw.

BEAN I like the way our postsleep activities went. We all did the same thing each time. The way it worked out is that the SPT and I got up, weighed, and then went in and started fixing our breakfast.

BEAN The PLT got up and weighed, and he went in and got some sample bags and got the new urine collection bags. And he took his urine sample and did all the business in there. And just about the time I was finishing eating, the PLT was coming in and starting to eat, and that cleared up the head. Then I'd go in there and do my things, and then about that time the SPT would be finishing up and would come in. So we did have serial activities in the head, and sort of semi-serial activities in the wardroom. It works out real well, if you can just fall into some sort of routine like that, where everybody's not eating at exactly the same time and then trying to fight their way to the head.

GARRIOTT Incidentally, this is quite contrary to the original plan, where we were all eating our meals together so as to provide

GARRIOTT
(CONT'D)

an opportunity for a little social intercourse. And we ended up eating no more than one meal a day together. And we did it serially for just the advantages you said, Al. It has some disadvantages, but if you're pressed for time as we were, because we were trying to get so much done, I don't think there's any other way to do it economically.

LOUSMA

I don't ever remember using the postsleep and presleep cards that you carry around with you all the time, so I think they're extra pieces of information you don't need. I think the idea of everybody doing his own postsleep activities is far superior to one plan we had at one time to have one guy do all the urine and that kind of thing. I think that everybody ought to do his own activities. That's the way we did it, and it seems to be the best.

BEAN

Urine Samples: I never did understand what advantage you got out of holding the urine compressed for 40 seconds once you got the urine in there. The only question that kept coming up is how hard you wanted to shake the bag because it turns out if you shook the bag pretty hard and dispersed the tracer you got lots of bubbles, and if you shook it gently and got a small amount of bubbles then you, of course, did not distribute the tracer quite as good. They can take a look at our samples, that are frozen now, and try to get an idea of

BEAN
(CONT'D)

what happened. For example, Jack consistently shook his more carefully, and ended up with less bubbles. I shook mine vigorously and got lots of bubbles. They (Medics) can decide which procedure they would prefer.

LOUSMA

The first week I shook mine less vigorously, and then the word came up to shake it vigorously, and so I did. The thing that I did that was different was that I'd spin the whole box in mid-air for a while trying to get the bubbles to go to the middle and the urine to go to the outside. They can evaluate whether or not my urine samples are different than anybody else's.

LOUSMA

There is no question that by shaking the box vigorously, it makes a lot of bubbles. If you don't want bubbles, then you're going to have to quit shaking it so hard.

BEAN

They're going to have to evaluate them and come back. Maybe that spinning is really a good deal, anyway.

BEAN

I like the way they put the half-urine sample days on the Flight Plan instead of having you try to remember. It seems to me, putting all that stuff on a card about half-sample/full-sample. You know right now that they don't even know how long they're going for.

LOUSMA They're just going to change their mind anyway, just like they did on our flight.

BEAN I think the thing to do is just have a card in there like we had, except you don't write down the serial number of the bag because nobody wants the serial number of the bag. All you want to do is write down the total amount of the urine that you measured, and you can transfer it to the urine log. So my feeling would be that they come up with a card that should have the day and number then go from there. Maybe leave a little space for a write-in of what it is, so when you read your Flight Plan maybe you could write in half-sample, then you don't have to remember it. Don't try to prefigure it out because it just doesn't work out. You want to say anything about where they put the half-samples, and fulls, and how it seems to bounce around and where they put the blood samples in there, and all that business.

GARRIOTT No, that ended up working out fairly well until the last few days. Just put each day sample in the numbered slot. I think that's far better. Just put day 55 in slot 55, all the rest of the way, and put the blood wherever you got a half-sample.

LOUSMA I don't think you ought to worry about it anyway, because all the bags are carefully numbered as to what day they were taken on and to have another place to have to put them is just a bunch of extra Mickey Mouse. I think you ought to just throw them in whatever slot happens to be available and forget the numbers and the box.

GARRIOTT It certainly helps keep track of the record, and it's really no extra problem to put them in the next slot. The one thing I was going to bring up, though, was this question of on day 20, you put it in the day 19's slot because it was really the urine that was collected from day 19. Did you fellows object to that, I mean by being sort of 1 day out of phase?

LOUSMA I never looked at the number in the box, just put it in the next empty hole.

GARRIOTT Okay. Well, I always made sure that we were putting the right day in each slot. Now just as long as one guy verifies it, then everybody'll be the same.

LOUSMA It doesn't make any difference really because you got the numbers in the bag, and that's what the important thing is.

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

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

BEAN Any other comments about those?

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

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

LOUSMA
(CONT'D)

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

BEAN

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

BEAN
(CONT'D)

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

GARRIOTT

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

GARRIOTT
(CONT'D)

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

LOUSMA

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

LOUSMA
(CONT'T)

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

BEAN

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

BEAN
(CONT'D)

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

LOUSMA

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

BEAN

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

BEAN
(CONT'D)

time I opened the lid, I ended up, I think, wasting about half. I wiped about the same amount off the bottle each time as I'd actually put on the food, so I ended up having to use twice as much. The total mission I used over a bottle and a half of Tabasco. It never was quite as good as if the food had been in a squeeze container. It was sure better than what we had the garlic salt and the like in. Eat Period: Owen and Jack.

GARRIOTT:

We didn't try to eat together because of time constraints. We found it more efficient to eat otherwise. I think we would have probably enjoyed meals had we had the opportunity to eat together. If you're pressed for time and if you're trying to get a lot done, that's not the most efficient way. So, I have no complaints about the way we did it; it's just the way we had to work.

LOUSMA

I'd like to reiterate. They have to eat at regular times.

BEAN

It's too easy up there in periods of high workloads to just let your meals slip. You tend to let that slide because it can slide and you'll end up all a sudden finding you're eating lunch at 4:00 in the afternoon which means not only have you taken a chance of dehydrating partially, but now you got another meal coming along in a hour or so which you're having a tough time in getting it down. I think that the food, and

BEAN
(CONT'D)

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

GARRIOTT

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

GARRIOTT
(CONT'D)

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

LOUSMA

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

BEAN

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

GARRIOTT

That is what it would require. It wouldn't require slipping it in hours, it normally requires slipping it in days. M092/93 had their windows that you had to make, and these windows were only 30 minutes wide. You know you wouldn't have missed an EREP pass for anything.

BEAN

No, you better not miss those.

GARRIOTT

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

GARRIOTT
(CONT'D) one. Although we sit here and say those are the three most important things when it comes right down to just what you asked for, Al, I don't think any of the three of us would have found that acceptable.

BEAN Those weren't the three that kept interfering.

BEAN There's not enough going on. There's always the night time. You can eat between ATM passes. MO92/93 only last a couple of hours.

GARRIOTT ... a meal in 2 hours.

BEAN No, I'm saying one man is not doing it so he can eat. The man that's monitoring it can eat. The only one that can't eat is the man that's running.

GARRIOTT I disagree. First of all, we're not talking about the third man who is already up on the ATM. We're talking about the two men doing MO92/93. You darn well do not want to be eating in here while you're supposed to be monitoring a medical experiment or else you'll forget to throw the blood pressure cup on or something.

BEAN That's possible.

GARRIOTT You obviously can't do it while you're the subject. So I don't think what you said is correct. We have too many

GARRIOTT
(CONT'D)

constraints. I don't think any of us would be willing to blow the medical experiment, that 3-hour chunk, because we wanted to go eat, or blow an EREP pass because we wanted to go eat. We wouldn't have done it.

BEAN

I don't think it's the problem.

LOUSMA

Because we never quibbled with the schedule if the eat period was a half hour sooner or a half hour later. We could take it the way it was scheduled. What we're saying is that even when it was scheduled at the right time, if you had something that you had missed earlier, you'd want to make it up during that eat period. You'd have to discipline yourself to take the eat period when it's scheduled properly without all the other constraints. You had to put those things that you missed and wanted to catch up on aside and do them some other time. You couldn't let them interfere with your exercise, sleeping, and eating.

BEAN

Presleep activities: Presleep activities consisted of washing up and doing the exercise you had missed earlier.

GARRIOTT

Yes, we ended up eating about 30 minutes prior to the time to go to bed.

GARRIOTT

That was about the only time we had.

BEAN We quit doing that towards the end.

LOUSMA You don't want to eat just before you go to bed because you can't get to sleep. You don't do that on Earth and you shouldn't do it up there. Your evening meal should not be part of your presleep activities. It should be scheduled in there even if you have to shorten you presleep activities.

BEAN That's right.

LOUSMA Another thing we never did was go to bed on time. We always had it scheduled at a certain time but you wanted to take a little time to wind down, talk about the activities of the day, or photograph some sight that was coming up in the window pretty soon.

GARRIOTT I know I'll be talking about this same point over the next 2 or 3 days. What you say is exactly right. I agree with it but we brought it on ourselves.

LOUSMA I know it.

GARRIOTT It's not the flight planners fault. It's exactly what we asked for. We said, "Keep sending us more."

LOUSMA We aren't trying to put the blame on anybody. We're trying to tell Jerry what's going to happen.

BEAN We didn't have any problem with it later. Instead of waiting until the end of the day to eat just before we went to sleep, we tried to find some slots 3 hours beforehand to eat. When a blank spot came, then we ate.

GARRIOTT Sometimes we did but it was all ad hoc.

BEAN That's right.

GARRIOTT We would find a slot when we could eat. Because we kept asking to work to 2300.

BEAN That's what you want to do. It was obvious that time was available because once we set our mind to eating before sleep time, we did it every day.

GARRIOTT Well, I disagree. You did it, I could not. Maybe Jack did. I don't know. I would say that on the majority of the days, I ate within the last hour before going to bed. And I exercised within the last hour very frequently or even after hours. It wasn't because that was when I wanted to do it, it's the fact that was the only time I could work it in.

LOUSMA We're going to have to give Owen an efficiency button.
(Laughter)

GARRIOTT The most probable answer is that I worked at a less efficient pace on many tasks.

LOUSMA I think my major comment on the presleep activities is that the eat period should not be part of the presleep activities. You should take it out and schedule it at the right time.

BEAN That's a good comment, Jack.

LOUSMA You would end up shortening the presleep activities.

BEAN Shorten the presleep and try to eat around 5 or 6.

LOUSMA The time is going to work out about the same. It's just that the eat period should not be in presleep.

GARRIOTT You're asking them for something different than what we asked for.

BEAN I know it. This is better, I think. We ended up doing it ourselves by looking ahead. We'd say, that's when we're going to eat. Then we would hustle down there and eat right at that time.

LOUSMA That's what I'd do.

BEAN Or when we were supposed to exercise at that point, we'd say I'm going to exercise before I go to bed I'm going to eat here. We did some self-scheduling.

LOUSMA We did self-scheduling on more than that occasion too. There were other areas in which I found myself self-scheduling.

LOUSMA I self-scheduled my exercise sometimes. If I had some non-time critical task come up, why I'd perhaps go and do it in lieu of something else. Jerry will find there will be some self-scheduling.

BEAN I want to comment about washing up. I thought using a washrag and the squeezer and towels worked out pretty good. The only thing that I noticed was that one time I did a lot of hair washing with the soap and that I broke out on the scalp a little bit. I quit using so much soap and it went away. You have to be careful because you don't always rinse your hair as much as you think. If you're using soap a lot, be careful you don't get it caked on you where you can't see it.

GARRIOTT PT ought to be on this typical orbit day.

BEAN Yes.

GARRIOTT Our normal daily schedule frequently had that split into two intervals of about 45 minutes each therefore totaling an hour and a half. Personally, I thought that was unsatisfactory.

BEAN So did I.

GARRIOTT I cannot get anything worth while accomplished in a 45-minute interval. Principally, because the first 15 minutes, you're

GARRIOTT
(CONT'D)

usually not there. You're usually finishing up the task that was just ahead of it because they didn't give you enough time for that. And then in the 30 minutes that was left, all you can do is begin to work up a sweat. I don't like to work up a sweat and then not have any time to get cleaned up at the end. So I - in spite of what our friends in the physiology department say, I would much prefer to have an hour and a half, clean up after it, and be done with it. I think it is also a far more efficient way and time-saving way for the total interval. We did most of our own PT scheduling, which usually turned out in the latter 30 percent of the day. But wherever it comes, I think it ought to be an hour and a half block and maybe it could even be more than an hour and a half.

LOUSMA I suggest that it not be scheduled after the evening meal also.

GARRIOTT Personally, I didn't mind doing it after the evening meal, if I really had time for it.

GARRIOTT It probably depends a little bit on the individual.

LOUSMA Well, after your evening meal, it gets done as part of your presleep activities so you exercise right up to the time you go to bed and then you can't get to sleep. It's crazy. It just doesn't work for me. I don't know, maybe you can do it.

GARRIOTT No, I'd rather not. I agree. I'd rather exercise earlier. What we're doing now with all these suggestions we're making is saying what we ask for in orbit was not right. They all work in the direction of reducing the amount of experiment time. I really tend to agree with you on these things, Jack, but I want to keep stressing the point that it's not what we asked for. Do you agree?

BEAN Oh, I agree with you.

BEAN I think what you have to do is work towards both of them as a goal. Most of the times we could schedule ourselves so we weren't doing exercise just before we went to sleep. Sometimes we couldn't. If we had EREP passes it interferred. You have to find some way to handle both situations.

BEAN You have be able to exercise and do EREP at the same time.

LOUSMA If we don't say these things, the flight planners aren't going to know what is best. It's preferable to do it that way. If it can't be worked out, so be it. But, if you can shoot for this, why that's better.

BEAN Yes, I think one of the things we all agree on is one exercise period for an hour and a half is the way to do it. If the flight planners can't do it, I guess they can't but that's the way it should be thought out instead of trying to do it the other way.

BEAN

Evening status report: The evening status report seems okay. The later the evening status report can be made, the better it is because it allows you to collect all the data. For example, it allows you to get some film in the report that you're waiting for later in the day to take. The film report always was a pain, mostly because you end up writing down the same numbers three or four times. You write down what you used the transporter for. Then you put what the supply had and the percent remaining in the takeup. Down at the bottom when you're writing out what's in each drawer, you write it out again. Not only does it take time but it allows you to misposition the numbers and that is painful, too. I think that the nightly report is a necessary thing, but maybe there's a way to streamline this photo report so you don't say the same words so doggone many times. Maybe you just read off what you took in the way of pictures and that's it. Or you don't do that and you read off what's remaining on all the different transporters. Reading each one twice seems awful time consuming.

LOUSMA

Here's the way I think you ought to do that. I think you ought to eliminate the drawer A configuration because you just set it up in the 16-millimeter film log. To go back and give the drawer A configuration is doing work in space that can just as easily be done by the people on the ground and you're doing

LOUSMA
(CONT'D)

their job. I found that I could do the drawer A configuration without looking at drawer A by merely looking at what was in the 16-millimeter log. A man on the ground can do that just as well. I think you ought to eliminate drawer A configuration on the photo log.

BEAN

Even if he doesn't know it, it doesn't make any difference because up there if you need film and it doesn't fit, you just load film and take it. It's a lot of extra work for no particular gain. You ought to give them what you did and then press on to the next event.

BEAN

Sleep period.

GARRIOTT

I thought sleep up there was remarkably good. You were naturally tired each evening and we did not waste a lot of time trying to get to sleep. Sleep was apparently lighter so we may - may have awakened a few more times than normal, but we didn't have any trouble going back to sleep. It was almost pleasant to go back to sleep.

BEAN

Owen said one day that he liked to wake up in the night because it was so pleasant to go back to sleep.

GARRIOTT

It really felt almost like I didn't mind waking up at all.

BEAN

I watched him closely for a couple of days.

GARRIOTT Just so I could go back to sleep again.

LOUSMA I think if there's anything you can't cut short up there, it's the sleep period.

BEAN You can't!

LOUSMA You cannot cut it short. If you get less sleep than you need up there it affects you more than it does on the ground. It did me anyway. And it made me feel tired all day, more so than it would on the ground. I had no trouble getting to sleep. I found it was very dependent on the temperature in the sleeping compartment. When I went to sleep, I usually slept well all night. I got by with less sleep up there than I would down here - about 6-1/2 hours. It's not going to be any high percentage. Maybe an hour less sleep but not anymore than that.

GARRIOTT To get your 6-1/2, it would take 7 hours in the sack. Wouldn't you say about that?

LOUSMA Yes, at least. I was usually awakened by Houston in the morning. It usually took me a little while to get to sleep at night, although when I did get to sleep I normally slept all night without waking up. I don't think you can get by with a lot less sleep because if you try to you will find yourself making lots of mistakes and you will find yourself not feeling well.

GARRIOTT I don't know why Paul said he thought he could.

LOUSMA Everybody is different. That was my own personal observation
on me.

BEAN For us, we all needed to get the right amount of sleep. About
the same.

7.0 ANOMALIES AND UNUSUAL ACTIVITIES

- BEAN List all significant anomalies and unusual events that occurred during the mission in chronological order.
- GARRIOTT Well, we noticed some sparkies flying by the window a time or two. That was sort of unusual.
- LOUSMA You hear weird noises at night that you don't notice during the daytime. You hear the effects of thermal gradients on the machine at night. You don't hear them so much during the day. They are little thumps, and bangs, and whomps. You can hear the TACS when it fires. It sounds like somebody is beating on your basement door or knocking on the water pipes down in the basement. If it's right where you happen to be standing, it sounds a little louder than it does if it happens on the other side of the vehicle.
- GARRIOTT You can hear the ATM cooler pump when it needs lubrication. You can see the puff of white smoke rolling by the window if the TACS on that side happens to fire. When you hear a thumping on the water pipes, you better start thinking about turning off the TACS.
- BEAN These noises that you hear at night (there are all sorts of them) are not the same from night to night. For a while there,

BEAN
(CONT'D)

we were hearing a series of thumps, maybe 10. It would go thump, thump, thump, almost in cadence and then it would stop. This happened every once in a while and then maybe the next night period you would hear one that sounded like a twang. There's a lot of different sounds. Even though they're not the same each time, they aren't anything to worry about. Another sound that we heard a couple of times that we should have worried about is when ground control dumped O_2 into the cabin. We had all our regulators in a position where we didn't expect any O_2 to come to the cabin. The ground wanted to pump it up and they were using their controls to put O_2 into the cabin. If they do, you'll hear it and be aware that it sounds like it is coming out down there in the mol sieve. Another sound that you hear a lot and is nothing to worry about is the mol sieve. When they change from one mol sieve to the other every 15 minutes, there is a big clunk and a lot more noise than you'd think. That goes on every 15 minutes. There's nothing wrong with the mol sieve when you hear some noise down there. It just was noisier than anything I had imagined.

LOUSMA

There's something I heard regularly. It was a long low rumble sort of like thunder in the distance. That was the thermal gradient at night. It was something you won't hear when you're doing the normal activities during the day. When you're quiet

LOUSMA
(CONT'D)

at night, I heard sort of a sustained rumbling. The tail was cracked someplace down around the oxygen tank don't you think?

GARRICOT

It sounded to me like it was toward the aft end.

BEAN

That's where you always heard it. It was like a roll of thunder that last 4 or 5 seconds.

QUERY

Can you think of any other unusual sounds?

LOUSMA

The refrigeration pump makes a high-pitched squeal but you're kind of used to it and, unless all the other fans are off, you really don't notice it too much. It makes a high-pitched whine. I've listened to it and it didn't change any in frequency or in intensity over the time that we were there. It's kind of masked by the waste management compartment blower which runs all the time. You don't hear the duct fans unless you put your ear right up the ducts. Basically the machine is quite quiet. The only thing you really hear running is the waste management fan and the squeal in the refrigeration system pump which you kind of become deaf to. You can always tell when urine separator blowers are on. I thought that the - sack would move a little bit sometimes to your heart beat and sometimes probably to the movements of the vehicle. I thought I could feel the vehicle moving.

BEAN I did too. The sack would move over in the corner.

LOUSMA Things we saw out the window.

GARRIOTT For example, we saw that satellite about a week before splash-down. That was one of the most unusual things that we saw and I guess Jack noticed it looking out the window. This bright reddish object was out there and we tracked it for about 5 or 10 minutes. It was obviously a satellite in a very similar orbit to our own. It was rotating and had a period of almost exactly 10 seconds because you could see the brightness vary with that period. We followed it until sunset and it went out of sunlight just about 5 to 7 seconds after we did. It held its position nearly the same, in the wardroom window for that 10-minute interval although we could see it drift in relative positions slightly, maybe 10 to - 20 degrees during the course of that 10-minute interval. It was reddish in color even when we were well above the horizon. As we approached sunset, it turned more reddish, presumably because of the sunlight change. What satellite it was and how it happened to end up in such a similar orbit, no one ever explained to us. And I would like to hear a few words from someone about that satellite.

BEAN You bet. We never saw it again. You'd think we would have seen it the next night or it would cycle by another time. Maybe it did and we weren't looking out the window.

LOUSMA You might point out that it never did take the shape of an object but it was always brighter than any other star or planet in the night sky. It was much brighter.

BEAN We tried monitors and everything on it but we could never make it into anything other than a bright light.

LOUSMA In doing T002, I had on other occasions, at least once or twice, seen other satellites although they appeared as star points of light.

BEAN Let's talk about caution/warnings at night and in the daytime. I noticed at first when we did have caution/warnings in the daytime we all whistled up there real quick to see what was happening. Then as the mission wore on, we tended to just let whoever was closest take a look. Without the TACS on, there isn't a lot that can go on except rapid DELTA-P which sounds different than any of the other caution/warnings, particularly just a caution. I recommend to Jerry and his crew, and I'm sure that this recommendation will be hard to live by, that caution/warnings don't appear to be anything you have to hurry and resolve or stop doing your tasks to race up to the panel

BEAN
(CONT'D)

to look and see what's going on. Now rapid DELTA-P and fire is another story. We had fire alarm once, didn't we?

GARRIOTT

Only because I hadn't turned the UV sensors off at the time we opened up the window. I know what it was.

LOUSMA

At night it was a little different. Whenever we had a caution/warning at night nobody ever knew who was near where and everyone thought the others were in the sack so everyone came out of the sack and converged on the caution/warning panel. So that's the way the caution/warnings were handled at night.

BEAN

At night, no matter what you say, if that thing goes off you are going to go up there. My recommendation would be to get these cautions and warnings that don't work too well off the line. The OWS interchange duct flow never worked worth a darn and should be kept off. The same applies to the CO₂ sensors and sieve flow. Even if you lost the sieve at night, it doesn't make any difference. When you wake up the next morning, they can tell you that you lost the sieve. Having a caution and warning trip off in the middle of the night gets you all excited; you miss some of your sleep and it just isn't the way to go. You don't want to inhibit a fire sensor, but some of these others that don't make any difference would be

BEAN
(CONT'D)

inhibited. Some one ought to go through that list and see which ones you can inhibit.

LOUSMA

A number of those were intermittent. You would go up there and the light would be out. You would have to do memory recall to find out where it was.

BEAN

That way when something goes off, you would know you've got something unusual to work on. One unusual event that we had was the time we went out of CMG control, center A, and a couple of other things. We made up our own procedure because the procedure called for us to go to the command module and power it up. That was the old procedure.

LOUSMA

It was called wing it.

BEAN

If you followed it, it said go to the command module and power up. We knew that we didn't want to do that. Two days later, they sent up a nice procedure. It uses the best capability of the workshop with whatever remains. Maybe Jerry will have a good command module but maybe he won't, so maybe he can use that to stabilize. With the TACS off, that thing is just not going to go anywhere very fast, so you really don't have to do anything in a hurry. If it does drift out of attitude, it isn't going to hurt anyway. The confidence in the reliability of the rate gyros and everything has gone up so you probably

BEAN
(CONT'D)

will not have a problem. If you do, you are not going anywhere that you have to get back in hurry anyhow. The best thing you could possibly do is just stand and wait until the ground comes up and take a look at it together, then put it back into place even if it takes an hour or 2. Even if it turned upside down or faced the opposite direction, it really wouldn't make any difference for a while. It would prevent your using the TACS you might want to use for looking at a comet or something of that nature.

LOUSMA

One other thing that makes a terrible noise that's actually normal is when you turn on the EVA water loop pumps and go through the cycles on those. They sound like they are falling apart and they make all kinds of different noises during the time that they are on. They don't run steady state. I carefully logged the kinds of noises it was making the first time, but that appeared to be normal so after that I did not and they always worked normally. When you turn them on, they'll make variable noises during the time they're running, particularly when they are first powered up. It is heard most distinctly in the airlock.

BEAN

Also in the airlock is where we first heard that noise that later turned to be on ATM cooler pump. The noise sounded to me like escaping gas underwater, sort of a squeak and bubble

BEAN
(CONT'D)

with high-pressure gas of a relief line relieving in a fluid tank. It still did sound that way. Owen and Jack kind of felt what it was as Owen described it as the water pump in his car ready to go. It appears that it was pump number that was going. We came off A and ran on B and C a couple of different times and found that we didn't have the squeaking anymore.

LOUSMA

I think both of those recollections are accurate.

BEAN

You'll become rapidly alert to all these noises, listening to them. They are not all exactly the same, but it takes you just a few days to realize which ones you hear regularly and are just part of the game, and which ones are a little bit different. If you do hear something a little bit different, it behooves you to report it so that the ground can work the problem. I reported one that I heard one night which never was completely figured out, finally just left as a noise.

LOUSMA

When you run the suit blower unit particularly at night, it sounds just like a leak. Another thing that makes a lot of noise is the rate gyro six pack.

BEAN

When you look out the window, you don't see anything going by. The only time you see anything going by that I noted is when you're running the white light, coronagraph. Frequently then

BEAN
(CONT'D)

you see bubbles going by. The bubble don't always look just like plain white bubbles going by, or white spots. If they are very bright or close, apparently they overdrive the tube and it makes them look like washers. In other words, they are bright on the outside, and the middle overloads reverses the display. You get a dark middle, and it looks a little bit like washers going by. It's not unusual to see those as you look out and I wouldn't be alarmed. I'd just consider them normal. If you see anything else going by the windows, you need to start looking around because that's how we first noticed that we had a leak in quad D. Owen looked out the window at night and noticed these bubbles going by.

GARRIOTT The best auroral display we had was mission day 6, right at breakfast time, just after we got up. After observing the aurora, it was suddenly obscured by this snowstorm. Jack first identified them and we got busy on the problem immediately. You shouldn't see anything going out by the windows.

BEAN If you do, you want to start looking for problems.

GARRIOTT H-alpha 2 has a problem like that, that surprised each of us in turn when we first saw it. Sometimes when you power up H-alpha 2, to begin with on min zoom, you're looking at the full Sun. When you first look at the display, it will sit there and zoom in and out and very bright as if the whole

GARRIOTT
(CONT'D)

videcon is being zoomed rapidly in with its gain wide open. It's very simple to correct that, by zooming in for about 5 or 10 seconds. Then it stabilizes normal thereafter.

BEAN

It gets bright and then dim around the periphery.

GARRIOTT

It appears to go in and out.

BEAN

The image appears to get smaller and then larger, so that it gives the feeling of zooming in and out, but it isn't.

GARRIOTT

Once you've seen it, you'll not forget it because you really think it's on its last leg. Fortunately, it's not on the verge of being ruined apparently because we've all seen it several times.

BEAN

The last anomaly we had was the problem with trying to vent down the S072 box. The urine separators, and suspecting that they had a leak somehow through the vent. It turns out they finally suspected they didn't have a leak there. Presently we have, on the plus Z SAL, the switch in VENT, which doesn't make any difference since the SAL's open all the time with the parasol out there. But now, instead of having a quick-disconnect cap on there, we have the hose. On the other end of the hose is its quick disconnect. My suspicion is when you get there, it will be either left that way which should

BEAN
(CONT'D)

be okay because you don't need the hose anyhow, or they might ask you to disconnect the hose and put the cap back on. They found out later the problem was not really at the airlock but rather in the command module with the secondary perking water. That was causing an evaporator torque on the vehicle that they weren't ready to accept.

LOUSMA

Also the S183 cap at the last minute was placed on that vent to see if it could keep the vent from leaking. It was severed from its location on the S23 and replaced. The lanyard has been cut, however.

8.0 CSM POWERUP AND WORKSHOP DEACTIVATION

BEAN Stowage Transfers: I think they've allowed about enough time to do it. The idea of getting two people to work on the films is a good one. On this film stowage transfer, it needs to be realized that you're not going to be finished shooting movies or your still photos 3 days or so before the end of the mission. So putting all these in bags and kind of hoping that you put everything in there, disregarding the fact that you've still got your cameras loaded, 16-millimeters and 70 and 35, is unrealistic. There ought to be a plan of what to load, a further plan the night before the last day where you offload the rest of your cameras and the like. That'll give you the last couple of days to shoot up the rest of the film instead of just offloading 3 days beforehand.

BEAN Stowage transfers, I thought, went well. The concept is a good one. The only thing that would assist is, whenever you get there, on about day 5 or 6 or whatever is convenient early in the mission, you ought to offload every single thing you've got on the command module, put it in the use location or near the use location in the workshop, then go back and reconfigure the command module to start accepting these reentry items for entry stowage. Then, when you have something that you know you are going to take back, and it's

BEAN
(CONT'D)

finished throughout the mission, you put it in the command module and leave it. It saves you stashing things all over and then later on trying to collect it and put it in the command module, and stow all at once. This gives you the advantage of having everything in a nice logical place, in the place you're working. It also allows you to put in these attachments that, for example, hold the EREP tapes in the right place, and the fitting that's going to be for 149 and all that other. You can get your stowage boxes all configured nice and neat. For example, take the two lithium hydroxide subcanisters you're going to use. Pull them out of A-6, put them in a bag, and take all the rest of that rig with lithium hydroxide down and put it in one of the stowage positions in the OWS. Makes you want to lay the bag with its two canisters in A-6. That's a good idea. You get everything out of there so that you can start neatly putting things back in the spacecraft, and it'll save you time later on.

GARRIOTT Does the deactivation checklist show the CDR stowing the command module essentially the way you did? I thought it worked out real well.

BEAN I think it does. CDR doing all the stowage transfers is the best way. He's the guy that really knows where most of all these things are. I got everything out of there about day 10,

BEAN
(CONT'D)

because I got tired of opening these boxes and seeing stuff floating out and wondering if that was something we had forgotten, something that was going to enter with us. I'm sure the ground did the same thing, like when we told them we had three constant wear garments and asked what we were going to do with them. They didn't even know they existed.

LOUSMA

VMC Filter Replacements: I replaced that just before we left. The only comment I got about it is that after you unloosen all the calfax fasteners, the seal between the fan and the filter has taken a set and is very sticky. It doesn't want to come loose, you've got to really belt it to make it come loose.

BEAN

You think you haven't unscrewed everything.

LOUSMA

Yes.

BEAN

You think it really isn't going to come loose and you have to put a lot of load on it.

LOUSMA

That's common, not only the seal between the filter and the fan, but between the seal and between the attachment of the whole unit to the floor.

BEAN

I think we did OWS lighting checks way too often. We did OWS lighting checks every week. They always passed. I think that is something that could be cut out of the SL-4 mission.

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

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

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

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

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

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

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

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

BEAN
(CONT'D)

If it's dirty, somebody will probably clean it. Setting it up to do once a week seemed to me to be a waste of time. Also there's a lot of cleaning that goes on in there that we've talked about that you could skip. For example, vacuuming the OWS plenum screen.

BEAN

I think you can just skip all that. Because when you float by them, you look at them and if they're dirty, you get out your vacuum cleaner and clean them. It just saves you time. The things you ought to concentrate on are the things that are not so obvious. For example, once a week there ought to be a message sent up to clean and biocide the hose for 171. Because it's not obvious that anybody ever did it before. You can't tell by using it whatever was done a week ago or 10 minutes ago. Whereas with the screens you can. Another thing that ought to come up about once every 2 weeks, at least, is vacuuming the inside of the aft heat exchanger. We need to show the SL-4 crew how to do that. It's kind of tricky to get back in there and it isn't obvious exactly what is going to be dirty and how it looks in there when it's dirty and how it should look when it's clean. One of the areas that is consistently dirty that we cleaned a little bit, that was never called up, was where we put in the garbage; in those six can holders. That was one of the gummy areas that never got a call.

LOUSMA I think one of the areas you don't need to clean so much is the trash airlock because all the bags that go down there are completely sealed and it never contacts any garbage.

BEAN I would recommend that what we do, rather than emphasizing this so much, is that we get with Crew Procedures and go through the SWS Systems Checklist item by item.

BEAN We probably could go through them individually and help the SL-4 crew decide what to clean and what not to clean, in a hurry, rather than trying to remember them all here.

BEAN Interior SWS Photography:

LOUSMA We did some.

BEAN Entry Procedures Review: Leaving the entry procedures review until the last day, for a couple of hours, is not the way to do it unless you've got a completely nominal mission. If you've got any sort of unusual circumstances, you probably ought to start reviewing those procedures several days in advance. First of all, the CDR probably ought to keep them reviewed as much as he possibly can. Then about 3 or 4 days beforehand the whole crew ought to walk through them in a touch-the-switch mode for a couple of hours. It lets you understand the checklist changes that may have issued, and

BEAN
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it also lets you get back in the swing of things. It doesn't take long to get in the swing, but it's sure worthwhile making sure that everybody understands which page to go to in the checklist.

BEAN CSM Quiescant Panel Check and Verification: No comments.

BEAN Prep for Suit Downing: No comments.

BEAN Urine Collector Hose Container Stowage: No comments.

BEAN Center Couch Installation: We had a problem trying to install the center couch. The reason was because we could not, up at the shoulder area, get the two pins in, one in each shoulder. We found out later that the reason this was not possible is because some little screws that are normally flush with the arms near the shoulder area had unscrewed themselves out and thus prevented the two mating surfaces from coming completely flat, one against the other, so that you can stick in the pins. When we observed this, we screwed the screws in by hand and then were able to insert the pins quite easily. This needs to be checked to ensure that they can't work themselves back out, for SL-4. I think this could be done simply by breaking each of the couches at the shoulder and tightening up those screws and then remating them prior to launch.

BEAN We'll try to demonstrate this to the SL-4 crew.

BEAN Waste Management Compartment Water Dump: Nominal.

BEAN Transfer Fecal Bundles: The only thing I noticed different there, is that we transferred fecal bundles, all of them, the day before. We tied them down and then when you got the last fecal bundles out, we took them and kind of unzipped the packages as they were strapped down; the last package which wasn't completely full. We stuck them in there and tightened the package.

LOUSMA That was a better arrangement.

BEAN Also it's important to make sure that onboard you have an extra bag for fecal bundles because you don't always know how many bundles are going to be required. It turned out that ours was the sixth that was required. If it had been 6-1/2, then we would have had to stir around and get another bag tied down. We need some leeway there.

LOUSMA I think there is some extra bags in the locker between the film vault and the photo locker; maybe another one in A-9 by the TO20 experiment. It looks like M071/73 bundles for a 60-day mission is just about nominal. It was for us. And it could very well run to seven or eight, which is your point.

BEAN We ought to make some allowances, and of course you can always stick those things around, but it would be nice to have.

BEAN Condensate System Dump: The condensate system dump we didn't do in deactivation, because we were trying to preserve the vacuum in there. The vacuum is still in there. They don't think they'll have to do anything with it for SL-4's entire mission. They should be very careful if they somehow open up any of those lines. The only one that's been open is during EVA day when you remove the one there by the aft hatch. It's got two quick disconnects and so far that hasn't presented a problem.

BEAN Urine Flush Water Dump: We did not use it.

BEAN Replacement of Solids Trap and Charcoal Canister: Simple.

BEAN Install Wardroom Window: Nothing.

BEAN Wardroom Deactivation:

LOUSMA The wardroom water, when it was dumped - the pressure in the dump lines didn't want to come down to its nominal value of 0.7 in less than 3 minutes, or something like that. We just pressed on according to the ground call. I think in dumping anything into the waste tank, the pressure never does come

LOUSMA
(CONT'D) down rapidly, as it is supposed to, so the checklist ought
to be changed to reflect that and there should be a procedure
as to what to do when it doesn't.

BEAN They ought to change the procedure.

BEAN Disposal of All Trash Bags: No remarks.

BEAN Cleaning of Collection Module: We cleaned it up real good
and biocided it and everything. That's the one that has all
the cans for the garbage and that is sort of a messy operation.

BEAN Deactivation of Cat Ion Cartridge: Nominal.

BEAN Closeout Wardroom Water System:

LOUSMA When you evacuate the lines in the wardroom water system and
then turn off the flow to the tank that you're using, and
then disconnect the wardroom water, for some reason you don't
have all the water out of lines and you get about a cupful
of water that comes out of the wardroom water line when you
disconnect it from its tank. That was the reason I had the
big rags in front of me. This did not happen when the waste
management water system was deactivated.

BEAN Deactivate WMC Water System: Nominal.

BEAN G&N/SCS Power Up: No remarks.

BEAN Terminate Power Transfer: Nothing.

BEAN IMU Orientation: Simple. I think the good procedure is the one we used. The day before entry, we powered it up, got the state vectors and all that other business. We aligned the IMU and kept it there all night. That's the way to do it. You shouldn't have to worry about it the day before you go home, or the day you're going home, getting all these alignments and everything because invariably you got ready to do an alignment. They gave us shaft and trunion for the alignment and were told to wait until dark. When dark came, we worked the shaft and trunion; stars were not there. The answer was "We are in dump!" Naturally you're in the dump at night. They give you numbers for solar inertial. It's just one of those things that invariably get in the middle of the act to make it a little bit difficult. There's no reason not to power that thing up and just let it run the next day. It'll also give them a good chance to get some great drift checks, allow us not to have to do any alignments once we were undocked, and it just seems to be a good way to go. I'd recommend that procedure. Also when SL-4 undocks, they will not be so worried about the star tracker. I'd recommend that they get their first alignment through the the star tracker and not have to look out through the red optics because you just can't see very

BEAN
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much out there. Once you get it powered up, in the daytime and SI is the time to do the rest of them, using auto pointing, because you can see those stars in the daytime and you're in SI attitude. At night, you can do it too, if you have auto pointing.

BEAN

CM/SM RCS: No remarks.

BEAN

Terminate Power Transfer: Nothing.

EAN

GDC Align: Nothing new.

BEAN

H₂O/Waste/Radiator Activation: What we can say here is, we ended up having to not activate the primary water boiler, and we activated the secondary one while still docked. It turned out that made such a torque that we had to turn it off. We spent about 5 hours or so on the command module there without anything but radiator cooling, and it was hot in there. It was hot and moist. It just wasn't a very comfortable environment. Your hands were sticky and your arms were sticky. I assume we lost some measure of water even though we never did.

LOUSMA

Cabin temp was reading about 85 degrees, and the water was condensing on all the windows. It was uncomfortable. Those three extra drinks we each had really weren't enough.

BEAN That's right. It really would have been better not to be in the command module near so long as we were. That's why we're proposing that somehow we get more things done the night before so that you can gain visibility the night before to the fact that you haven't got much to do to get into the command module, so there couldn't much be wrong. The reason we were in there so long was if something did go wrong, since you're keyed for this single impulse deorbit, you've got to really get that on time. Jerry hopefully won't have that. He'll have the two impulses like the plan, so he won't have to be in there near as long. But staying in there very long without any water boilers on is kind of tough. Maybe if he has some extra TACS left over they can just let his water boiler run and go ahead and waste the TACS since they're not going to be using it anyway.

LOUSMA All this stuff that we're talking about on deactivation day should be done on the day before leaving. You should put your suit on, get into the command module, and leave.

BEAN How true. Cut down on the length of time that day. You sure would be able to do better when you get back home as far as physical fitness, and taking those tests.

BEAN Transfer Urine Samples, Condensate Blanket, IMSS Container, and Fecal Bundles:

GARRIOTT I understand when the IMSS container got back, it was frozen rock solid. The fish were not. They died, but it wasn't because they got too cold.

BEAN Got exposed to one-g again and died?

GARRIOTT It's possible. You know Arabella went also, incidentally.

BEAN Oh, is that right?

GARRIOTT Yesterday. If it is really that cold you should consider the possibility of loading it up the night before, instead of that morning. The lid was not 100 percent sealed. There was a little tiny crack where I could see all the way around the edge. Apparently there was not much of a heat leak but the urine containers were so full that the lid came down and clamped normally, but lifted up off the hinges about as high as it could go, leaving maybe a 1/16 to 1/32 of an inch crack around container lid. Still it seemed to hold real well. We want to see if we could move that up into the night before, instead of early morning transfer.

BEAN You bet.

BEAN The thermal blanket, that ought to just go along with wherever that canister goes, instead of stashing it in there between the lockers and the CSM. They you got the cans in the cooler. You got the item itself somewhere else and then you got the

BEAN
(CONT'D)

thermal blanket with the CSM. You just got to go around and hunt them and try to remember where they are. You ought to just carry the whole business down there, take the stuff out of the IMSS, stick it in the chiller with suitable tape or whatever method you're going to use to fix it. Hopefully, that would be a change. Put the blanket and the container itself somewhere else all together. Then you don't have stuff scattered all over.

GARRIOTT

SOP Docking Load Straps: Was a waste of time. We knew it was a waste of time before launch and could never get anybody to say that it was. We've got garbage all over that spacecraft tied down less securely than those SOP docking load straps. Just a big waste and it's foolish to continue even doing that sort of nonsense. It ought to be cut out.

LOUSMA

AM/MDA Closeout: We already mentioned the fact that we got a fan pointing at the rate gyro six pack. Last we saw, it was running and pointed proper. We also had some question about lighting configuration. We had copied an up-link wrong. We got that circuit breaker situation straightened out. One of the closeout photos on panel 202 is not equal to the current panel configuration because the closeout photo camera was secured before we reconfigured the circuit breaker panel 202.

GARRIOTT We got the TV vidicon also mounted on the end of the ATM panel as the message required the last few days. It's already been pointed at the MDA CM hatch. It's been turned on, checked to be focused and everything just right. All you need to do - it's all plugged in - is just turn on the power switch over on the input connector and verify that the video selector switch is in TV. I'm not sure how that one was left, but just verify that it is in the proper spot, which would be TV. You're taking pictures of the entry from the command module.

BEAN We ought to keep in the checklist where you put the probe and drogue. In a couple of months, you sort of forget where the best place is. The procedures in there that say - put this one on the couch and put that one over behind in the PLT's couch, et cetera, is good dope.

9.0 SEPARATION AND ENTRY

BEAN We undocked with a nice thump and then started to back off. It only got 0.3 ft/sec as indicated on the EMS, instead of 0.4. It's quite easy to fly out there. We flew it back and would go off just straight as could be. No pitchup, pitch-down, or yaw. It just moves right back. We were flying the docked DAP at that point and it flew real well. No flyaround. We just kept backing out and when the sunrise came, Jack took some pictures. Did you take both Hasselblad and movies?

LOUSMA Yes. We just sort of had a wing on the settings, hoping we got something.

BEAN We went to our burn attitude. We used different maneuver modes. We used the undocked DAP, the docked DAP, and the SCS, all of which flew precisely like the ground had indicated they would. I had a lot more confidence after flying it that it was going to be a simple operation. It was just good. The thought had gone into the checklist and had gone into setting it up and informing us the best thing besides checklist changes that came up were these little entry study guides. They went into details of how you fly it, limitations, and the like. Those are particularly good in case an off-nominal situation occurs. You got lots of paper up there in that teleprinter. Any extra information is sure useful. We never

BEAN
(CONT'D)

had too much information on anything we did. At least I never felt we did. We always had either enough or sometimes we'd liked a little more or so. Anytime there's a question, just shoot it on up. There'll be something else to read.

LOUSMA

Sextant star checks: We didn't do one there although we did an alignment. It worked well. SPS thrusting: SPS thrusting went well. I'm glad we got that information that we were going to have about a 30-percent duty cycle on right translation to correct the two-jet-failed case CMG misalign. It turned out we were able to keep that within a couple of degrees all the time. Our procedure was we made sure we didn't pull until we were within 5 degrees. But we were well within the 5 when we pulled and the burn came out real well. I took a scop/Dex about 10 minutes before the burn, right? We inflated our counterpressure garments.

BEAN

No, you and I took one after the burn.

GARRIOTT

I took one an hour and half prior to splash which would have placed it about 15 minutes prior to the burn.

LOUSMA

During the burn, we had ourselves strapped in very well. I noticed that it didn't seem to kick me in the pants quite as hard as I had there during rendezvous when the SPS lit off. It was a steady comfortable acceleration. I felt no tendency

LOUSMA
(CONT'D)

to gray out or to black out or to lose my attention span. I was able to give a cut-off time on burn, monitor my gauges. I had the feeling that Al and Owen were able to do the same or theirs.

GARRIOTT

I confirm it absolutely. No tendency to have any alteration in vision or concentration or anything abnormal. The burn was as smooth as you would want. Performance, personnel, I felt was as good as during the previous burns.

BEAN

Yes. Another thing is I always notice that this vehicle didn't seem to start the engine at time zero. Just at time zero, the valves may open, but it doesn't start to the guy watching the CMC. It starts about a second later. The same thing on this burn. We went 0, 3, 2, 1 and Owen had pulled back there. When it got to zero, nothing happened. In about minus 1, then you feel it push on you. That's something to be aware of. But that's not new. It happened every burn, just a little bit more noticeable there perhaps. I agree with Jack, no feeling of graying out or anything. If I had it to do over, I wouldn't bother inflating the counterpressure garments. I don't think they added a thing to preventing graying out. I think they added a heck of a lot when you're on the ship to keep the blood up in your body. But when you're lying in those couches still in zero g, and your legs are even or above you as they would be during the burn, I don't think you gain any advantage. I wouldn't do that again.

GARRIOTT I think the medical tests bear out exactly what you said, Al. When we were on the water essentially in a horizontal position, our heart rates were 60, 70, and 80 approximatley, very slightly elevated if at all. When we were on the ship, then we got a number of tests which showed the very positive effect the counterpressure garment has on heart rate. It bears just exactly what you said.

BEAN I would recommend the next crew not bother to inflate those at that point. We ate our lunch in there, so we had some trash, but we moved the trash into the food compartment and got the bags in there. There's quite a little extra room in the food compartment storage area. We just shoved things in there. We had a few items in our TSB's and we had some personal items strapped down on A-5, in the bag, and that worked our real well.

LOUSMA We had one suit out of a bag, and it stowed rather well, just like it would be in a bag. No problem. I've got a personal hangup about putting those suits in bags. We might need them. I think they are as far from being available as they can possibly be by putting them in bags. I don't agree with the whole philosophy of putting them into a bag at all.

BEAN You could tie them down just as well out of a bag.

LOUSMA When you need them, they would be there. I just don't agree with the philosophy of strapping them down real tight where you can't get them and putting them into a bag where they are not going to be available for your use if you need them then.

BEAN You never notice the comm blackout.

LOUSMA There's nobody to talk to.

BEAN Ionization: You see that just before 0.5g and it's interesting. I had noticed it during Apollo. But what happens is you can see it in the black of space and not on the Earth. It is almost like it just colors the black of the space slightly orange and the Earth, it leaves about the same, at first. Then it gradually gets where you have a nice fireball behind you, spiralling back there. It goes from peach color to bright yellow.

LOUSMA Even before you sense any g buildup, the whole night sky, black space turns a very light peach color, then a more intense peach color, and then you start picking up the g's.

GARRIOTT I think we're right about 0.1g.

LOUSMA It was right in there.

GARRIOTT I had to keep watching for 0.5g. I just tried to get a glimpse of it out of the corner of my eye, while you guys were over there describing all these interesting scenes out of each window. And that's what reminds me that it was 0.1g.

BEAN Control modes: We control moded it just like it says. We flew it 'pulse' until 0.2g and it passed the test and we went CMC, AUTO.

Drogue chute deployment: Earlier in there, when we blew off the service module, I didn't have the switches set up right to fly the command module. And so the command module wasn't flying correctly. It headed over towards gimbal lock, so I turned on the direct RCS and flew it back to the center, and we got the switches. It was a mistake on my part with the checklist.

BEAN Owen was reading the checklist and I interrupted him. Then I give him a change to the checklist right there which was dumb. But it worked out well.

LOUSMA I was able to look out the window a lot. And on the initial phases of the entry, I noted something that the films probably won't show; that is the - entry fireball. The fireball itself did not fill the complete window as the films always show. It had it's own definite and unique vortex pattern and you can see the blue of the Earth around it. That was

LOUSMA
(CONT'D)

a very intense flame, about the brightness of looking into a steel furnace, a very white hot flame. But it still had its own characteristic shape and it described sort of an S pattern. Everytime the RCS would fire, it would blow up this pattern of white-hot flame. The whole window would be filled just for a short period of time with this white light. Then it would go back into its characteristic shape. But you could see around this white hotness. You could see the spirals, you could see the Earth, below the Earth, and so forth. I have never seen day entry photos that looked like that and ours probably won't show that either. But that's the way it looks.

BEAN

It looked to me like a ball was back there that was very bright and then coming out from around the back of our spacecraft, sort of spiral, were several arms that went into that ball, feeding it. So you had a ball that was continually being bright there behind. As you rolled and fired the thrusters, the ball would move and these little spirals seemed to be feeding energy back to that ball. It probably was really doing something like that and just drifting away as you were looking at in in depth. So it would seem like a ball to you. It appeared to me that it would move around with the thrust.

LOUSMA It had sort of a unique shape with an outline to it as opposed to just filling the whole window.

BEVAN Now that 'peach' filled the whole window to me. Once we got going in, then it assumed this sort of ball shape back there being trailed behind.

Visual sightings and oscillations: Nothing, except it really hauls. After you do the retroburn, you can see that you're dropping in and getting lower. It almost seems like you're coming towards the Earth with about a 20-degree dive to me, but you know you're not. You look out the window and it looks like you are in a 38 going down with about a 20-degree speed brake-out approach.

LOUSMA When you get used to the Skylab orbital velocity, and then you do the entry, it's significantly faster, and you pick up speed, and it looks like you're going to hit the clouds and on through into the water anytime.

GARRIOTT One other thing we ought to mention is the visual characteristics. I never had any tendency to gray out, or dim, or anything else at 3g and we were 3g for 2 or 3 minutes there. We had all the normal functions. We could move our arms around although we certainly had to make an effort to reach the control panel. I made several arm movements just to verify that I could. I think I saw you guys doing the same sort of thing.

LOUSMA I remember turning the ECS selector from PRIM to SECOND, back to PRIM, to check the the steam pressure read-out and so forth. During that period of time, I never had any indication of losing my attention span or ability to concentrate on a checklist or anything like that.

BEAN The only thing that drove me crazy was I was now pushing on this little button that is at the bottom of the counter-pressure garment, right in the middle of the back. That thing ought to be moved because I still have a sore spine from that. I suspect that you do, too.

LOUSMA I do too. There's also a little matching snap on the coat that ought to be just cut off and cut that button out of the back of the hypertensive garment, so that it doesn't crush you so hard. I still have a bruise back there.

BEAN I think that the SL-4 crew's hypertensive garments are up there. So that when they get up there, put them in the command module, unbag them, they ought to cut out those two. It won't hurt the hypertensive garment a bit. When they put their jackets in there for entry, cut those things out and then it won't be a problem. It also hurt when you landed but mostly when you were entering.

GARRIOTT Drogue chute deployment: I thought things happened awful fast. From the time we hit 0.1g until the time we were on the water was no time at all.

BEAN It's faster than launch, it seemed to me.

GARRIOTT It's a good thing there weren't many things to do in the checklist. You mostly sat there and monitored stuff. It was an interesting experience but there just wasn't much time to do anything, if I had been required to do very much.

LOUSMA I have a comment for Bill. If you took the drogue time and backed up from there according to the landing cue card, to where 90,000 feet and the steam pressure peg ought to be, it didn't come out right. The steam pressure pegged say 15 seconds after the time it should have on our little card, so that DELTA-T from drogues back up to 90,000 feet ought to be researched one more time to make sure that we have the right time and everything, because the steam pressure pegged came late.

BEAN Communications: Communications went well. I was happy to see that the ship did not talk to us too much. That was the best recovery I've seen as far as communicating with us. I was hoping that the helicopter pilot would tell us the altitude we were going to hit at. Fortunately, I asked him and he said you're about to hit now.

LOUSMA

When I heard them say you are about to hit, I put my head down and we hit at just about the time. We hit at an indicated altitude of 200 and some odd feet on our altimeter. I think I probably should have called out at about 500 feet and said "Okay, we ought to get braced for this thing right now." That may be something that is worth doing; 500 feet down, you probably ought to be braced because can hit at any time. And ask the helicopter pilot and see what he thinks because he can tell you. You thought the bump wasn't too bad. I thought it was a pretty hard bump, but it doesn't hurt or anything. Several days before coming home, EVA day, we noticed on the workshop communications, the four-cycle tone on the intercom if you were to turn the volume rather high. We did some troubleshooting which was ground controlled on the comm system and I think we alleviated the problem somehow, although I don't remember exactly how. Upon getting into the command module, after having disconnected all the communications from the workshop, I noticed the same sound on the command module communications that I had noticed earlier in the workshop. I think we had had thought we had solved the problem by troubleshooting the workshop but apparently the problem was in the command module. It was not a loud sound but it was the same sound that I had heard on EVA day and that was again heard on entry day in the command module. So it may be something that somebody would like to take a look at within the

LOUSMA command module communications and sort of close it out of the workshop. But at least it looks like we were on the wrong track earlier, and the fact that I heard it in the command module later is an indication that perhaps we were troubleshooting the wrong system and ought to go back and rethink the problem.

BEAN ECS: The ECS worked well.

GARRIOTT There's one question I don't understand on that. It was apparently after we were on the water, as I recall, and you were throwing either some circuit breakers or opening the postlanding vent or something like that.

BEAN I put the postlanding vent circuit breaker in after we decided that I was the guy that had it.

GARRIOTT I would swear that it was the equivalent of rapid compression in the vacuum chamber because we got water vapor through the whole cockpit. It cleared in about 5 to 10 seconds.

GARRIOTT Why were we overpressed?

BEAN Because we had the DIRECT O₂ valve on. You put that on after landing and we thought we just drove up the pressure with Direct O₂.

GARRIOTT We must of had 2 or 3 psi overpressure, so that when that valve's circuit breakers were placed in, we really fogged up the whole cockpit, just like a rapid decompression chamber.

BEAN My guess is that we didn't have 2 or 3 but some small amount. I think a lot of that was the water that was in the duct. Don't you remember the water came dripping in?

GARRIOTT The whole cockpit fogged at the same time. It was nothing that blew in. The whole cockpit went zap and it was filled with fog.

LOUSMA I remember one other thing too before we hit the water, when you went to BOOST/ENTRY. You could smell the explosives, the pyro fumes come into the cabin.

BEAN When it said go dump or whatever it was, you could really smell it. I was afraid it might make us sick later, but it just came in and kind of blew out again.

10.0 LANDING AND RECOVERY

BEAN Touchdown-impact: I think that we already discussed that. We discussed the fact that we liked the communications. We approved of the idea that the helicopter pilot had given you sort of a feeling for how long it is before you're going to hit the water so you can get your head positioned and ready for the impact.

Sequence and procedures for main chute release: No comments there.

LOUSMA I think we went over to Stable II immediately, and it didn't hesitate at all, just went over.

BEAN Postlanding Checklist: The only thing I noticed that was a little bit strange in the Postlanding Checklist is that we were not in the proper configuration on the hatch handle when we got on the ship. Apparently, in the checklist somewhere, we're supposed to put it from latch to unlatch or from latch to neutral or something like that. And I thought we went completely through that checklist but apparently we did not. So, that needs to be looked at just to make sure that those callouts are in the checklist, in the right place in an obvious way, so that when you get on the ship, and the Recovery Officer comes up to open the hatch, he doesn't have a problem in opening it.

BEAN
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Temperature and Humidity: It was real cool when we got it going, I thought.

LOUSMA

I thought the environment inside the spacecraft was very acceptable.

BEAN

Communications: Spacecraft Status and Battery Power. We didn't have any communications. When we bobbed upright, we apparently had our comm key on the comm and, as a result of this keyed comm, we had no communications in. We only had communications out. Exactly why this occurred, I don't think any of us know.

LOUSMA

We had normal communications just prior to impact. After impact, we were only able to transmit out and were unable to hear anybody and we didn't know it.

GARRIOTT

But it does appear from what we observed that it was some malfunction that occurred so that it keyed at least two, if not three of the mikes continuously. This would have been the thing that prevented us from receiving because essentially we were in TRANSMIT the whole time. I've been told since that they couldn't hear the SPT very clearly, but the other two guys were apparently quite clear. On the other hand, it doesn't really sound like it was any malfunction on one of our umbilical areas.

LOUSMA It was apparently not in the cobra cable but was something common to all three crewmen.

BEAN Postlanding ECS: Ventilation was good. I don't think we had any symptoms of sea sickness. We were happy when we were in Stable II and happy when we were in Stable I. We did notice that there was a lot of sea out there and also that the frogmen were working pretty hard to hang on as they put on the flotation collar. Our procedure went well. It didn't take nearly as long as we thought it might to upright because of the heavy seas, and it uprighted in about 3 or 4 minutes.

LOUSMA No, it was probably a little longer than that. One other thing that you do notice you kind of wonder about at first, then realize it's okay, is that the windows fill up with water immediately. It looks like water is coming in the spacecraft but it's just seen through the windows. .

BEAN Couch position: Nothing there. Physical comfort: The only physical comfort thing was this same old snap that was down there at the lower spine on the bottom of the pants. It was bumping into the lower part of the spinal column and that needs to be removed.

Internal pressure: As Owen pointed out, when I punched in the circuit breaker to start the postlanding vent, it opened that

BEAN
(CONT'D)

vent and it acted like there was this overpressure in the cabin, probably from the direct O₂. It kind of vented down the cabin a little, then everything else came along okay after that.

Spacecraft powerdown and procedures: We powered down per procedures and, when we couldn't get the comm, we decided to power it up again and see if we had electrical power on. We powered it up and still nothing happend, so we powered it right back down again. On the ship, all that procedure is good. We stayed in the couches. Just before egress, we should have checked our blood pressure and, when we went to check our blood pressure, we found the blood pressure cuff didn't work. We found out later that the reason it didn't work is that the little ball that fits underneath the metering valve had become lost. We found that little metering screw floating in the MDA and we put it back in the blood pressure cuff. We didn't realize there was also a ball bearing that went with it. Jack did find a small ball bearing during entry sometimes, so that was probably it. What did you do with that ball bearing?

LOUSMA

I put it in my pocket or attached it to something so that it wouldn't go astray but I don't remember where it is.

BEAN

So that added some time. There seemed to be too much time once we got on the deck and the hatch opened before we got out. But I think that can be minimized simply by the fact that - you take your blood pressure cuff and tape the little knob on there so it won't come off in zero g. Then when you finally get on the ship, use the same procedure we used to check everybody's blood pressure. So it looks like a good procedure. We just had an equipment failure.

Egress: Crew egress went well. I like the procedures of going to the chairs and moving around. I particularly liked the fact that they had several guys there to help you when you got out. After a couple of months, you may be strong enough, but it seemed to me that my stability was not satisfactory to go walking around without somebody to give me a hand. I think it would be too easy to trip and fall. You've kind of forgotten a little bit how to walk. And also your stability is a little bit funny. So it's certainly advantageous to have a couple of fellows right there when you get out of the hatch to put their arms on you and sort of guide you over to the chairs. It doesn't harm anything and certainly might help you.

GARRIOTT I agree with just what you said. The procedures that were set up on the ship were about right. They were sufficiently flexible that, had we needed more assistance, it was available. Yet it did not appear to be a whole medical emergency facility standing by to help us out of the spacecraft. Paul Buchanan deserves congratulations for setting it up as well as he did.

LOUSMA I think those are all accurate statements. It turns out that you give your legs a good test or a good workout in zero g for standing up straight. The exerciser does that and so does the bike. However, you get no exercise for side loads and your legs aren't adjusted for the swerves.

GARRIOTT Exactly the way that Bill Thornton had described it to us. I hadn't thought of it that way, but I thought that his description was exactly right.

LOUSMA If you start to go sideways, you're going to keep going until you fall over. Your legs just don't have the word that they're going to have to correct for any kind of side load at all.

GARRIOTT Doctor Buchanan has been thinking about what sort of tests might very well be delayed until a later date, say R plus 1 instead of R plus 0. There may very well be a few things that could be delayed from R plus 0 to R plus 1. But my own impression is that things are changing so rapidly in that

GARRIOTT
(CONT'D)

interval. Things like urine changes, vestibular functioning, our sense of balance, plasma volumes, perhaps things that relate to M92/M171, although I'm not so sure in those areas. There are many things that are really changing fast and my feeling is that we should make every effort to get as many of those tests that are important on R plus 0. And I'm not the best one to decide which ones those are. To do that, the things that we were talking about yesterday, to shorten the deactivation day and the final entry day, so that we can have a more reasonable time instead of 24 hours plus on R plus 0. It is all important to get that done. I think that's all consistent still with doing those medical tests on R plus 0, the tests that are important for the rapidly changing physiological functions.

LOUSMA

Owen is right and I think that we do need to do the medical tests as soon as we can possibly get them done. But the problem was that we were doing them during normal sleeping hours, after having already spent a pretty good day. So the thing that needs to be done is we need to knock off the front end of that day so that we get the medical tests completed by normal sleeping hours. And the other thing that is bad about doing the tests when we did is that we couldn't get anything to eat until we were almost finished with the medical tests. So we had gone for one or two meal periods without

LOUSMA
(CONT'D)

having anything to eat other than some butter cookies and a coke. I think that contributed to just an overall punchy condition. We were not only doing medical during our normal sleeping hours but we didn't have anything to eat either. All we had that whole day, until the medical tests were over, was breakfast and lunch and those left a good deal to be desired because they were cold. First, you need to get finished by bedtime. To do that, you have to cut the activities at the beginning of the day. Secondly, I think you ought to get something to eat - so you'll feel normal.

BEAN

Any comments about this shifting around of the circadian rhythm and how it may have helped or hindered you when you finally got on the ship?

LOUSMA

I don't know if it helped or hindered me. I couldn't tell, to be honest with you.

GARRIOTT

I'm inclined to think that we'd have been better off to stay on Houston time for the whole mission, and when it came up to entry day, if we needed to shove it ahead by 4 hours, we should have gone to bed at say 6 p.m. Houston time. We should have taken a Seconal or whatever was the appropriate sleeping pill for the individual. Then we should have arisen just 4 hours earlier. I think this would have had a smaller effect on all the medical experiments, a smaller effect on our own

GARRIOTT
(CONT'D)

internal timing mechanism and it would have been easier all the way around. Whereas the way it was, we ended messing up our sleep habits for about the preceding 6 days. We ended up either taking extra sleeping pills or trying to get to sleep without it. Really, I think in general, we screwed up the whole timing. My impression is that we'd have been better off without it.

BEAN

That's my impression too. I think if you'll look at the general physical characteristics of the guys for the last 5 days, the weight loss and all that other business, you're going to find out that we moved off the stable position that we had been on for about a month and a half and started going downhill. I think a lot of it was these odd hours we suddenly decided to go on, for no real reason. We could have very easily done just like on launch day, which was no trouble. We never had any bad effects from it. We kept going along at a normal day, until that one time we went to bed early and got up early, and we never felt any bad effects at all. Moving the time around confused me concerning what time it was. I never knew if it was time to eat lunch, breakfast, dinner, or if we ought to go to bed. Nobody knew what time it was when we were on PET and pseudo-GMT. You just waited until somebody told you it was time to eat and hoped it was. You hoped somebody was keeping up with it.

GARRIOTT One brief comment on the experiments again. MI33, the sleep cap experiment, was scheduled for R plus 0, 2, and 4. I think that's definitely a mistake. We didn't end up doing it that way because we had apparently forgotten that R plus 0 was scheduled. We did do it on 1, 3, and 5. There's no question that sleeping in that cap in one g is more difficult than it is in zero g. And that's not the time to be messing up your sleep because we've been tired for days and we need all the sleep we can get. And R plus 0 is a bad time to schedule MI33. Days 1, 3, and 5 are marginally acceptable.

11.0 COMMAND MODULE SYSTEMS OPERATIONS

11.1 GUIDANCE AND NAVIGATION

BEAN ISS Modes, Optical Subsystems, Computer Subsystems, G&N Controls and Displays, Procedural Data, CMC SPS TVC: The only thing I can think of concerning these topics is we had some sort of optical CDU problem during the rendezvous days which was solved by the ground. Somewhere in there we zeroed too soon or we zeroed late or we didn't zero frequently enough or we entered a mode where you need to re-zero afterwards or something.

GARRIOTT I can't remember the symptoms but I am convinced that it was not any problem with zeroing. It was some more obscure programming problem that we had never encountered in training, and fortunately a couple of people had seen on the ground or something like that. And it was easy to avoid once you knew what to do. And it really was never any real problem to us.

11.2 STABILIZATION AND CONTROL SYSTEM

BEAN Controls, Thrust Vector Control, Displays in Loop Control Functions: When we ran the entry minus 5 systems check and did TVC, you could hear the gimbal motors growling back there. We never heard them during rendezvous and we never heard them during entry. I think this was because the CSM was powered down so much that you could hear what was going on a little bit further back. But it worked out okay.

11.3 SERVICE PROPULSION SYSTEM

BEAN Delta V Thrust Switches, Engine Thrust Vector Alignment, Delta V Remaining Counter and Rocker Switch, SPS Thrust Direct ON, Direct Ullage Button, Thrust ON Button, SPS PC Indicator and PUGS: No comments there at all.

11.4 REACTION CONTROL SYSTEM

BEAN SM/RCS: The first possibility that we were having some RCS problems was when I ended up sort of out of plane there at that one time and noticed that I was about 30 degrees off in yaw and wondered why. I should have troubleshot it a little bit more right then. Then we saw the sparklers and determined that RCS was in bad shape and we shut it off. Now when we had the RCS problem on the vehicle, the thing that triggered off first was not a low pressure but it got cold because the gas was escaping out the quad. It cooled the quad and the quad gave us a "cold." We were up there wondering why that temperature was low when the ground said, "we think you have a leak" and to shut it off. We need to check our malfunction procedures and be more alert to the fact that a leak of a single propellant is probably going to give you a temperature "low" indication before it gives you anything else. And we need to be alert to the ramifications of an unusual temperature low situation. Also,

BEAN
(CONT'D)

be alert to the fact that looking out the window in that general area might give you some added information, whereas in the simulator it does not.

LOUSMA

I could never hear the service module RCS fire, although it was obvious that it had, because the attitude changed. And the attitude change is kind of like one of these kiddie cars at a circus, where the car makes an abrupt change to the new attitude immediately. It is not a real smooth change from one attitude to another. The other thing is that you can see when the RCS is firing if it's in sunlight, or in sunset, or in sunrise, because little particles do come off the thrusters when they fire. If it's a forward firing thruster, you'll see little incandescent-looking particles streaming out ahead of you.

BEAN

I could hear those things fire.

LOUSMA

The command module RCS, if compared with the simulator, the simulator makes more of a loud rasping long-term noise than do the RCS thrusters in the command module. The real command module is more like a bump or a thump when the RCS fires.

11.5 ELECTRICAL POWER SYSTEM

BEAN

Fuel Cells: It works well. I like the way they shut down and we never had any problems.

LOUSMA I guess we got a caution and warning once or twice. From our standpoint, they operated normally.

BEAN One thing I noticed about the fuel cells was when I shut down the fuel cells and went through the procedure - I thought correctly - and then later on when I was going through quiescent mode checks, I noticed that some of the circuit breakers over on the fuel cell panel, and I don't remember the number of it, the one that has all the fuel cell pumps and things, were not in the position that they should have been in. They were in the position that they would have been in if the fuel cell were operating, though I didn't at that time go back and see if I had just failed to check that panel because I found all the other switches in the spacecraft in the right place. I'm wondering now if that procedure at the end of fuel cell shutdown puts you in the configuration it wants you to be in prior to undocking. I think that ought to be checked in the systems book to make sure that those two circuit breaker positions are compatible with one another. Also, when you finish the fuel cells, you install the overboard vent in the hatch. I found that to be pretty straightforward. I also found that once you had installed that vent, you wanted to make sure that you did not put on the surge tank and the repress package because their pressures will vent out through that opening. So once

BEAN
(CONT'D)

that's installed, you probably will want to keep your repress package closed and your surge tank closed until it's time to enter and then remove it. Now one other thing occurred as I was going through those checks prior to entry. I discovered that the pressure relief valve over on the EVA panel, which you install to let the high pressure out of the O₂ tank, was still installed. You leave that installed until the ground tells you to take it out. Now, they had never come back up and said to remove it, so it was not removed. I asked if we should remove it, and they said yes. You want to really give a thorough check of the spacecraft there before you start throwing these switches because it's conceivable that we could have bled out some oxygen that we would have wanted through that relief valve, if we had not discovered it. The thing to do is realize that you're going to get into a non-nominal configuration on these fuel cells both with the O₂ and the water dumping. You want to make sure that you put the command module back into its entry configuration before you start powering it up. I might mention here that when we dumped water from the waste water tank down to the holding tank in the OWS, it was an easy procedure. It will be one that Jerry and his crew will do, and they'll want to practice that one time. Not connecting the connectors, because that's nothing, but noticing which hoses connect to where

because the confusing part is to figure out which part of the OWS water equipment you're using, because they all have about the same name. Take a look at that and see how it's done. It does not have you remove that fitting, you want to go back and remove that fitting before entry. I don't know if it'll make any difference but I think it's a good idea. There seems to be a laxity once you finish doing these procedures. The ground will come back and tell you at another time, "Okay, we're finished with that, remove it and put it back just like it was" for launch or entry. They tend to just leave the things in there. For example, they never told us to remove the water fitting, but I removed it anyway about 5 days prior to entry. I don't think it made any difference.

BEAN Batteries:

LOUSMA I have something about batteries. The batteries worked good. They have a lot of poop in them. But somewhere during the last few days, perhaps during the entry SIM, we had used our entry batteries to some degree. The ground, because of the fact that we weren't going to be long between undocking and deorbit, elected not to charge up the entry batteries. When we asked about that, that was the rationale and it seemed like a reasonable one at the time. However, I don't think

LOUSMA
(CONT'D)

you ought to get yourself into that position, because here's what it did. The entry batteries were down around 31 to 32 volts, and that was the same voltage at which the main batteries - descent batteries - were working at. I agreed with the ground rationale in the way we were operating. It turns out that the cause of the problem later on was unforeseen. And that is this - before the deorbit burn, when we put the entry batteries on the line using the main bus ties, the voltages were so equal that I was almost unable to tell that the entry batteries had actually come on the line. We were going to leave them on the line for the separation. It was very difficult to read any current at all on the battery buses. The zero for the battery bus current was down below that indicated on the scale. Apparently they were only pulling about 2 or 3 amps, but that was almost unreadable because that was just about enough to bring the ammeter up to zero. There was some question as to whether or not the entry batteries were really on the line. I assumed that they were and I was able later to verify that they were, but it was almost undetectable. From that standpoint alone we ought to have the voltages up on those entry batteries so you can tell that they're actually on the line. The other problem was about the time that the checklist said to get them only we were

LOUSMA
(CONT'D)

out of ground contact and weren't going to have any more ground contact until we were on the chutes. The only way I verified that they were on the line was to watch the battery bus as the gimbal motors came on, then the jump in the current as the gimbal motors came on was almost imperceptible. What I did later was turn 1 main bus tie off and watch the current needle very closely. I could see an almost imperceptible jump as it went off the line and came back on. So, I wasn't able to verify that they were on. It was sort of uncomfortable wondering about it. I think that you should make sure your entry batteries, regardless of how much or how little you are going to use them for the entry, ought to be up to full voltage for that very reason alone.

LOUSMA

Battery charging went well. We only did battery charging early in the mission.

BRAN

DC Monitor Group, AC Monitor Group, AC Inverters, Main Bus Ties, Non-essential Bus Switch, G&N Power Switch, Cryogenic System, Cabin Lighting and Controls, Split Bus Operations, Gimbal Monitor Transients: There is nothing here worth talking about.

LOUSMA

The gimbal motor transients as they went on and off the line were easier to see if you monitored the service module

LOUSMA
(CONT'D)

source than if you monitored the bat bus. There was a perceptible change in the current and also in the fuel cell flow as the gimbal motors came on the line.

11.6 ENVIRONMENTAL CONTROL SYSTEM

BEAN Oxygen System and Cabin Pressure, Oxygen Flow Rate Test,
Cabin Atmosphere:

LOUSMA Cabin atmosphere prior to entry, after closing the MDA hatch, became very, very, humid. There was water all over the walls and windows. The temperature went up to about 85 degrees and stayed that way for about 5 or 6 hours. That was a bad way to be prior to entry.

BEAN Water Supply System, Water Glycol System:

LOUSMA We had a leak in the water glycol system. That's adequately documented. It seemed to go away later after we closed the heat exchanger bypass valve.

BEAN When we put it in suit heat exchanger, primary into bypass it did not leak. I think it was leaking during that 7-day test when we'd bring it out of bypass for an hour and operated it. During that time it would leak. When we put it back to bypass at the end of that time it would not leak. The change after we found the leak was to stay in bypass which we did. We never had any leaks after that. The ground made a good

BEAN
(CONT'D)

choice in electing to stay in that bypass position. It does point out the need to check everything during these 7-day checks. You can be okay for a week or two and think you're okay for the rest of the time and not really inspect it. I recommend when you're in the command module and doing that 7-day check that you look in the little panels, look around, get your flashlight out and float around to all the panels. Try to make sure that everything is like it should be, because you're liable to run up against a leak or something. Also these leaks are hard to detect because they don't make big bubbles. They just lay flush with the fittings or flush with the equipment. They are hard to observe. You need to use your flashlight and feel and touch, open and close doors and try to detect them that way. This will keep you from losing too much fluid.

BEAN Suit Circuit, Gaging System, Waste Management CO₂ Absorbers:

LOUSMA We did use the black bag in the waste management system. That's the only part we used, and that was coming home. We put the UCTAs and the fecals that we didn't have a chance to get dried into the black bag.

GARRIOTT Were there any of those? I thought we had to put all the fecal bags into the ...

LOUSMA I don't know if the last one we took got dried or not.

LOUSMA The black bag is something you'll probably be wanting to use, so keep it where you can find it.

11.7 TELECOMMUNICATIONS

BEAN Individual Audio Center Controls, VHF: I gather that the problem in the workshop with audio is going to be there for Jerry. That problem was in the workshop. So they're going to be operating on channel B and recording on A and their checklist will reflect it. Their EREP checklists and the like will show operating the proper switches on each panel. We had to go back and change ours. So, there's not a lot to be said there.

GARRIOTT It might not hurt to remind those guys that for EVAs and for EREPs those comm channels are parallel. We nearly embarrassed ourselves a couple of times by forgetting that.

BEAN That's true. Once when you're in that configuration you need to be particularly careful about what you say on intercom and what you say near the comm sets because a lot of them are on VOX.

LOUSMA That's a good point. Maybe we did embarrass ourselves and no one has told us.

BEAN

The VHF family comm, I thought, overall was poor for the simple reason that somewhere somebody a lot of the time didn't get the switches right. The reason we felt that this was the problem is because 30 minutes later we'd run the same thing with somebody else on this family comm and it would be perfect. I recall one instance where Jack couldn't get any family comm. He could hear the ground but they couldn't hear him. He finally gave up. The next pass, which occurred about 30 minutes later, Owen heard it perfectly. The pass after that where I was going to do it, I could never get hold of them. We hadn't changed the comm in the spacecraft, yet you just couldn't hear anybody. One of the things that would add a lot to expediting getting good comm is to realize the VHF doesn't lock in until a few minutes after the S-band. So you never can get the VHF right off the bat. Another thing is if the ground would quit trying to ascertain whether or not the crew has their switches in the right position and spend more time deciding whether they have their switches in the right position. We never found a situation where we were out of configuration and they were in configuration in 2 months. Yes everytime we had a problem that was the first way they troubleshot it. We only have to throw about six switches. The first thing you do when you're up there trying to get comm and it doesn't work is go through your switches. Now if the

BEAN
(CONT'D)

ground did that with theirs instead of trying to check ours, I think the whole thing would come out a lot better. Fifty percent of the time it was great and 50 percent of the time it was unacceptable. When you have a situation like that you realize it's probably not a mechanical problem but some sort of procedural human error. So it seems to me if we have comm problems for Jerry that the ground ought to concentrate on their problems and just assume that the spacecraft is right. And we'll try to do the same thing up at our end of it.

LOUSMA

Usually the problem was that we could hear the ground but the ground couldn't hear us. Lots of times when the comm was working two-way you'd get an echo. You'd hear yourself talking almost as loud as you were talking. And you would also get a lot of background noise. I recall very few times when there was good clear communication.

BEAN

It sure worked nice for entry. When they want to get that VHF working, it's great. It's just these family comms are just poor.

LOUSMA

I remember one time I tried for 2 days to get a call home and couldn't make it.

GARRIOTT

I hate to mention this, but this is an illustration of how virtue always triumphs in the end.

BEAN You better mention it or they're going to wonder what you
 are talking about.

LOUSMA I don't know what he's talking about.

GARRIOTT I went 2 months and never had a bad VHF comm. Every single
 one of my family conversations went off perfectly. I don't
 know why.

LOUSMA Somebody must have reset the switches for him.

GARRIOTT There might be something to that.

BEAN On the other hand, he might have forgotten whether he had
 good comm or not.

GARRIOTT I don't know why you guys had such tough luck. Every time I
 went up there the bloody thing worked right off. It was
 really good comm every time, Jack. I don't know why.

LOUSMA I know why he was never complaining.

GARRIOTT I just never had anything to complain about on that score.

BEAN S-band: S-band worked well.

BEAN Tape Recorders, VOX Circuitry: VOX circuitry was excellent.
 The diagram that was put in the systems book and also the
 EVA book that shows the comm configuration during the EVA

BEAN
(CONT'D)

and during normal operations is very helpful when somebody says, "I can't hear too well," you can look at that diagram and see which panel controls his volume and then work with it. That was particularly helpful during EVA. I think maybe the thing to do, is to take that picture and make it into a little cue card for the command module during the docked phases. If you have comm problems instead of having to find the book and read it, the card would be there. You can stick it over near the comm panel on the CDR side, which is the one you fool with mostly. USB emergency keying was not used.

11.8 MECHANICAL

BEAN

Tunnel: Worked well. We already discussed the fact that two or three of the docking latches fired but they didn't hit home on the rail. We didn't do anything with them. We just left them like that. Struts worked great. Probe worked well. Side and forward hatch all worked well.

12.0 SATURN WORKSHOP SYSTEMS OPERATIONS

12.1 COMMUNICATIONS SYSTEMS

BEAN

Audio: I still think it's unacceptable the way you always have those squeaks between the comm systems. I can't believe that in this day and age there is not a way to somehow baffle the front of those comms or at least three or four of them to make them work properly. We received a nice report from McDonnell-Douglas telling us how it was going to work, namely put all of them at 9 o'clock and they are really great. You can put all of them at 9 o'clock and you don't get any squeak. The only problem is you can't hear anything unless you happen to have your ear right next to the set. Since we don't normally operate that way you have to turn some of them up to hear. It's also difficult to hear when you are riding the bike. It's difficult to hear when you are pulling the exerciser. You don't like to be left out, because during that time comm is coming up and you really need to know what's going on. You are torn between turning that comm system up real high and squeaking some others, because you'll forget, or just being out of the loop. I think it's more preferable not to be out of the loop. If you are, the other men in the spacecraft ought to be aware that you are exercising and you probably don't hear. You need to be alert when they

BEAN
(CONT'D)

call from the ground with a message for the SPT and the SPT doesn't answer for a few minutes, to let the ground know he's exercising and I'll take his message and give it to him later. Now we didn't have too much trouble with that but it looks to me like it could be a problem.

LOUSMA

I think that the most annoying thing was the comm. It was never configured so you could talk to the ground without going somewhere and adjusting the box.

BEAN

The best way to have it, is the way we tried to have it. We kept the volume up on the one in the wardroom and the volumes of all of the rest of them down pretty low in the workshop. Sometimes you would have to moderately turn up the one in the head and that would be okay. The two of them that constantly nailed us was the one over the bike when it was turned up and the one over the minus-Z SAL.

GARRIOTT

That is the one you turned up when you wanted to hear in the experiment area.

BEAN

That's right.

LOUSMA

The one in the dome, you never used. Some of the comm boxes you never use, including the one in the dome and the one next to 512.

BEAN VHF Ranging: Worked well, I thought.

LOUSMA We had enough ranging to get us solutions from NSR on it.

BEAN It's all documented on the onboard tapes.

BEAN Teleprinting:

LOUSMA We failed one teleprinter because the little black drive roller came off and we never did fix it. I think they ought to be sure and take a replacement teleprinter head up for that.

GARRIOTT There's one other thing. It is the insert on the end of the teleprinter paper. We lost one. Why don't you describe that, Al?

BEAN That's right. There are two little mountings to hold the teleprinter paper on the head. One is the white one and each teleprinter roll has one. One is a black one, with a spring in it that you use to take off the old roll and put on the new roll. We lost one of those little black ones, so we took a spare in the MDA. I'm not sure whether we recorded that or not since things like that usually show up on the fan screen. It never showed up for some reason and it's important that Carr's crew take up a spare one of those, because if you lost one you'd sure have a mess. Another thing about the teleprinter, I believe you can send more information up on the teleprinter. As long as it's reading

BEAN
(CONT'D)

and explaining what you are going to do, it's probably good. The teleprinter problems we ran into were only the ones where you had to cut them out and paste them in or make changes. Those took time. Just the reading of it, or the explaining how to do a specific step, was always welcome. If there was a special procedure being sent up, the best thing to do was just contain it on one long procedure. I particularly liked it when they made checklist changes, if they made them complete in themselves, so you took that particular paragraph or page and just pasted it in and when it came time in the checklist to do it, you just went down that page rather than having to go back and forth between pages and make marks. It takes a lot of time to put in all the checklist changes up there, particularly if it's something like the Deactivation Checklist or the SWS Systems Checklist. The Deact has three of them, SWS systems has two and the idea would be to minimize all the work it takes to put those in. The little procedures like the special procedure for dismantling the probe. There should be all sorts of extra words in there to explain how to do it, because reading it and having it fully explained allows you to do the job faster than trying to figure out some of these steps yourself.

LOUSMA

I think there's enough teleprinter paper up there for a 600-day mission.

BEAN There's a lot of it up there.

LOUSMA About a factor of 10 over supplied.

BEAN Okay, that and soap. Jerry won't have to take any spare of either of those.

LOUSMA Okay, how about television?

BEAN The only thing that disturbed me about the television all the time was that we need on the next generation to have some sort of little light on the television box or the television camera that says this light on means the television you're taking is what's going on the recorder to the ground. We got in trouble a lot of times by taking TV and (1) not having the recorder on, or (2) having the recorder on but not having the switch up there by the ATM panel, in either TV or in ATM MON 1 or 2.

LOUSMA Another irritating thing about the TV was that you always had to go up to the MDA to turn it on, and most of your TV was down in the workshop. Every time you wanted to turn it on or off, you had to go up to the MDA or have your friend up there do it for you. We should have had a switch down closer to the place where the action was.

LOUSMA Tape recorders: Something that was irritating about the tape recording was that the ground would frequently dump

LOUSMA
(CONT'D)

right in the middle of one of your activities. Say it was a scheduled 509 activity. There was no warning that what you were saying wasn't going on, so you never knew where you were cut out. Suddenly the green light would just be gone and you wouldn't know where it was that you left off or if you were recording a message you might not notice that the light went out and you would have to record the thing all over again. I think we have to be careful that we don't schedule a tape recorder dump and activity conflicts. It would be nice if we could figure out a way so that we always had a tape recorder to record on whether or not the ground was dumping.

BEAN

It looks like to me like they did it sometimes and they could do it more often. Another possibility is maybe the ground is able to tell when you're recording. When they get ready to dump they can look up there and see that your tape recorder is running.

LOUSMA

We asked them that, and they said they couldn't do that.

BEAN

They couldn't see if it was running?

LOUSMA

No, they couldn't tell when you were recording. Another thing that happens, if you are recording and they take the recorder away from you or if sometime in the interim when

you're not recording, the green light is out and they start to dump and you hit the record switch; they're dumping and the light won't come on, but when they're through dumping that signal is sitting there and the recorder is going to come on whether you want it to or not. That's another thing to watch for so you don't use the recorder when you don't want to. We've got to figure out some other way of coordinating the ground dump time vs recording onboard. The way that we thought we might get around it was by having them announce when they were going to dump the recorders, but you don't mentally time the time to the next station when they're going to dump. If they do start dumping and they tell you about it, you're not going to hear them because you're on the recorder recording and you're turned to a different channel and you're just not listening to up communications.

BEAN That's a good point right there. You don't know it. You're the one guy that doesn't know it, because you're over recording on another channel.

LOUSMA That's right. So we got to figure out a way to smooth out this ground dump vs onboard recording systems.

BEAN You want to make any comments about the tape recorders we changed out and what to do?

LOUSMA Tape recorder changeout is a very simple operation. There's nothing to it, really. There are some more spares on board and it looks like if history repeats itself you get a chance to use them all.

BEAN Also it looks like you can take up a few tapes and not carry up any recorders. You got all sorts of recorders on board and that's something that I don't know whether SL-4 is carrying up recorders, but they shouldn't be. There's all sorts of them there that looks like you can put the tape on and they would work.

LOUSMA What do you mean, the drive belt?

BEAN Yes, the drive belt.

LOUSMA There's at least two of them that have broken drive belts between the transmission and the tape recorder and you would have to have some training on the ground to make that replacement.

BEAN Not much.

LOUSMA I don't know. It looks to me like you'd have to make a major overhaul on the tape recorder, and tear up some wires to get in there well enough to put the drive belt in.

12.2 THRUSTER ATTITUDE CONTROL SYSTEM

BEAN ATM Attitude Control: Owen, do you want to say anything about the possibility of JOP 13 in the light?

GARRIOTT I think the TACS system under control of ATMDC went precisely as advertised. Remarkably well. I don't know what our total TACS propellant usage was, but it was pretty darn small over the 60-day manned interval, and I think the ground knows how to handle that. Everytime they gave us some commands and we followed them to the letter, it behaved to the letter, and it looks to me like you really zeroed in on it and know exactly how it's going to behave. We're in a good position to utilize what thrust we have remaining, and I'm sure the plans are to go ahead and make the maximum use of that capability.

BEAN What you're saying there is that we were in a mode most of the time of not using TACS, period.

GARRIOTT Right.

BEAN But they'll be in the mode, hopefully, of using whatever TACS is left to point at whatever they want to point at.

GARRIOTT That's right. How do you maximize and use it to the best advantage?

GARRIOTT That's right. How do you maximize and use it to the best advantage?

BEAN I think this idea of keeping the TACS off during most of the time is a good one even if you got TACS. Because then you sort of have a good feeling that nothing's going to run away in the workshop, even with some sort of computer failure.

GARRIOTT Performance was exactly as advertised. Works well.

BEAN The only problem we had was that one day the computer couldn't figure out what to do with the TACS, and we had sort of that high rate and everything else. That was the computer problem, that looks like maybe it's solved.

12.3 ENVIRONMENTAL CONTROL SYSTEM

BEAN Environmental control: The ground handled all that and they come up from time to time and say put the purge fitting in the wardroom and let it bleed a while. We want to get ready for M509 or T020, and then later on they'll say turn it off, or they'll say, go up and turn off the O₂ N₂ controller for a while. We want to get more oxygen in there. You really don't have to know anything, all you need to do is follow the ground, let them worry about it. The only thing you need to do is request that the ground tell you when they're

LOUSMA Yes, you probably over-trained in a lot of this stuff.

BEAN Any other comments? You need to know how to open and close those pressure relief valves. You work them a lot getting this atmosphere management correct. The same thing with the CSM. You work those two cabin relief valves in this procedure.

LOUSMA Thermal Control, Coolant Loop: Well, they know more about that than we do because they are going to service the primary but the secondary seems to do its job.

LOUSMA Electric Heaters: Well, I don't remember when they were on. They may have been on and I didn't know it.

GARRIOTT I wonder if they ever did come on?

LOUSMA I don't know.

BEAN Insulation was adequate except we noticed that Owen's sleep compartment got warm during Z-LV maneuvers. Took a little while to cool off. We also noticed when we were up in the area of where M509 is stowed and facing outboard there, that we got a lot of radiative heating. We seemed to get hot faces and heads when we were in that area. If we were facing in the other direction or any other part of the workshop, that didn't seem to be true. Just in that one area that I found it to be hot.

GARRIOTT Made some checks at one time and there was at least a 5-degree wall temperature difference, over a span of 2 or 3 feet, between my sleep compartment and Jack's sleep compartment. It felt like even more than 5, but there was at least a 5 and maybe up to 10-degree temperature differential.

LOUSMA That was right after a double EREP pass.

GARRIOTT It was after some special attitude maneuver.

LOUSMA Thermal control, I thought, basically was pretty good. The temperature stayed about where you wanted it to although you do notice the effects of high positive and negative betas. When when we came down towards zero beta, the place cooled off and was more comfortable for sleeping at night. It actually was a little bit warm for sleeping at other times.

GARRIOTT At the high beta.

LOUSMA Yes.

GARRIOTT I went from sleeping under the covers in the zero beta to sleeping on top of the covers at high beta.

LOUSMA Yes, I did about the same thing. I used to have to use the outer blanket at zero betas, and at other betas, why, it was little warm to sleep even inside the netting. I think it might help if you get the lights and stuff off prematurely

LOUSMA
(CONT'D)

before going to bed in the workshop. Get those lights off a little early to bring it down to regular temperature.

BEAN

They'd like you to leave that thermostat at the setting it's at, which is about 69 to 71, and not do any thermal controlling with it because it tends to cause them to bring heaters on, maybe when they don't want them on. Anyway, they can't predict it. So you should check with the ground before you move the thermostat any, and they can understand better what's going to happen as a result of that thermostat setting.

Atmospheric Control, Ventilation and Atmosphere Cooling:

Ventilation was great. Fans don't make much noise, you always got all sorts of air blowing around.

Moisture Removal: Measuring the airflow through the workshop, there is generally about 1 foot a minute, I believe. Temperaturewise, as it was for SL-2, the MDA is always cooler than the workshop. If you want to cool off a little bit, you can whistle on up in there.

LOUSMA

The workshop is not uncomfortable, I didn't mean to imply that.

GARRIOTT

Two or three degrees difference.

LOUSMA

It is cooler in the MDA.

BEAN Moisture removal, I thought, was good. We never saw any moisture anywhere. Yet, I know when I use the washroom and the showers and things, I made a minimum effort to keep the amount of free water down and didn't seem to bother. It seemed to just go off and disappear pretty rapidly.

GARRIOTT If anything, the humidity was too low. If there was anyway to bring it up, it would be a help.

BEAN You've got a good point there. They ought to try to bring that humidity up a little bit, because we cracked our fingers and lips and noses.

GARRIOTT It affected our nostrils for the whole flight.

BEAN They ought to be able somehow to cut out one of those heat exchangers.

GARRIOTT I don't know if they can or not.

LOUSMA The best way to remove odor was to send Owen to the MDA. He believed in a firm offense. His defense is a good offense. Contaminant control in moisture removal we weren't really careful about crumbs and particles and drops of water. We kind of let them splatter and go all over because they kind of just got out of the way and the water dried up wherever it went. The particles all collected up on the screen. You

LOUSMA
(CONT'D)

don't have to be as careful as we were when we first got there about not letting things escape.

GARRIOTT

That's true. I think it's more enjoyable if you don't worry about all that stuff, if you just enjoy your eating or bathing, let the chips fall where they may. If you're constantly being careful, you really don't enjoy it.

BEAN

One other thing I think ought to be added to housekeeping is some sort of wash of that OWS dome screen, whatever the name of it. Rather than just vacuuming it once per week, you ought to take a wet rag up there and wash it off. And you get an awful lot of hairs, small particles that the vacuum cleaner doesn't get and also foods that have gotten in that screen up there. There may be a better way than just using a towel to rub it, but seems to me that would be useful. Maybe you want to pull the duct off the side, the one that comes from the AM, and reach over with your hand and rub the inside too. It would be an advantage to clean out more than just using the vacuum cleaner.

LOUSMA

I think another thing we had trouble keeping clean over a period of time was the windows. After a while, you'd rubbed the stuff on the windows around enough so you'd just couldn't get it off. There wasn't any agent that we had that would take the crap off the windows. You could use a cleaning

LOUSMA
(CONT'D)

rag and as much water as you want to, it didn't seem to do the job. Whenever you use a wet-wipe, it seemed to just compound the problems. You need some agent that would clean windows like Windex, you know. Some sort of an alcohol type cleaner that would clean the windows off quick and easily. It would improve the photography and observations, as well.

GARRIOTT

About once a week you need to vacuum out the inner pane in the wardroom, too.

BEAN

You put a good vacuum on and if you let atmosphere back in there through that minus-Z SAL dryer that doesn't dry it enough, and so you get moisture in there. If you pull the vacuum on and just keep it vacuumed, it still gets in there. My guess is somehow that other little fitting on there is leaking. So when you pull the vacuum on it, it gets nice and dry, the moist air from the workshop goes through that hand-tight fitting. We never tried to tighten it too much because we were afraid we would break it and we just accepted the fact you could put a vacuum on it every week or so. But it's too bad we can't fix that problem.

LOUSMA

That's the wardroom window we're speaking of.

BEAN

Never had any problems with those O₂ loops. Had enough cooling for EVA, provided you didn't do too hard work.

GARRIOTT That's the key to it right there. They explained that I was working about 800 Btus per hour and you, Al, at about 1000 Btus per hour. I thought that was as hard as we would want to work. I still lost a couple of pounds of water in spite of the fact that it wasn't all that much work. As far as the work I did, the first EVA was by far the hardest, where I had to mate those two 11-section poles. My guess is I was working at least 50 percent harder. Wouldn't surprise me if I was between 1500 and 1800 Btu per hour part of the time.

LOUSMA I don't think we could have done the first EVA with air cooling alone.

GARRIOTT Right. We took 6 hours as it was. And if you're talking about 10 hours, maybe so, we could have. But I don't think it would be realistic to say that that first EVA could have been done on air cooling alone. Although that may be a slight overstatement if we would've really stretched it out.

LOUSMA We did work hard as it was.

GARRIOTT I thought so.

Al, I know you're awful efficient in the EVA activities. Maybe that efficiency would've permitted you to do it. But working at it the way I was, I thought that the water coolant would've been essential on the first EVA.

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

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

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

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

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

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

BEAN
(CONT'D)

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

LOUSMA No.

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

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

12.4 CREW SYSTEMS

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

BEAN

I tried the double mushrooms and found them to be okay. They are easier to get into than triangles. The only trouble is that there is not a passive restraint, so if you start getting your mind on doing something at the same time you're being restrained and let your legs relax, which you intend to, at least I do, then a lot of times I'd float out. So I took them off after a couple of days use. I used the little mushrooms one day and the big ones the next. Generally, I like the big ones better than the little ones but I didn't like any of them relative to the triangles. I thought that the triangles could have been improved somehow, so that you could get them in the triangular spaces better, by providing more clearance between the triangle and the space available. On a space station you've got to have some way to connect yourself to the floor. One of the nice things about the EREP C&D panel was that you could use your triangle shoes, so it gave you both hands free. One of the disadvantages of the VTS was that you didn't have any foot restraint and you were always trying to put your legs around something else or hold on with your hands which meant your hands weren't free to hold something else. I think maybe in future applications we ought to try to always have some sort of foot restraint at every station. That allows you to move your body and do work with your hands.

LOUSMA

I think that the restraints were basically pretty good except on the following places: The one that Al mentioned at the EREP VTS. Another was in the waste management compartment. Another was in front of the film vault. Another was over by the food lockers. There was no unacceptable restraints in those areas. One restraint that we had and never did use was the chair in front of thy ATM.

GARRIGUE

I actually tried that chair and found it unsatisfactory. It was just like the M131 chair, you "sit down" so-called in quotes and you float right out. You have to tie yourself down, uncomfortably, to even attempt to use it. And it's just tying you in a posture that there is no reason to be in. It's an attitude and a position that you don't want to stay at very long. So I did try it and found it unsatisfactory. I'll just say a couple more things about the restraints. The SPT's triangle locations in the wardroom at the dinner table are such that the little socket for your triangle apparently is rounded off or something, because very frequently when you take your foot out, you end up with the triangle half cocked. So it will neither go in the next time or come out reliably. And so as a result, I used the thigh restraints about half of the time, maybe even more at

GARRIOTT
(CONT'D)

the table in the wardroom. I found that the thigh restraints there worked pretty nicely. And I think that was another different kind of a restraint which did work rather well. As far as future designs, not relative to Skylab, I think magnetic designs or something like that, or a whole host of other varieties like that ought to be considered. We could get along without the triangles, perhaps, but still have something to serve the same function.

LOUSMA

Mobility aidwise we used the fireman's pole at first and it's mounted now, but we took it down quite early in the mission and I think we got around better without the fireman's pole being there. Another place where mobility aids are noticeably lacking is in the MDA. The MDA is just a hodgepodge of projections sticking out all over and there's nothing that you really can grab onto to rotate yourself around, unless it's the ATM panel. I think that the MDA is built like a spacecraft that we don't want to build one like in the future.

BEAN

Lighting System: By the way, we got numerous comments on restraints and mobility aids under crew systems in the M487 experiment recordings.

LOUSMA

I know it, looks like we're going to have to go through that again.

BEAN We talked forever on those things. Anyone who wants to have more details on restraints and mobility aids or any of these items under the crew systems should consult M487 because we spent hours on board discussing them. I think maybe here we should just talk about the items that are applied to the next mission and anything that we think is critical or particularly important. Because this whole crew systems section you can take 3 hours debriefing if you want and we probably took on board a total 9.

LOUSMA On the lighting systems, we can say that the lighting was usually adequate but there were times when it wasn't and everybody routinely carried a flashlight around with them. If you wanted to make a close inspection, you needed to use a flashlight.

BEAN That and I used that headlamp and that worked real well. I would recommend that if they've got a little extra room on S1-4, which they don't, that they could come up with a slightly frosted bulb to diffuse the light somewhat, but essentially that's a pretty good rig. I think in future space stations you might want them.

LOUSMA Stowage: I thought one of the places that had some good stowage and some bad stowage was the film vault. Some of

LOUSMA
(CONT'D)

it was very good, some of it was lousy. For example; the upper right drawer where you keep the handheld cameras. We had to improvise some straps in there, otherwise there were three or four camera and associated other items floating around everytime you opened or closed the door. They bang against either end and against each other. That's not too good for Nikons and other precision instruments. That stowage certainly should be better. I don't know whether it's worth trying to take up some inserts to improve it or not. The other one was the S019, where we had one more film canister than we really had places to keep it. So everytime you opened the drawer above it you could not close it without reaching down behind and pushing S019 back in its position or taping it.

GARRIOTT

I have a suggestion for correcting that problem; that upper right-hand drawer where the cameras are. We leave those cameras out 16 hours a day when we're up there working around at the place where we're going to use the camera. And then for 8 hours of the day, we're supposed to go put them back into that drawer. I think it's a waste of time and effort and results in potential damage to the cameras the way Jack was just describing. We ought to leave those cameras out 24 hours a day. It's only a 50-percent increase on the fogging. The film was only exposed for the 2 or 3 days that

GARRICHT
(CONT'D)

we were using that camera film anyway. And I think that the whole thing is very likely an over conservative approach. We'd be better off to leave the cameras where we're using them.

SPEAKER

Good suggestion.

BEAN

Another thing that you could do is instead of having the 35-millimeter and 70-millimeter film up in the portion of the film locker that has thinner front sections, stick it down in a lower section and make up the radiation. So if you're worried about the total radiation, make it up there and when you get this film out, just leave it out for that very few days that it's out before you use it up.

LOUSMA

That's a good suggestion.

BEAN

I think they ought to address the stowage of SC19, and things like that again. If they send them up, figure out a neat little way to connect them into the film vault. My only big comment on stowage is let's get all the equipment out in the command module on time and get it right where it belongs. Then use it and as we use it up, put it back into the command module so that it's in position, then you don't have to do so much transferring around.

LOUSMA There is getting quite a few empty lockers up there now for just throwing things. That's going to help Jerry. The food locker and dome lockers are getting emptied out.

BEAN Also, we went through on the tape, channel A, before we came back and gave a complete readdown of every bit of food that was there. We went through an inventory of all our clothes and through an inventory as to what was in some of the big food lockers that were now empty so that Jerry would know where things are. And it seems to me that it would be advantageous to make up new stickers for those lockers so that he could come up there and stick them on the front and it would tell in nice neat letters what's in there now. And it would be much better than leaving the handwritten ones that we have on there now or in some cases, like in the wardroom where we've got some clothes of different people that are actually wrong. For example, it would say, SL-4 CDR clothes and really it's clothes that we had remaining and stuck in there when we swapped Jerry's out. It's quite easy to figure out what's in each compartment. We read it off and made a little list and went up there. It only takes you a few seconds to put the stickers on and then that way you can look at the stickers to see what you have. I'm much in favor of getting these stickers right. It helps you out a lot.

BEAN
(CONT'D)

Clothes: Thought the clothes were adequate. We had more clothes than we needed as evidenced by the fact that we've left all sort of clothes up there that were our clothes. Particularly trousers and shirts. I wore Jack's T-shirts a lot because they were a little bit larger. Owen wore mine because he liked to wear more per day. The only thing that we all saw that was consistent was we all preferred to have more socks, but if we didn't, we probably could of stood it. None of us filled out our clothing form because we thought it would be more efficient just to give you a nice inventory at the end. You can take the number of days and divide by the clothes that we wore and find out what the usage rate is precisely. And so that is what was done and if the gentleman that was interested in clothes usage would check channel A, he could very simply determine exactly how many socks, pants and everything else we used.

LOUSMA

The footwear - I never wore the soft boots at all. I always went around barefoot or with the triangle shoes. My triangle shoes ripped out. Everybody's triangle shoes wore on the back where the little Teflon insert along the heel and the Achilles tendon wore from the inside through. All the shoes have two holes in the back.

BEAN This was about 2 inches up from the sole, right on the left side.

LOUSMA That's right, on either side of the center line 2 inches up from the sole. Mine wore and ripped out. The right boot ripped out along the lower right sole. The material just ripped where the boot is sewed to itself, down near the right sole. It was about a 4-inch gash that was wide open. You could see my foot through it. The only way around it was to bind it up with tape every day.

SPEAKER The toes wore through too, didn't they?

LOUSMA I put the toe caps on. That was required after about a week's use and in spite of the fact that the toe caps were on, the boot itself started fraying but it didn't cause any structural failure. The only structural failure was on the outside of the right boot at the bottom.

GARRIOTT I wore through my toe cap. I didn't install it correctly either. I took a shortcut on the installation and put the toe cap over the sole as well. I just gray taped it.

LOUSMA Gray tape.

GARRIOTT It lasted for 60 days.

LOUSMA We're not professionals.

BEAN Looked like a hockey player more than anything else. Gray
tape over his toes.

LOUSMA But it worked. You can't argue with success. Didn't affect
his brain at all.

BEAN How about comments on the clothes, once again read 487, we
went to so much detail on those clothes. They shouldn't take
up any clothes. There's so many clothes up there. You can
keep clothes for years up there.

LOUSMA I never wore any of those brown turtleneck T-shirts. I don't
know what you guys found out about them but I had heard in
the past that they didn't soak up the sweat very well or
something.

GARRIOTT I don't know what you found. I didn't even wear it. I didn't
like it, that's why I quit. I wore them for a while and found
them to be just as good as the T-shirts. They don't feel as
comfortable to me.

BEAN I don't think they're being used any.

LOUSMA I wound up doing what Al did with his clothes and that is
taking the elastic inserts out of the sleeves and out of the

LOUSMA
(CONT'D)

legs to make it cooler. They were not required to keep your trousers from riding up or your sleeves from riding up. The clothes assumed their normal shape in zero-g just as they did in one-g and there was never any requirement to snap the tops to the bottoms.

BEAN

That's right; that was it. In fact I don't think I ever snapped the tops to the bottoms.

GARRIOTT

I was a little different. I took the knitted portion out of the trousers and left the knitted portion in all of the jackets and rather frequently I would snap the jackets to the trousers.

BEAN

All the way around or just the back?

GARRIOTT

No, there's just two snaps. One on each side.

LOUSMA

Surprising to say that Owen did several things that were not required. And omitted several things that were. (Laughter)

BEAN

How about inspections every morning? I never showed for inspections.

LOUSMA

Why would a guy want to flunk inspections any more? That's why I didn't show up.

BEAN How about the crew quarters?

LOUSMA I think all that stuff is adequately discussed - on the important stuff. I don't think we ought to go through all of that. Must have gotten some outstanding comments.

BEAN Essentially the quarters were adequate to live in. There's parts that could be improved. Certainly the lighting should be improved in the quarters so that you could read a little bit better. The stowage provisions were adequate to hold whatever you had. It would have been nice to have some place a little bit larger to hang up your clothes that you wore during the day so that you wouldn't have to just leave them floating around at night. It worked out okay. Instead of putting my clothes in my compartment at night I hung them out there on the 131 control box.

LOUSMA Trash airlock: Let me talk about the garbage disposal man. I want to introduce to you now, the super garbage man, Bean.

BEAN You got a two-phase garbage disposal. Generally, Jack put them in the metal can. He put them in the bags, I put the bags in the track airlock. We discussed the trash airlock previously here, and we've also discussed the fact that about the only place that is really dirty during this whole operation

BEAN
(CONT'D)

is the time from getting the empty food cans out of their holders in the workshop and putting the lids on. That part is a little messy. Cleaning up that area around there is messy, all the rest is fairly antiseptic and not very difficult to perform. So if it behooves the guys to use, instead of putting it in the six food cans, to try to slip it in its own little wet waste disposal trash bag. We found when we left there that there wasn't too many disposal bags left. I don't know the exact number but it would certainly be on the tapes. We inventoried them. There was a moderate number of urine control bags. There was just all sorts of trash bags. I think Jerry's going to want to get up there and use trash bags as much as he possibly can. I don't think he can throw urine bags in them. I think he can use them a lot more than we did. I guess if we had fully understood the total relationship of these different trash bags, urine bags, and disposal bags, we could have put more garbage in the trash bags.

LOUSMA

I think Jerry's going to want to take up a bunch of plain old disposal bags because if you're going to dump the garbage and you'll have to clean the garbage area about once a day as far as replacing the empty cans are concerned, those won't go in the trash bags. The only thing it'll go in is a bigger bag.

LOUSMA
(CONT'D)

So I think he's going to have at least one a day just for getting rid of the tin cans and garbage at a certain point. It never seems like there's enough big cans to replace the ones you fill in there. So sometimes you have to shake out the cans and reuse them.

BEAN

Food Management: I don't think the ground needs to send you messages to tell you to change the food around. You'll notice you don't have food and the impulse is to go and get more. So I would recommend they quit worrying about that. The best way is to do it, two or three guys at once because it's just a lot more fun. Go up and grab the big bundle, float it down and using the tape around the food bundle lids, sort of tape the big food can to the top of the OWS food table. Then just stand there, one guy get on one side and one on the other. One guy can put up drinks and the pudding, while the other fellow is taking out the big cans. About the time that one gets finished with the drinks and puddings he can start working on the little cans. You don't interfere one with the other and you can get it done real fast.

GARRIOTT

Don't you think they need to allow time on the Flight Plan, even though it's not scheduled?

BEAN I don't think it would hurt to schedule it in. Toward the end they weren't scheduling ours in, we were doing okay. We were taking it right out of sleep time. It wouldn't hurt to schedule it in. Here's the point. You shouldn't schedule the food changing if they're going to schedule and allow time until the day that the food's running out. If you're going to eat your last meal today, it ought to be done today. Sometimes they have us changing food a couple of days in advance. We couldn't do it then because there just wasn't any room in the food drawer. Furthermore, you'd have to take the food that's presently in the food drawer and move it all to the front, which was a big job if it was 2 or 3 days. Then you couldn't get all of your food in. So definitely it shouldn't be scheduled until the night of, or the late evening of the last day that your food's in the tray.

BEAN How about Waste Management?

LOUSMA Works, great system.

BEAN Works well but if we ever ended up with a new system I think we'd want to improve the flow in both the urine system and the fecal system. One of the things that I thought could be improved would have some way to not have to use a tissue after every urine use to wipe off the penis. At the end I would

BEAN
(CONT'D)

wipe it on the cuff and that worked fairly well, but it seems to me they could have directed a slight airflow at a certain point on the lid of that cup that would allow you to eliminate all the urine and you wouldn't have to use a tissue to do the job. Did we change hoses and cups as often as they recommended - once a week, once every 8 days?

LOUSMA I changed probably once every 2 weeks.

BEAN You just did because they told you to, it wasn't because you felt like you needed to.

LOUSMA Just for bugs and you can't tell when you need it on account of bugs. There's set of three cups and hoses which come with every bag replacement kit. If you remember you can use them, swap them out.

BEAN We only had a couple of urine spills towards the end. I had one one time when my little rubber grommet wasn't fit perfectly on the centrifuge. I noticed the spill. I looked in there and saw that it fit correctly on one side, and on the other side it had bent under. So apparently it had let urine somehow come out that way.

GARRIOTT You're talking now about the interface between the bag and the separator.

BEAN That's right. Right there one time that rubber tucked under.

LOUSMA I noticed that some of the bags leak. When you pulled vacuum on it you can hear the air hissing into the little black boot. I noticed that one time when I had a bag that was like that. It did leak around the boot where it fits on the separator and I had some urine spill. If they find a bag that leaks when they pull a vacuum on it they might just want to throw it away if they have plenty of time. I never did that because I didn't know how deep the supply was.

GARRIOTT SPT had no spills at all. He also cleaned all the drawers out just before deactivation. I think we got a nice clean system all the way across there for the next crew. The whole thing looks in good shape.

BEAN Water System: Water system was easy to work. Jack did most of the work. Every once in awhile they'd want somebody else to measure the iodine and put in new. That was straightforward. We always measured it, told the ground and they came back and told us what to put in and we put it in. We never used the onboard chart that I know of, did we?

LOUSMA I always doublechecked it. They always gave us the right number.

BEAN Jack and I took showers. I took two and I think Jack took one. Owen didn't take any.

GARRIOTT I would have if I'd had more time just to fill the square and see how it went, or for the fun of it. But you judged the time it took; I guess it took between an hour and a hour and a half. Is that about right? Including setup, take a shower, and then tear down again. I just didn't want to spend an hour and a half on something that was socially unnecessary for personal cleanliness. There is the towel and washrag bit, which I think was quite adequate to really maintain personal cleanliness.

LOUSMA It did take a lot of time. It seemed like the suction device didn't suck up near as much water as was squirted in there. One of the other reasons I didn't take any more showers, beside it was taking just too much time and not doing that much a better of a job, was the soap. The soap was kind of stuck to you and it kind of stung. It had an odor that persisted for a couple days after you took the shower. I didn't like it so I didn't take any more showers.

BEAN I found that it was just too distasteful. Two parts, one is it took you a while to rig it up and usually by the time you rigged it up, you could have had a washrag bath. In the second part, it was right after you finished the shower

BEAN
(CONT'D)

part you were standing around inside that can trying to vacuum it and you'd bump into it and you'd get cold. It just was unpleasant; it was it was like taking a shower in a place where there was a draft. After you finished the shower and instead of being able to dry off you had to stand around inside the shower for an additional 10 minutes and halfway freeze. So it turned out to be easier just to forget the whole thing. Although it gets you nice and clean. I would recommend to have a shower in the future space station but they have it connected into the plumbing just like the rest of the water. When you step in to take a shower and then when you get finished, turn off the shower and get out. You just leave the shower with water around on that area; you have revisions made so that the water's automatically sucked off.

LOUSMA

I would like to have taken an shower and highly recommend having one in the future but the one that we had, I didn't like and I didn't like the soap.

BEAN

I found that we had to replace the seal on that washrag squeezer. The washrag squeezer is going to need to be dismantled and cleaned for the next crew. It looked like it was picking up some sort of grime, and grit either from dirt or soap or something on the moveable parts. Looked like a simple

BEAN
(CONT'D)

procedure, but by the time that it became rather obvious to us that something needed to be done, we were running out of time - optional time. So we didn't fix it. We reported it to the ground, but I think they need to go up there, dismantle it, clean it up, and reassemble it - it will be a lot better. They may need some lubricants. Also one of the things we noticed is, if you don't have that handle fully extended so that the piston is all the way out, then when you close the lid on the squeezer you stand a good chance of tearing the seal or folding it back and once you've done that, it just isn't the same. So it's important that when you're using that squeezer to make sure the handle is fully out before you lower the lock and engage it so that it doesn't catch the lip of the piston seal. I found it was much more fun to bathe in there when I did not worry about getting so much water around. It's like the crumbs from eating; they went around and kind of disturbed you for a little bit. After you got used to it, it wasn't bad and it made things go faster. I tended to throw a lot of water around in there whenever I bathed and it was a lot nicer and it didn't hurt anything. It just got the place a little wet and I had to clean it up, which was a lot better than trying to be so tidy all the time.

LOUSMA

Vacuum Provisions: I thought the vacuum worked very well. We changed the bags nearly every time we used the vacuum, it

LOUSMA
(CONT'D)

seemed. We used a lot of bags and you could vacuum up the screens without tearing up the blower that was behind it. So the vacuum when used for cleaning the place was good. I used the vacuum for suit cooling inside the MDA during the last EVA and it was marginally acceptable. We also used it for suit drying, on which it did a good job. It was a good setup, I thought.

BEAN

I want to comment on the vacuum provisions. You ought to change the bags when you finish using it because sure enough that vacuum cleaner doesn't have a lot of pull. The second one was when it comes time to vacuum your OWS heat, exchanger, you need to understand what you're looking for so you can reach in there, and how to do it. You have to use two hands to do it and you have to use a little brush and you can't hold the brush by the end. You still have to hold the hose and kind of push it in there. We'll try to work with the SL-4 crew and show them how to clean it. I guess it's important to keep that clean in order to get good heat exchanger thermal characteristics.

BEAN

Oh, and by the way, vacuum provisions. I think it's also a good idea when you clean the coarse and fine filters in the works and the head, which you do about every 2 or 3 days, to

BEAN
(CONT'D)

be sure to disassemble those two and vacuum because you can't get the vacuum off the fine filter with the coarse filter in place.

LOUSMA

Maybe you're talking about the vacuum that's outside. You know, for pulling a vacuum on different things.

BEAN

The previous was vacuum cleaner provisions, now we're going to talk about vacuum provisions.

LOUSMA

The only one available for our usage was the one in the lock. Besides the normal ones that are used for evacuating the water dump.

BEAN

You commented already that the pressure goes up in that dump tank faster than it does on the simulators. You have to be careful. We've also commented that the gages in the head that tell you the temperature in the tank don't work. So you have to ignore those. You tend to count on the ground to give you information about how the vacuum's going and count on them to tell you what's happening.

LOUSMA

We were never trained to be cautious when we reached a certain pressure in the tank, before we left. I think that if there's a number floating around that is recognized as maximum, it ought to be a part of a guy's general knowledge before he

LOUSMA (CONT'D) goes. So the guys should find out what that is and find out whether it is a realistic one or not and use it.

BEAN And get the checklist fixed to operate in this situation where these different gages aren't working, or off scale. So that you can use them or get the simulator running that way.

LOUSMA Orbital Maintenance: I thought orbital maintenance should pretty much fix things up there the way you do here. You need the same kind of tools. The couple of tools that we could have used at one time that we didn't have was a hack saw and a drill; i.e., some kind of electric drill would be what you want. You could use some kind of a hand drill. So it was those two tools that we didn't have up there that you'd never be without at your workbench at home.

BEAN Yes, a sharpening stone is necessary too.

LOUSMA That's right. A sharpening stone is necessary for your knives and other tools that need sharpening is another thing that we should have had up there. Basically you fix things up there the same way you'd fix things at home. It's just a little different matter of retention. And so anything you need to fix something at home, you need up there.

BEAN

What you do need up there in the next generation is some kind of bench that you can put your equipment on and has a couple of plug-ins and has some springs or something to retain items. Using tape to retain screws was okay. By the way, I'd recommend using that silver tape as opposed to the gray tape. It's a lot stickier. But we need a place so we can put whatever we are working on down with good lighting and has some restraints that will hold the item you're working on, plus the parts that you take off and the best possible thing is to have some clips there for your checklist and for things that they sent up. We tend to use the top of the waste compartment vent fan, up in the forward compartment. You can set things on there and use the food locker wall with springs to place the tools and the like. That worked so-so but needs more light and, of course, that doesn't have any electrical connections nearby.

LOUSMA

I think the next set of tools we make ought to be a craftsman-type fitting set of tools instead of fitting like a used set of linker toys because they tend to come apart real easy.

LOUSMA

Crew Safety: I never felt unsafe.

BEAN

I think you've got to stay alert all times to keep your thoughts about safety but I didn't feel that we ever jeopardized ourselves. I felt that we could have done a lot

BEAN
(CONT'D)

more things that the ground didn't want us to do that were safe to a point of view. For example; they didn't want us to test the dump probe that we removed because it got hot. But we had a vice up there, we could have secured it to the floor. Further, even if we didn't have a vice, we could turn it on and - and not touch it. You're not going to float into it any more up there than you do down here. Particularly if you realize it's going to be hot and tell everybody. It's just like working here on Earth and somebody left a 1000-degree hot piece of metal around on your desk. Somebody would get burned but if you ran around and saw everybody and said, "Look, I'm leaving this thing right here, don't touch it." You're going to stay clear of it. So we should be less inhibited about testing some of these items in the best way. For example: there's no reason not to touch these electrical items with voltage on them just as you would on Earth. As far as voltage/temperatures are concerned in zero-g, I think you've got the same ones on Earth. If you would test something with voltage on Earth, then you probably ought to do it the same way up there.

LOUSMA

I think one thing that we worried about up there - that we worried about before we went and had to concern ourselves with, is those earplugs for driving around M509/T020, I don't

LOUSMA
(CONT'D) think those thruster noises hurt your ears in the least.
Not loud enough to bother you. I don't think you had to
worry or sweat about earplugs.

BEAN One thing that is noticeable up there, though, is that you do
need those goggles or else get a blast in the eye every once
in a while. Plus a lot of things are floating around. So you
want to wear your goggles.

GARRIOTT I couldn't wear those goggles. I just kept getting
condensation underneath them and I just couldn't see through
them.

BEAN Yes, but that was when you were the operator.

GARRIOTT Yeah, yeah.

BEAN I was thinking more for the observer.

LOUSMA The observer did not fail to wear his goggles, when he needed
to.

BEAN I think he gets zapped every once in a while.

LOUSMA I don't think anybody needs those earplugs. Those are a
pain in the ear, you might say. I never felt unsafe. I
always had the greatest amount of confidence in our systems
and our checkup procedures for EVA and all other times.

LOUSMA
(CONT'D)

The only thing that that I guess doesn't quite hang with my thoughts is the idea of putting the PGAs in a bag and tying them shut and sticking them away for entry. I think they ought to be out there waiting to use them if you need. Putting them in the bags leaves them several minutes away from them being useful.

BEAN

Anything else for crew safety, Big O.?

GARRIOTT

I can't think of anything, any special item.

12.5 INSTRUMENTATION SYSTEMS

BEAN

This thing on instrumentation system - we commented on this previously about the problems that are associated with dumping. Other than that, the ground controlled it and that's just the way it ought to be.

BEAN

Every once in a while they called up and said they had a recording problem. They asked us to change it. That was the way it sounded good and we'd go change it.

LOUSMA

We already commented on instrumentation with regard to caution and warning system.

BEAN

We don't have a command update to the time reference system. We had a time reference failure. We then had the secondary time reference system put in there and it worked okay.

12.6 DIGITAL COMMAND SYSTEM

GARRIOTT Our only comment about this time reference system is there a switch on the SCS panel which said RESET. It doesn't have any yellow marks around it or anything like that. But apparently, if you push RESET on that switch it fouls up the ground's timing and tape recorder dump data and the like. It seems to me that this is the switch that you don't want to do without checking with the ground. Maybe the SJ-4 crew wants to stake up a stick or at least be briefed that's not the thing to do in event of time reference system problems. My feeling at the moment from the way it was labeled and my understanding of it, was that it was not a big deal. It was something that you probably ought to push if you had a problem and hope to get a reset just like you do most of the resets we have.

LOUSMA It does more than reset the clock like it does on the mission time with command module. It reset the whole system and the ground don't like that much. (Laughter)

GARRIOTT We had the impression that the ground didn't care for it.

LOUSMA Teleprinter Messages: You've got a lot of them.

BEAN There's a lot of them and we just didn't tell them, not enough. You can just send more information if you want but I'd

BEAN
(CONT'D) minimize those that you have to convert over to some other format to stick in books.

BEAN Be sure to take up some spare rollers. I don't know if they're going to need another head or not or just that roller.

12.7 CAUTION AND WARNING SYSTEM

BEAN We've discussed the desirability of picking out the ones that trip frequently that are not critical and eliminating or inhibiting them. Anything else about caution and warning?

BEAN Oh yes, the testing - way too much. Every week or two was a caution and warning test, a fire sensor test. Forget it. We ought to test that thing when Jerry and them get there on a low-priority basis like at about day 5 after they've moved in. And then maybe once during the middle of the mission and that's it. That stuff just doesn't break and even if it did it's not going to mean much difference; it isn't going to bother you that much.

GARRIOTT Controls and Displays: We probably had too many parameters on the caution and warning and some that we really didn't need. Those ones that we went around inhibiting were really not essential. There were just things we thought we had in the original design but it turned out we didn't need them all.

12.8 ELECTRICAL POWER SYSTEM

BEAN Solar Array System: They did all these battery checks which were simple enough, except they were time consuming. We can do those if it's necessary.

LOUSMA I felt that I was being employed in the busywork operations from time to time on this battery check, particularly when you checked the same battery that you checked a day or two before.

BEAN Power Conditioning Group; Batteries, Battery Chargers, Bus Voltage Regulators: Want to say anything about that funny you had, Owen? That went away and never came back.

GARRIOTT Well, it was reported on the down-link and I presume that we're talking about the one where we changed the CBRM selector switch. When we rotated to the new position, as I recall, both the chargers and the regulator kicked off, all three, and batteries. I forgot whether they all kicked off, but I think they did.

BEAN That's what I remember.

GARRIOTT It was never repeatable after that. Although I thought the ground had some vague suggestion as to what it might have been. Some sort of a transient in there. It happened on one occasion. I flipped it twice to make sure that it

GARRIOTT
(CONT'D)

wasn't just two different CBRMs. So it wasn't just my imagination, and I don't know any other explanation at this point for it. There was normal operation after that, I know of no other problem.

BEAN

Power Distribution; Buses, Shunt Regulators, Ground System; Power Transfer; Control and Displays: You might want to say something about ATM at this moment.

GARRIOTT

We have a problem with turning power on both ATM TV buses simultaneously.

SPEAKER

Turning if off?

GARRIOTT

You somehow power up both buses at the same time when you throw the sync gym switch. And to avoid that, we're just using ATM TV bus 1, as I understand it. And the ground is essentially doing that for us. We have a piece of tape over the sync gym switch. Apparently this is the way we want to continue to operate in SL-4. And we also have some problems with the AC buses. But I would rather get the EPS experts to try to explain that problem and try to do it without having had a chance to talk to the system experts first, and at this point we have not yet had a chance to talk with them. We may only have one AC bus available, instead of two. Can you add anything to that, Jack?

LOUSMA Negative.

GARRIOTT So the story I've just given you has some reservations as far as accuracy is concerned. I'd like for you to talk with the ATM experts before really getting a clear explanation together to give to the next crew.

LOUSMA As far as operating all the electrical power system, instrumentation and all that, the recording and so forth - the ground handles all of that and occasionally they'll come up for a request to adjust the pot or something like that, but other than that it's all ground control. I'm glad it is because there are too many other important things to do. It was very satisfactory arrangement, I think.

GARRIOTT They can do such a much better job of it anyway, because they can monitor real time, monitor telemetry, look at it continuously, and find any glitches that show up and they're just far better equipped for it.

LOUSMA You seldom find yourself doing anything to that whole system. An occasional glance, maybe, to see how the batteries are doing, for your information, but other than that, the ground takes care of all that.

13.0 PREFLIGHT AND POSTFLIGHT EXPERIMENTS

- LOUSMA We are supposed to comment on each of the following with respect to time required, discomfort, and so forth. What about MO78?
- GARRIOTT MO78 - Bone Mineral Measurement: I don't think we've been asked to do too much except that we did MO78 on R plus 0, I believe. We had already reexamined to see whether or not R plus 1 or 2 wouldn't have been equally good, particularly due to the findings and anyway you two guys lost nothing. I lost maybe 1 percent of the calcium. And in view of that, you probably ought to reconsider whether or not it's necessary on R plus 0.
- BEAN Plus, also determine whether or not you gained any of the 1 percent back, which I doubt so, it may not make any difference.
- GARRIOTT It's really right down in their measurements noise as I understand it. So that's probably primarily data and they may change their minds later. The rest of it was well run.
- LOUSMA I think so, too. I thought all that was acceptable. It wasn't particularly uncomfortable. People are always there to

LOUSMA
(CONT'D)

do the job and work it into the schedule. It didn't take much time.

GARRIOTT

I agree, no problems.

BEAN

M111: Cytogenetic Studies of the Blood.

LOUSMA

I think all those 100 series go together. We couldn't separate them ourselves. Somebody else has to do that.

GARRIOTT

It was just a question of what we thought about the blood draws and the timing and so forth. I thought that was very appropriate. There was no bother to speak of while you're laying there on the table and our friends from the 110 series come along and tap our veins for a while.

GARRIOTT

I thought it was probably important to get it done right then. Because we know there are rapid changes in blood plasma going on and if you don't do it quickly you probably lose your chance.

LOUSMA

The only thing I objected to in this whole medical business was staying up all night doing it. I don't think that was the medical people's fault. I think it was the operational people planning at the beginning of the day. It shouldn't have done all that. We should have gotten in the command module and come home, and forget all about all this powering down business.

BEAN Each part, the medical and the operational, felt that they had a whole day. But they didn't. They each had half a day and it would have been better to think that way and solve the problem.

GARRICOTT It would have been better if they would have had a whole day. Unfortunately it's the same day.

LOUSMA I didn't object to doing any of the medical protocol upon return to the ship. I thought it was important to do it immediately. You only get one chance at something like that and that's exactly what you ought to do. But I did object to spending a whole day in getting ready to come home.

BEAN I think they ought to consider on this next flight taking one of the crew and trying to get him back to health just as fast as possible by giving him additional blood or additional whatever. Try to see how you can recover a guy on this flight instead of just letting us march along. Right now our blood volume is way down. That tends to slow us down. Of course, it gives you good data and all that. It looks to me like at the end of the third mission you're going to have some good data from a total of six, seven, eight people. If you pick one and saw how you're going to recover him because I guess half of any sort of problem is determined on how you're going to fix them and it might be

BEAN
(CONT'D)

worth while. I'm not any expert but it seems to me that you could learn something very important if you try to pick one man and do whatever you thought best to cause him to recover the fastest.

LOUSMA

I should modify one thing that I said about the medical experiments. There's one thing I did object to and that is they didn't give us anything to eat until we were completely finished with the medical protocol. In other words, we eat breakfast and lunch at the normal time. Then we went through the remainder of the 24-hour day before we had anything else to eat. And I don't think that's realistic.

BEAN

Except a snack.

LOUSMA

A coke and butter cookies which you eat normally anyway. That's still nothing as far as I'm concerned.

BEAN

That's true.

LOUSMA

It was well into the night before we got to do a M092. I think they could have fed us first without impacting the M092 data whatsoever. I think I would have felt a whole lot better if I'd had something to eat. Besides being up all night and tired to begin with, I was also hungry. I can't help but think that degrades the medical data.

14.0 INFLIGHT EXPERIMENTS

14.1 MEDICAL EXPERIMENTS

GARRIOTT MO71 Mineral Balance: About all we had to do with mineral balance was take that supplement each morning. And there were lots of things that were inconvenient about that. The boxes that they came in, the way you get the pills out, and all those things should have been much better arranged. They come up in a sequence on each morning medical report with five digits. We arranged those pill packages in sequence. So if it said 10102, we'd simply go over there and pull out 10102 in sequence from those five packages. I don't know of any better way to arrange it. If we were to do it again, I think there would be a lot of changes in the way that was packaged and arranged. I don't think there's much of anything else we can talk about at this point.

BEAN We found it I think pretty easy to keep up with changes we made during the day if we did not eat something or if we ate extra snacks, or whatever, just by turning around and recording it on the daily status report. That was a good way to keep information flowing to the ground. The only thing that looked like it was a little bit loose was exactly how much we were eating in the way of spices. But it would appear that the ground could get a good idea what the spices were

BEAN
(CONT'D)

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

BEAN

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

GARRIOTT

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

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

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

GARRIOTT That's right.

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

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

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

GARRIOTT
(CONT'D)

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

GARRIOTT
(CONT'D)

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

BEAN

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

BEAN
(CONT'D)

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

ICUSMA

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

BEAN

One thing that I observed during all this food and particularly the water was that I never got to a place in flight where I felt that I would have naturally eaten the right amount of food and taken the right amount of water. The couple of times in flight that I attempted to do that particularly with water, I noticed that my urine went way down and I became dehydrated. From that, I got the impression that if I had just been left on my own devices, particularly in the water area, that I would have become very much dehydrated. A little bit of it I think is a redistribution of fluids may be so that you don't want water, the other may be you're always doing something. You're just not sitting around wishing you had something to do and decide to get a drink of water or a coke for a break. Time for that sort of thing did not seem to be available up there and you just kept going harder and harder and skip those things.

GARRIOTT

I sort of had the opposite impression. I would have preferred to have been on a free-running diet and allowed to eat and drink just what I wanted. Al's point about being in a hurry and therefore slighting the opportunity to go ahead and drink, I think is a good one; I felt that also. Aside from the fact that I didn't have as much time to do those things as I would have liked, I would have preferred to be on a diet

GARRIOTT
(CONT'D)

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

GARRIOTT MO74 - Specimen Mass Measurement: On 74, we replaced one of the electronic units; it's about a 5 to 10 minute job, no problem. Calibrations I thought went well. One of the

GARRIOTT
(CONT'D)

things we asked for and sent down was to check to see whether or not there was any change during the GG-dump maneuver. The verbal communications came back from Bill Thornton that he thought he could see it; I haven't been able to see it and we are still a little bit skeptical. I think any sort of restriction on the crew as far as calibration or measurement during GG dump should be eliminated and any corrections, if Bill can find them, should be made postflight. The device is easy to use, it's convenient and apparently it's pretty accurate.

BEAN

I would suggest that they eliminate the requirement to weigh those items three times: the fecal matter and any food that you happen to use. Just weigh it once and write it down and forget it. It's going to be so close it isn't going to make any difference.

GARRIOTT

Were there more than two occasions when we weighed food?

BEAN

I think we did when we were feeling bad. I weighed one item besides fecal on the specimen mass the whole time.

LOUSMA

I think we calibrated the wardroom mass measuring device too many times because we calibrated it more than we ever used

LOUSMA
(CONT'D)

it. We used it maybe once or twice at the beginning of the mission, and thereafter the only time we ever used it was to support a television show demonstrating how we used it.

LOUSMA

We spent at least three sessions of a half hour each calibrating that thing.

GARRIOTT

It took a full hour to go through each of those complete calibrations, and I guess we measured one food sample through the whole flight. I measured a sweat sample in there, twice. That was about the total time it was utilized for its principal function. The one in the head of course we used for weighing feces.

GARRIOTT

The fecal bags do not fit in conveniently underneath the hold-down place. There was a bad design to match but I presume that it was designed independently.

BEAN

The little screws came off the front of the specimen mass measurement device in the head. We used our pocket knife and put some of them back. Some of them had floated away. We actually removed a screw or two from one in the wardroom, which had not floated away, so we had about equal numbers on both of the units. So it might behoove the crew to glance at that unit and if the screws have come out again, screw

BEAN
(CONT'D) them back in before they loose them because they are very,
very small.

GARRIOTT Little tiny Allen head screws. Then we also found the one
on the side on the hinge that hadn't been loosened, Al.

BEAN That's right. When the hinge point for the arm that
controls the rubber hold down fitting, hold down whatever
it is, came loose they didn't come out fortunately and the
unit wouldn't work too well. Those were screwed in.

LOUSMA Everybody's going to want to know how many screws are missing
so they can subtract that weight.

GARRIOTT It is a small fraction of a milligram. Would be the weight
of each of those and there's probably one or two missing.

BEAN Look at TV and see.

GARRIOTT I think it would be worth including in the day 5 or day 10
checks to go through and verify the tightness of those screws.

BEAN That's not a bad idea.

GARRIOTT Not on activation but on day 5 or 10 somewhere.

GARRIOTT Let's go to 92 inflight IBKP. The machine worked exactly
as advertised.

BEAN You have to be careful when you put that hoop around it and lock it. One time I locked that hoop (Morman clamp), and the whole hoop around the body was not centered over the two flanges and it locked and felt good yet it was not sealed. I think it is important to visually inspect the complete circumference when you close the Morman clamp.

GARRIOTT Another point we ought to talk briefly on is the saddle. Now we all found that the saddle positions that we had to use in flight was two to three steps closer to the iris than they were on the ground. That's apparently because there is no friction between your back and the plate which supports you in zero g the way it is here on the ground. As a result, your body will float higher. You just get sucked right down into the LBNP. In each case, well, in my case, I was three steps closer toward the iris and two steps closer to the iris than when I ended up back up here on the ground post-flight. We didn't move it one step closer toward the iris, now that I'm in postflight. Did either of you have that same experience?

BEAN I was 6 in flight, 8 postflight, and 9 preflight. I think the postflight is the more proper number. It seems to me the SL-4 crew ought to take a look at what numbers they're using and subtract 2 right off the bat and have their card printed that way.

GARRIOTT That put's the iris right at the crest on the hip bone there. That's just the way you have to raise that saddle. I think you'll find that there is extra pressure around the abdomen. In flight, it's not exactly the fact that you're pressing up against the iris but just the extra suction seems to be felt right around the abdomen and it's, even at 50 millimeters, approaching a rather painful state at times.

BEAN That's right.

GARRIOTT And that's another necessity for raising the saddle up closer to the iris so that you don't get that extra pressure, excessive pressure, right across the abdomen.

LOJESMA It's kind of a pulling sensation. And there is a lot of pressure on your seat to on the saddle which you don't feel on one g.

GARRIOTT Because you are right down against it, you don't have that extra friction on your back. Now it seems to me that, since I returned, the pressure doesn't seem anything like as high as it did in orbit.

BEAN I couldn't agree with that more. This baby over here just seems like you're not even pulling down.

GARRIOTT Twenty or 30 millimeters and yet your setting there at 50.

BEAN Suppose they ought to calibrate that to see if they are really pulling 50.

LOUSMA No, I don't think so. Everytime they load more millimeters on it, it feels like it's pulling the skin right off your stomach.

BEAN I think they ought to calibrate that myself, now that you mention it because we all agreed with that preflight. During flight, we said it hurt and postflight it got easier so fast. I think they ought to figure out a way to check that one out for Jerry's crew to see if they are really pulling 50 or if they are actually pulling more.

GARRIOTT There must be variety of easy ways.

BEAN I would recommend that they figure a way to calibrate that LBNP to make sure that when it says we're pulling 50, we really are. Now one things that's interesting, both the gage on the can and the one on the electronic assembly indicate 50. Make sure they're independent. They're probably checked. It just sure seems a lot.

When you're suiting up, there're all sorts of different thicknesses of sponges that go in your electrode harness. It seems to me that you can't have any one particular technique such as open the package and dry them off and put

BEAN
(CONT'D)

them in your harness. Sometimes that works and about 3 days later you have to get some dry ones and you dry them off and you're up a creek. The one that seemed to work the best for me towards the end was two things: One was after you washed off the sites with that little paper cleaner in the kit, then take the towel and using the nonfuzzy side, rub those sites again and rub them briskly. It would dry you off more then and cause the stoma seals to sit better, but mostly I think it roughed up the skin where it got a better contact. That was one thing to do to get a much better contact. The second thing to do is when you put the little pill, as we call it, the little sponge with a little juice on it, before you dry it off or do anything, put it in the sensor, and take it and push down on it with your finger to the height that it will be when it is on your skin, which is pretty near level with the edge of the electrode. And then see what's happening. If you push it down and it squirts out a lot of juice then what you do is dry it off a little bit. If you push it down and it doesn't squirt out any juice, get rid of it and get another one. It will save you a lot more time if you do this closed loop test. Be particularly careful that you do this before you remove the covering on the stoma seal or you get that juice right on the stoma seal and it won't stick. But if you do it beforehand and see

what's happening, you can do the closed loop test and you can get a much better seal. We found a way to do it was keep it as good as you possibly could so it wouldn't squirt out when you pushed it on the skin, it was the same level as the base of the electrode. That's worth practicing before you go. It will save you a lot of grief later on, particularly now that we're trying to make these windows.

All those neat rules about 92 are just interesting because the very first day you get up there, you start flunking them, but you don't want the guy to get out of the can. It seems to me that the best check of everything is watching him and then having him tell you how he feels. How do you feel, do you tingle, or, do you feel okay in the head? That's the best check and all those rules are just interesting. The most important thing is to float back near him and watch him and have him talk to you about how he feels. If he starts feeling bad, or if you start noticing that his heart rate has been building up and it starts down - you might be alert. But realize that both the blood pressure cuff and particularly the heart rate indication jump around quite a bit. So you really know if you're catching him with his heart rate going down or it's gone down quite significantly. My feeling for all this is you're not particularly stable up there to begin with, and you don't want to take any chances of getting your-

BEAN
(CONT'D)

self physically in worse shape than you are. Maybe at the first of the mission, where you are a little bit erratic if you feel bad on that LBNP, you ought to reduce that pressure right then and hold it. Now I don't think there is any stigma attached to it, even though the ground becomes very interested in how you're doing. I think you ought to plan on stabilizing eventually, but right at first if you start feeling bad, you ought to reduce the DELTA-P and then wait until next time to try to keep it up there. Sooner or later you're going to get where you can fly the right DELTA-P and then do it quite easily. But you shouldn't be touch and go right at the first all the time. It makes it hard on yourself and hard on the observer, and you stand a chance of going a little bit further than you want to. One time I did. I finally punched out of it at 50 millimeters and I should have punched out of it 30 seconds beforehand. I don't think there's any advantage to trying to go as far as you can up there. You don't have the recovery mechanisms around that you down here on Earth.

GARRIOTT

I think it's a good point about the erraticness or the degree in which the blood pressure and the heart rate jump around. It makes it nearly impossible for the observer to sense the onset of syncope. And the most reliable indication seems to be the subject himself. That doesn't mean that the observer

GARRIOTT
(CONT'D)

should not be very alert. I think it's essential that he monitor things very closely. But still the most likely way to find out when you should level off on pressure or drop back a little is going to have to be the subject himself.

BEAN

MC93, Vectorcardiogram.

LOUSMA

We were always glad to see it because it was a shorter protocol. You didn't have to crank up the MA.

GARRIOTT

The limits set for calibrating the O_2 , N_2 , CO_2 , water, from the cal bottles are so tight that the MA always fails to pass. That means you have to recycle back through your checklist, and go back and recalibrate your voltages, gains, and so forth, and it really slows you down. I think you ought to reconsider whether or not it is necessary to recycle through all that. Or, alternatively whether or not to touch up the appropriate gain at that particular molecule might be an adequate procedure. Now if you can just touch up the gain for say CO_2 or O_2 then that would be a much shorter thing and it would also save some time. But better yet, it would be just to widen the tolerances so that you don't keep failing the tests. I think that would probably save 5 to 10 minutes on each of the MA calcs.

BEAN

Backing up a little bit, postflight when they cal these leg-bands in the can over here on the ground, they don't go to such great length to get the thing exactly zero and exactly the cal number. They sort of get close to it, then that's it. They let the cal give the numbers and I assume their computer program ratios it off or whatever happens.

We were constantly fooling around with those things getting them zero and the cal number. Maybe there should be a wider limits there too. In other words, get the man in the can, put his leg cuffs on, and before you cal it, close the can and get the number - Get him in the can, run the numbers up to about where it's correct - I mean plus or minus 0.5 instead of plus or minus 0.1, and then go from there with the cal. They always vary during the run. They're way off by the end of the run and it doesn't seem to hurt anything, which gives you the feeling they don't have to be right to the cat's meow; otherwise you just waste time. If we could somehow loosen those up and still not degrade the data, and loosen the ones up on the 171, you could get those in much faster and your chances of hitting the window would be much better. Then you could end up doing a few more experiments because you wouldn't be spending more time doing those.

GARRIOTT 0.1 may be too tight. Stowage on 92, that's a pain. It started out to be a pain in the neck until finally they sent us a message on exactly which cuffs to use. Al took the time to sort through and put the ones that we were going to use into the slots for each of the individual people. After that, we never had any problem. So I suggest that you identify the ones that you are going to use and then stick with them until there's some reason you have to change. Once we got that organized, it saved us a lot of time instead of having a whole range of cuffs that were acceptable.

M171 Stowage: The only thing we stowed there was the sensor kit which was satisfactory. The hose we left up on the panel except after cleaning. After cleaning we would normally leave both ends free so it would get a little better circulation and dry out better.

Noise Level: It's a noisy machine - the old ergometer. We've already talked about the complications of trying to hear the ground over the pedaling.

LOUSMA I think we wound up using less handlebars than we had there, at least I did anyway. The only part of the additional handlebars that I used was probably the first 4 inches that stuck out of the other handlebars. I never used the rest of the handlebars that went around it. My method for riding

LOUSMA
(CONT'D)

the bike was to cushion my head against the overhead and hang on with the arms to the hand grips that were there. Sometimes I'd move them back a few inches to include part of the new handlebars and then push with the legs and take up the opposing force with whatever combination of head, arms, and upforce on the pedals that seemed to be right at the time. I never used the remainder of the handlebars. Maybe the other guys can comment on that. The only other time I guess they came in handy was when I was pedaling the bike with my hands. I put my head underneath the crossbar of the new handlebars to support the back of my neck with the handlebars. And I didn't use the new handlebars much and maybe one of the other guys found more advantageous than I did.

BEAN

I found them to be extremely advantageous, I seldom used the pad on top of my head. Most frequently I used different hand positions. One thing that I did notice was that you could ride the bike several different ways. Putting your hands different places and letting the handlebars provide that ability lets you relax your legs and lets you extend them sometimes and with your knees up sometimes, just to make a change. One thing that puzzled me was that it looked like the insulation that was around those handlebars didn't really do the job. Maybe that Teflon wasn't supposed to also insulate the handlebars. I kind of thought it was, but I

BEAN
(CONT'D)

did notice that a lot of times after the run if you held onto the handlebars, you flunked the isolation test whereas you let go of the handlebars, you'd pass it. Maybe that's not important, but I think it is something that was a little bit of a surprise.

GARRIOTT

I also used the extension on the handlebars I think, but not all the way around, of course. I used them as far back as where the little jog occurs and then probably another 3 or 4 inches beyond the point where it jogs out to the wider width. I held myself on the bicycle essentially in three ways and you just mentioned all of those. It's partly by up torque on the opposite foot and partly by handlebars and partly by my head. Of those three, I would probably be using two of them at a time. I'd try to just rotate around them, and when my arms got tired then I'd use head and up torque, then sort of rotate around to try to keep reasonably or not overtaxed in any of those three methods. The handlebars, I thought, were useful. The remainder was to physically or mechanically hold the parts of the handlebar that you were using.

BEAN

We replaced the screw in the pedals of that bike. It looks to me like, although it's a little bit hard to get your left shoe in, if we could keep those screws in there that the bike problem is solved. We didn't have any more problems

BEAN
(CONT'D)

with the load module after that one time that Jack ran it a long time. So apparently those limits are satisfactory whether or not they can be further enlarged, I don't know. But, at the moment, they seem to be able to provide adequate exercise and at the same time prevent us from overloading it.

GARRIOTT

There's no one going to overload it again, I don't think, because all the SL-4 guys are our size, Al, and there's no way we can overload that machine. With the present tolerance they've got, it's safe enough.

BEAN

I didn't know if Ed Gibson, in particular, was really running that bike.

GARRIOTT

He works like the devil and he's awful strong, but he's not that big. I don't think he's going to come close to what Jack's output was.

LOUSMA

I wound up splitting my exercise period in two for that reason. I guess that the most I've ever put on there was 5000 watts in about 18 minutes or something like that. It seemed to hold up with no problem after that. One other thing about the pedals. I don't think it would be a bad idea to take an extra set of pedals because if you loose the pedals and you've had it with the bike. You don't have any replacements like you would the load module.

GARRIOTT That's what I was going to ask you, Al. I thought we were going to bring up more pedals. Or at least a replacement for that one.

LOUSMA I'd take up a extra set of pedals. You never know when one of those are going to break and you may not be able to fix it.

GARRIOTT It's essential.

LOUSMA We were lucky to get that fixed the way it was, like breaking in some other unfixable fashion the next time.

BEAN Maybe those pedals are interchangeable where you can just take up one and actually provide for two.

GARRIOTT The angle might be different, I don't know. Replacement I'd assume that would be sort of part of their task. To replace that thing even if it is working. Maybe not; maybe we'd want to leave it the way it is.

LOUSMA Maybe you could work up a pretty good load using the air method in a hurry and you could pedal it in any attitude. We showed pictures of us doing it inverted and all that kind of thing but the way that was the most comfortable and the most used was to wrap the ankles around the trash airlock and put the head underneath the improvised handlebars and just pedal away in that fashion.

GARRIOTT Limb Volume Measuring System: Nothing.

GARRIOTT Blood Pressure Measuring System: BPMS went fine. You don't get your isolation, as you know, when you get sweaty, but apparently that's no big deal.

GARRIOTT Calibration: We've already talked about. The BPMS works fine. We did that one fairing and you replaced the temperature probe.

GARRIOTT Experiment Support System: ESS worked like a charm. No problems.

GARRIOTT M131 Vestibular Experiment: Stowage was okay.

LOUSMA The box has the same problem as the box on the ground. You have to work to get the thing closed.

GARRIOTT So, you throw the latch over the hook, but then do not snap it shut and it will stay there.

Rotating litter chair works great.

BEAN You have to clear all the clothes bags and SOP and things out of the way because when that's rotating you kind of cover a big swath there. Also, you tend to float out of the chair, and when you get ready to move your head, in the head movement directions, you find that you can't always hit those

little sensors; at least I couldn't. Now I noticed that in the postflight testing here, they haven't even brought out the sensors.

LOUSMA They did for me.

GARRIOTT I touched about a third of them.

BEAN I was going to suggest if that hitting those little sensors is important, then I would recommend that they take up four little wire adapters that take those sensors and make them more movable. In other words, it would be like a standoff. You would snap a piece of wire onto the present sensor and then on it would be another wire that you could move up and down and try to get more adjustment to it. You could get it up higher and get it wherever you could touch it with your head, when you are spinning around at 30 rpm, which seems to reposition your body quite differently than when you're here on Earth.

BEAN Another problem I noticed was that the goggles are sort of semi-out of focus.

GARRIOTT We figured out why. We got that straightened out I think. It's because the eye-to-eye spacing is not quite right and it's too close. You move your eye over to the right, and it will get into focus. You can't leave your head centered,

GARRIOTT
(CONT'D)

or your mouth centered on the biteboard and have it that way. I think it was worse for me than you guys. My eyes are not quite as far apart. I think that's the problem because once I moved it out to the right, then it could be focused properly.

LOUSMA

I didn't know that had a significant effect on the experiment, though.

GARRIOTT

I agree. The OGI is visible either way, and I don't think it makes any difference.

LOUSMA

It would be a good idea to schedule OGI in the morning because it's awful easy to go to sleep with that experiment, difficult to concentrate, especially in the afternoon. You could even go to sleep real easy in the morning. It's a good sleep-inducing experiment, and it should be done when you're fresh.

BEAN

Biteboards worked okay. The goggles worked. Controls worked.

LOUSMA

It seemed that they wanted us to always read that nitrogen pressure and it never changes.

BEAN

I think it ought to be eliminated. Another thing they ought to eliminate is the same questions after each run, because

BEAN
(CONT'D)

you end up saying same as last time. Maybe we ought to have the questions and you answer them, if you want to. But there should be no reason to answer them, whether you have anything new or not. In other words, just glance over the questions you, if you have an addition answer it; if not, just forget it.

GARRIOTT

M133: Stowage was okay. Cap fit okay. Comfort in zero g is better than it is in one g. Sleep compatibility - satisfactory.

Jack and Al didn't mind it at all. I minded it somewhat. The thing that I found most annoying is the fact that it takes 15 minutes to load up the cap with extra electrolite and get the cap ready for wearing. Then as compared with the ground-based cap, you almost always end up with a lot of extra electrolite running all over the place. The way I ended up doing it was to fill the electrodes, and then give it another 5 minutes to seep out, and keep cleaning it off with a wipe, and then after it had seeped out, for about 5 minutes, then I put it on my head. This would avoid having a half a cc or so of the electrolite matted in your hair the next morning.

I did wash my hair two or three times during the flight, and I tried to clean it out fairly well after each of these

GARRIOTT
(CONT'D)

wearings. I didn't particularly like the way the schedule ran with 3 days consecutively just before reentry because those managed to fall right on top of the days that we were also trying to readjust our sleep cycle. Readjusting that in addition really made sleep difficult. The same thing is true with postflight scheduling. I don't think 0, 2, and 4 are good days; 1, 3, and 5 are better. I guess that the data look good and I hope it all came out well because I put a fair amount of effort into making sure that the data all work right - about 15 minutes required presleep and about 5 minutes required postsleep to get the stuff out of your hair.

Log Book: I didn't know there was a log book. I did check the sensors both before and postsleep to make sure that they were working well and with the exception of 1 day, I did get good signals. And I understand that all the tapes were good.

LOUSMA

M151: In the beginning of the mission, we did a lot of 151 and took extra time to set up the cameras and stuff. At the end of the mission, same deal, but they didn't bug us as much in the middle of the mission. It seemed good not to have to set it up but we didn't have to set it up what seemed to be 100 percent of the time, like we did in training. Seemed like we did it constantly in training. It was

LOUSMA
(CONT'D) probably good practice, but we weren't plagued with it that much during the mission. We shot up a lot of film with it at the end. It seemed that they wanted to have three S183's in a row which seemed to be redundant.

GARRIOTT We just heard today that the settings may have been wrong. Is that right?

BEAN We had the best settings. The settings were right. It's just that apparently there isn't enough light down there, and this makes the films grainy. My recommendation would be that the next crew bring down one of those high-intensity lights and use it down there and get some good pictures. There is no sense in taking data that doesn't come out good, even if it's a little more trouble to bring the high-intensity lights down there.

LOUSMA I thought SL-2's pictures came out all right; the ones we saw. I'm surprised that our's didn't because we generally had all the lights on to take the pictures.

BEAN Well, maybe they have only seen one roll. Maybe that one turned out bad for one reason or another. I think that in training your time should be divided between doing 151's and television and not do so many 151's in a row, because that holds you up and it really doesn't add anything. Once you've

BEAN
(CONT'D)

done a 151 or two, that's just about the end of it. Over in training, you ought to get the fellows that are going to be working with you to get the cameras set up and everything else. If they want 151 data prior to the flight, they ought to set it up and do it, except for the several times required to learn the procedures.

LOUSMA

One camera we never could figure out how it should be located is the one in the dome.

LOUSMA

It was M509/T020. We never could figure out where it was supposed to be hooked up and none of the things were ever right. We just sort of pointed it down to the center, somewhere.

GARRIOTT

M172: I think we all learned how to operate a little bit better and the importance of sort of tensing your gut before you start and sitting nice and quite. Also, Al taught us the importance of using the shoulder straps and how to lock the shoulder straps. I'm convinced now that it really does make a difference in the data and you really can get your accuracy down to a couple of places in the fourth decimal place. In other words, X.XXX and that last decimal would be a couple of digits up or down from the mean, if you're careful. It might very well be worth while, the first man

GARRICOTT
(CONT'D)

up there each day, letting oscillate the chair there by itself for about 10 seconds, to sort of free up any restrictions that there might be and get the whole thing limbered.

I did get the impression that the first few measurements of the day sometimes were not quite as accurate. They would trim up and then level off at another steady number. So Bill Thornton might think about that.

BEAN

There were two things that made the difference for all of us. When you got in there and got the shoulder straps locked and then punched that thing off like your pushing off the trigger of a rifle, don't punch it off hard. Push it slowly until it finally releases. The other one was, as Owen said, as you get situated in there and you get all tensed up, good and solid, you let it rest there a minute from the time that you unlock the lock before you start pressing on the button to release it. Let everything settle down. Don't just release the lock and squeeze off the trigger. You ought to release the lock, kind of let it settle there for a minute, and then slowly push off the controls.

GARRICOTT

Calibration: It takes a long time to break out those 509 bats and the four different trays, get them all rigged, and everything secured. I think we did the calibration too many times. Two at the most on SL-4 at the beginning and

GARRIOTT
(CONT'D)

the end should suffice. We need a lot of extra experimental work on 172, and I think we were all glad to see it. Anything that's new and interesting and provides extra medical data, I think, for the most part, we were glad to receive. But I think we did get a little bit tired of so many calibrations, when we were repeating stuff.

Checklist: We did so many calibrations that we ran out of checklist. Weighing the Body: We maybe didn't do quite enough of these special weights, before and after exercising, and just before going to sleep or just after waking up. I think a few more of those might have provided some extra information for the PI.

LOUSMA

The onboard calibration curve is no longer of any value up there. We should consider updating that so you can log your own weight instead of having it shipped up to you every morning. This would help to verify the operation of the instrument.

14.2 ATM EXPERIMENTS

GARRIOTT S052 - White Light Coronagraph: Door operation was normal. We had a tendency on several occasions to forget to turn the videcon off. My guess is that we probably had the videcon on maybe once every other day, during the door operation. Apparently, it didn't hurt the videcon any but we would like the team to rethink the necessity of those, and if you still like the idea, just stress it in the final training for the other guys. We have a little sign up there, to help remind us of that fact.

Pointing system: We've actually got a couple of pieces of red tape up there, about 2 inches long, across the - up 8 and right 18 position. Works real well. I didn't think any of us had any trouble with it.

BEAN The secret of that alignment is to keep the x10 switch in the x1 position. You may have to take it out of x10 to do some sort of special procedure, but we ought to look over our onboard data for SL-4 to make sure those procedures, where it tells us to go out of the x1 to the x10; at the end of that procedure, it has you to put it back to the x1. And that way you always end up operating there straightforward and simple. I remember one time we got out of configuration.

GARRIOTT You ought to always remain in $\times 1$.

LOUSMA Another point that wasn't clear to me when I went up there, when you roll, when you have the WLC ... on, and you want to roll to a different position about Sun center, to set yourself up for Sun center roll with your switches. That is, have both switches enabled (MPC enabled) as opposed to having it off. You do roll around the red marks, Sun center roll, very neatly if you've got both MPC and roll enable switches up enabled and it will hold in there very well and you probably won't have to adjust the pointing at all, after you've made your 180 - or 190-degree roll.

GARRIOTE If you inhibit the experiment pointing, then it tries to roll around the line of sight, and it involves the computer generation up/down, left/right signals at the same time and it just drives your pointing around more erratically than it does to leave them both enabled. I think that a good point for rolling Sun center is to leave everything enabled. The cal's that we went through went well: It's a good display. We were able to catch several transients before they were reported from the ground. The visibility, particularly of the loops or bubbles, as we called them was good.

BEAN You had to use high contrast though and you had to do some twiddling around. You had to get the brightness up and the contrast up on that one, to get in the ballgame.

GARRIOTT On both WLC and the XUV MON, I normally ran with a full open contrast up at 9. Then you just had to vary the brightness.

LOUSMA Another thing that you find advantageous is to make sure that the STS windows are closed and you'll probably want to turn off three or four of the overhead lights, to make sure you've got good visibility in both of the displays. That's particularly true in trying to interpret the S052 display.

BEAN Good point. That's one of the best things to look at when you've got a free moment or two.

GARRIOTT This comment will apply both here and on the 82B, but I think it is a good idea to start off the day, (you're normally starting off with a synoptic JOP anyway) with a good photograph of the WLC and one of the XUV MON at Sun center. Then you can use that as reference for the rest of the day. We tried to do that although it was not always completed. I think it's a good thing to have those two as references, because they're many subtle things that show up in the corona. You will think to yourself, "Now, this looks different than I saw it before." On many occasions, five or 10, maybe more, I would think that this was something new. By comparing that with my WLC photo from the morning, I would find that it had been there all along and I just had not registered it.

GARRIOTT
(CONT'D)

It was so subtle that a sketch would have never shown it.

I would never thought to have put that on a sketch. As far as I'm concerned, the sketches are of little value as compared with one decent WLC photo. It's easier to have a WLC photo. The crew should attempt to get one of those early on each morning.

Streamers, rays, and coronal holes: I don't know about coronal holes. I never saw the connection between a coronal hole and a WLC feature, myself. The coronal holes are visible but sort of subtle on the XUV MON, not anywhere near as clear as on the 82A photograph, for example. I was never really able to connect anything that I saw on the XUV MON, as a coronal hole, with the corresponding feature in the WLC.

Diffraction rings: They are visible. Pylon is very fuzzy, somewhat larger than it is in the trainers. Contamination is certainly visible.

BEAN: Not any more.

GARRIOTT: When it's there, we saw the dust particles on the edge of the ring and they've been cleared well, by our two good brushes. We also very often see little particles of contamination flying across the field of view. An average frequency would be on the order of 1 minute.

GARRIOTT
(CONT'D)

And if they're in close, they will look like washers, as Jack just described earlier on this tape, presumably because the secular point being very bright. It overdrives the videcon and inverts the signals. If you get them much more than once a minute, you're probably dumping maybe the M092 or maybe a water dump through the trash airlock or a dump into the oxygen tank.

BEAN

These diffraction rings on the WLC display, there are some right around the display. I noticed that out at one radius, two radii, and three and further on out, there are also circular rings sort of out in there. You have to be careful. Sometimes you can minimize them by using your gain in contrast correctly. You have to be careful for you can sometimes kind of invent your own little coronal disturbances by mal-adjusting those controls and causing these little rings that are around there to interact with the normal streamers and then you think that you've got something funny out there, when in fact you really don't. It's a little artifact that shows up and you have to be careful, when you use the coronagraph, that you don't discover something that just's an artifact on the coronagraph.

LOUSMA

The occulting disc is not perfectly round either, like in the simulator. It's kind of egg shaped. Also, the whole display (WLC) seems quite grainy by contrast to the one in the simulator.

GARRIOTT You didn't think resolution was as good as the one in the simulator?

LOUSMA No, I did not. Not the way I remember it, anyway.

GARRIOTT I didn't notice too much difference there, but maybe I sort of got resynced to the spacecraft.

LOUSMA Everything seems more well defined, as far as the S052 goes on the simulator, than it does in real life, as far as the display is concerned.

GARRIOTT As far as the detection of transients is concerned, I think the fact that we did detect several when called up from the ground, we observed several more, indicating that it is very useful for that. And they show up pretty obviously. Not by the fact that they're in motion but by the change in the configuration. The loops and the bubbles are the most obvious things. Secondly, we sometimes noted that the rays were bent into the nonstraight streamer that we normally saw, or it's an alteration from the configuration that we had seen or photographed on an earlier orbit. There's no question that that display is very useful from the standpoint of detection of coronal transients.

LOUSMA I think sometimes that we noted the coronal transients, because of increased brightness; sort of discontinuity in an increased

LOUSMA
(CONT'D)

brightness area. On the other hand, sometimes we noticed the discontinuity into a sort of hole or darkened area instead of the increased-brightness area that we noticed in the simulator as being the coronal transients. There might be a sudden discontinuity into a dark hole which also turned out to be a transient as I recall.

GARRIOTT

That's right. Behind the transient, there was a region in which the corona appeared to be depleted. I don't think that would've been a corona hole.

LOUSMA

I should not have used the term corona hole because it's ambiguous. It looked like the hole in the bright picture that we were looking at.

GARRIOTT

I had forgotten until you mentioned it, but I remember talking about one in particular that was just that way.

Mode Operation: In JOP 7, we just pretty well went by the rules. Mainly we initiated the mode at 1 plus 25 time remaining, and I think usually we tried to stop the experiment and close the door manually, just about 1 or 2 seconds prior to effective sunset. I don't know that this is necessary, since it would have been done automatically anyway. But just as a backup, I normally did it 1 or 2 seconds early. After I noticed that the third frame had already been taken 5 or 10 seconds prior to that.

LOUSMA That point was never clear to me. Owen mentioned that but it was never brought up in training and so sometimes I'd let the door close itself and sometimes I'd close it early. I noticed in order to get the door closed before the Sun did the job itself, or before the system could have damaged itself, you had to start the door closed maybe 5 or 6 seconds prior to sunset. So somebody should come up with a well-defined procedure which says either you do need to close that door before sunset, or just let it close itself.

GARRIOTT I think you're right, Jack. The JOP only shows a stop right at effective sunset and we ought to take a closer look and see whether or not it's necessary to do anything manually.

LOUSMA We should decide on one, proper way to do it, and do it that way, because it was never clear in my mind after Owen mentioned it, as to which was really the best.

GARRIOTT I did not spend as much time as I would like to looking at the corona as we came down close to sunset. Because anytime it turned out that we were going to have an opportunity to come down close to sunset, say GG dump not inhibited or so on, we were almost always doing a JOP 7. And I would like to have looked at the effect of the Earth's limb coming into the scattered light into the videcon more times than I did. It is possible, if you leave the videcon on and the door open,

GARRIOTT
(CONT'D)

as you come down within about 20 seconds or so of effective sunset, when sunset's occurring at 40 kilometers, to see a brightening on one side and then the whole corona begins to get lopsided and the videcon is clearly getting a lot of extra light that it shouldn't have. Very shortly after that, the door will close. Each time I did that, I turned the videcon off promptly and closed the door as soon as I began to see things getting out of hand. I think we ought to think through just what's happening there and try to let the SL-4 crew know a little bit about what to expect and decide whether or not there's any potential danger to the instrument, in case we should let it go into sunset.

HOUSMA

I saw that phenomenon several times. In watching H-alpha during sunset, you'd notice you were Sun centered; the Sun's image would become lopsided just before sunset and you'd see the density waves of the Earth's atmosphere, and you see them progress across the H-alpha display, as the H-alpha Sun became lopsided and then the door would close.

GARRIOTT

Long Exposure: I only did one of those. I thought it might have been useful to get several long exposures. You have to wait until you get down below 600 frames before you can do that. I'd have thought it would have been useful to get maybe several. Film camera, controls and displays: We knew

GARRIOTT
(CONT'D)

how that all worked. We did not cycle the main power after you told us and we had that thing taped so we didn't cycle those relays anymore.

S054: There wasn't any Door operation. Flare detection system: I think we ended up with a scheme that was working pretty well; that is, with thresholds estimated for both the PMEC and the beryllium counter on S056. I think we ought to have those things recalibrated because the threshold on the beryllium counter was substantially higher than it was on PMEC; at least from the sorts of flares we were observing. It would cross the PMEC threshold before it would cross the beryllium threshold. We're expecting that these thresholds were set more nearly the same, so that you could use either one at the same trigger point. I think that ought to be reevaluated.

BEAN

They did tell us that the beryllium came later, and that they were convinced that the best early flare indication was the PMEC.

GARRIOTT

Well, if it were working right, but we know that it does not always work right nominally. It's got an awful lot of noise on it, although as they point out, once you get a flare and you get above the noisy portion, then it begins to smooth on out. I still think that we used the beryllium counter and

GARRIOTT
(CONT'D)

and the IIC about as much as we used the PMEC. Not because we had any bias in their favor, but simply because it turned out to be equally useful.

BEAN

I found myself setting the PMEC, and all I used it for was to alert me if something was going on. Then if it triggered off, I looked at the others, to see if something really were happening. If something really were happening, then I went into action. One of the things they keep saying on the ground is, we've got to get a flare that's rising. You can get so many flares that are rising that it's sickening. But there's no way to tell, when one of them's rising, how far it's going to go. We can get them 50 rising flares but there's no way to tell whether it's just going to rise and stop or rise and keep going. What they want to do is somehow have you pick the one rising that's going to be a really big one. As far as I can tell, there's no way to do that. Because you don't ever know that until after it's made the rise.

LOUSMA

You never wanted them to fire off the flare mode unless it was going to be a biggy, and you never knew it was going to be a biggy until it was over the top.

GARRIOTT I agree with all that except that I don't really think we can see quite as many flares as you were suggesting. They will add more time for sitting and waiting and I understand there are JOPs being modified and prepared to do just that, so that they will have more time, just to sit and wait on likely spots, than we did. We simply didn't have that time and we thought we needed to keep making progress on the building blocks, which is what I think they wanted. As far as the ways to use it, you described the PMEC alerting you, and then getting confirming evidence before proceeding to take data. That's exactly the way our JOP 3 procedure is written and that's the way we used it. I think we had it worded and prepared in just about the right way. I'm pleased, as a matter of fact, with the way that JOP 3 went off.

BEAN We didn't miss many, and the ones we missed were the ones we wanted to miss.

GARRIOTT Had we had the film and the time available, we could have gotten earlier phases of not only several good flares, but a lot of things that never developed into flares as you pointed out.

X-ray image display: I don't think it was very useful. Although when we had a flare, we could see the signature on the X-ray image display. One of the things that we considered

GARRIOTT preflight was that it would be helpful for would be pointing to the right spot. We never had any doubt where the flare was occurring. There was never any doubt near as I can tell, in any of their minds when we had a flare which exceeded even a low PMEC setting, exactly where that flare was located, because we could see it on XUV MON; we could see it on H-alpha and we probably knew before it ever started where the most probable location was to begin with.

LOUCMA I don't think it was because of any shortcoming of X-ray image. It was just the other indicator was so much stronger than we had anticipated they would be in training, that we used them instead of the X-ray image.

GARRIOTT That's probably true. It might be somewhat less intense than we planned before, because the normal Sun will not provide any elements that are above the threshold; we'll see nothing on there. We have to have a flare before anything is visible. And, whether or not that was fully understood before flight or not I'm not sure.

Visibility and brightness, display shield effectiveness: It is essential. You have that or you would never see anything. Location of a flaring region is obvious but, as I mentioned before, we would have already found it and we've seen nothing in the corona; there's not enough intensity to see anything

GARRIOTT out there. The mode operation is fine, that little switch
(CONT'D) you brought up is used routinely. It's a big help, but it
would be nice if the 256 single sequence position was really
timed properly, it's actually about 12 seconds too short, and
so when it drops from green to orange, you have to always
wait 10 seconds.

BEAN How about white to orange?

LOUSMA They aren't any more because the little cap came off and all
you get is a bare exposed lightbulb. On the white. I looked
all over for it and couldn't find it.

GARRIOTT I hadn't noticed that.

BEAN I hadn't either.

LOUSMA It's an exposed bulb now.

GARRIOTT Is it in danger of being broken, do you think?

LOUSMA If it gets bumped, it will get broken.

GARRIOTT We better look at it then to see whether or not we need to
get something to back it up.

LOUSMA The little white cap for the white light on the timer is
missing.

BEAN I wish that orange one were green because I made quite a number of mistakes glancing over there and saying it's finished, and then doing something and realizing that it wasn't still in the white. That white bright and the yellow bright are almost the same color if you're not careful.

HOUSMA I always wrote down on the ATM schedule, the exact number of frames when I started the S054 and the exact number it was going to wind up being when that mode was over with. Subtract eight frames or subtract seven or whatever and I still wrote them down because I was never sure whether the timer was working right or not, and sometimes you could easily forget to switch it from 256 to 64 and you could wait all day for something that's already finished, plus the fact that if it times out too soon, you never knew if you had to wait another 12 seconds. So I just wrote down the number of frames every time and when it got there, the light would cue me that it was time to do something. I would always doublecheck it to make sure that it was on the right number, and that's how you also noticed that S054 was taking double sequences as it did periodically.

BEAN That's a good point. I don't know if Jerry's crew knows about the fact that sometimes it'll just decide to cycle right through again. When it does, it doesn't harm you; but it can

BEAN
(CONT'D)

get you a little bit confused because you'll hit the start, and it'll be already past the first few frames.

LOUSMA

If the thing is cycling and you look at the little timer and you say, well, maybe I forgot to start the timer the last time. That's why I always found it convenient to write down the number of frames that it was going to stop the sequence.

GARRIOTT

S055: Door operation is fine. UV detector operation: I guess it's pretty well known that detector number 5 in particular kicks off all the time. The PIs might think about whether or not there are any particular locations that they would prefer to have a detector 5 scan located, because, as Jack pointed out the other day, it did seem like after it had been off for a long time, it might very well stay on for 5 minutes before tripping out. After it tripped out a time or two, it is normally about a 10-second operation before it tripped again.

BEAN

You're saying it might be worth while to put the 5 off until that certain critical time to put it on again.

GARRIOTT

I really suspect it's not all that big a deal; it's just as convenient to get along without the 5. I'm pretty sure that detector 5 is aligned to continue but you could pick up some other time as easily as not. The very intense flares will

GARRIOTT
(CONT'D)

also trip off other detectors. Detector 4 tripped occasionally, detectors 7 and 6 occasionally and our one class X flare even tripped off detectors 3 and 1 on one occasion.

LOUSMA

I got a comment about alignment now that we're talking about it. I think you ought to have one crewman do all the alignments on the thing.

BEAN

I would keep an eye on him.

LOUSMA

Yes, keep an eye on him but have one crewman do it; otherwise you're going to have a different alignment every time.

GARRIOTT

Grating selection operation: I thought we did pretty well. We tried to leave it in OPTICAL all the time and we caught ourselves a few times in MECHANICAL when we shouldn't have been.

BEAN

The best thing we got in a habit of was, if you ever were not configured in zero-zero optical, it was your job to write it on the top of the next crewman's schedule sheet, so he could read it plus search him out and say the thing is in such and such, but the best way to just write it on the top of his schedule sheet so when he got there he saw it and that was the first thing that was on his mind. Sometimes when you told him, by the time he got there he's already forgotten. So I don't think we really had too many problems there.

GARRIOTT We had a few mixups, but not often. I don't think we lost much data because of that.

LOUSMA You need to do the same thing with the mirror position. Sometimes I'd find that thing off a 932 after having done a few.

GARRIOTT As you were saying, Al, we have several JOPs now which do require us now to move away from 932, and it's easy to forget.

BEAN And they never tell you to put it back. Also that line 25 thing, in line 9, is another easy one to goof up. I think the best way is each JOP which uses 55 (which is all of them) right down there where, you know we had marked line 25, I think they ought to mark it for the other lines too, so that you read that each time.

GARRIOTT You do. We say slit center.

BEAN Do we - I thought there was some we didn't say either one. Oh, then maybe you had to assume slit center. There should be one or the other; it just keys your mind and then you can go over and take a look at it, which doesn't take long.

LOUSMA One other thing that was strictly OJT because it was never in a simulator although we always asked for it, was peaking up the detector and you ought to pick some of your favorite

LOUSMA
(CONT'D)

grating positions and plan to use them to peak up the detectors. You can sure get a lot better data by doing that. Sometimes the hottest spot is not necessarily beneath the cross hair. That was a rapid course in on-the-job training. It was very helpful once I knew how to do it.

QUERY

What pointing are you talking about now?

LOUSMA

The detector.

BEAN

I think Jack has a good point. It seems to me that one card that we have up there called mirror position or line versus grating position. We ought to take that card and revise it a little bit in some way so that it's categorized by interesting lines in for example prominences. If you want to find the hot part of a prominence, you can glance up at that card and it'll say look at detector 3 at 1160 or detector 1 at zero et cetera. That will tell you the hot lines for each thing. The same thing is true for the middle of the sunspot and other phenomena that you are hunting. There may be some now that they know about these little UV bright spots and those ought to be pointed out on that card; so everybody know's what they are and uses the same one. And then if the ground finds out those are not good ones, they should change that card. As it is, there is still a little bit of folklore. If **Jack** is hunting UV bright spots he does it one way; and if I'm

BEAN
(CONT'D)

hunting UV bright spots, I do it a different way. We don't know which is better or if they are both acceptable.

LOUSMA

What Al is asking for is a card that compares the grating position plus which detector to use for hunting for different kinds of features. Another good thing to have on that card would be what an average detector reading is and what is a good one.

BEAN

That's not a bad idea.

LOUSMA

Sometimes a reading of 200 is a great one and sometimes a reading of 20,000 is a small one.

GARRIOTT

I think that's a particularly good point. We had to gain experience with OJT before we really knew what the average numbers were that we're looking at.

BEAN

That information is available now, if somebody would just put it together.

GARRIOTT

A quick way is to slew off to one side to acquire a region, see what it looked like, and then back on.

LOUSMA

That's the way we did it. By comparison.

GARRIOTT

There's a strong bias to use oxygen 6 which is detector reading zero. It's simply because you don't waste any time.

GARRIOTT
(CONT'D)

Anything else you pick is going to waste 3 to 5 minutes just to get to the right grating and then come back to where you want to work.

LOUSMA

Occasionally I found myself, somewhere up in the grating numbers and when I looked on the card, the closest line would be one that wasn't any good for that particular feature.

BEAN

Another thing I found myself doing a couple of times. I used detector 3 because it always seemed to be hotter. I peaked up detector 3 and then I'd look down to see what I was supposed to be doing and I was supposed to be doing a mirror auto raster on detector 1. Here I had gone to the trouble of peaking detector 3 and I wasn't even going to use it. I was only going to use detector 1.

GARRIOTT

Mode operation: Good set of modes, pretty flexible instrument. It just takes a little time to go around from the auto raster grating auto scan but you can't get around that. Lots of data and it takes time to collect it.

LOUSMA

I was frequently giving short mirror line scans past a bright spot.

GARRIOTT

Down to 20 or 25.

LOUSMA
(CONT'D)

Maybe a minute's worth. I thought that was some value to them. About the end of the mission, they came up and said it's not much value to give us a 30-second line scan. I never knew why.

GARRIOTT

If we would have had a chance to talk about it face to face, we could have clarified that point. If you are looking for fluctuations, then you need a lot more than 30 seconds. If you are looking for contrast, which is one of the reasons we're also doing this shorter section of mirror line scans or an abbreviated mirror auto raster, 30 seconds might be very adequate for looking at the contrast between this bright spot and the background.

LOUSMA

That was usually my purpose. Then I recognized that if you want a time history, then you're going to have to spend a lot of time doing it.

GARRIOTT

I think the comment that came up from the ground was misleading, Jack, and what you were doing was still of value.

LOUSMA

I'm glad to hear that. Typically what I would do if I had extra time is run a grating auto scan on a bright spot or some interesting feature. If there was a little time left, I'd give them mirror line scan over the same thing because there wasn't usually enough time left to change your pointing

LOUSMA
(CONT'D)

to something else. Sometimes I noticed that they like to run a mirror line scan down through the sunset so I just let it run down through that period of time.

BEAN

I'd say that the SL-4 crew ought to get pretty handy running 55. I bet they're going to be running that alone, and a lot of it. They ought to know all the different modes backward and forwards and also some of the variety of things. They ought to enlarge their shopping list.

LOUSMA

That's right. That's the thing you can run when you don't want to blow film. We wanted to do shopping list items that we thought were interesting but we couldn't do them because we didn't have any film. 55 was another thing we could do shopping list with.

GARRIOTT

Intensity data display maximizing and minimizing: We've already talked about that and it is a very useful technique and we can do it well.

BEAN

Say something about the UV bright points.

GARRIOTT

There is a technique for finding UV bright points. You can find one and be sure you are on the peak within about 5 minutes. The way to do it and the one we'd recommend for the SL-4 crew, is to make sure your electronic cross hairs on one of the displays (we used display number 2) was as

GARRICPT
(CONT'D)

closely as possible coaligned with the H-alpha 1 and also on the XUV MON.

In other words, you put the cross hairs on the XUV MON to be coaligned with the point that you're looking at in the H-alpha 1. You then find your feature on the XUV MON with the integrate switch. Normally it takes your right hand on the integrate switch and you cross your left hand underneath the scope and put it on the MPC then slew over and put the bright spot on the XUV MON underneath the reticle. I would normally hunt around a little bit with the MPC until my detector 3 peaked up. If I had an extra couple of minutes, I would then manually step left, right, up, and down a few steps to make sure, moving 5 arc-seconds at a time, I was directly on the peak. Then at that point, having satisfied myself that we were really at it, I would go into the grating auto scan and photography as required. It's about a 5-minute job. I think the XUV MON pictures that you get at least once a day or as often as you want will show where the principle bright points are. Their time constants are probably average, 12 to 24 hours. You know that from the ground data as well or better than we do. Some of them have shorter life times and I suppose some of them longer. You can normally see where they are going to be from your XUV MON picture, pick out the brighter ones or

GARRIOTT
(CONT'D)

the smallest ones if that's what you want, find them
and go point at them. I think it's a very useful technique.

LOUSMA

I think Jerry and Bill, not being as familiar with it as
Ed is, should, before they fly, look at several different pictures
pictures of bright points and several different pictures
of Ellerman bombs because they don't look like they do on
the JOP summary sheet. They look different on the display
sometimes and they look different than the ones that are
always presented to us in training. If you don't see one
that looks like that, you may say that's not a bright spot
or that's not an Ellerman bomb when in fact it is. You just
don't recognize it, because the picture you saw didn't look
like it. I think you ought to see a variety of pictures of
what Ellerman bombs look like and what bright points look
like before you fly.

BEAN

There ought to be pictures that are changed so that they have
the same angular resolution. Ellerman bombs, on photos,
are pinpoints. There's hardly any such a thing as pinpoint on
the H-alpha zoomed in. So Ellerman bombs don't look like
pinpoints; they appear as little brighter blobs. They look
larger. Compared to the pictures they look about 10 times
larger. If we really did get pictures of Ellerman bombs
like they think - there were some going off at the same time

BEAN
(CONT'D)

we took pictures - we ought to be aware of the difference in appearance and not look around for these small pinpoint spots of light, which never show up. You can't get that resolution.

GARRIOTT

0056: I guess everyone knows that it has a bad habit with some film loads of stopping in midsequence. The story that we get is that load 4 is apt to be a little better shape because it hasn't been exposed to air or vacuum for so much time.

BEAN

It didn't go through the qual, and apparently that makes a lot of difference.

GARRIOTT

So hopefully it'll work better.

BEAN

I found that I could usually catch those much better if I sort of kept my eye on which filter was taking a picture. Watch those little windows. I hadn't been doing that prior to flight, because there was no reason to, really you just waited until the light came on and went again. And by watching those, you can determine quite easily whether it's hung up. So you should learn the sequence of those, how long each of the things sort of takes, and then you can glance up there, and you know that you've been going 2 or 3 minutes. And if you see that it's still on number 2, you probably got a hangup and you can do something about it, instead of waiting to see if it's going to do any better in the next minute or 2.

LOUSMA I referred frequently to the ATM Experiments Book that showed how many seconds each filter ought to take depending on what mode you're in. If it turns out you get a lot of hangups, it might not be a bad idea to have something like that posted right where you can take a quick look at it and know whether or not it's hanging up.

LOUSMA Invent a little cue card that they can put on there that operates with that in mind. How long after you start, what frame number should you be in, different modes. It would be simple to invent, because you don't use very many different modes and you could see if it's hung up and get out of there instead of waiting to determine whether it is or not.

GARRIOTT Door operation: We did have a hangup there; I didn't get it cleared. We got the ramp off the 56 now; I don't know if that is going to eliminate any potential problems and just hope that it stays clear.

BEAN That's the one we always open after we powered down for the night so that it wouldn't track all night.

LOUSMA Millican likes a lot of single frame longs. If you want to make exact time exposures, it turns out that from the time you throw the camera power switch on until the time the frame quits is 4 seconds.

BEAN But it still apparently times when you throw the thing on.

GARRIOTT The exposure is complete apparently. As soon as you throw camera power back on, you get the changeover 4 seconds later. HV detector operation went exactly right. The X-RFA seems to be working just as advertised and is very useful as a flare indicator. Watching the windows count down there is helpful, just as watching the windows on the filters is helpful to determine hangups as Al was mentioning.

LOUSMA I think the point that we made earlier, though, was that 40, 50 or whatever it is on aperture 1 does not equal the high setting of the PMEC. We ought to have that looked at so that you get closer correlation between the setting you're interested in on the aluminum apertures in the PMEC.

GARRIOTT Let me talk a minute about mode operations. Now, Jim was very interested in providing the crew with as much flexibility and independence as possible. We took him at his word on that and did take liberties with his experiment that we did not do on the operation of the other experiments. In particular, we were interested in saving the film as much as possible. And it turned out to be a good thing that we did on the second load particularly because we didn't have as much film as we would have liked to have had right up to the end of the mission.

GARRIOTT
(CONT'D)

Such things as active 1 longs, when you look at the exposure lengths on filters 1, 3, and 5, they are very close to the same sort of exposures that you get in single frame short. We generated our own little cue card which we posted on the clipboard up there to indicate some appropriate substitutions. We would frequently use single frames 1, 3, 5, instead of active 1 long, in order to both save film and also prevent some hangups in the automatic operation. We did reserve active 1 shorts for times either of potential flare or flaring activity. So you would go to the active or auto modes at the times of flares. We also gave him long exposures whenever we could remember to do so. This was on our shopping list item number 13, on our shopping list items. We did cut out some listed exposures on our JOP summary sheets when they appeared to be repeats of modes that we had done very recently. Many of the summary sheets show repeating patrol normals on the second sequence or things like that, just to say 5 or 10 minutes after another patrol normal. We cut those out. We would be interested when we get a chance to talk with Jim about how well he thinks the performance went, but we did take extra liberties with that scheduling and operation that we did not do with the other experiments.

BEAN

This is a comment that doesn't apply to just 56. It seems to me there's probably a better handle now on how much total observing time the SL-4 crew's going to get while they're up there. And also it should be known very soon how many frames they have. So I'm hoping that they go back and look all over these JOP summary sheets, even the ones that are going to be used again, and try to pare some of these exposures, these duplications. Particularly like 56 we'll shoot many times in a JOP. The same pictures with not much time between each. Try to minimize the number of corrections that have to be sent up on the schedule pad every day. Because they're going to start off, I suspect, not being able to shoot as much film as they'd like, and hopefully the JOP summary sheets will have been changed prior to launch so that they reflect this situation.

GARRIOTT

S082A - XUV spectroheliograph: This door ramp has also been removed. We essentially never used the auto modes on 82A, since we only have a total of 200 frames. I shouldn't say never; we did run a couple of autos. But there were just one or two hands full for the whole mission. The time mode I think is the only satisfactory way to go when you got such a limited number of frames.

GARRIOTT
(CONT'D)

Controls and displays: All fine. The operation of 82A is just as advertised, gave us no problems. I don't believe we made many mistakes in its operation. We were very careful. I think we each doublechecked all the switch settings before making an 82A exposure because we are so very limited on film there.

XUV MON display resolution and quality. My guess is the resolution is about as advertised, on the order of 15 arc-seconds. The quality of the display we do have to run in position 7, just as the first crew did because the intensity is too low. Extra attenuation is in there somewhere. Bright spots are clearly evident. We can see them on our Polaroid photographs. We brought those photographs back and we can use them for training purposes and for discussion. Filament channels are not quite so readily identifiable as such. They look like a hole or something. We were told a couple of times that this coronal hole was an old filament channel, which is interesting information, but we wouldn't have been able to identify that as such without the previous history of what the Sun used to look like. Now coronal holes are visible on the XUV MON but not anything like as clearly as they are on 82A photographs. For example, one of the JOPs (I forgot whether it was 15 or 17) does involve our pointing only left and right of the boundary about 5 arc-seconds.

GARRICHT
(CONT'D)

I think that's marginally possible, and if you do do that, it really is going to take extra time to make sure just where this boundary is. You can never be sure that you're right where the gradient is sufficiently steep that plus or minus 5 arc-seconds really gives you any change in intensities, without quite a bit of work. You can't do it on Oxygen 6; you got to go to magnesium 10 to search back and forth and find the coronal hole boundary. On the XUV MON, it may or may not be distinct. The last time I had it, I was disappointed because I didn't do it as well as I should've because it just wasn't that clear a boundary.

The coronal hole is visible but just not quite as distinct as you would like for it to be. I really think you're going to have to do extra searching with magnesium 10 to define the outline of the hole, if you want to get it precise, scanning back and forth to decide just what the orientation of the boundary is, if you want to put the 82B slit parallel to that boundary, and just take more time to get it properly identified.

BEAN

Time's got to be provided. I really think that one of the best things is to take a good photograph, look at it there, find the exact line or where it is, then go over there, and hunt around using the image monitor. You can study it and

BRAN
(CONT'D)

find what I think is the best gradient points, because you'll see the UV come up and stop quickly in some areas. Some places it kind of just deteriorates and becomes a hole. So you can kind of hunt the place just a little bit at your leisure using the photograph and then go to those points.

GARRIOTT

You're exactly right; that's a good description, exactly the way to do it. You need a good photograph first, and then do just what you said.

LOUSMA

I think all these remarks ought to be prefaced with the comment that all the observations are made by use of the integrate switch and the persistent image scope. There is very little of anything that you can see just by looking at the scope. Sometimes, if you turn the lights way out and you got some real bright hot spots on the Sun, you can just barely see them on the unaided scope. If you got a flare in there, you can usually see it on the scope without the aid of the integrate function. Every comment that's been made has been made with the assumption that the integrate switch was used.

GARRIOTT

Flare location: No problem on the XUV MON. We've talked about this in real time from the spacecraft. I expect we'll want to talk about it more when we can get to the person-to-person debriefings. It's my impression that the core of the

GARRIOTT
(CONT'D)

flare is right below the resolution limit of the XUV MON. It's right down on the order of something less than the 15 arc-second resolution on our scope. It's a very small point. We will see this point on the XUV MON at least as early as see it on the H-alpha. Now, we see precursors in H-alpha. We may see those precursors on the XUV MON too, where there is a transient brightening of little points along the neutral line or in little arcs around the edge of the plage or wherever the flare is going to occur. We will see those same sorts of things on the XUV MON. When a flare does begin even though it's a subflare, we'll see if not always, at least very frequently, a little bright pinpoint on the XUV MON at that spot. It does then give you a good location as to where your pointing should be.

LOUSMA

I think we ought to point out also that you can't see the little cross hair on the XUV MON. We set up the electronic reticle and they'll want to do that too. We have some reason to believe that the electronic reticles somehow got off their center pointing on the XUV MON just before we left. They'll want to retarget the electronic cross hairs on the XUV MON to make sure they're lined up properly so you can tell where you are pointing.

GARRIOTT We did tape them once we got it adjusted. You can move your hand across that tape and move them back a line or two up or down on the raster.

BEAN Get different tape, get some of that silver tape. Get rid of that gray tape.

GARRIOTT We talked about flare location. I did skip over some things like coronal activity. We can see prominences quite well, although we don't see the structure that I've since seen in some of the 82A photographs. We can see near the limb, where the coronal brightness is. It may extend out 2 or 3, maybe 5 arc-minutes, above the limb of the Sun. I never noticed a lot of structure in this prominence activity. But if we're doing the JOPs for example, which requires taking a number of grating auto scans or 82B spectra above the limit of the Sun, the XUV MON is very helpful in finding that part of the corona that is the most bright. It is not always that nearest the active region. Sometimes it'll be up or down by 10 degrees or so, from what you'd expected based upon H-alpha alone. In my own case, I expect Jack and Al did the same, tried to use XUV MON as the decision instrument for setting the roll in pointing instruments rather than just the H-alpha, for looking for spectra into the corona.

LOUSMA Frequently, they'd ask for data on an active region you could not see in H-alpha. The only way to know that you were there was to use the XUV MON.

GARRIOTT It might have been just over the limb.

BEAN I think they need to say just a little bit more on their scheduling pad about some of these things that are a little unclear on how they want you to maximize. In other words, point at the area that you see is the brightest in the XUV, or point where you think it is on H-alpha or use your best judgment using both. A lot of times they were slightly different places and you had to try to figure out what they really wanted, or what you thought they wanted to point, particularly when you're talking about active regions near the limb. I think they should maximize these sorts of things and minimize general-attitude pointing numbers that they give you. Like you mentioned in one JOP you did once, that if you had taken the numbers they gave you without knowing what they wanted you would've exposed a lot of film that would not have given them what they wanted. So maybe they ought to say this is an attempt to get at the brightest point and here's where we think it is. Then you'll know it isn't where you get there. If it isn't, you can go to the brightest point, tell them about it, and take the data. You saved them quite a number of frames one day as I recall.

GARRIOTT They got better toward the end of the flight, because we had asked for more explanatory information and background.

BEAN They shouldn't just put it in the SAP They should stick it over there in the place where you're doing the pointing. A couple of times you were taking data and doing okay, we thought. Later on, they said, "Why aren't you doing such and such?" The information on what we should have been doing was over on the SAP. That isn't the place to put the pointing and roll information.

One other thing about connections between active regions. I'd like to bring that up because particularly during those couple of weeks that the Sun was active, those were very apparent on the XUV MON with a bit of integration. We could see those loop structures running from one active region to the other. The 82A photographs must really be fantastic showing that stuff. It really must be fascinating to see how all those things are connected. We could see it on the XUV MON. We made some use of it, for example, in finding the best locations for our mirror auto rasters and things like that. We could see in several cases you were looking for maxi rasters to encompass the connections between a pair of active regions. So, it was of some help to us there.

GARRIOTT Dispersion-clear operation - no problem with that. The best dispersion-clear operation is usually with north at the top. Not always, of course, but there's a pretty good highly probable orientation. Other features noted - we certainly noticed artifacts. We noticed artifacts finally on the XUV MON. They don't always show up those internal reflections where you would think they would. I never did notice those darkening spots on the XUV MON. Even after you told me about them, I went back and looked and could not really identify them.

GARRIOTT 82B: Door open operation was nominal. XUV slit display for larger lines.

BEAN You could get it to be correct if you put down the brilliance to about 2. Set the intensity way, way low, and contrast low. It would be a gray-black display but it would have nice line on it and everything else.

GARRIOTT But it was still too large. They were way over 2 arc-seconds.

LOUSMA There were real wide lines on the cross hairs and not regular. Sort of ill defined along the boundary or the edges.

GARRIOTT I didn't noticed that when I got the brightness down.

LOUSMA If you had a gunsight like that, you wouldn't know what your shot meant.

GARRIOTT For the alignments, you want to put the white light limb on the inside edge of those appropriate slits. I really need to go over and show you exactly on the simulator what I'm talking about. But it means that the white light Sun is slightly smaller than the H-alpha Sun. Unless I turned it around, I believe that's right.

BEAN Why do you want to put them on the inside the edge instead of trying to put them right in the center?

GARRIOTT Because, if you put it on the center on one limb, it's going to be way off on the other limb. You want to get them equally balanced, between the upper and lower and the left and right limbs. There's no way to do it unless you intend to put them toward the bias. In other words, bias them slightly on both ends.

BEAN So you're assuming for all practical purposes that that the height of the photosphere/chromosphere is 2 seconds.

GARRIOTT I'm just trying to get the best alignment possible. And in order to get an alignment that matches equally well on opposite limbs, you have to bias slightly either the H-alpha or white light to alignment.

GARRIOTT
(CONT'D)

Regarding resolution and quality, it's not a very good display but that was known beforehand. It wasn't intended to be a very useful display as far as finding the white-light features. You can see more than just the umbra on sunspots. When you go to a sunspot by turning the contrast way down and adjusting the intensity, the penumbra can be discerned. And the best way to separate the two, I think, is to look also at a H-alpha display at approximately the same zoom. So that the sizes of the two images are as close as you can get them to each other, then sort of comparing the two and their shapes and so on. You can tell where the edge of the umbra and the penumbra fall.

BEAN

This is not always helpful anyhow because they're so small usually relative to the slit or anything else you're doing, it's often times just interesting information. It's just information. You say, I see them now and then you go place your slit on one and it's covers one third of the slit's penumbra and the rest of it is by white Sun or whatever.

GARRIOTT

But in the end, we did have a couple of sunspots that got up to about 40 arc-seconds.

Uniform emission for slit position: We just did the best we could. Usually on the basis of H-alpha XUV MON.

LOUSMA I think some of the best training they had in the simulator was those pointing sessions where we did nothing but go and point. That was particularly a help on 823.

GARRIOTT Percentage of slits filled on average: I don't know how to answer that without talking about the specific kind of target. Since we only did that when we had the big sunspots or at least we tried to. The ground tried to schedule them for the last couple of weeks when we had big sunspots coming across. I think we probably got up to half of the slit filled with umbra. I think we had a 30 arc-second umbra.

BEAN On the network elements, I guess we had at least 40 arc-seconds pretty well aligned with the edge of the network element.

GARRIOTT As far as a flaring region; i.e., a bright point on the other end, all we would have would be the few arc-seconds diameter of the bright point. And I would try to make sure that the rest of the slit didn't overlap anything that was particularly bright. I would try to avoid having a cross or part of any nearby plages or anything like that. You are not getting anything there to fill the slit except that bright spot itself. On flaring activity or work along neutral lines, we would try to roll the neutral line up and down so that we would fill as much of the slit as possible. And I think you can probably judge for yourself how well each individual case was done by looking at the H-alpha photograph that goes along with that particular spectrum.

LOUSMA I think you can usually find the bright area that applies to fill at least 75 to 80 percent of the slit with bright. And when you added filament, I think we usually fill 100 percent of the thing with filament.

GARRIOTT Yes, the filament would have been filled.

LOUSMA So filaments, we filled 60 arc-seconds and probably 40 to 50 arc-seconds at least, if not more, when looking at a bright area within a plage or along these lines.

BEAN Jack and you are saying two different things. Jack is saying if he wanted a bright area, then he rolled so that he got as

BEAN
(CONT'D) much other bright area as he could in there. You're saying if you wanted a bright area, you rolled it so that you minimized the other bright areas.

CARRIOTT I didn't mean to differ. I put the bright spot in the center of the slit and then rolled to get the rest of the bright stuff away. If you're looking at plage, then you roll to fill the whole slit.

LOUSMA You distinguish between spot and plage areas.

GARRIOTT Okay, the auto hold and all that sort of stuff, I think it's a pretty flexible instrument. I guess it was shopping list 19 that came up there at the end where we were essentially stepping S055 and 82B independently all the while taking photographs with the X-ray instruments at a spot near the limb. All this flexibility worked out very nicely. Auto hold worked well. Never any hangups or any problems.

BEAN That was a good thing. I don't think I understood until I did it up there that at the end of the auto hold you had to go back to white light display in order to keep from having the mirror follow the limb as you did something else. Maybe it's because when we were training, we always seemed to get to the limb and then interrupted practice until the next day. We never did practice to the end. So it ought to be in

BEAN there at the end that you have to go to white light display
(CONT'D) to keep the mirror from trying to track.

GARRIOTT I don't think any of us had thought of that and were glad
it came up on the pad because we probably would have overlooked
it a couple of times before the ground figured out what we
were forgetting.

Film Camera: Works fine. Controls and Displays: Nothing.
I'm sure you'll be hearing a lot less autos than we did.
That means you're doing it a lot more times and I understand
you got a special timer that's coming up. That will make
that a little easier.

BEAN Do they have a special timer?

GARRIOTT Yes, something that's going to tie in underneath the panel.
Those are those connections where you started taking the bolts
loose. They dial in the time you want or something like that.

BEAN That's a good deal too, because that then allows you then
to use this for 82A or a long exposure on 56.

GARRIOTT Maybe - I don't know how it'll work.

BEAN That's good.

GARRIOTT H-alpha 1 and 2 Door Ops: Works fine. Displays: The display onboard always jiggles back and forth - both H-alpha 1 and 2. It's more noticeable on 1 because that's the one you normally have zoomed in at max. They'll both jitter at about the same rate and at about the same length. I'm trying to remember if they jittered together or not. I believe we finally decided they were independent. My memory is a little vague on that. They both jitter and wiggle back and forth at about a 1-second oscillation rate and 2 or 3 arc seconds in size and magnitude of the jitter. That will mean that any H-alpha photographs that you try to bring back on a Polaroid are also going to be fuzzy.

GARRIOTT Network Cell and Prominence Visibility: Are pretty visible. You can do pretty well. You can return to the same cell as long as you have a decent H-alpha photograph to bring you back. I don't think sketches or memory are adequate if you want to go from one rev to the next. But with a pretty decent H-alpha photograph you can do that. I believe we got the network cell job done properly several times using the photographs. It's helpful to know exactly how much motion you should expect due to solar rotation. When you're scheduling these things it might not hurt to provide a little extra information about how much change to expect or let the fellow on board remind

GARRIOTT
(CONT'D)

you, since he can estimate it pretty well also. It's about 12 arc seconds per hour at the center of the disk.

BEAN

I think it's important to try to get something else when you're doing the network cell. It's important to get something that's more visible than a bunch of other cells in the picture. You can use that as gage to place your crosshairs. If you could find a network cell where one of the crosshairs intersected a filament just right, you could find it a lot quicker. I think that any of those things also are best if you'd go ahead and spend some extra time at first finding the best possible cell. Not because it has edges of the cell aligned but because you have other ways that you can locate it and then start. It's much better to use time there than it is to grab just any old cell and start working on it. Then as you progress, you suddenly discover that it doesn't have any unique characteristics and is hard to discern among the other cells. Time is well spent at the beginning to find an unusual cell, a cell that has all the characteristics that you want, and then run a JOP.

GARRIOTT

Well said.

Flare Location: Again there's no question in finding it. Frequently there will be several black spots that are beginning to increase at the same time. The old trick that we had

GARRETT
(CONT'D)

practiced in training by turning up the contrast and down the intensity will normally help you find out which the brightest of those is. We found there was a tendency toward variable brightness which preceded some flares. Our reading was really getting to the point where it was apt to be a flare producer. You can look for this variability to also be present.

Umbra and Penumbra Visibility: You can make both of those out in most cases. Not as clearly as on a good white light photograph from the ground but still you can identify umbra and penumbra from H-alpha.

Active Regions on the Limb: We see substantial limb darkening in H-alpha. They didn't get very clear as they approached the limb. The XUV was normally brighter and gave you a better indication of where the active region was and the H-alpha when it was within 5 to 10 arc seconds of the limb. We did see several surges. I've been annoyed with myself for the last 3 weeks that I didn't take better advantage of the one really good surge I saw over on the east limb and throw away the rest of the program to work harder on that one surge. They are visible in H-alpha when they occur.

BEAN

We had a beautiful surge one day.

GARRIOTT Yes, that was the one I was talking about over on the east limb, but I didn't press and didn't do as much with it as I should have.

BEAN No, this was a different one. It happened when I was there.

GARRIOTT That's probably another example of one we should have worked on.

Structure at the Limb: We frequently can see structure out to 50 arc seconds or so above the limb. They are not as good as the 82A pictures are going to be. For H-alpha, the way it's designed, it's pretty darn good. You can use it for pointing 82B. Normally we tried to make 82B more or less tangent to the limb so we wouldn't get a lot of radial gradients affecting the spectra. On some cases where the structure was particularly bright we would put the 82B slit directly along the aligned feature in H-alpha even though it was far from tangent to the limb.

Surges on Disk, Filament Changes: We did see some of the filament changes and variations in an H-alpha configuration, particularly during the times of the flares.

Erupting Prominences and Disappearing Filaments: I really never noticed a disappearing filament in progress. I could notice on the basis of photography that there used to be one

GARRIOTT
(CONT'D) there several hours ago but I don't recall having seen a disappearing filament in the process of disappearing.

LOUSMA I saw a disappearing filament one time.

GARRIOTT Did you?

LOUSMA It was called to my attention and I continued to watch it. Sure enough, it did disappear. I took data on it. I never even noticed it myself. Things just happened too slow to notice it.

GARRIOTT H-alpha Reticles: They moved as advertised and we only moved them during the alignment periods.

Zoom Operation: Was nominal. We did have to zoom H-alpha 2 some time at the beginning of the day in order to eliminate this blooming effect that we talked about before.

H-alpha 1 Film Camera: We assume worked fine. Polaroid Camera; Frequency of Use: We ended up with about five packages of film left. We also found that several packages, after having the tape removed from battery contacts, when inserted into the camera would not function. I don't know if the remaining five packs are going to have that problem or not. I don't know if the battery had discharged or whether there had been some contact film on the battery contacts. I wiped them but I didn't rub them with alcohol. I tried to wipe

GARRIOTT
(CONT'D)

them off with some tissue; still several of the packs did not work. There are about five left unused down in the film locker. You can tell from that how much more you need to take up and approximately what our frequency of use was. I would guess that we took on the average of about 4 or 5 photographs a day. Maybe a little bit more than that. Certainly you do need to get a couple at the beginning of each day for reference.

BEAN

I thought it was a good idea to take an H-alpha picture also at the first of each day when we had a lot of different active regions on the disk. It saves you trying to remember which active region was which. If you just have one or two or three like you normally do, then you don't have to do that.

GARRIOTT

That's a good point. I used those photographs that you made and drew in with ink. It was a real help when we had seven or eight active regions on the disk.

BEAN

I think you should use that. We didn't use it as much as we could in an effort to save film. We probably should have used it more than we did and used up that film. They should take enough so that they can take as many pictures a day as they need.

GARRIOTT

You'd want six or eight just because of the time. We are going to talk about the persistent image scope. We normally

GARRIOTT
(CONT'D)

left that mounted on the hood. To do the camera you have to take it off, mount the camera, get focused, and find time in the observing program to do it. That's another reason that you tend to limit yourself to six or eight Polaroid pictures a day.

BEAN

It takes too much time to get those interchanged. Here is another thing I think would be good. If somehow they could minimize the light leaks on that little adapter mechanism so that when you switch from one to the other not quite so much light leaks in around the cloth there. This is the origin of some of the artifacts on the screen in the XUV. You're looking in there and you see three or four lines. You think you have an arc or something and then you put your hand around trying to shield those places and you find out it's from the outside. And I believe that if you could come up with a technique to close off those light leak areas you'd end up with better, more accurate, visibility inside. You would save yourself some time trying to run down artifacts on the screen that you're wondering about.

GARRIOTT

The 15 and 17 JOPs are the coronal holes and the bright spots. I would say that we used it every time. We used the camera and the scope every time that we were going to try to track down bright spots to work with or the location and orientation

GARRIOTT of a coronal hole. They were very useful and the frequency of use was 100 percent. I don't know if we can say much more about that since we have talked about these few things from time to time the last few days anyway.

Solar Radio Noise Burst Monitor: I was probably the only one who fiddled with that very much. I did follow calibration procedures that were a little bit different than the one in our book. I think that it paid off in a greater sensitivity. The procedure I used was to essentially leave the gain wide open, and adjust the - I've forgotten the name of the control now - but essentially the zero setting to whatever the radio noise intensity was for that day. It's on the order of 125 flux units. The scale on the meter was incorrect. You couldn't read off 100 flux units. It did mean that even relatively small radio bursts did result in a deflection of the needle. On several occasions we did see radio burst from the spacecraft. They were later confirmed from the ground. In a couple of cases we got bursts which were never confirmed from the ground, but I think that they really did exist. They did occur, at least on one occasion, preceding a flare on the Sun. I think that it's something that should be used and can be an early indicator of flare activity.

LOUSMA I don't recall that we ever used it much for that purpose.

GARRIOTT Not a great deal. I merely added that on a couple of occasions I saw radio bursts in one of them preceding a flare. One of its utilities is, of course, as a backup to the X-ray sources. Our X-ray sources have been doing pretty well. We haven't really needed it as a backup to the X-ray arms.

False Alarms: You're going to get some if you set the threshold close; you also need to get the orbital period right. I was messing around the orbital period almost the whole mission trying to get adjusted correct. Toward the end of the flight - I hadn't mentioned this to you yet, Al or Jack, I think I was using the wrong orbital period. I was asking for the period from ascending node to ascending node. I think what I really needed was a period adjusted for rotation somehow. I kept reducing the period by a couple hundredths of a minute to where it is adjusted to just about right now. I think was because I never asked the ground for the correct period.

LOUSMA Just think, Al, if he had asked us, we could have told him that.

GARRIOTT So I think it can be used right, and it is a useful instrument. Although it's certainly not essential and didn't result in any big increase in our performance.

Manual Pointing Control: All works very well. As far as stability, it's excellent. You can either inhibit it or even leave it set, don't touch it and it won't move an arc second

GARRIOTT
(CONT'D)

for the whole orbit. As far as moving it in 1 arc second increments, you can usually do that, at least it was my impression. Suppose you wanted to leave it on 950, you can get it on 949 and 951 frequently, but to try to hit the exact arc second, sometimes it just won't set there.

LOUSMA

I found that sometimes you can get it to the exact arc second, and then sometimes you could try all day to get a certain one and you would never make it.

GARRIOTT

I'm not sure, but it's exactly that, because in the way that thing is mechanized, this little counter was originally set up in tenths of arc seconds or maybe it was eighths. Maybe it was an octal code. It was set up in an octal code. Now since we're divided into tenths, since readings are all digital. There are two numbers that always get left out. I think it may well be that mechanically it's impossible to reach certain numbers. If you're satisfied to plus or minus 1 arc second, you can hit it pretty accurately, pretty quickly. Then it'll stay there, once you release that control. You will find that the Sun sensor really holds - it's stable.

BEAN

Plus there were many times when we had to be near that close as you pointed out when we discussed it. Usually it could be around that area and it would do just as well.

LOUSMA That was another point that never was cleared during training. It was close; you really had to be. When they said 4800 arc seconds in roll, I put it right on. You came along later and said, well they'll take a plus or minus 20 or whatever. That was never clear in training. Pointing accuracy was never clear either. I think it'd be worthwhile to have the SL-4 crew know what their tolerances are in pointing and roll, so that they don't spend all day or a lot of time getting it right on. I tried to get it right on every time.

GARRIOTT Plus or minus 10 was the number they sent up on roll and we know that's probably even more accurate than required on the basis of our Ku_z updates.

LOUSMA That's right because when you get those, it changes 100.

GARRIOTT So there's really no point in being a heck of a lot more accurate.

LOUSMA I think it's important for the guys going up to know what those numbers are because I wasn't aware of them when we went.

GARRIOTT On the pointing they can't get very accurate.

LOUSMA We know far better on the basis of our displays. You're right though, I'm not disagreeing with what you say. We need to have that clear understanding to just what those limits are.

LOUSMA

Roll Characteristics: We've talked about them a little bit. Rolling about Sun center as Jack was just saying; it's better to roll about the Sun center, and it results in less perturbation to the pointing. When you've got it centered on the red mark, let it roll around Sun center because that is Sun center roll. It does wobble around just like it does in the simulator to get it to go where you want it to go. Usually it winds up not Sun center, but you roll about a point. If you roll at a higher rate, it wobbles just like in the simulator. That's a good representation and it doesn't end up exactly where you want to be rolling about. You have to repoint it if you roll about that much.

GARRIOTT

ATM Operations Boards and ATM Chair: We use the operation board pretty much the way SL-2 had left them. They have essentially worked out well. We used all three of them every day in a pretty fine configuration. ATM chair - we talked about it. We didn't use it and didn't want it. The biggest problem was where to store it.

ATM Schedule Pad: Maybe you want to talk some about that, Al, I don't know.

BEAN

Well, my comment about the scheduling pad is that they need to add a few more words to it so that you end up not having all the information on scheduling and pointing all right at

BRAN
(CONT'D)

one spot and not skip around in different points of the different pads.

Observing Time For First Pass of Day: That always gave us a few minutes, 5 to 10 minutes. I think that was useful. Sometimes at the first pass of the day we had the synoptic JOPs and you were kind of observing as you did the synoptic JOPs, so either way would be okay, synoptic JOPs or observing times.

Observing Time With Shopping List Items Indicated: I think those are good. That was one of the best things that happened up there, Owen, you coming up with the shopping list items, and I hope that SL-4 is getting even more of them and better ones. They're going to have a lot of time up there to do that sort of thing, because you're able to optimize certain parts of certain instruments without using the other ones. You can kind of stretch your film out and yet get information you couldn't get otherwise. In other words, you aren't wasting the time of other instruments taking data for long exposures.

Changes to Building Blocks: I hope they go back and look at all these building blocks and JOPs with the idea of total times available for SL-4 and what kind of film loads they have, and then try to think through the total amount of film to be used. Towards the end we had modifications to every building block,

BEAN
(CONT'D)

modifications to every JOP. We were running on mode single on everything we did. It was different from the training and it just seems to be that they can foresee some of this a little bit better. They can then make the training match the actual in flight. It wasn't that much trouble. It just required a lot of timewasting, reading, and scheduling pad changes.

GARRIOTT When there was a change required I think the way it came up was satisfactory. They put change and then they threw a 54, filter 3 or something. I think the format was adequate. Very satisfactory.

BEAN I noticed that when they changed the JOPs they always changed them in groups, and you'd end up having to spend quite a little time up there marking up the JOPs to get them right. You think that's the way to do it?

GARRIOTT I don't know any other way.

LOUSMA I noticed the little note they put on there about when they had specific pointing coordinates. They said these are precise coordinates and we want to point exactly to them; that meant that we didn't have any leeway. On the other hand when they do have coordinates which are close, but are not necessarily precise, I wish they would say that too, so that would give us a little leeway to shop around for a better pointing.

BEAN And say what the idea is, what they're thinking about, because it isn't always obvious. We can be using a JOP in which we think they're trying to ascertain the exact size of a filament and they're really trying to determine the width of it. So they're more interested in lateral direction than vertical; something like that. They need to give a few more pieces of information.

LOUSMA Another thing I thought was good was when they put a different building block with a given JOP. It made you question what they were doing. But they usually added the comment that they did not make a mistake, but they wanted you to use this non-standard building block with the JOP as it was scheduled. So I think they should continue with those kind of notes.

GARRIOTT SAA and Horn: I think we finally decided we didn't want that information because we weren't using it very much.

BEAN The reason we were not is because we were on the panel all the time anyway. So you were never off somewhere listening to the SAA activate the flare alarm. When you're on the panel, all you want to do is have the SAA kick it off and then you look to see if your beryllium or your eye monitor is there. If it isn't, then you know you haven't got a flare.

LOUSMA Usually, you were talking to Vanguard about that period of time and you knew you were down around there somewhere.

BEAN I think those could be eliminated.

GARRIOTT One thing on the momentum dump that I never did get worked out right: I would like information about when our GG dump interval began to infringe on our solar observing period; when it moved effective sunset above the 40 kilometer point. We never had that information. It just happened, we had to assume, or ask the ground what was going on. So we need to find out some place, perhaps on the solar activity pad, or maybe on some different pad, some extra information about what the GG dump is doing to our periods, to our observing interval.

BEAN They could stick it down there right now, where they give you effective sunrise, effective sunset, and beta angle. You could have another sentence that says just what you want it to.

GARRIOTT Solar Activity Pad: We talked enough about this, indicating that a few other bits of information about whether or not they are precise or suggested and so on would be helpful.

BEAN On the solar activity pad, those are just general pointing coordinates. We won't use those for pointing. Those would be just for finding the area faster.

GARRIOTT NOAA Summary: I thought it was useful.

LOUSMA I find it somewhat useful and somewhat just "gee whiz" information. For example, they would say active region 98's got a Delta configuration developing. You could go and look for it, you know. But some of the info was useful and some wasn't, I thought.

BEAN I don't know how the ground will ever tell which is which, because we have a lot of teleprinter people, and it is quick to read and therefore it probably is better to send up.

GARRIOTT Experiment Hardware Paragraph: A good idea.

PI Comments: The same thing.

Flare and Coronal Transient Guidelines: Fortunately, we had slew days every day. I don't think we had a single non-slew day, which was just what we were hoping for. On the coronal transient guidelines we did use that on a couple of occasions, I guess.

BEAN We ran into one problem on both of these. We had these canned procedures for flares, and coronal transients, and when we actually ran into these things, we never exactly did those because there was always circumstances that prevented us from using it; either film or the fact that it was a small flare, or we didn't get to the flare, or the flare was already in progress when sunrise came, or something like that. It would

BEAN
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be desirable for SL-4 to do some thinking through of how they want to do the flare and coronal transients, and instead of operating in this classic way that's written here, try to come up with a little more guidelines on what the ground wants them to do. A lot of that has to do with just how much activity they think is going to be coming up in the next week, or how much film is left. And maybe say a few more words down there as to what their thinking ought to be. Now they started doing that for us because a couple of times they would say, "Don't depart from the schedule unless you have a flare that exceeds the following limits," or "Free to quit what you're doing and go over and shopping list the flares." I think they ought to figure out what several classes these might fall in, and how they might manage the film during each of them. It's obvious that when the flare goes off you just don't go to that flare and do it.

GARRIOTT You are suggesting a somewhat more flexible approach. They should try to give the crew an idea of what they want.

BEAN Yes. That's right.

GARRIOTT This would result in having fewer specified procedures where you just follow down, line by line, but instead a more general understanding of what your objectives are.

BEAN You might want to write the flare box, where you fill in a little bit more each day with general strategy. For example, what do you do when 56 says give us auto short unless you think this is going to be a so-so flare, in which case don't give us a thing. And then you just read down through there. Also, get as many guys on the panel as you can, if you do have a flare or coronal transient. Usually, they are free anyway and they can come up for a few minutes to assist.

GARRIOTT Any time we had a good flare, we had at least two people there and they both kept actively busy.

LOUSMA Particularly with the modified flare program as we had to execute them because of film shortages. That comment won't apply as much if you had all the film you wanted and you just ran it off according to the book. But when you are up there and you are trying to time exposures and run everybody's experiment individually, especially because of his particular film problem, why then it becomes a 6-hand operation.

GARRIOTT Voice Updates: They were pretty good. I thought we maintained communication with the backroom quite well.

LOUSMA They were particularly helpful in the operation with the experiments, when they weren't working properly, to identify where the problem was; particularly the hangups with SO56. They could tell you in a jiffy whether it was hung up or not.

BEAN I didn't hear much of this Blue and Red Shift business.

GARRIOTT No, I didn't really hear any. I don't really know why that's even listed.

BEAN The only thing that I know along those lines that came up, that I remembered, is somebody mentioned that you could see certain things in H-alpha at sunrise better than at sunset because the filter was being shifted.

LCUSMA I think sometimes they were a little reluctant to say what they really needed to say. They were afraid they were going to hurt our feelings or hurt our professional pride or something like that. Sometimes their comments were worded just a little too diplomatically. I'd appreciate it if they'd speak up and say what they think instead of being wishy-washy about it; afraid they're going to hurt our feelings.

GARRIOTT Extensive Changes on New JOPs: I think it's nice to get those at the Science Conference so that we understand it a little bit.

BEAN You have to be careful, particularly in the ATM world, because they seem to depart mostly from the idea that we didn't quit doing anything or change our procedures unless we saw it as an official change. So a lot of times they would just talk to you about it and hope you changed it. Other times they talked to you about it and didn't want you to change it until

BEAN
(CONT'D)

they sent you a message. So it seems to me that that particular world is going to have to realize that they should talk to you about it and then send you a change, but nobody plans to change their mode of operation until you get the change. Of course, if it's a door not working immediately, you ought to get some comments about the next day. Same thing with some of the checklist that we used in sunrise and sunset, and powering down for EREP, and all that sort of thing. They ought to have a marked-up copy down there and the minute they want it changed, they ought to talk to us about it and send up the change. I noticed, for example, activation deactivation and others, were very good about that. But the ATM was a little lax sometimes. They'd ask you to do something, and you'd say I didn't know I was supposed to and they'd say, "Yes, we talked about it a couple of days ago." You'd say, "Where is the change? We remembered talking about it, but we decided you had changed your mind." They've got to follow the rules of the game or it's going to get a little messy.

LOUSMA Sure takes time to change those JOPs, too.

BEAN I'm not sure that we want to change those teleprinter fail JOPs. What you want to do is maybe they send up the changes for the regular JOPs and then they send up another copy called Teleprinter Fail JOP. And you just attach it somewhere, maybe

BEAN
(CONT'D)

to the teleprinter fail list, and then you don't ever put those in unless you have a teleprinter fail because that is a lot of extra work for nothing. Yet, if you did have a failure at the teleprinter, you would take 3 hours away from the ATM and put them all in.

GARRIOTT

Looking back at the time I spent, it really wasn't as bad as I thought it was at the time I was having to do it. I really didn't spend more than 2 or 3 hours total, I suppose.

ATM Scheduling; Building Block, Prep, Power Down Times: Was no problem. We always had time to do all that.

BEAN

Concerning the prep and power down times, many times they allow you a lot of time at the end to power it down for night or in the morning. They are a little slow in getting started. When you go up there and get ready to run, they ought to run the first pass in the morning, as far as using the time. If they want to allow 10 minutes for observing, it ought to be 10 minutes from sunrise to 10 minutes from that point. A lot of times they seem to start maybe 15 minutes after sunrise and then give 10 minutes observing time. And also the last pass of the day, they tend to kind of peter out. It is desirable to go ahead and schedule whatever time you've got there to do something. If they want to allow 10 minutes to power down, then it ought to be the last 10 minutes, and not have you

BEAN
(CONT'D) power down 30 minutes before the end and then the last 20 minutes you just stand around and wonder what to do.

GARRIOTT Well, what we ended up doing was using that time for shopping list. Of course, this relates somewhat to personal preference. I always like to see shopping list time myself, and you didn't like to see too much of it. On SL-4, I think there is going to have to be a lot more of it because of the film limitation.

LOUSMA It all depends on the activity you see on the Sun. If you have lots of activity, you like to see some shopping list items, but if you don't have much activity, I didn't like to see them too much because there wasn't too much to shop on.

GARRIOTT Well, when it gets quiet you've always got bright spots. There are several interesting shopping list items that we never got around to much. They take a little longer, such as looking out into the edge of the corona. There's a lot of things that we didn't do because we really never did get around to it.

LOUSMA I noticed that we seemed to emphasize bright spots near the beginning of the mission and later on they apparently were not too interested because they never asked us to go for a bright spot. Seems like they took those different subjects in groups and had us go after them and later on they seemed to lose interest.

BEAN That's right. Once they found out we could get bright spots and got a few, they were content to forget them. I mean try to find something else.

LOUSMA Ellerman bombs, bright spots - they came and went.

GARRIOTT That's sort of reasonable.

LOUSMA Yes, it is, but you kind of mess around with a bright spot on a shopping list item because they don't appear to be too interesting. They haven't asked for one for 3 weeks and so why worry about it too much. Then you're at a loss for shopping list items if the Sun is real hot. If there are lots of bright spots around, there is lots of activity in the Sun. Then there's no questioning the fact that it is fun to go around and do shopping list items on everything around.

GARRIOTT As far as scheduling, I think the scheduling times were just about right. They were based on simulator work. I think it was reasonably accurate.

BEAN The only ones I thought were a little bit low was when you hunted for bright spots. That was hard, and when you tried to find a network cell to work some good network JOPs. There should be a little more time there for these more difficult initial pointings. When they want you to go to an active region and point to a bright spot, that was simple. They

BEAN
(CONT'D)

want you to find a quiet Sun network cell, then they got a little bit tougher and they should allow time. That should be obvious to you that you've got some time.

LOUSMA

I think generally, though, any time you had to use the XUV monitor to do your pointing that they ought to allow a little more time. That includes bright spots, active regions on the limb, all holds and any time you have to use the XUV monitor because you had to set up a persistent image scope. You might have to take a photograph and you were never quite sure you were pointed right by using the XUV monitor because it was such a small display.

BEAN

I think Jack was right there. You set up your persistent image monitor, then you decide you shouldn't have done that and you take it down and set up the camera. You take the picture, then you put the persistent image back on.

LOUSMA

Any time you use a lens scope, I think you've got to allow a little more time for finding the target.

BEAN

Actual number of passes for crewman? I think you could work it all day and be happy.

GARRIOTT

I got as many as six a day. I don't think you get tired, do you? You get tired, but still I don't get complaints about running six a day. It's fine. It's interesting work.

LOUSMA He's up there in his own little world listening to the music and all that while everybody else is working down there slaving over medical experiments, BMD and all that stuff.

GARRIOTT I don't even think six should be the maximum, but I suppose that five or six a day ought to be the upper limit. And that can be during night side passes. I like to be a little on my own to pick up odds and ends in there myself. There's hardly enough time to do much of anything scheduled. You maybe could catch a half of a meal; Al can always catch a whole meal.

LOUSMA You catch part of the exercise that you weren't able to get when you were supposed to.

GARRIOTT I picked up in PSA pretty often if I had the first ATM pass. I'd go down and change the urine drawer and all that sort of stuff.

BEAN I think you made a good point. When they give us the first ATM pass, they've got to make sure that they give him his full sleep activities in addition to that because he can't do them. Now about 70 percent of the time, they did that, but somehow when it was a real tight day they just kind of forgot that guy.

GARRIOTT And give you two or three ATM passes at the beginning.

BEAN I think what this says here, if you haven't scheduled your housekeeping by time and if they're just giving you a block and telling you to do it if they've given you a few extra items that you've got to accomplish during the day that are not on the schedule if the ATM night side passes are perfect. If they did like they did at first where they had every single motion scheduled, then you don't have a lot to do during the night passes. I liked it better at the end where you always had something to do anyhow.

LOUSMA I think that if you look back though, you can find very few ATM night passes that you scheduled back to back where you didn't have something you can do or had to do to fill in the time and you probably didn't have enough time to do that.

GARRIOTT The point is we ought to leave the man at the ATM for those night intervals and let him do it.

BEAN He can go vent the S019 or something like that. He knows he's got it on his list.

GARRIOTT Why don't you say something about these science conferences since my opinion might be a little biased.

BEAN

Science Conferences: I thought they were useful. They dwelled mostly on what you could do different next week or the week after. A lot of times they started talking about the results that they got on film from such and such. That was interesting but didn't always help you in what was upcoming. I thought it was most useful when they talked about what they were planning to do next week and why, and what kind of pointing would be required, and whether or not it was going to take all week and what sort of data. Giving us results of what we did wasn't always useful because you couldn't use them. Unless they were something fantastic like telling you that maybe we didn't get the rise time on the X-flare, that it had already come 20 minutes beforehand during the night period. That was interesting. But if they had gone into which lines were being shown and it was strong oxygen or something you couldn't use it. A lot more interesting than useful was that next week we're going to work on the UV bright points and we're going to want to do this kind of scans. Or if they told you that the maxi-scans were real good and they were planning some for next week and they wanted you to be very careful about your pointing. I think this is the time they can do a little coaching in here, and not so much reporting of results but saying, "Hey, you guys are doing okay on this, but if you'd watch your pointing a little bit more closely,

BEAN
(CONT'D)

we found that such and such occurred." It's a good coaching time for the guys to come in and talk to you. I like that fact that they had different people each time talking with you.

GARRIOTT

They gave each experimenter a chance.

LOUSMA

I think an update on how-goes-it type of thing is pretty good too. Let you know, "Well, you're running a little behind on ATM, but according to schedule looks like you're going to make it." That type of thing.

BEAN

That helps you decide if you had to slip something, what to slip.

LOUSMA

How you arrange your own schedule if permitted to do so.

GARRIOTT

On the reference book, you've already mentioned that the things you used it for and I used it for were almost the same things, Jack - looking at S056 exposure times and that sort of thing. I thought it was very valuable book to have.

LOUSMA

I never did go back and read up on the content of the JOPs and the philosophy and that sort of thing. I think those summary sheets that we had made up on each experiment were the most helpful.

GARRIOTT

I agree.

LOUSMA I used them on more than that experiment.

BEAN Perhaps you should take those JOPs that we've got right now - the JOP sheets usually have some room on them somewhere - and take some of the more important things that are on that one JOP summary sheet, since it talks about each of the JOPs and put that information on the individual JOP sheets. You usually have the JOP sheets out, you're running the panel and you're kind of set, and you don't want to quit working that problem because you got to go get the book out and find the page. I'm not sure that we couldn't take some of that information that's in there about the JOP you're running and put it on that sheet. Then you could read it and you'd have a much better understanding of what you're doing.

LOUSMA It might work; I haven't thought of that.

BEAN We're printing on both sides. But there is still a lot of spare room that you could put some philosophy on that might help you a little bit. It would be right in front of you and you're looking for things to read there. You don't want to get out other books; you have more pieces of paper running around.

GARRIOTT JOPs - Suggestions on Formats, Size and Tabbing: My own view is that the format, size and tabbing worked very nicely. There

GARRIOTT
(CONT'D)

are undoubtedly changes which you have already have well in hand for alterations to the JOPs. So I think it would be inappropriate for us to comment about those changes unless we have something that we think is very important. We've made a few comments already in the past, but the basic idea of the way it's laid out is pretty doggone good. I like them printed on both sides so we won't have so many sheets. I presume that yours is already that way.

BEAN

We do tend to wear them out.

GARRIOTT

Yes, they stayed real well.

BEAN

I'd say that both sides or one side. If you're making the decision on the basis that you're going to wear them out, we didn't have any that were even approaching wearing out.

GARRIOTT

Teleprinter JOPs: We presume that you talking about the teleprinter fail JOPs. We very seldom used them. The only thing that we ever used them for is if we had some question about running a building block or JOP on our own, in the observing period. We might look at the teleprinter fail JOP to find out what the recommended exposure ranges were. Al made the suggestion yesterday, that maybe on the changes we wouldn't want to make all of our changes to the teleprinter fail JOP. That would save a bit of time if we didn't have to do that. But we used them very little.

BEAN Also, we kept them in the far right-hand compartment of the three writing desk, by the ATM panel.

GARRIOTT ATM Systems Hardware and Operations; Attitude Pointing and Control Subsystem, Cluster Stability: Well, we all apparently have some comments about that, but it was doggone good. In terms of the fine sensor stability, it would hold the point to which it had been left to our accuracy, to read it out and observe it. You know that we have a little bit of jitter on the H-alphas, but as near as we can tell the crosshairs never moved out at all. For example, the white light slit position. You could never see any jitter in that. You could leave it pointed to the borderline between the 7 or 8 arc seconds, and the display would alternate back and forth between those two positions, but that was just because our pointing happened to be right on the dividing line. It was extremely stable.

LOUSMA EREP Maneuvers: Went off good. We made the first maneuver back to SI on our first EREP and I failed to put the new time in and fired off about 11 mibs. Thereafter we changed the maneuvering pads that came up so that after we initiated the maneuver from SI to Z-LV that we immediately loaded in the new time for return back to SI and after that we never had any problems in firing mibs. When you're up there working on the VTS, you are usually looking through it up to the last

LOUSMA
(CONT'D)

minute. You get in a big rush and make a maneuver in a hurry, you're going to foul something up. So we recommend that you do it as we did. We never had a problem after we changed the mode of operation. Star tracker doesn't work except periodically for updating Nu_z and so forth. We don't use the star tracker any more for EREP maneuvers. Other than that, the ground gives you good numbers and there is no need to fire any mibs. You can do it their way.

SPEAKER JOP 13: Did you have anything on EREP, Al?

BEAN Nothing except to say that you got to be careful that you select the Z-LV and put in the biases right on time.

LOUSMA Sometimes it's easy to forget to push ENTER after you flip the switch to Z-LV. Of course your time starts from the time you push ENTER your biases.

BEAN Moding the new times the way that we do, sort of prevents it. It's the first thing on your mind after the Z-LV and enter, is to put in the new time. You've got to enter to get the thing cleared out so you put in the new time.

LOUSMA Normally, we like to have the ground take a look at the maneuver load, and we are sitting there with fifty thousand and one or the last Z-axis entry waiting to enter, 10 or

LOUSMA
(CONT'D)

15 minutes before we made our maneuver. We hit Z-LV and ENTER at the same time and then immediately go to a new time to go back to ST and all that we had to do after the pass is to hit the SC switch and you're on your way.

GARRIOTT

JOP13: we only did one of them and it worked to perfection. The inner gimbal angles were only a couple of arc minutes off on the second star after the touch-up maneuver was completed. So I think that it was certainly a double JOP. The JOP summary sheet looked to be planned well. There were a couple of additions to it that will want to be made in the JOP 13 Summary Sheet. But you certainly ought to be planning to do it. That's a good way to expend some TACS. I'm sure that you're planning it for Kohoutek and it just works fine. I'm just sorry that we didn't have a chance to do more of them on SL-3, but nevertheless, the one that we did worked fine.

GARRIOTT

Star Tracking System: Jack commented a while ago about the door does not open and close always as it should. The sensitivities of the stars are probably about within spec, but it does mean that you don't have as many stars that would be nice to use for JOP 13. It's okay for the - the ATM and for EREP maneuvering for the most part. But on star tracker operations, the systems expert can give you more detailed analysis of just how it's performing.

BEAN

I always had the impression that the outer gimbal angle moved around the lock during the day, but the inner gimbal was pretty much like the pad, but if you just put it on the inner gimbal angle and went backwards and forth in the outer gimbal angle you could find the star. Very rapidly we found out that on some stars, the inner gimbal angle only changed may 10 arc seconds a day. We found other stars where the inner gimbal angle changed much more. So on this star tracker pad, part of that pad should give you a feeling of (1) when the inner and outer gimbal angles they give you are good, and (2) what sort of variation that the inner gimbal is going to have during the day. Namely, is it going to get larger in about every hour or two, or is it going to be 4 or 5 arc seconds larger? Because you can spend quite a bit of time searching for it through outer gimbal angles that are wrong inner gimbal angles. And if you're just aware of how it's going to be varied that day, you can look at the times that pad is good for, look at the present time, select a new inner gimbal angle that is accurate, and then you can find it through the outer gimbal real well. One of the techniques that we used is, every time someone had a lock on and went to auto, you wrote it down, and then you could look at the little list and see how the inner gimbal angle was drifting, then add a few more seconds on to the last one and you could probably lock it up.

BEAN
(CONT'D)

But if you didn't have that field, you could spend a lot of time trying to find stars. So you want to make sure that your pads are such that it tell you when the inner gimbal angle given is good and how it's varying by the hour.

GARRIOTT

Momentum Dump: The ground monitor did it all. We never had time to look at the angles to see if they were normally within 5 or 10 degrees or so of SI. It seemed to work fine. The ground handled it when it was necessary for contingent samples and all that sort of stuff. We just never had time to participate much in the operation. The one thing I think that we would have wanted to know, was when a momentum dump operation infringes on solar viewing time. That would have helped us understand a little bit better how close we were getting to the horizon and a few things like that.

GARRIOTT

Controls and Displays: Were adequate for APCS and I don't see any other comments in there.

BEAN

The only thing I can think of was towards the end they were scheduling the exact times they wanted to do a Nu_Z update for the star tracker. They usually wanted to do it on the day pass before we had a SO19 or something out the airlock that was looking at the stars, or they wanted to do it before a Z-LV maneuver. I think it's important to put those requests

BEAN

(CONT'D)

for Nu_Z on the pad of the person that's interested. For example, if you're getting ready to do EREP, probably the request for the Nu_Z should be down the top of the maneuver pad because sticking it on the ATM pad at a point when nobody is even around the ATM or even looking or even thinking about ATM gives it a chance to get lost. Whereas, the fellow that is doing the EREP maneuver is starting to think about maneuvering at the same time that they are requesting a Nu_Z update. If that was put on the EREP pad, then it would be obvious to him and he could click it off. Putting it in your detail pad allows you to lose it, because a lot of times you don't check the detail pad. You just work from the main index to the other. My recommendation would be if you got a Nu_Z update to be made at a time when nobody's on the ATM panel doing ATM, that it ought to be made part of the pad of the fellow that is going to be needing it. Like, if it turns out that S019 needs a Nu_Z update, and nobody is going to be at ATM panel for a couple of times, the top of the S019 pad should be "Needs star tracker update," and give a time that should be available to get it. Then the S019 man will be thinking about it and he can go get it.

GARRIOTT DAS Operation: No problems, exactly as advertised. Anything else?

BEAN The only thing that I can think about is that a couple of times we cranked up in the morning, and the lights on some of the displays didn't come on, including the DAS. We fiddled around trying to figure it out, and finally we found that the simple fix was to cycle the inverter circuit breaker. When we cycled that breaker it would reset the logic and cause the lighting to come off on the DAS and the others. Now it seems to me that ought to be sort of standard procedure if that the system doesn't come up. This was always in the first pass of the morning. During the night, apparently, that bus had gotten tripped off, or powered down or whatever. It happened to us about once every 5 days.

GARRIOTT Toward the end of the mission. Never happened earlier. Incidentally, I assume that the SL-4 crew is going to get a subsystem briefing on each of these areas from the appropriate flight control group, because they sure need to be brought up to date on just this sort of thing, so that they understand all of those funnies very carefully.

BEAN We had a briefing and it helped us.

GARRIOTT Structures and Mechanical Subsystems; Rack: For the EVA things we know that the Sun-end tree hangs up in the little mouth that it has out there. You've got to really tug on it to get it loose. There are some ramps missing on three of the doors.

BEAN It's real hard to open the S082B door.

GARRIOTT Yes, when it comes time to open it for the replacement of film, you have to tug on it real hard.

GARRIOTT You've got the extra cables running around from the gyro installation.

BEAN You've got to be careful when you're moving from the Sun end to the center work station and back again that you don't kick those cables because they are in the area where your feet are.

GARRIOTT One other thing that you can never explain is that the SL-2 crew reported that the S054 door was only held by magnetic latches. On the second EVA we went to that door and it was held mechanically just as normal. I don't understand how there was a misunderstanding on that point. It's locked normally now.

GARRIOTT Deployment: All normal and everything. Electrical Power System; Solar Array: Everybody knows how those things are working and the flight controllers can give them a better

GARRIOTT
(CONT'D)

briefing on that than we can. I think they ought to have a briefing on the way the battery tests run, how the ground is discharging the various CBRMs and determining their state of charge and their charge capacity. We had not had any of those briefings prior to launch and so had to figure out from the teleprinter info that came up. They should get a good thorough briefing on the EPS and all of the tests that are contemplated.

GARRIOTT

Thermal Control System: On the ATM, we did have a pump failure in the ATM coolant loop; pump A. We switched over to B and C. Apparently things are working fine. You've heard our descriptions earlier on what the noises sound like. You should be alert for any failure of the ATM coolant pump so you can get it turned off before there are any particles ground off, or any potential damage to the coolant loop.

GARRIOTT

We also had a problem with one of the monitors, when it would not turn on normally right after a EREP run. And the general consensus seems to be that that was probably a thermal problem also. And so SL-4 ought to be careful about scheduling the operation of the ATM monitors too close, or during EREP operations. Now we did have a problem with one of the monitors just about the time we were leaving.

LOUSMA

MON 1 was the culprit. I don't recall any problem with MON 2.

GARRIOTT Yes, MON 1 was. I believe that we got that sorted out, because it was after the thermal system got back in equilibrium, we had no more problems, I believe.

GARRIOTT The SL-4 crew should have a briefing on the exact status of that thermal system with respect to any monitoring operation and so on.

GARRIOTT Instrumentation and Communication: I don't think we ever fooled with it, the whole 8 weeks. I remember switching antennas one time or something like that, at ground request.

GARRIOTT Alert Light Subsystem: We had one light taped. I think it's the bat charge alert light. SL-2 crew left it taped and we never took it off.

GARRIOTT Explosive Devices: Nothing to say.

GARRIOTT Lighting Subsystem: Now, there is some stuff on the lighting, but I don't think we're the best ones to describe which of those buses are available and which ones are not. With the present panel configuration, we leave the numeric integral in the fixed positions. We never go to variable. That's because of the availability of certain buses and problems on the other buses. And I'd rather not try to describe that and get it mixed up. I'd rather get the ATM people to give SL-4 a good briefing on it.

GARRIOTT ATM Crew Operations: No comment.

GARRIOTT JOP Operations; JOP 1, network Cells: We think we did that and did find the cell with pretty fair reliability, using the H-alpha photograph. It would have not have been a workable scheme, had we had to rely on memory or sketches. The Polaroid photograph is essential, and I think Al's comment about taking the time so that you get what you want is a good one. Should allocate an extra 5 minutes over what you gave us to really make sure that you're happy, time for the photograph, and all that good stuff.

BEAN Joe had mentioned that some days you can see the networks and some days you can't. And maybe you ought to schedule them the days that you can. I thought about that a couple of times and he's right. Some days they are great and some days they are are poor. But there is no way that they can schedule those things so that you can either do that JOP or something else, depending on how good it.

GARRIOTT I really think that you can see them on any day.

BEAN I think you can see them on any day, too.

GARRIOTT And so there's really not that big a deal on trying to pick when good or bad days come along. But you should give the crewmen a fair latitude on where to pick it out; near an active

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(CONT'D)

region, or near a quiet region, or near the limb, or where you in general want the network cells selected. But then I think any time of any day any of the three of us could have gone and found a suitable cell.

LOUSMA

I remember that in picking out a network cell that you could look around the edges of the monitor, at max zoom, and find one fairly readily. Then when you pulled that over into the center of the monitor, it seemed to fade.

BEAN

That's right. I think Jack's right. You would see them until you tried to get on them then they weren't so great.

LOUSMA

It seemed like the center of the monitor washed them out somehow.

BEAN

That's a good observation there, Jack, That's true. The contrast in H-alpha 2 is perhaps different from the contrast that you were looking at in the zoom position in H-alpha 1.

LOUSMA

If you picked it off of the edge, picked out a good network cell on the edge of the monitor, so you moved it to the center and it washed out.

BEAN

I agree with Jack. In some way you just saw them around but you just could never get on one that you really liked. I never got on one that I really thought was classic although I saw them around.

LOUSMA Seemed to be a 2-to 3-inch diameter circle in the center of the monitor where the thing would fade out every time you got it in there.

GARRIOTT Concerning the limb I need to talk specifically with the PIs and draw some sketches on the blackboard. Because what we're really trying to do there is - I think the ground would have liked us to find an identifiable spicule and put the slit parallel to it, probably not perpendicular to the limb, and then get the observation both on and off the spicule. Perhaps I misled them a little bit initially, saying that spicules were visible in the H-alpha photograph.

GARRIOTT In summary, it appears that the general appearance of the limb is sort of like looking at the edge of a peach with a magnifying glass. You can see the H-alpha limb and the spicules look like just a little fuzz sitting up on top of it, but there's lots of little fuzzy hairs overlapping each other. Now, occasionally you'll see one spicule about twice as long as the rest, and it will extend, usually radially, out above the rest of the peach fuzz and this is what I really should have been a little more clear about. So you do occasionally see a spicule maybe twice as long - maybe 4 arc seconds instead of 2 arc seconds - something like that, above the white light limb. And we can put the slit parallel to this but it will

GARRIOTT
(CONT'D)

usually just be perpendicular to the limb of the Sun. I can't always find these things, but sometimes I see these individual lengthy or extended spicules. Maybe that will help you decide to what extent you want to look for individual spicules. I would say that what I have described just now is not always available. If you roll about Sun center while looking at the limb, surveying the better parts of the Sun's circumference limb, about half the time you'll find a few spicules extending out above the rest. That's my general impression. I think a procedure improvement could well be done on an observing time segment. If you're scheduling the fellows such that they have a fairly lengthy period of observing time, just put in your notes for that day that you would like to perform the following segments, if they find a satisfactory spicule. I'd have thought that would have been a satisfactory spicule procedure for us. Another procedure that I would like to have seen would have been a list of about two or three things like spicules at the limb such that when you found a good one during the day, you'd take perhaps a 30-minute block and insert it at that point.

GARRIOTT Coronal Transition Region and the 55 Mini-MAR: I thought those mini-MAR procedures worked very nicely. I have yet to see what the data looked like on the ground, but our voice reports were that the procedures were working well. As far as I'm concerned it looks like a good JOP technique.

GARRIOTT Active regions: A short active region program such as we had on our shopping list items seems to me to be a good sort of thing to accomplish when you have a fairly active Sun. Any time you have about 20 minutes of observing time available, just spend 5 to 8 minutes on each active region sometime during the day. I think this would help your synoptic studies and would also give you some sort of baseline data if some of those active regions should become hot and produce subflares or flares. It seems to me that this is a one satisfactory and desirable way of getting baseline data when you don't know which region is going to be your flare producer that day. Develop something like our shopping list items, between 5 and 10 minutes in length, and try to get it worked in on each active region on the Sun sometime during the day.

GARRIOTT Neutral Line Visibility: I think they're pretty visible. We could pin down the neutral line any time we needed to.

BEAN I didn't have any trouble. Usually if you were doing any work you had other things like plage right along the edge of it or a nice little filament or something that found it for you.

LOUSMA We were fortunate in that we had active regions of sufficient size and activity that it was a pretty well-defined item.

GARRIOTT I didn't think the comments on the solar update were particularly helpful in the region of neutral line discussion concerning how it looked and where it ran and all that sort of thing. We could either see it ourselves or we didn't really need to know. We used it on flare detection use. However, as Al just said, the other clues such as bright features parallel to the neutral line were equally valuable and really clued you just where the likely flaring activity would start. Also we could see the plage brighten and the bright points along the neutral line fluctuate in intensity and all these things gave us early flare detection.

GARRIOTT Changes in Active Region Structures: We did note the fluctuating intensities. Towards the end when we were a little more alert to Ellerman bombs we could see them near the penumbral regions. We could notice their coming and going from hour to hour and the changes in intensity of either Ellerman bombs or bright points along the neutral line.

BEAN Care to describe the difference between what you saw as Ellerman bombs and what we thought we were going to see?

GARRIOTT Well I thought - you described it yesterday accurately; although I think their location is one good clue. They do seem to be predominately located near the penumbral region around Sunspots. If it were not for that clue to location, they would look

GARRIOTT
(CONT'D)

much like small bright spots along the neutral line someplace. I thought they were a little smaller than you suggest. They were pretty small, but still not the pinpoints that we were all expecting.

BEAN

I think they need to change the picture on the JOP summary sheet to one that is more realistic.

GARRIOTT

I would also show the crew some H-alpha pictures obtained from SL-2 and SL-3 in which Ellerman bombs are identified. Make sure that they understand exactly how they are located with respect to the penumbra and so on. I think this would be a target of opportunity and if you agree that they should deviate from other planned observations in order to catch some of these, make sure they understand that before launch.

BEAN

One thing that constantly plagues us up there was trying to decide whether we wanted to interrupt what we were doing to go do other interesting things like Ellerman bombs or little small flares or lifting prominences or departing filaments if we saw that occurring. I never really had a good feeling that I was departing from the planned program with the same regularity that they wanted me to. Now it seems to me that for SL-4, they need to figure out some sort of way to convey to the crew the relative desirability of wandering off and doing interesting things that don't come by often or staying right there and following the plan.

LOUSMA Yes, I had the same difficulty. It was frequently not clear whether it would be better to go and get one of those other features than it would be to stay with the program.

BEAN Yes. A lot of times they'd call up and say, "We want to let you know that they have a surge on the west limb." You'd say, "Well, okay, I'll think I'll go over and point at it," but the answer was, "No, we just wanted to let you know, we want you to keep doing what you're doing." Consequently, it wasn't always obvious whether there was a surge big enough to look at or whether it was just interesting. Somehow they've got to come up with a scheme that allows them to understand what the general priority listing is at any one moment.

GARRIOTT My own view is that we were provided that information such that we could make the decision, because the ground does not have it in real time to see. I don't think we could have expected anything else from the ground other than that sort of an answer. We're the only ones with the eyes to see it. I guess what you're asking for is some additional discussion time prior to launch in order for the ground to feel more confident in making the decision that I believe only they can make.

LOUSMA

Well, maybe the ground doesn't even make the decisions. Somewhere in your training you've got to have the information that permits you to make that decision yourself. You know if the first of 12 surges is important, you should go over and get it, but after you've got the twelfth one, you think, "Well, heck, we've got 11 of them, why go and get the twelfth one?" Somewhere during the progress of the mission, depending on how lucky you are to get some of the significant events, your priority changes. Then you wonder if your changes match the grounds' priorities, and that's what has to be established.

BEAN

In other words, are they interested in Ellerman bombs this week or do they have so much data on Ellerman bombs that they want to forget them and concentrate on an active region they've been following all the way across the disk. You think you ought to go look at a flare, but they want to make sure that they get this active region because it's the last chance they're going to have.

LOUSMA

I noticed that the ground's priorities changed over the progress of the flight, too. Sometimes they wanted us to go for flares then later on the flares were sort of passé and Ellerman bombs were in one week and the next week it was bright spots. You really never knew what they considered the priority to be and you had in your own mind some confusion as to what the priority was.

BEAN Maybe they could list it some way. It's a problem and needs to be addressed.

GARRIOTT In my own mind, I almost always put top priority on the things that required fine pointing. That's what man can do and they cannot do from the ground. I was almost always biased heavily toward fine pointing targets. I figure that they can get their own maxi-rasters if necessary.

GARRIOTT Chromospheric Velocities, Comments on Grating Step Procedures: That all worked nicely. It's a pretty simple straightforward procedure to see what step gives you the highest count and then step until it goes to half. Now, incidentally, I noticed that the couple of times I ran it, Jack had done it before me and he'd left his little numbers right on the chart. It would happen at exactly be the same step and looking back on the data and how repeatable the profiles are, it's possible that you can run this by just calling out the step. For example: go to step 43 and run your mirror line scans instead of the procedure that is now listed in the JOP. I think it would be worth looking at the data to see whether or not even this simplification might be possible. Or if you don't have time to do it before launch, you can even consider calling it that way on the ATM schedule. Just go to grating position X and do the mirror line scans, if that is a satisfactory step.

GARRIOTT JOP 3 - Flares: Flare location difficulty was minimal. Any time that there was a decision that a flare was in progress, I don't believe that there was ever any doubt in any of our minds where that flare was located. I also don't believe we ever missed getting to the hottest spot of the flare. There were occasions, in fact it was frequently true, that the hottest spot may move by 10 arc seconds or so during the 15 or 20 minutes of flare duration. That was a sort of normal procedure, but I believe that we always went to the hottest spot and found it without difficulty. We did it as we talked about before, either on H-alpha and/or XUV MON, by looking at the small point at which the flare was started. In H-alpha it could very well be a ribbon or something larger but it would still at max contrast show the hottest location. We think that the flare detection procedures are written down pretty accurately. Namely, use whatever you can as a first clue that there may be a flare in progress and then step right on through looking at beryllium, IIC, and so on for confirmation that this flare is really in progress. You can get to it and get started and I would certainly stick with slew ways. We don't waste any time by slewing to it. As a matter of fact, in the process of setting up other experiments or deciding what you want to do, you can even roll to maximize the configuration of 82B. I'd certainly continue to stay slew the way you did for our mission.

BEAN We've already discussed the fact that you need to have a different approach for flares than just the full blown ones. You ought to have some smaller flare plans.

GARRIOTT We also talked about the necessity for sitting there at likely spots if you really want to catch their rise.

BEAN Didn't you have a suggestion for detecting flare precursors?

GARRIOTT Flare Precursors: RNBN is a possibility. It happened on at least one occasion to alert you that there was activity underway on the Sun. Fluctuating intensities of bright spots along the neutral line.

BEAN In other words you would see them start to pulsate and you would go over there and stand by.

GARRIOTT That's right. For example, oxygen 6 numbers, if I remember right, might very well be running 3000 to 6000 counts per interval. If you come over a bright spot which you can see on the XUV monitor and it looks hotter than it had been on the last rev, you might find the count had gone up to 10 or 15 thousand in oxygen 6. If you sit there and run mirror fine scans along the appropriate lines then the technique I used was to run mirror lines scan for a couple of minutes and then stop for just a moment. That, of course, recenters the beam at the point you were centered on, SWS center, and

GARRIOTT
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look at the intensity. The 10,000 may have dropped to 8 or it may have gone up to 15. If you see the intensity begin to fluctuate like this I think that is a potential precursor to the flare activity.

LOUSMA

I think that's all well and good if you're planning to sit there and watch. I'm not sure anybody's is going to do that. I think there's still a problem catching a flare in the rise. By the time you watch it go up and you wonder if you ought to go over and get it, it has either just about peaked out where you have your flare setting set and there's no point in going over, or it doesn't go high enough above it to give you any really good data. I think what you need to do is say today we're going to set our flare P MEC down around 300 and anything over that we're going to go over and get a flare on the rise.

BEAN

We know that some percent of them will never make it. This way you will get some flare rise data.

LOUSMA

The problem we had was we didn't know if the flare on the rise was going to be a big flare or not. We had already shot a lot of film on flares and wanted to be conservative about it, so I continued what I was doing unless the flare is a big flare or not. We had already shot a lot of film on flares and wanted to be conservative about it, so I continued what I was doing unless the flare is a big granddaddy. Well, the flare

LOUSMA
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lights off a P MEC, you go over there, and that's as high as it gets, then it starts going down. I think that you're going to have to expend a certain amount of film on small flares to get something on the rise and chance that maybe one of them will go high instead of using the technique we used. With the philosophy we used or were trained to use, I think that you have a low probability of getting a flare on the rise. That's the way I always felt. Every time I went over for one I always wondered if I should because our procedure says don't go over there until the beam you see reaches a certain amount. It would reach that amount and that's about as high as it would get.

GARRIOTT Jack, you're suggesting our procedure is fine but you want the threshold lowered.

LOUSMA That's right. I would think that would be a good idea.

LOUSMA If we could get them to buy the idea that we should go over and get on the flare when it started at a lower count then you'd at least get the rise even if it peaked out at 600. You would have use some film on a flare that didn't get very high that time. Eventually you're going to get one that goes high if you go over to it at a lower P MEC.

GARRIOTT That is consistent with what I was describing before. What I described before assumed that we had already gone there.

GARRIOTT
(CONT'D)

I was talking about doing mirror line scans and looking at all this. So we're already pointed at what we think to be the flare.

LOUSMA That's great if you aren't already there.

LOUSMA But that's not the mode that we were ever in. We were always working on some other JOP or another observing program when this occurred. We were never sitting there waiting for it to cook off.

GARRIOTT Except on one or maybe two occasions.

GARRIOTT I think the way to get around that is to provide more observing time so we can do just what I was trying to describe - looking at intensities and staying on a region that has not flared yet, but has potential. There should be a flare wait building block, which there is, which allows you to take the data at a lower rate than the flare data. That coupled with a lower threshold, since you're already there, I don't think the threshold will have to be lowered very much, but maybe some. I think we'll have a readable opportunity of catching the rise time better.

LOUSMA Well, I'm happy to see that there are some improvements in that area, because that was always a point of indecision. The decision that Ed made seemed to always have opposing information.

GARRIOTT Flare Fall Criteria: We did not pay much attention to the number of counts per minute decreasing. Things were moving too fast to use something like that. What I think we used was a variety of things which seemed to be more realistic. First of all, we looked at how many minutes remained until the end of the orbit. That's of some significance, whether or not we think we ought to stay in the same mode we were in, or whether we had 20 minutes left, and we don't want to take or expose the film at that rate for the full 20 minutes. We looked at how much it has decreased from flare maximum.

BEAN How much film was aboard; how much data we had on this sort of thing previously.

LOUSMA We used the ground recommendations in several cases.

GARRIOTT I think all those factors we've just mentioned led you to the conclusion that it was time to get out of the high mode.

SPEAKER Tone/Light Switch Philosophy On SAA and Horns: We finally decided we didn't want to pay any attention to it because we were at the panel usually anyway. All we wanted to know was that there was an indication of a flare or that there might be a flare. Then we looked for other confirming evidence. So the SAA and horns we began to overlook.

SPEAKER Tone Light Switch Philosophy: We tried to leave it set at either the recommend position or below, so that it would give us again an earlier warning. We had a man at the panel all day, so we never needed to worry about whether or not we inhibited it there, and left it on down in the workshop or vice versa.

LOUSMA I found that once I inhibited it, I would forget to turn it on again.

GARRIOTT That happened to us a number of times. On the other hand, I don't think we ever missed a flare because of that because we normally had our eye on the PMEC and the IIC and the H-alpha and the XUV Monitor, with sufficient attention, that we probably would have known about it prior to the alarm going off. - -

BEAN Most of the time we did see them before the alarm went off.

BEAN Most of the time we had H-alpha 2 up, along with XUV Monitor, and there were very few times that the alarm went off on a flare that we did not already know about.

GARRIOTT I don't believe there was ever a case that we were not alert to the possibility that a flare was imminent. I can think of a couple of cases when we might have had our attention drawn to the hot spot, where the flare was actually in progress,

GARRIOTT
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but only a couple of cases out of 8 or 10, were we not aware before the PMEC reached its threshold. A valuable point that we haven't made before that should be brought out is that we had been watching other indicators with sufficient attention in the majority of cases to see it before the PMEC hit the threshold.

JOP 4: Prominences and Filaments. No problems, and we usually just followed the ground recommendation and the preplanned JOPS.

BEAN

I think they ought to put on those JOPS the different spectral lines that are best for finding the hot spots that they want, so that we end up not using detector 3 on zero or detector 1 on zero; that they think are most important. They can even update that from the ground and we can write it in. That way you have, in your bag of tricks when you go over there and hunt to do a JOP on one of those prominences, just exactly which one they are interested in maximizing for the day's work.

LOUSMA

On those prominences and filaments, particularly the prominences, they frequently requested that we align the slit along the longitudinal structure of the prominences. And we seldom found one that was long enough to get the whole slit

LOUSMA
(CONT'D)

on in it, unless it was parallel to the limb. You might want to reconsider the pointing instructions in that case.

GARRIOTT

We did notice structural changes as we have talked about before on some occasions. I think particularly on prominences and occasionally on filaments.

GARRIOTT

JOP 5: Constant Latitude Studies: We do have on the JOP sheet ways to find the appropriate pointings manually, all on board. I think it's much better to do it the way we did it than the way you did it, by sending us the appropriate rule: up/down, left/right coordinates. Then we can, of course, juggle from those a bit to pick an appropriate nondisturbed or uniform region for the pointing. But it saves the fellow on board the problem in deciding exactly what latitude and exactly where he is going to go. It just works out more smoothly to let the ground figure that part out and let the operator make sure he's doing the pointing and the experiment operations correctly. That's the way it was done for our flight and I think that it worked well and, as far as I know, there were never any hitches in our constant latitude studies.

JOP 6: Synoptic Observations: These were scheduled routinely and we all made a few mistakes on exposures and things like that, but I don't think any of them were too serious and we

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began to find that we could catch up on our photography, and a few things like that, by getting in our H-alpha, or our XUV, and our white light coronagraph pictures, while we were doing the synoptic studies. That all went just about as advertised and we can do it any way that the ground might want to modify their program.

JOP 7: Atmospheric Extinction: That went well. I'm not quite sure how many extra opportunities Jack and Al worked in on JOP 7.

BEAN

I just did what they said. I felt like we did so many of them we must have reams of data.

LOUSMA

I did all the ones they asked for, and usually when they came to the end of the orbit, I just let 55 run on whatever it was, usually a line scan. I didn't let 52 run, unless they asked for it. I made a special point to get in as many of them as I could. I think we are going to come up with about a 5-to-1 ratio of sunsets over sunrises, because usually I forget at sunrise, or get tangled up on other things, and forget to get the S055 detectors on, on time. There's no other timing problems at sunrise because we never did anything but an S055 sunrise JOP. We never used any experiments other than 55 for atmospheric extinction. Now

LOUSMA
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we did, of course, take, on some occasions, S052 for atmospheric scattering but we never had any X-ray photography, or 82B photography on atmospheric extinction, except on one occasion. It all went well. I am anxious to see exactly how many we got, building block 15's at sunrise and sunset. The thing to do is to make sure that all the SL-4 crewmen have in mind to take advantage of every reasonable opportunity to get the S055 detectors on, just after sunrise and as far as sunset as possible.

BEAN

I think we should look at this powerdown between runs and see if we really want to power down as much as we did. For example, they always wanted us to put 55 on stop and turn off the detectors. Then, when you came out in the sunrise, you put it back to where it was and put the detectors on again. I never did understand why we just didn't leave it like it was. It seems to be in the category of busy work trying to put this thing in a semistorage position just for neatness, when really you could just leave it like it is, if you possibly can.

GARRIOTT

The only reason for turning them off is a backup to the automatic cutoff. Now that resulted in getting almost no sunrise building block 15's. We would have had them regularly and routinely as possible, if we'd just left those detectors

GARRIOTT
(CONT'D)

on and let the computer turn them off at sunrise and sunset. This is a change that we should make sure is at least considered, and hopefully be incorporated in the procedures. It saves crew time and it'll get a lot better JOP 7 data. JOP 8: Coronal Transients: We observed quite a few. We have already down-linked the way they were observable; principally by structure rather than by time changes. Fortunately, that was one of the things we learned in just about the last week or 2 prior to our launch. We looked at a few of the SL-2 photographs. Al made the first comment about "Look, you can't mistake that bubble." As a matter of fact, that loop structure was exactly the way we detected almost all our transients. You could see curved arches and so on, when they are pretty far out, but basically it was the structure that clued us in.

GARRIOTT Ground Detected Transients: We got that information up from you pretty promptly. Most of the time you said there was a transient under way, we could see it.

BEAN The one thing that was disturbing to me about all these transients was the fact that I never knew whether to go into the coronal transient building blocks, or JOP 8 sheet, or whether just to take a few pieces of data and kind of play it by ear. This was even more noticeable in some of these

BEAN
(CONT'D)

minor flares. Most of the time in the flares you knew whether you wanted to go into the flare procedure or just some sort of modified approach but the coronal transients weren't that way because maybe there were more of them and also because it was always difficult to know whether you had a good one, a bad one, or a medium one. Somehow before SL-4 goes, they have to come up with a plan so they have a feeling when a coronal transient takes place, either the ground or the SL-4 crew sees a bubble, whether to know that they want to give it the full blown treatment or sort of a half-way treatment on the bubble or a three-quarters of the way. You don't want to give them the full treatment or you'll use up all your film, once again real fast. But how you decide, I don't know, but I'll bet it can be sort of thought through.

GARRIOTT

We had more transients than we would have guessed. I think that Bob MacQueen would have been happy if we would have had a couple of good ones and my guess is that we probably got six or eight good ones at this point.

LOUSMA

I agree with Al; although, we never did jump into the coronal transient guide lines as given on the solar activity pad.

GARRIOTT

But we really did the equivalent. As far as 52 is concerned, I think we essentially operated in the mode that we would have been in, had we gone to the JOP sheet.

BEAN

But it was the others. The SL-4 crew has got to solve some of these problems and not go blindly down the road hoping to operate the ATM like you do when you got all sorts of film and you don't have many events. That's the way we train to do. We always train with all sorts of film and not many events. In real life, a lot of the times we had not much film and a whole bunch of events. Somehow if they can swap their thinking around a little bit and understand the deviations as a result of not much film or the deviations as a result of a lot of events. I think they can make much better judgements on what to do, in each case.

GARROTT

JOP 16; Disk Transients: I don't believe we really over used JOP 16. We did have a few cases in which disk variations, I suppose transients, were observed. They were very subtle changes like a filament which disappeared over the course of 15 or 20 minutes. I don't believe we really ever went to that particular page and used it. I don't really believe there was an occasion when we should have gone to it.

JOP 11; Chromospheric Oscillations and Heating: It is sort of an automatic procedure for us to follow. I think that there is scope for a little bit more observing time or shopping list scheduling on JOP 11. If there is more time

GARRIOTT
(CONT'D)

for it, I think that would be a useful JOP for Ed or some of the others to take 30 minutes out and go work on that JOP on times of their own selection.

JOP 12B; 55 Calibration: We all went through that a number of times and there's no problem with that.

JOP 12B; 82A and B Calibration: There are no problems.

JOP 13; It's a good JOP. We only had a chance to do it once. The procedures work fine. The JOP needs to be revised slightly, based upon changes in hardware and so on that we observed.

Drift During BB20: As I mentioned before, only no more than plus or minus 1 arc minute was observed on the inner gimbal angle of star number 2. I didn't go back and check inner gimbal of star number 1, even though I thought about it because it would have been just information of interest and would have contributed nothing to the actual performance of the JOP. And I didn't want to take any chance of messing up the procedure, so I didn't waste the time to go back and do that. But it looked like the stability was within an arc minute or 2.

JOP 15; Coronal Holes: We have talked about that a fair amount already by indicating that we saw them on the XUV MON but

GARRICOT
(CONT'D)

not with the clarity that they were seen on the 82A photographs. We do need a little bit more help from the ground, particularly on getting roll correct, if we want to get the 82B slit wholly in on the border and without the coronal hole. We need, at least an extra 5 minutes beyond what you have already given, to get that pointing pinned down a little better. You have to use magnesium 30, not oxygen 6 and that again takes some extra time to get that set up.

Persistent Image Scope: This was essential. A Polaroid camera has already been discussed as essential to get a good photograph before you start. That will help you with the roll, just the way Al had discussed.

BEAN

Owen, please discuss the persistent image monitor and whether you recommend them taking another one.

GARRICOT

I understand this has already come up before the board and I did talk with Al Holt about it. The recommendation is that they do take up another persistent image scope. Based upon what the manufacturer said, the symptoms we observed for about a week or 2 in the second half of the flight are consistent with a high contact resistance; the fact that we could see a difference in the positions of OK and TR during the first half of the mission, whereas we should not

GARRIOTT
(CONT'D)

been able to, is again consistent with a high contact resistance in the IR position on that switch. I think that that's the whole problem we must have had; either at the batteries, or more likely at the switch position, there was just an extra resistance across the contacts. The new scope should be very carefully cleaned to make sure that those contacts are in good shape. It is my understanding also that they have ground that lens down, to where it is of uniform magnification, all the way across the whole lens. It was a pain. It distorted the view that you had and was a considerable annoyance. I think that this new scope should be helpful and would be a significant advantage.

JOP 17; Bright Spots: Again we used a persistent image scope with the electronic cross hairs position correctly.

BIGAN Discuss the best way to align the electronic cross hairs with the other cross hair.

GARRIOTT You can do it in several ways, but one convenient way to start is to simply go to the limb of the Sun; to the left limb, for example. You put H-alpha 2 on the left limb. You then look at the XJV MON and move your vertical cross hair to the left limb of the Sun. Then you go to the upper limb and do the same thing and put the horizontal limb on the XJV MON on the upper limb. That will get it very close. Then

GARRIOTT
(CONT'D)

you would want to check it, I would think, by looking at any bright spot, any small feature, that you can see on H-alpha and the XUV MON. It may be simply the brightest point in a plage, or if you have a fair amount of activity, then maybe a really small, bright point, that's either a small subflare, or a potential small subflare. When you find that, you can put H-alpha 1 on it, and then make sure that your electronic cross hairs on XUV MON are also centered on that spot. Another way is to find one of the prominent bright spots on the disk. Frequently that will have a very small H-alpha signature as we've discussed on channel A. You simply fly it in near to or as close to it as you can on the XUV MON, identify that little bright spot by looking at oxygen 6, or any other convenient line, to make sure that it really does peak up, so you're not just misled about some other spot in the network. Verify that you are really at that correct location and then, once again, make sure that your electronic cross hairs are zeroed in on the bright spot, on the XUV MON. After that, you simply tape it down. There're taped right now to what we think is pretty close and check it once every 2 or 3 days and you're in business.

JOP 17; Coronal Bright Spots: Again, the same comments about the persistent image scope and the Polaroid camera are appropriate. I think they are essential for doing a good job.

BEAN

Shopping Lists: I think it was one of the best things that was created for the flight. It allowed us to do a lot more useful work. I think they ought to be enlarged and amplified and even made more specific because it looks like SL-4 is going to have some opportunities to do good work there. I do think they could stand to be even better done and you could get even more data out of them. I particularly liked the sections where you had individual experiments, where you could work, and you find out that maybe you had only one particular experiment that could stand any sort of film usage, then you could go right to that section and they had the ones that could be taken. I thought the shopping list items that tended to operate with just one or two experiments, for example, one experiment plus 55, are more useful than the ones that operated a number of experiments at once; and only because there was a lot of time we didn't have much film. When you have a lot of film, then you like the other kind. The ones, for example, you can point at prominences or point at active regions were useful. Toward the end of the mission they became nonuseful because we didn't have any film available in those cameras. You wondered when you did those, if it was useful to do just one or two out of four or five. I still don't know the answer to that.

LOUDDA

I like the shopping list items, particularly when the Sun was active and there was a lot of useful places for them. When the Sun wasn't as active, why you don't seem to have as much use for the shopping list items. Also when the film gets low, you hesitate to use the shopping list items too because most of them are film burners. Most of our shopping list items came down to running 3056 on long frames and running 3055 on bright spots and that kind of thing. So, shopping list items were not as useful when we got low on film as they were earlier. But there were all kinds of opportunities for their use and I think they were a good addition. We ought to expand them and probably have a little more training on them. We didn't get the shopping list items in time to have other than a brief explanation of what they were all about. But I think we could have done even better, if we'd had opportunity to train with some of them. I think you ought to get your shopping list items made up now and start using them in the simulator a little bit, so that you know what's important and what isn't.

OWEN

I got the feeling that I was running the same shopping list that Jack was and that Owen was and you never really know what they did during their shopping-list-item time. It might be appropriate to add to the SAP, down near the bottom somewhere, a list of the desirable shopping list items for that particular

BEAN
(CONT'D)

day. In other words, they could say item 13 on active region 10 is good; item 14 on prominence 2. As you went over there, and had free time, you could do that shopping list item, the top one for example, and maybe make a little mark by it. Then a couple hours later, when somebody else is on there and gets some time to do a shopping list, he could glance over there, note that the first item had been done and proceed to the next open item. We may find out that we were all doing the same shopping list items on the same active regions because we had no real coordination when we were doing the shopping list. An individual wouldn't keep doing the same one but it is possible that the three of us may have been doing the same one. One day, I recall, they did call up, and we made a nice little list, and crossed them off as we did it. Maybe every day at the end of the solar activity pad, they could call it the "Shopping list action today," and then just list them. Then you would have a good place to go and get a feel for the best shopping list items to work on.

LOUSMA

That's a good idea to avoid being repetitious. Sometimes I would find myself with the opportunity to do three or four shopping list items, and I recognized that this was the same three or four that I had the opportunity to do yesterday. You wonder, should I repeat those on a different active region or should I just forget shopping list today? It's not always

LOUSMA
(CONT'D)

clear, how much shopping list items they would like on a particular active region subject. It would be appropriate to know just how much of it you ought to really be doing and how much of it's just really a waste of film.

MEAN

You may be able to create a new part on the solar activity pad. They have a part now called "experiments," where they discuss each experiment that might have some problems. They could have a part called Shopping List. Also in that area they might give you an indication whether they want you to stay on the JOPS, or do they want you to maybe quit doing the JOPS, or do a minor flare if you get one. It could be called "Shopping list and JOP operations for the day strategy." By reading it, you'd understand how important it was to stay with the schedule. They could also say in there to do any JOPs that you like but don't under any circumstances, do 56 on any shopping list items because we're low. That would allow you to do shopping list items and yet not feel that you may be using film early in the mission, that they're trying to save until later. It would allow inflight control of some of the film you were using for shopping list items.

GARRIOTT

Those shopping list pages were more heavily used, by a factor of two or three, than any other sheet in our whole repertoire. I think that's an indication of how important the shopping list was to us. We all used them extensively. I'm sure

GARRIOTT
(CONT'D)

there are improvements that can be made. We found most of the use during the active periods. I think part of the reason for that is that we had had no training because they only came into existence during the last 10 days or so prior to launch. There was really no time to use them in training. We simply talked them over, what the concept was, and how we would use it, and then we did it. Some training, I think, would undoubtedly have helped us in the utilization of all of the shopping list items, rather than just say the half dozen that we used most extensively. There were a number of other items that I think could have been used on quiet regions, for example on the limit of the Sun on spicules, and things like that. We didn't use it too much for those because we hadn't been familiar with it and we'd never trained for it. Usually we didn't have time for it because they took more time. We were usually limited to only 5 or 10 minutes at the end of an orbit and about all we could do is to squeeze in a little bit of the active region study or special event study and that sort of thing. With more observing time, it will be possible to use some of the shopping list items that take a little bit more time, like 15 minutes or so. With a little more training on how the shopping list item can be used at the limb or on filaments and prominences, I think a greater fraction of the shopping list items will come into place.

BEAN

Another thing that might be possible, since a shopping list item means you are kind of rummaging through the little sheets over there, is to list those shopping list items two or three times by different uses that they have. For example, you might want to have one shopping list item that is a class called "Small flares," and then you have several shopping list items under there. It might also be that that same thing could appear under quiet Sun networks, or something like that. I noticed from time to time that the ground would request you to do shopping list items and they'd say, "Do shopping list item 18 or such," and that wouldn't have anything to do with what 18 was listed for under your shopping list. In this way, if you say I think I got a good prominence today, you could go to the prominence shopping list section, and you'd have all of the shopping list items that were appropriate to be done on prominences, in some sort of priority order. The shopping list items ought to contain more pages with some of the items put on there more than once, just so that when you decide what you want to do such as go to the limb, you will know what's available.

Another thing that I noticed came up in shopping list items was that you could do better shopping list items if you tended to stay in the area you were working, at the end. If you

BEAN
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were working the center of the Sun, and you had 5 minutes left, if you tried to go over on the limb and orient and get something, you usually wasted a lot of time. If these were put on pages with a more flexible, wider range of what you're doing, you could use the technique of saying, "Okay, I'm working on the limb of the Sun today and I'm right over here by big UV region; let's see what possible shopping list items could go for high UV areas" and doing them. And not trying to point somewhere completely different and waste a lot of time repointing.

GARRIOTT

A couple of possibilities for new ones. The chromospheric heating is a potential one. I think we could have used a shopping list item for a quick survey of active regions. I mentioned earlier that I think it is a good thing for each day, when the Sun is fairly adequate to take at least a quick glimpse of each active region, with at least a partial mirror auto raster, and probably one 82Bframe and X-ray photo or so. I think none of those shopping list items involved partial mirror auto rasters. Yet I think they should because scanning from line zero to 25 or 30 is a good technique and slit center is located up around line 9. We can save about 2-1/2 to 3 minutes on a full raster, even though I know it doesn't give 55 all the information they would like. The extra time saving is probably worth it and would enable you to survey

GARRIOTT
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more active regions in this synoptic fashion of, say, one glimpse per day as convenient. As far as new JOPS and additions are concerned, certainly the maxi-raster and mini-limb scans are candidates either as a JOP or as special shopping list item. I'm assuming that all of the 82B autos are going to be eliminated, or at least almost all of 82B auto operations, in order to conserve film. So these are major changes that are going to be involved there in your guide.

BEAN

A number of times you felt that you would like to give them an auto raster but you didn't have 5 minutes. A little shopping list item ought to be created or a technique ought to be developed so that you can estimate what they need to cover to make it reasonable and then have that as sort of a canned procedure.

A partial MAR: How much more than what you think is interesting has to be covered to make it useful? That is the question.

GARRIOTT

Coalignment operations: These operations worked good enough.

Video Tape Recording and TV Downlinks: They were on the ATM schedule and it worked well that way.

LOUSMA

In relation to what they really wanted, I wound up giving them a kind of tour of the Sun. I showed them all of H-alpha 2 and I'd take them up to an active region and then flip over

LOUSMA
(CONT'D)

to H-alpha 1 and then back to H-alpha 2 to go to a new one and kind of keep them oriented. Took a tour around the limb, and all that kind of thing, but that might have been too much. If that's of value they ought to know and if it's not, then they should cut it shorter.

The whole business of the TV down-link wasn't very clear to me, when I went. It is something you catch onto in a hurry. I think if you were briefed precisely on what was expected of you, and why, there would've been less stumbling around when we first got there.

14.3 EREP EXPERIMENTS

BEAN

One of the things that we did not do aboard the space craft that we ought to be able to do by some way is somehow decide on board whether or not we ought to take EREP data on a specific pass. We found that a number of times that we were supposed to take clouds, and we were running all sorts of cameras, tapes, and there were no clouds around. Other times, we were supposed to take the site itself, and we got there, and we were running the cameras, and taking data, and it was fully clobbered in. Obviously, the weather reports were incorrect. The point I'd like to make is this. We claimed that one of the advantages of having man in orbit was because he can decide whether or not to take data. Yet on the Earth resources experiments we are running up there, he never does this. He always is assigned to do it, and then if he can see it, he takes it and if he can't, he's generally taking it anyway. I don't know how to solve the problem but we should start taking the first step to improving this dilemma. One thing that struck my mind as a possibility is that Owen was looking out the wardroom window frequently when operating the ETC, and he could say for example, when we ran on the Japanese sites, "Look, you're not going to get any Japanese sites. Things are clouded as far as I can see and we can go up there north of Tokyo." He knew that long

BEAN
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before we started cranking all our cameras and tapes to try to get the information on Tokyo. So, onboard we had some capability right there to do a better job than we were doing. As it was, we just ran on time and I recognize that some of the information on clouds is usable. But certainly we shouldn't been running the 190A or the 190B. Because Owen, for example, knew that they weren't going to work. SL-1 should try to improve on this situation. I don't know if we can hit it perfectly but it certainly is worth the next step. I don't know how we can do it. I would suspect that when we do try it, we'll find out that sometimes we will cancel data when we should have taken it, or we will have taken it when we should not have taken it. But at least it is the next step forward in trying to get the best possible results from the man on board. Right now it's like an unmanned spacecraft, except that man throws the switches. For example, on all the experiment except the VTS, you could program a black box, send up the time on the pads, and that would be the end of the game. He doesn't do anything except throw the switch at the right time. My proposal is that we start trying to look at an improved way to do this with onboard information. Whether we have to station somebody at that window, or ask the VTS operator to look ahead. There must be a better way than the way we're doing it. We could

BEAN
(CONF'D)

improve the total amount of data returned, and make it more of the data we had in mind, by doing something like this. It will take some work and some practice. SL-4 is not going to have that much in the way of film or tapes, so that they can afford to just shoot them up. It would be much better if we could start approaching the problem by using the on-board observer to determine whether or not he can do it. This means also, for example, the use of the 190B, the writing of the pads is going to have to be a little bit different because each of the uses of this equipment is going to have to be in self-contained blocks, with the man at the window saying, "Okay, it's good enough to do 190, I think," and he shoots, or, "Let's cancel 190." But the switch setting has got to be such that if he cancels one that was planned, when the next one comes up and it's okay to do, that you can start from there with your switches and still complete a good pass. Also, it means the man at the window must have his schedule in sort of a GO/NO-GO idea. A certain time prior to data taking, he must be able to look ahead, the pad must say, "Determine if the next 30 seconds is good enough cloud cover." He then looks to see, if in the next 30 seconds it is or not. But anyhow use his judgment. This is the name of the game. We must start building on the way we're doing it now, for the future. And this is a good opportunity.

LOUSMA

I always felt that the weather that we were basing our observing times on was a lot older than it should have been. I based this primarily on my operation with the VTS. I think we must figure out a way to get more current weather and make our decision on EREP at a later time. With regard to the use of the VTS, there were several occasions when we asked for the weather and found it to be different than it really was. We had opportunities to pick up some of the sites we were trained for, instead of doing nadir swath. Sometimes we were requested to get a site and it was clobbered in and we should have done a nadir swath. I think what you need to do is give the VTS operator more flexibility, and more leeway, and decide whether or not the weather is good enough to go for his sites, or to stick with the nadir swath.

There were occasions when I could have gotten some sites when I had to do a nadir swath, and the weather apparently was good enough to get those sites. And it was not established what the priorities ought to be in that case. So I think you ought to establish those priorities before you go; either the VTS operator, or the opportunity to go for the sites, if they are available, if that's what you want them to do. Tell me then what is the highest priority and if not, well then to go for something else. But give him more options than given on our flight. There were a couple other cases

LOUSMA
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when we had sites on the same groundtrack, where we could swap places from the C&D to the VTS and pick up some of those sites in which we were trained. We attempted to do this once, but the cloud cover got us, but it's a feasible thing to do, if you look ahead. And all you have to do is take the U.S. map with the orbital path on it and the times written on the orbital path, and add those to the time at which you're going to cross the Equator, and you can figure out when you're going to be directly overhead the sites on the U.S. map and then subtract 65 or 66 seconds off it, and that's your 45-degree time. The way we worked it, we fitted those times in between the nadir swath and everything else to see if it would be legal to go for them. In some cases, they conflicted with the nadir swath that was assigned and in some cases we could have gotten those sites, had we been permitted to do so. I think you ought to go up there with a clear understanding of whether or not you're going to go for your sites or go for a nadir swath. In every case, we ought to have more current weather. I found that flying the sites with the airplane was most helpful and I'm glad I did that. When the weather was relatively clear well then it was no problem getting the sites I was trained on.

BEAN

Attempting to shoot volcanos, if they are not putting out smoke, is a little bit tough. I know we had volcanoes a

BEAN
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couple of times. They'd give you the coordinates and some pointing angles, and you would look down and I can't remember or any of those occasions even seeing a volcano. They just weren't obvious enough. Now if they'd given us that volcano in New Zealand with its different color or the one in Sicily that was putting out smoke, you could have gotten it. But to find a volcano, for example, in the middle of the mountains in Mexico is a little tough, and I think we ought to realize that some of these EREP sites, without previous training, are not appropriate because they are just not that discernible through the optics.

JARRIOTT

You mentioned using the third man to assist in weather determination. There is an easy way, using the S063 bracket in the wardroom window, to mount a little binocular scope or something which points parallel to the minus-Z axis. It will be essentially parallel to the Earth terrain camera. By simply looking into that scope, you can determine what the Earth terrain camera will be photographing. If you'll tell the operator what it is you want, whether it's clouds, whether it's - cumulo nimbus buildups, whether it's the Sargasso Sea, whether or not it's the mountains of Bolivia, he can determine whether or not it's going to be visible. I would think it would be a very practical manner to conserve film to let him decide the GO/NO-GO on the pad which had

GARRIOTT
(CONT'D)

been previously sent up. He can tell the fellows in the MDA that it is clouded over and we're not going to see Bolivia, so let's not run this pass. Or, it does look like we've got a good capability today, so let's go ahead and take the preplanned one. I think the easiest thing is to not set up too many new opportunities because that takes so much preplanning but, instead, save film by negating those passes which are not going to provide you with the desired coverage. If you have plenty of film available and tape, why of course, there's no reason to do that. But I don't believe we're in that situation. We could have conserved some very substantial fraction of our tape and film, had we been given a no-go, as appropriate based on the particular objective.

BEAN

Controls and Displays: No longer do we have the capability to align the VTS. Apparently the door comes closed, but whenever it's closed, it doesn't hit the micro switch allowing you then to move the optics around. We've got tape on the two alignment controls for the VTS, and they ought to stay there. I suspect that when SL-4 gets up there, they are going to open the door and leave it open. Incidentally, I don't think we saw any degradation in optical qualities during all the times we left the door open. Nor did we see, looking out the window in the area of the VTS, any sort of

BEAN
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contaminants floating around at any time that would lead you to believe that it's going to get worse. I think it is okay to leave the door open.

LOUCMA

On the control and display panel, I don't think we picked up any new funnies during our flight that weren't selfevident during SL-2 or preflight.

Tape Recorder: We used both tape recorders. We cleaned them religiously. We cleaned the best we could with the half-dried swabs we had. We think we did a pretty good job of cleaning them. They never were very dirty. The tapes were apparently good clean ones. The heads very seldom had anything on them. The dirtiest part of the whole tape recorder was the pinch rollers and it takes a little bit of work to get them cleaned off. We always checked the other rollers as well and kept them pretty well cleaned up. You can't get all the dirt completely off but we think that we did it as best as we could. We used just about all the swabs and the ones that are up there are half dry. They will need to take a complete set of brand new swabs up there to clean the tape recorders. In loading the tape recorder, you have to be very careful to make sure you've got everything all lined up and fit down tightly and so forth. One time I noticed that you can install the top reel and not have the

LOUSMA
(CONT'D)

little astro pin that is on the bottom of the center hub completely engaged and the tape will fit down and will turn everything else except that the tape will turn under as it goes on. But the tape recorder will work perfectly and you'll have just about an eighth of an inch of tape turned under, on the top reel. So you must make very sure that when you install that top hub that you've got it seated all the way down. After you get the tape loaded, look at it very closely to make sure that the clearances are proper and that all the rollers are set up perfectly, because it's very easy to load the tape and make yourself think that it's loaded properly, and you still have it wrong.

You'll need additional light because there's not enough light up there to do the job, so you get a flashlight out and inspect it very closely. Now the empty reels are in the empty reel canister at the head of the C&D panel. Both tape recorders are empty and it's hooked up on tape recorder number 2 and the down-link box is hooked up on tape recorder number 2 at the present time.

BEAN

I'd recommend that the cleaning procedures be revised in training, so that you don't use all those different swabs and so that you don't clean so many points so frequently because most of the time they are not even dirty. I don't

BEAN
(CONT'D)

remember getting any dirt off of any roll, except the pinch roller. Yet, I was constantly taking the tape off and rubbing those things. That's just a big waste of time.

Changes (Checklist, Timeline Pads): I think if you want a Nu_Z update, it ought to be on the VTS operator's maneuver pad. The pads ought to be similar to ours in that having the time for the maneuver back to SI loaded immediately after you load and start the maneuver to Z-LV. The time to go back to SI ought to be on both pads somewhere. Time to go to Z-LV ought to be on both pads somewhere. The times that should be on the pads are these: The first thing you should have is the time to turn on 191 power. The next time that should be on there is the time for warmups, and the last time on there is the time to go to Z-LV and the time to start taking the data. You should have every time that is associated with running EREP on these pads in one spot, so that when it's time to do EREP, you just get out your pad and then all of the information is there. A couple of times we found out when we were running EREP, a couple of the critical numbers were over on our detail pads or over on the ATM pad or something like that. And that constantly plagued us because you're just not thinking ATM at that time. So anything that has to do with EREP, whether you do it with the ATM or do it with something else, ought to be

BEAN
(CONT'D)

on that pad and easy to do. One other point, since we're using the down-link box much the same as another experiment and in the event you got any down-link work that ought to be on the final configuration portion of the C&D's operator checklist. The checklist says, for example, 194, POWER, ON; READY light, on; MODE B; or whatever it is. The next one should say down-link box attached to blue dots, TV switch, ON, switch in TV, or whatever. In other words, it should have the same sort of format and attention paid to it as any other experiment, even though it's kind of hanging down there on the end of a couple of cables. It's still important to get the data and it should be treated just like any other experiment in EREP.

LOUSMA

Cue cards are the only way to go. We used them exclusively, except when we needed some detail information. We didn't need all the time that was allotted for getting ready for EREP. I think it's sufficient to start 5 minutes prior to warmups and go from there.

BEAN

I can make a couple of comments about those cards. Cue cards are the way to go except for one thing. The cards have got on them the same distance from the margin, both the things that you do every single time and the things that you do once in a while. It would be advantageous to make the things that you do every pass right along the margin, then the

BEAN
(CONT'D)

things that you do every once in a while should be indented even more noticeably than they are now. For example, tape depletion or camera depletion, you'll read that on the notes on your pads so you'll have them on your mind. But what I noticed we were having to do as we ran through the cards, was to read a lot of the things (a lot of lines) that we weren't planning to do just so we would make sure that we didn't skip a line buried in there. So this should be re-formatted so that the things you do every day are against the left margin and the special events are over more towards the right; almost like an emergency procedure.

LOUSMA

Equipment Racks: We only had one equipment rack, where you hang the S190 film when you bring it up. That seems to work satisfactory.

BEAN

By the way, the times on those cards should be the latest times you want to do something. For example, they had at minus 10 minutes you ought to go through the pre-operate check. That's a good idea because that's about as late as you want to do it. But back up in the earlier parts of the things to do, they had you doing things at 90 minutes that you could easily do at 60 minutes. So those times should be the latest times you ought to be there doing the job. Then, for the first few times when you start to prep EREP, maybe 45 minutes early, then you can get ahead of the game. Then

BEAN
(CONT'D)

after about four or five runs, you'll get into a groove where you wish to see if you're ahead or behind. The times as presently shown on the cards are not useful and they could be made more useful than they are by making the times more realistic.

LOUSMA

Malfunctions: The malfunctions that we had are pretty well documented and are being looked into at the present time on S193, with the door in S191, and the alignment problem. We didn't have any malfunctions with S190 nor with S194. The S192 problems are pretty well documented.

S190, Multispectral Photographic Facility: During the EREP deactivation, I was asked to photograph the lenses on S190 because we had reported that there was some debris in there. So we took some photos and inspected the S190 optics according to the pad that was sent up and noticed that the S190 optics had some kind of specks, dust-size particles, within the camera system. Each lens had it to varying degrees. I also noticed that the forward most rotating shutters had some binding marks on them, some rubbing marks, and it turns out that the ones that had the most rubbing marks also had the most debris inside the lenses. All this has been well documented on channel A, and photographs have been taken. Information about the cameras is probably more completely

LOUSMA
(CONT'D)

covered somewhere else. We noticed that we could clean the platens with water quite readily. They'd get film streaks on them and it seemed kind of hard to get off until we started working on it. Al worked on it somewhat with just plain water in getting the platens clean and most of the film streaks came off, although you had to dry it very quickly so that it did not leave water marks.

The cassettes are a little hard to get out of the drawers, but they come out okay and they mount very well. We never had a cassette malfunction at all. We have loaded quite a bit of film for S190, of course, and the first thing I noticed was that the leader on the new film didn't look like the picture in the book; the distances and everything wasn't the same. So what you should do before you go, is take a couple of rolls of real S190 film and load it, instead of the training stuff, because it doesn't look like the real stuff. Finally, after figuring out the code, it became apparent the way we should load it. It seemed that I picked one to load, the first time, and it was different from all the rest anyway. Most of the rest of them appeared much like the drawing in the book. Loading the S190 film is no problem. It is a little time consuming. You just follow the procedure that's in the book and it works very well. There is some despooling that takes place, after you've

LOUSMA
(CONT'D)

loaded the film, and there is not much you can do about that. You just plan to get some malfunction lights and a new load of film for SL90 the first time around. But it goes away after a while. Then when you unload the film, you can hold the film cassette in your hand and you can feel a despooling in there. So all of it's probably coming back despoiled. The filters we seldom did anything with, occasionally changing them, depending on whether or not we had to do a lunar cal. Normally the filters were left on the cameras. At the present time, the down-load instructions were to take the filters off; so, they're all in the tool box. The tools we didn't use much. We didn't have any requirements to use the tools. One thing that we had to swipe out of the M487 gear was the tape measure. We just left it up there in the M130 equipment container box, so that we could measure the tape load every time after a pass. There's no place to stow it. We just stuffed it in there.

Desiccant: Is something you're going to have to change every 2 or 3 days because they turn from blue to white in a hurry. If you have never seen a dried-out desiccant, you better take a look at it, because I never had. And all the ones that were up there, whether they were in a sealed container or not, were all wet. There wasn't any of them that were in a nice row of blue color they were supposed to be, even a

LOUSMA
(CONT'D)

new one. A new, dried-out desiccant will have a very royal blue appearance to it. If it's not royal blue, then it's probably not any good, and I'm sure you'll have to change it immediately after you get up there. We baked out two sets of six in the fecal bags, and sealed them off, and put them in the M130 stowage locker. You'll find those two sets in there. And you'll probably want to put them in right away. We baked out the desiccants in packages of six for 40 or 50 hours, and they turned a nice royal blue. They seem to get white in a hurry.

Camera shields: In training, and in the checklist you're instructed to take that aft camera shield off (rear cover) and mount it somewhere to do your film loads and all that kind of stuff. But it is not necessary. All you have to do is unhinge one end and swing it away and there's plenty of room to get in there and load your film.

Stowage: Not much to say about that. You put the film back and the S190 rotates up into it's stowage position. You want to get that window protector on as soon as possible to protect that window.

Filter return container: We didn't use it.

LOUSMA
(CONT'D)

Si90: Worked like a champ; we never had a failure, although we had a few malfunction lights on a brand new load, which you can expect. But by merely checking the numbers and comparing them all, why, there's no difficulty in telling whether or not the film transport mechanisms are working. They are easy to load. It seemed good to put the total EREF operation together in one place for once. In spite of all the training you get, it's a little difficult to tell exactly how it's going to work out when you try to do it here on the ground. The first time you do it aloft, it all becomes immediately obvious how it's going to be and there is less mystery to it, once you get it all together up there, than there is on the ground here.

Si91: We talked a little bit about the viewfinder tracking system already. We noticed that the door jumps and it apparently takes a longer time to open and close than it's supposed to. So we wound up leaving it open. And as Al said, we had no degradation of the optics. The door is now closed, so that we wouldn't squirt RCS all over it. You'll have to get it open. The alignment system doesn't work. You can't, with the door closed, slew the optics over to get it aligned. The last we saw of it, it was aligned very well.

LOUSMA
(CONT'D)

And we have the alinement wheels taped, so that they can't be moved. The floating mechanism works just like advertised. If I had one to design over again, I'd do a lot of things different with the left-hand thing. You've got five fingers, but you have to hold on with four of them, and you can only operate one of those switches at a time. Whereas, you'd really like to be sometimes punching the data button, running the camera, changing the zoom, all at one time and you just can't do that. You waste a lot of time with your left hand. We should have had a foot restraint for the VTS because most of the time you're not looking through the optics, but looking through your maps and doing other kinds of things. If you had a foot restraint, that would leave more hands free for working that left-hand stuff. We normally pulled the photographs and maps out of our site book and stuck them around with clips in different places, or taped them to the wall, and had all the 191 area looking like a paper-hanging shop. That's the only way to go. Organize your sites. Leave that site book somewhere else because you're not going to have time to flip from one site to another. The sites go by so fast that, if you don't know them like the back of your hand and haven't reviewed them, you're going to miss them. We already have commented some about weather versus nadir swaths versus sites. The VTS operator should be allowed to determine whether or not he's going to get a real

LOUSMA
(CONT'D)

site, or a nadir swath, depending on weather. I was always tempted to go off and get a site whenever I thought I could get one, rather than a nadir swath. It should be clear on the pad, if that nadir swath that you're given is really high priority, and do you want them to get that as opposed to all else that comes into view, and so inform them. If not, you should give them the leeway to go and get a site because that's what he's trained on. You can get all kinds of nadir swaths without even having a man on board. But if you want to use the man, you better give him the option to go for that site. Finding sites is sort of an individual matter. Everybody works out his own techniques. One thing in finding sites, and that is, if you've got much cloud cover, you probably are not going to find it. Even if you've got scattered clouds, it turns out that you obviously can't see your site through clouds because it's pretty difficult also to see that site if the shadow of the cloud is on it. So if you've got scattered clouds, finding the site makes it more like broken clouds because the shadow of the cloud prevents the light reflection back into the optics. And you can't see in a dark place. That's what you got when you're looking underneath a cloud.

BEAN

There are a lot of times you don't see your site at 45 degrees, particularly if it's hazy. The most important thing to do

BEAN
(CONT'D)

is kick off that IMC at the right moment, and if you don't have your site in view, and don't know exactly know where it is, don't touch the controller. Let the IMC keep tracking along until you have a way to go. The best rule you can have is, don't try to hunt for a site unless you know where you are, and then you go from that point to the site. If you just don't see it out about 45 or 40 degrees, and you start fooling around with the controls, you're going to lose whatever pointing you had to begin with, and you would probably be better off if you left it alone. I did do some of that maneuvering around at first, and I found to my regret sometimes that I was off and didn't know exactly where to go to get back to the original point. Later on, if I didn't see the site, I just started the IMC, and held it there, until I knew exactly where I was. Then I would move it to the right place because you're not always on. But you're always close enough to the site in the pointing, that when you got good visibility, and were at the right angle to something, that you should be able to see it. My recommendation is that if you don't have your site picked out, or you don't know where you are, do not touch the controller, just let the IMC keep bringing you in closer and closer and pretty soon it will become a lot more obvious to you.

LOUSMA

If you don't see the site when the time comes, go to IMC, ON, the ground has been homing us in pretty good, and if they home you in a little bit off, why tell them about it, because they'll correct it next time. One other thing about doing that if the IMC is not quite right, the viewfinder drifts off the site very easily. So what you should do if you don't see the site, still pick some object within the field of view that you're looking at, and when you go to IMC, ON, try to keep that object the same relative point in the field of view as the IMC moves down. Because otherwise, it'll drift off. One of the real disadvantages of the system, the way it works out, is the fact that the system does not point at the same place when you're at MAX zoom as you are at MIN zoom. So you always have to go to MAX zoom to get your site and that messes you up for getting other sites because, before you can go get them, you have to zoom out and look for them and then zoom back in. If we had the thing pointed properly at all zooms, why you could get a lot more sites because it would save you time from not having to zoom in and out. The fact that the optics is not lined up is a real disadvantage.

BEAN

And so that SL-4 will know, the pointing that they give you from the ground is such that you'll actually be above and to the right of the actual site you're looking for. Now, that

BEAN
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means that at the exact moment, at 45 degrees and all that business, if you would zoom in fully, you would just be right on the site. But zoomed out like you always are, you're above and to the right of it by about 60 degrees and by about three widths. So what you need to do is turn on the IMC, and instead of looking exactly where the open space is in the reticle, you sort of look down to the left, and that's where your site is. Now when you zoom in, you'll notice that the optics move down and to the left. So when you finally zoom in, then you're right on the site itself. There are all kinds of neat little tricks you can use for going for sites that the ground doesn't give you to track. A lot of times you can find one of your sites that is off course right or left and pick it up pretty readily when it's out a long way. However, if it's out more than about 16 or 17 degrees, right or left at 45 degrees, by the time you get around to zero, you're not going to be able to track it any more. So, it turns out that you probably shouldn't go for anything that's more than 100 miles right or left of your track, because you're not going to get it. You're not going to be able to track it through nadir because you don't have enough right or left gimble angles to do it. Also, since the data is most important near zero, it's just as bad to have a site that goes far to the right of you as it

BEAN

is to pick up a site early and quit tracking it before it gets down to about plus 15 or so. So, if you think you can see a site to the right or left, that doesn't mean you can get good data on it, even if you can track it. You've got to track it until it gets within about 15 degrees of the nadir, or you won't get the right data, as it's looking through too much atmosphere.

LOUSMA

S192 Multispectral scanner: There is very little to report from the control display end of it because you turn it on and let it go. When you go to ready on, the tape recorder works normally, the malfunction light comes on momentarily, and in a few seconds, it goes out and the tape motion light proceeds as planned. This is not necessarily true of tape recorder 2, which we used very little. It has a little bit different behavior with the tape motion light which flickers a lot and the malfunction light will be on more. With tape recorder number 1, it works just the way it was planned. On S192, the main interest is the visible/thermal alignment. We did a lot of work with that initially and you probably are aware of the fact that the detector wasn't seated properly on its mounts. We loosened it up, reseated it, tweaked it up again, and we got it up to some better settings. I never had the feeling that the ground was completely happy with the thermal alignment, although we worked on it a couple

BEAN
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times with new procedures and never was able to get it any better than it is now. The decision to bring it back, and work on it some more, obviously wasn't implemented. We did not use the little indium shim that was sent up in the on-board data for our mission. So, it's up there somewhere and if you want to take it out and replace it, why it's still there. The little feeler gauge that we used to check the clearances between the detector and its seat is taped inside the gold S192 box. The alignment numbers, the last I remember there, were something like 82 - 83 percent on the left meter and about 65 on the right meter. The thermal was somewhere around 45 percent. That's the best we could do. That apparently was satisfactory.

LOUSMA

Cover: Concerning the S192 cover, I don't know what to say about it, except that it goes on and it comes off. The S192 cover was always on. The box was always closed except when we were doing alignment. So, we never operated with the cover off. It was always covered all the time.

S193 Microware radiometer/scattermeter and Altimeter: The rad/scat/altimeter business should be pretty well documented. We reported that the antenna wasn't behaving properly in several modes, and we had various caution lights to come on

LOUSMA
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in regard to that experiment. And finally that thing was shut down. We have not been appraised of what the situation is on that unit at the present time.

S194 L-band radiometer: It's one of those things you kind of turn on and let it do its thing. The malf light comes on as expected. We didn't pick up any new funnies on that one. Then the malf light goes off after the calibration is complete. It works just as advertised.

14.4 INDIVIDUAL EXPERIMENTS

LOUSMA D008. We didn't do that.

BEAN That's what I was just going to say.

LOUSMA D008 was probably the dosimeters. It was one of Owen's jobs - radiation in the spacecraft.

BEAN When you were doing dosimeters, was that D008?

GARRIOTT I didn't know it if it was. All I was doing was reading dosimeters. I'm not sure that those daily numbers are necessary. It's no big deal. It takes about 2 minutes of one man's time every day. If it is established that it is really essential, then it's no big deal.

BEAN We brought all our personal radiation dosimeters home.

GARRIOTT My little film clip was given to Dr. Paul Buchanan.

BEAN Same here.

LOUSMA How about the radiation survey meter? I don't remember a requirement to use that, except for waving it around a little bit during EVA. It showed zero.

LOUSMA

It seems like it did nothing. We never used it for anything. It just sat there. The other one is the Van Allen dosimeter that was just setting between the wardroom and the waste management compartment. We never did anything with it except turn on. I guess somebody down here has something to do with that. So radiation in the spacecraft is a passive thing. It kind of makes you wonder what's going on.

BEAN

D024: Let me hit the O24. We retrieved D024 when we came in from EVA-3. It was quite simple to do. The only thing I noticed procedurewise is it said to see if you can remove the pin. If I had, then I would have had a loose can. I think it's much better to put the two experiments in their proper locations, close the lid and then remove the pin. That's what we did. I think I was fairly cautious about not touching anything. The only thing I touched was right where my thumb was supposed to be. Because the instructions were clear in the EVA checklist I was able to fold it over and put it in the right slot and also get the handle to go in the right direction. The inside of the D024 box was bright metallic and nice and clean. Around the area of the samples it was sort of a light tan color. The samples were many different types and colors. Some of them looked like they were becoming slightly debonded although I never saw anything get lost as I put it in the can. When we get it back to Earth, it's

BEAN
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possible that one or two of those little sample arrays or dots may have debonded but it did not occur during the EVA. Everything went nice and just as planned. Retrieval of panels was simple. The panel grips were adequate. Sample return containers were nice and stowage was certainly simple. Other than the comments that I made earlier there are no additional remarks on D024. It is a worthwhile experiment.

LOUSMA

M512: We really didn't use. In the whole M512 series the only one we did was M518, which is in the supplement. That consisted of using the multipurpose electric furnace. We completed all of the experiments that were associated with that. I enjoyed doing that experiment simply because it was something new and different. The equipment worked as advertised. I thought it worked quite well with the exception of the numbers in the checklist for the maximum temperatures, the times involved in soaking the experiments, heatup, and cooldown didn't agree with what I read. I continued to try to get that piece of information updated so that I could check the programmer but never received that information. The one complaint I had was the checklist numbers, with regard to times, didn't agree with what was really happening on the box. I sure hope somebody knows what was happening because the thing had a mind of its own, did its own thing and did

LOUSMA
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it at a different time than I had expected it might. I got all the samples installed. The little furnace installed very well in the M512 chamber. I installed each set of three cartridges in preferential order. If you were to look at the inlet side of the furnace with the relief valve at the top, the three slots for the cartridges were arranged in a triangular fashion. The slot at 1 or 2 o'clock we'll call A, the one at 6 o'clock B and the one at 10 or 11 o'clock is C. Each one of these three cartridges was numbered and lettered for purposes for troubleshooting. I put the cartridges into those three slots in numeric order first and then I alphabetic order second. For exmaple: if they were numbered 1 Alfa, 2 Bravo and 3 Charlie, they went 1, 2, 3, in those slots. If they were all numbered 11, A, B, C, then 11A went in the first slot I mentioned. That's the way they were installed. It was very clear as to what I should do with each cartridge as far as their program was concerned. The checklist was very clear. I had no problem with it at all. It ran itself. One thing I did notice in putting the cartridges in. I would shake every one very lightly to see if they were loose and I noticed that some of them had some loose inside and some of them did not. When they came out of the furnace they exhibited the same degree of looseness as they did when they went in. It's important to know that

LOUSMA
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whichever ones were loose when they came out were loose when they went in. Maybe something happened in the boost phase or maybe they were made that way. When they came out, they all had heat marking on the outside, the severity of which was dependent on the temperature to which they were exposed. In every case that I can remember, all three in each series had uniform heat marking which was an encouraging find because that implies that all of the furnace slots were working equally well. The event down in the chamber just took a few minutes and it was no problem to repress it. It took less than a minute to repress it, get the door open and start a new experiment. Depressing and repressing the little chamber is no problem at all. The only thing I used the control panel for was to see what the pressure was in the chamber and monitor it. That worked well according to the checklist. Other than that we didn't do anything with the whole M512 series of experiments except to bring home a few items out of the stowage box. That completes the debriefing on the M518 and associated equipment.

BEAN M487: There's nothing to report other than to say we have done 487 a number of times. All the information concerning 487 is in the 487 report. I think it would be appropriate to put some 487 information in our final pilot's report. I recommend that we skip 487 here and let that be a piece of data that stands by itself.

GARRIOTT May I make a comment?

BEAN I wish you would.

GARRIOTT My comment is that M487 should not have their debriefings inflight. I realize that to some extent your memory may not be as sharp and that it is not as immediately handled as it would be with the crew debriefings that were scheduled on orbit. On the other hand you are taking up an unreasonable amount of crew time inflight to go through these discussions. They even asked for roundtable discussions which take three times as long to get the same number of words across, and to me it is just totally unwarranted. I think it would be reasonable to take it out of the inflight schedule and put it in ground debriefings such as this. We could have handled it right now with nearly the same sort of accuracy, perhaps even better, because we have had time for reflection at this point, and are not quite as hurried as we were inflight. My own view is that it should never have been placed there and should be removed from SL-4's inflight debriefings schedule.

LOUSMA Thank you for your comment, Owen.

BEAN M509: The M509 came off real well. The reason it did is because it is one short maneuvering unit. It's got a lot of

BEAN
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capabilities. It's heavy and large. You certainly wouldn't want to build one for use outside that way. But to have one inside to evaluate. It's certainly good. The structure worked out real well; it mounted well. We had no trouble working it. Mounting the gas bottles and putting in the batteries were simple operations. Incidentally, we were worried about the batteries before we launched. We ran battery checks on them and both batteries passed quite easily. I would suggest that Jerry run a check when they first get there to make sure something hasn't happened to those batteries during the meantime. We ran additional checks on battery 6, midway in the mission, because we thought that one time when we used it, it ran down unusually fast. We were afraid we had some degradation. It turned out that we didn't.

Attitude Control: there are three modes. DIRECT, RATE GYRO, CMC. Now the DIRECT is just like DIRECT in the spacecraft. I thought in all honesty that that was the best mode for the simple reason that it required less electronics, it required a minimum of attention to fly it, it was very intuitive. If you put in a pulse to turn left, you didn't have to remember to stop the left turn, it was just intuitive. When you had gone far enough, you would simply put in one to stop it. So it turned out it was quite simple to fly in

BEAN
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DIRECT. I did notice when Owen flew the vehicle, and he did not practice, he had a little more difficulty flying in DIRECT. He didn't as long as he was erect within the workshop, but the minute he got upside down relative to the water tanks and the like, he'd tend to get confused sometimes with whether his rotation needed correction or his translation. Toward the end of the period he had less difficulty in determining which was which. I think that if he had had any work on any simulator at all on the DIRECT mode, or had more time flying DIRECT in just the spacecraft itself, that wouldn't have been a problem. However, I think it is something to think about if we are trying to invent a maneuvering unit where we do not use any simulator but just strap it on the back on the person who is going to fly it.

Flying it up there in DIRECT I thought was the best mode. You use less fuel and it is simple. The next best mode and the simplest mode to fly was the CMG mode; mainly because you translated in the direction you wanted to go, and for attitude control you move the hand controller and the CMGs cause you to rotate. It was a very precise mode. When you let go of the hand control, you held attitude precisely. It was by far the most precise mode that we had of the three.

BEAN
(CONT'D)

The RATE GYRO mode was somewhere in between the two. It required less skill to fly because it always returned to a zero rate or near zero rate when you let go of the hand controller. However, it used a lot of fuel. One time when I was flying around I sneezed, and my goodness, it used up a tremendous amount of fuel. I don't think you would necessarily be doing that thing EVA but I mentioned it only to bring up the point that you use a lot of fuel in the RATE GYRO mode. Also the RATE GYRO mode appeared to me to have deadbands and gains that were unusually tight, and certainly you wouldn't need it. You can be a lot more sloppy up there to save gas than you might want esthetically. Just the same as in the command module when you're flying it, unless you get ready to dock it, you sort of let it drift around. It saves you fuel and it doesn't hurt you. Even though esthetically you might like to make a finer adjustment, there's really no need. If I were building one tomorrow to be used in space, I would build the simplest one that I possibly could with the DIRECT mode only. I'd make sure that I had isolation circuit breakers close at hand, so that in the event of any stuck thruster I could isolate that stuck thruster and still return. The six degrees of freedom which you need in any maneuvering unit, no matter how it is controlled, you could then isolate that thruster. By using

BEAN
(CONT'D)

the other thrusters I could continue to fly the mission or certainly return to your starting place and shuck the maneuvering unit. So I'd simplify the maneuvering unit, make it light, use the maximum amount of propellant, and provide a way to isolate each of the thrusters, both electrically and propellantwise.

We couldn't do each of them from a propellant standpoint; we could only do the whole group from a propellant standpoint. So, if you had a stuck-open thruster, you would really have a problem. I think you'd want to try to figure out a way where you could have four switches with isolation valves so that you could isolate one whole thing as a quad. Something similar to that so that you would still have enough capability left so you could return to base. This would allow you to operate without an umbilical, which is what you really want to do, yet provide some means of safety in case you had either a stuck-on or stuck-off thruster, both electrically and/or mechanically.

The arms were big and I think in a future device you should make it much lighter. You could make the arms nonrigid, where you could actually take the controller, move it out in front of you, hold the controller with your left hand and fly it with your right. Then when you got near the site that

BEAN
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you wanted to work on, just take the controller and set it down. It would be quite easy to do. If you wanted to, you could put both the translation and the rotation controllers on the one box, and just hold it in your left hand and fly it with your right. Or, you could put it on semirigid and fly just as we did 509. When you get to the destination, have them so that you can move them out of the way. I certainly saw no advantage to operating the vehicle with the feet as we will discuss in T020.

One advantage of the controller as it was, it flew just like an airplane, certainly just exactly like the spacecraft. So, intuitively, you could operate both translation/rotation without having to do a lot of mental calculation. In the shirt-sleeve mode, the restraint system was just inadequate. It doesn't hold you rigid to the vehicle. The Kluge that was sent up where you use other straps worked well. I don't know whether the plan is to continue with that. It is certainly adequate for SJ-4. It takes a little longer than something that would be preconceived and sent up there to be changed, but it will do the job. I think the reason is this; there was a feeling before we started flying it, that at zero g, for some reason, you did not have to strap yourself to these vehicles near as tight as you do at one g.

BEAN
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There was a feeling that you could sit on these different pads in the crotch area and it wouldn't bother you as much because you were at zero g. True, it won't bother you at zero g, but at zero g you're not restrained to the vehicle. The minute you start tightening yourself to either 509 or T20 sufficiently so that you're locked in, then you are by necessity pushing yourself down on these restraints. From that you get the feeling, at least in the unsuited mode, that you've got to have padding around the seat area, and you've got to have some straps that hold you in very tight, because you still have your mass in operation. I noticed that after I flew 509 for a few minutes, say 10 minutes, then when I would fire a roll jet, by then the straps would have loosened, and the 509 would rotate and I would not. Then it would run into me and cause me to rotate. It would just bump you, and you felt like you were in a vehicle and you weren't entirely strapped in. Like a bumpy car - without your seat belts holding you to the seats, you tend to bob around a lot. That is uncomfortable and pilots don't like it. You tend to like to feel that you are part of the vehicle. You need to be strapped in rather tight. To do that, you need a system of straps that will do that. I think it is quite easy to figure that out on the ground pre-flight as long as you don't fool yourself, that when you get in

BEAN
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zero g, the straps are going to work and the cushions will feel comfortable. You are going to have to be in there tight at one g and comfortable at one g before you're going to be such at zero g.

Hand held maneuvering unit: It flew pretty much just like we learned to do it up at Denver. I don't believe you could learn to fly it without a six degree of freedom like you had a Denver, because it's just too difficult a thing to learn to do. It's fairly subtle, it's not a bit intuitive, you don't put your hand at the obvious places, you don't fire the thrusters the obvious way. When you first try to do it up in Denver you find that it is extremely difficult. Later on you find that you can do it. I would not recommend using a hand held maneuvering unit. If my boss came up to me and said you are going on this flight I want you to take the hand held maneuvering unit outside and fly it, I'd probably do it. But, if I were the boss thinking about sending someone else outside I wouldn't tell him to do that. I'd say we aren't going to have the maneuvering unit like that. We're going to get one that works right at 6 degrees of freedom. We don't have the weight and strength we did before. If it is a job worth doing, it's worth doing right. If it's a job that needs a maneuvering unit, let's get a good one, so I think we're just whistling

BEAN

Dixie when we do a lot of discussing the hand held maneuvering unit because although you can make it work, it just does not have the capabilities that a unit ought to have. It's a little bit like saying I can learn to ride a unicycle. I could probably use it to ride to work. I think I could and if somebody demanded that I do it, I probably could, but at the same time I don't think it's the sort of vehicle I want to go from home to work. I want a car, or at the least a bicycle. I feel that way about the hand held unit although it was possible to fly. Incidentally suited work in the hand held maneuvering unit was much more difficult than unsuited. For two reasons; one, you couldn't get your hand in the right position all the time. We had learned to accommodate for this in Denver, but more important, there was a lot more thruster and impingment on the suit. Flying it shirt sleeve produced one effect and you put your hand there suited and fired the thruster and you got a much different effect because the suit was larger than your normal body and it tended to deflect the thrusters much more than we had realized. I think this is a change that needs to be made in the simulator up in Denver if Jerry plans to fly it any more. Somehow get the difference between the effect of suited and unsuited put in there. I know at Denver that they had about the same equation for suited and unsuited except for the change in the mass.

BEAN Donning Station: Worked well, no trouble.

BEAN Battery Charge: Nothing.

BEAN Noise level: You could hear it and it was nice to be able to hear the vehicle make thruster noises. You knew when it was firing - you could feel it - but this was an additional cue. I think that you might be able to hear those things in space not quite in the same way you would hear the thumps and you probably get some cues as you fire these different thrusters.

BEAN Stowage and Unstowage: Simple. We did not stow it completely between runs because it took too much time. It's presently stowed up nice and neatly. It should be no trouble for Jerry and them to unstow. I would suspect that they would want to keep it rather loosely stowed between times.

BEAN Photographs: Simple, not much to say there.

BEAN 509 was a good unit. I got the feeling that if we ever want to have a maneuvering unit, we could take parts of this one and make it work right. Discussed a lot in the debriefing were if the ratios between the thrusters were correct and whether translational harmony was right with rotation. I think all of that business is just lost in the noise of whether or not the suit fits you and how the

BEAN
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visibility is out the helmet. In other words, we're operating down in the microscopic level of problems when we really should be addressing the problem of, is the vehicle as light as it can possibly be? Does it have as much gas on it as it can possibly have? Is it strapped to you tightly? It is easy to don and doff? Those to me were much bigger problems than whether or not you had harmony in the control systems. If we had one that operated bad in harmony the man would adapt very quickly to it, whereas if it doesn't fit you properly and hops around you can try adapting all day and you never quite make it. So it seems to me that some of the things that concerned us about airplanes and are very important in airplane parts are going to concern us in the maneuvering units. Maybe one last comment. This was a well-run experiment. I think that Lou Ramon and Ed Whitsett did an awful good job of getting it ready, following it, and making it work.

T020; Foot Control Maneuvering Unit; stowage and unstowage: Fairly simple, although between operations, we tended to leave it kind of casually stowed so it wouldn't take so much time.

Restraint and Harness: Not satisfactory at all with T020. Probably the biggest reason for that was the sudden feeling once again, as I said back again on 509, that in

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zero g you didn't have to strap on as tight. It turns out that's not a fact and now that we experienced one it's fairly easy to realize that. So my comment would be that we want to keep the padding that is on there, maybe take up some additional padding or do some more scientific job of padding the T020 than we did. Also it takes quite a little bit of time to hook up this sort of unusual harness. Although it worked okay, it still takes time away from trying to fly the vehicle. I don't think this is particularly bad, but laying out the time lines this ought to be observed. By the way we put on the additional harness we put on the suit. I'm still not clear myself whether you need to, but I think it an easily established fact on the ground. Merely go over it in one g and put the unit on with the suit tight to see if you're locked in there right for one-g operations. If you are you'll be set for zero g.

Shoe plates: Seem to work well. Once again there is a lot of discussion about whether they ought to be certain heights, or widths, certain toe ends or anything else. The thing I noticed mostly about it, is that you adapt very quickly to any shoe plate position, even suited, it doesn't make any difference. The bad part about it - it is very easily to kick your shoe out of there at any end with the shoe plate

BEAN
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on your foot and not attached to the vehicle. It sort of gives you a helpless feeling if you're flying, because the minute you try to put your foot back in the shoe plate you're going to fire thrusters again. Now it seems to me that even for this usage that we have up there, that they ought to come up with a little bolt or nut or clamp or something so that when Jerry or whoever is flying this gets his shoes in the shoe plates, he tightens them up and then he doesn't stand a chance of shoes plates coming out of their restraints. Just isn't the way to work.

BEAN

Backpack Assembly: Was fit too loose. Needed more straps. Needed the cluge to actually hold the place. I think the biggest problem, besides the fact that there is several big problems with T020, is the fact that you haven't got 6 degrees of freedom. It never came home to me so much as when I was suited up there and every time I'd fly somewhere or even if I had to get there, I had to just hang on until somebody came over there and rescued me and put me back to a new starting position. At no time in T020 can you even do anything as you could in any other maneuvering unit. I would much rather be outside without the maneuvering unit and just a cable or nothing than I would be with T020. You get T020 strapped on you, it's a big rivet down by your feet, it's also

BEAN
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a big one on your back and it's hard to push off in the right direction, you don't know where your c.g.s are any more. You certainly can't fly it any where you want because of the fact that you don't have 6 degrees of freedom. You're just trapped on it. All the time I was on there I felt like I was on the front end of a truck. I could stop and start the truck but I was about helpless as you would be out on the front end of it. In other words, you couldn't get back to steering it too well. You couldn't get any brakes on it. You were always going to go towards your head or your feet. If you happened to end up going sideways, which you did much of the time, you were stuck. You could not fly this vehicle to the middle of the workshop and stop in the middle. You just couldn't do it. Without 6 degrees of freedom, you're stuck. We discussed this long before flight, and said it was bad. I never realized how bad it was until I got up there and tried to go somewhere. You might make it to that point, but once you're there you're stuck. You're not going anywhere else. It is just an unacceptable piece of machinery. That's all there is to it. I think sometimes you're fooled. Because, for example, this piece of machinery was never put on a 6-degrees of freedom simulator up in Denver for various reasons. I think it would have been immediately obvious in Denver because you would have flown

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from one side of the workshop to the other and that would have been it. Somebody would have to reset you. You would have never been able to fly back to the starting point. You're stuck. When you're operating on the air-bearing table, the way it was worked - you always position yourself on where to fly to a certain point, then they would get you from that point and reposition you and fly to another. For some reason, that didn't seem to bother you too much. Once you got up there by yourself like you would be in a real EVA situation, you realized that when you went from point A to B that you were stuck at B for almost forever. You realized how unsatisfactory that thing was. Just a bad concept. Would be like having a car and you didn't have a steering wheel. You had everything going for you, you had brakes and an accelerator, but you couldn't steer the thing. I'm sure it's going to be okay because you're only going to run it on the desert. Even on the desert you might want to go a certain direction; here the same way. You couldn't steer it very well and it just was unacceptable. 2020 is just interesting and should be flown with the idea of trying to decide what part of the control should moved to the feet. Now let me address that problem, if I can. I saw no advantage whatsoever controlling anything with

BEAN
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with your feet. Now I know with your car and airplane you do, and I think there's probably reason to because you have your hands doing other things. For example a car, you need two hands to steer, you'd like to have one hand to shift, you'd like to have another hand to operate the radio or something like that. The maneuvering unit isn't that way. All the time I flew the foot control maneuvering unit, my hands were free. I had nothing to do with them; they were useless. They are probably the most important part of the body except the head maybe and then you're operating this way. There's nothing intuitive about operating the feet if they change it around like they said. They said next time we're going to build one, we're going to make one of them translating a little left foot and the other rotation. It still doesn't give you an advantage. Why not use your hand? I think a much superior arrangement would be to put the hand controller like they are in the spacecraft. Now, someone says now that's too bad, when you get near the object you bump into it. I didn't find that to be true. Even with the big hand controller that we had for 509, if I wanted to come up close to something, I just merely tipped the whole 509 down so that the object I wanted to work with was about 45 degrees between my head and my hands. My hand controllers

BEAN
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didn't give me any problems and neither did my head. Also you could come up with more simply collapsable arms, so that you could keep the arms out and use them. When you are near whatever you're going to hold onto, you take the arms and fold them back. Quite simply you could have done it with this, except thrusters were mounted so that they impinged on the arm and they didn't desire to do that. But I see no advantage, period. No advantage of operating these things with your feet. None.

Backpack Assembly: It looks like you got this thing down by your feet, out of the way, and you don't have anything on your back. Well, you do. You got the big backpack on your back to handle the propellant. In this case you've got a backpack on and something between your legs. It traps you. You can get off the 509 fairly easily. Simply undo the straps right on your chest. This thing is down between your legs and your feet are strapped on. When you're in a suit it's not quite so easy to get off. That's another reason for that sort of trapped feeling.

PSS Propellants: No comment.

Power Umbilicals: The EVA umbilical puts entirely too much torque on both 509 and T020. However, the one with just

BEAN
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oxygen doesn't appear to affect it significantly. There's much more affect caused by the suit fit and the clumsiness that you have within the suit or your ability to fly that there is with either air blowing around the vehicle or from fans inside the workshop. By the way, they had us turn those off when we flew those vehicles. I think we should leave those on. Small potatoes compared to actually operating this maneuvering unit. In fact, if you've got a maneuvering unit that you have to worry about, small air currents, even though there wouldn't be any air currents in EVA, it doesn't have enough controllability or authority. But anyhow, to get back to this. Our recommendation would be: For unsuited, go ahead and use the umbilical if you want. A better arrangement would be to get some comm in there. We did not rework to come up with this. We work it by leaving the oxygen hose and enough electrical connections to make some comm. I think that would be very good thing to have. I wouldn't try to strap the electrical lines against the oxygen cable all the way down or put it in a sleeve. That's just going to make it a stiff cable again. What I would do is take the wiring and then maybe attach it five or six places, maybe every 10 feet, just with a little wrap of tape. That would tend to cut out

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some of the friction that could be found between the umbilical and the electrical wiring. I think that could operate both maneuvering units quite simply with this improved umbilical. The lightweight umbilical works well but you still need an umbilical that will let you have comm in the suited mode. Normally the umbilical puts too much torque in to check the M509 and T020 vehicles out. However, the new one with O₂ and just a couple of comm wires should do the job satisfactorily. My recommendation would be to modify the umbilical that remains up there, the one that we used for our first EVA, take out everything but the O₂ line and the two comm electrical lines and run that way.

Donning and doffing: It takes time and once it's on, it's pretty good. Head and ear protection: I think that you need ear protection. I don't think it hurts to have ear protection - the universal ear protection, those little plastic earplugs that are very nice. You certainly need eye protection. The operator needs that protection, but even more than that, the observer does because a lot of times he'll come up near you and you'll be firing a jet and it'll zap him. If he doesn't have his eye protection on it could be a problem. With his eye protection, not much. Short sleeves versus suited, we've talked about. The most - the things you notice most is the the sloppiness that you fit on there unless you

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along the new cluge harness arrangement. Suited sould fit on pretty tight. One thing I think could improve this whole vehicle is that they come up with the rig that would rigidize the backpack to the seat - to the bottom unit. As it is now, you provide the rigidity and you just don't like to be that rigid in zero g. You sort of like to ride it like you might ride a horse with some flexibility. The minute you try to ride this with any flexibility, you soon find that that you're going to have c.g. changes and thruster changes. Although I couldn't ever isolate them, I'm sure they were occurring.

BEAN

Maneuverability: Poor. You've only got maneuverability fore and aft and if you suddenly discover you have any side motion or forward and aft motion, you're stuck. The problem is simple. Let's say, for example, you are slowly drifting forward and want to stop, because if you continue to drift forward to the site you'll miss it. Then you pitch up - you're very active pitching up, fire thrusters that increase the rate of forward translation. Then you get up to where you can stop your forward translation, your feet are now facing the former direction you were facing. You thrust up forward to stop. The minute you thrust upward you have stopped the forward translation but you introduced some translation as you pitched up. Now you've introduced

BEAN
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translation when you came to a stop before you fired forward and also in those two maneuvers as rotations to get into position. If you made any lateral thrust that you didn't plan, neither forward or aft, up or down, but laterally, then you've got that to take out. Which means immediately you're saying, well I stopped the forward translation and I'm still heading toward the target, I think, but I can't see it any more but now I've got some lateral translation to take out. The whole point of the thing is you haven't got it with this degree of freedom. Forget it. It'd be dangerous. It's hairy. It's unacceptable. We can afford to build a machine you can maneuver in all directions. At no time are you under control with this vehicle. You cannot fly to the center of the workshop and stop. You just can't do it. You can do that in any mode in 509. This is just an unacceptable maneuverability capability. The tasks that was invented were simple. The tasks were to hold you somewhere and then you fly across and stop, and that's it. Or fly across and grab something before you float away. Sometimes you can do it and sometimes you couldn't. A lot of it depended on luck. A lot of it depended on how much time you wanted to take with your initial alignment, so that you knew that your thrust would lead you right to the target. You know that you can't count on something like that and you need true EVA operation.

HOMICK There were three questions. Goggle fogging, which I don't know if you mentioned in the report, and restraints, and communications. Doc submitted these to me after you were on your way back.

BEAN Let's talk about the goggle fogging. Owen was the only one that noticed much goggle fogging. I did notice that when I first used them they tended to steam up. I don't know whether I put them on tighter or put them on more loosely, but after the first time, they did not steam up. I had no problem with the goggles. I think it's important to wear the goggles if you possibly can. If you're troubled with steaming you can ask the observer to take your goggles over and put some anti-fog compound on them from the kit which is hanging on the wall there for EVA. My guess is you can find some way to put them on where they won't fog.

GARRIOTT I tried them both loose and as tight as I could get them. I still don't know what caused them to fog. They fogged up so badly that I could not see out, I simply could not have used them.

LOUSMA It may have had a lot to do with the temperature and the humidity.

GARRIOTT Those steamed up on each side of the eye.

LOUSMA I found the goggles were uncomfortable to wear for any long period of time.

LOUSMA You sure do want to use them. You can really get your eyeball clobbered if you don't have them on. I can't say that's true with earplugs though.

BEAN What were the other questions?

BEAN We commented so many times on restraints. To sum it all up, you need to have those additional straps as restraints when you're unsuited. When you're suited, I'm not sure that the rigidity of the suit and the sizing of the present straps doesn't do the job, provided when you tighten them up, you tie a knot in the straps. The straps are made out of rather thin webbing. Even if you get the vehicle on you tight after it has fired a few times and jiggled, your straps will loosen up quite a bit. You can prevent this by tying them in a knot. Pull them up tight and tie a knot in the straps adjacent to the point where it slips through the buckle.

LOUSMA Communications is the only other question.

BEAN You definitely need communications with 509 when you're suited. You could easily get away with using the non-communications umbilical, the one that is up there now, when

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you're flying in shirt sleeve. The observer can holler at you and you can holler at him. It's quite simple. Once you get inside the suit without communications you are really out of business. You can't hear him and he can't hear you. Many times you don't see each other because you're displaced from one another in orientation. It just makes it difficult. I would highly recommend that SL-4 go up there and somehow modify one of the umbilicals that remains over to an umbilical that feeds oxygen alone plus whatever it takes to have two-way command get rid of all the rest. I suspect that this could be done by just selecting the right wires out of the wire bundle and discarding the rest. It's something worth doing. At the same time you do that you're going to have to modify the plug or take along some sort of jumper plug that allows you to plug into all the power connectors yet it will deface the ones that have already been cut and only leave the ones with power on, the ones you need for comm.

LOUSMA

S009 nuclear emulsion is the next one. We didn't do that experiment, although I was trained to replace the motor. We took a motor along and I was never scheduled to change it for some reason so we had the procedures and the training but we never used them. So right now it's sitting up there just the way it was left from the first mission.

LOUSMA

Skip S015. S019: We did have that. We used two film cassettes. One of them quit working. It seemed like it came at the end of the film, but it was too early for that. We went through the malfunctions procedure and were unable to change its status so we just brought it back. I won't be surprised to find it used up all the film. The problem with getting S019 in and out was very well documented and we got it back in. Al adjusted the chain drive on it and it worked good thereafter with no problems at all. Although we would suggest that when you're extending the mirror and bringing it back in, when you get to the end of the 13 turns you don't let it hit against the stop. Move into it very gently, count your number of turns, and on the last one ease it into the back position full extended or full retracted. S019 was a pleasure to handle up there compared to on the ground. You just let it float if you have something else to do with your hands and it's handling any other big package up there. It's a pleasure to do it because it's just so easy. The S019 pads are pretty self-explanatory. I think more often than not we had to make the Nu_Z correction. Make sure you get a Nu_Z update prior and make sure the dump has been inhibited.

BEAN One time we did make a run without the dump being inhibited. The ground blew it but I think we should have checked it also.

LOUSMA You have to be careful and make sure the ground inhibits the dump. The pads are very crowded; you have to start right on the money, so you better be ready to go or you're not going to get it finished. We enjoyed working S019. We've believe we compiled a lot of good data. Since S073/T027 went away we had a lot of opportunity to use S019.

BEAN I think one of the things that helps you operate it better is never to use locks on the shaft, rotation, or the extension. Just take those locks and remove them. Put them in the unlocked position. There's no when tendency for those things to drift. That's why when you're changing rotation and tilt or changing extension, you don't have to have that added amount of time to unlock it, move it, and lock it. Just unlock it and leave them unlocked the whole time. Nothing moves, nothing tends to drift, and you get just as good pictures as you would otherwise. Karl's comment initially not to touch the S019 while you're taking data is a good one. We didn't have any trouble that way. I noticed a lot of difference between operating the controls for S019 on one of those caristers and the other. One of them operated quite

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easily when you went to carriage retract and the other one was quite stiff. According to Karl and the ground, that's just the way they are. They're not all the same.

LOUSMA

On one the the rotation dials, the luminescence has come out a couple of the digits but you can see the impression that is left. Don't be surprised when you have to look hard to see a couple of digits.

BEAN

One of the questions we had was, we'd come up on the comm and start doing S019 a lot of times somebody would be at the window doing T002 and you could do those intermixed with one another. Another thing we wondered, to get proper timing, if you had to keep the recorder on all the time during the long exposure. The answer to that is no. All you have to do is be in record when you open the shutter. You can shut it down and go do whatever else you want to do and when it is time to turn off the exposure, turn the recorder back on. And in comm again, give them a mark. If you forget and accidentally run an exposure too long or you have to close it down too early, remember the main thing is to get marks at opening and closing. They can take the data and change it as a result of the exposure length. If you can't hit a 90-second exposure for some reason and you have to go

BEAN
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at 60, be sure you mention it. Be sure you give the marks when you start, even if it's 58. You can mark it zero and mark it 58 and it's usable. You try to hit the right numbers but every once in a while you don't and if you don't just be sure and give good marks and the data remains usable.

LOUSMA

The widening device on S019 times out too soon. For example, a 90-second widening exposure using S019 is about 72 seconds. It's not a full 90 seconds on your watch but Karl wants you to use the values on the widening mechanism for his 270, 90, and 30-second exposure. If you came up with an unwidened exposure, he wants you to do that one on your watch. That's the mode of operation he prefers.

BEAN

You'll find out that you don't exactly get the right number of seconds on your watch either. It takes a hand or two to open the shutter and at the same time you're supposed to be punching the watch, which happens to be on your other wrist, so you have to get a technique where you open the shutter and then count to yourself and punch the sweep second hand on your watch. You can let it sweep through zero but if you wait too long, you'll find that you are using up time that you don't have. You may not finish all of your exposure. You go ahead and close the shutter when the second

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hand it that number of seconds less than the total number of seconds than they called for in the pad. It takes a little bit of technique to do it.

LOUSMA

We always used the comm carriers, the same as you use in the suit for doing the recording at the minus-Z SAL and then we found that we you got the best fidelity and it didn't slip off your head. We never used the lightweight headset. We had one of those permanently set up there at minus-Z SAL and if you want to use it for T002, you just reached up through the whole in the ceiling and brought it down through the hole and used it down into wardroom. You didn't have to unplug it and bring it down to wardroom. We had the same setup for EREP where wer left two of them hooked up, one on the intercom box number 102, right in front of C&D panel, and the other one was hooked up to the intercom next to the ATM panel. We left those headsets and cables hooked up permanently there. That is where we left them when we departed so it would be all set up for SL-4 to use.

BEAN

A good trick for any of that is when you put your headset on and turn the intercom switch to push-to-talk is to turn the other switch on the box to the channel you think you are

transmitting on, and give yourself a comm check. You can hear yourself if it's working. It's sometimes possible to have your headset on and think you're talking - your record light is on and you've actually thrown the switch that works with the speaker but you're on the headset. You want to give yourself a closed loop test before you start any long term data recording.

LOUSMA Another neat little trick the ground sometimes pulls on you, is you might be recording something for 509 or S019 and they'll want to dump the tape recorders. If you're lucky enough to find out they're going to do it, or remember they are going to do it, you can stop in the middle. Sometimes you look over there and the green light isn't on. That's a coordination problem that the ground needs to continually be aware of. Check with them whenever you think they might. Make sure you keep the tape recorder particularly for S019 where you need to give those marks on time.

BEAN Another point. We noticed in some of our canisters. The film hatch would leak the vacuum. You close the film hatch when there is still a vacuum on the experiment. That means there is a vacuum behind the hatch. When you put the cover on everything is hunky-dory. Now it sits in the film vault

BEAN
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and the vacuum inside of the film hatch area is some of the air that's between the canister cover. The canister sort of leaks into that area when it does you can't get the cover off. It's simple to fix. You get the depress fitting and put it on the canister cover, let it depress, take off the cover and then you are back in business. It doesn't leak the vacuum out completely. And your film hatch is still held close. I assume your film is still in pretty good shape. It's just a small leak, but it still prevents you from taking off the canister cover sometimes.

LOUSMA

We should make a couple comments on the operation of the SAL. It works normally. It takes a long time to press and depress so you ought to give it some lead time. It takes a long time to depress, maybe 5 minutes or more. It takes more time than you really want to spend on it, so give yourself some lead time on setting anything up in the SAL. Give yourself plenty of depress time from 5 down to zero psi. It never failed to leak check. All leak checks work perfect. SO20 we did not do.

BEAN

Which one did we do out in the air that one time in a cluge configuration?

LOUSMA

That was T025.

BFAN S020 - I fit the EVA brackets on it, and it fit real well. That's what I did. I received a request from the ground on S020 to fit the EVA bracket on it. It worked well, it fit properly and we took them back off and put it in the box. I'm not sure that's not the one I also put the sticker on. It was either that one or T025. In any event both S020 and T025 fit, the stickers worked and it looks like it's going to be a good thing to do EVA .

GARRIOTT S063: There is now an adaptor that gets between the AMS and the S063 window and that adaptor had eight lugs around the edge. One of those lugs has come unscrewed, and the bolt itself is gone. It unscrewed in zero g and disappeared. We never found it up against the intake duct. It doesn't need all eight and this is reported down on channel A. We better make sure that the replacement gets sent up on SL-4. Stowage and unstowage all went as planned. Everything is right where it's supposed to be and it works well enough. It just takes a little bit of time. The filter stowage is very bad over here in the trainer. The location of the twin filter stowage is underneath a lid that you can hardly see. And sure enough, in zero g it's still underneath the lid where you can't see it because of the lighting. You are

GARRIOTT
(CONT'D)

looking up into a black hole with bright lights all around the edge. It makes it difficult but still it can be done. The filters are all in good condition, both the twin filters and the single filters. There was a problem in one case with a timer malfunctioning. We never really sorted out whether or not it was a legitimate malfunction or whether I might have had the motor drive switch on the back of the camera slightly out of configuration. I did manage to reproduce the malfunction on an intermittent basis later on without any film in the camera. I think at least part of the problems were associated with hardware and the other 75 percent were generated by myself. We should have gone up there with more 2485 film. We had three rolls for the experiment and one left over for general use. We used all four rolls for the experiment. Various malfunctions ended up wasting about one roll. I wasted 10 frames, for example, on the end of one where it triggered off automatically and a few things like that. All of these things have been documented on the down-link. So there is no point in repeating it here. The setup in stowage and unstowage is all nominal just the way the training program runs and the times allotted for it are probably about right. The film magazine is just a normal 35-millimeter cassette. There is no log book other than the standard photo log. You put the information on the voice tape recorder. The only comment I would

GARRIOTT
(CONT'D)

have is take up enough 2485 film, and let's get another Nikon camera frame so that 2485 film can be used for targets of opportunity, like aurora and also cities at night, which are unrelated, of course, to S063. We haven't seen how the aurora photography came out on this flight. If it doesn't come out well, we will have missed a great opportunity. I say an unparalleled opportunity, one that we will probably not have another chance for in I don't know how many more years, maybe decades. All because of the fact that we didn't have that camera frame and 2485 film available. Other than that, S063 procedures ran reasonably well. The tracking tasks are reasonable, although you really have to hurry to get in those two photos on the same target. We need to practice that a little bit with OJT. If there is adequate film you ought to go ahead and try to expose the film at the same time. It is a difficult task to do two on the same target. I don't think I have any other comments on S063.

BEAN You mentioned earlier that you thought there might be a way to modify that and put it in the wardroom window do some other things. Do you still feel that way?

GARRIOTT I think you are talking now about nighttime photography of cities. A better way to do it is with a 2485 film so that you don't have to track it for long intervals. We were only

GARRIOTT
(CONT'D)

considering trying to track it because of the unavailability of 2485 film.

BEAN

SO73/T027: I think that was one of the biggest mistakes we made on the flight. Of actually taking that experiment and sticking it outside when we were not sure that it was working correctly. We could have easily kept that inside, extended it and run all the different programs to see what was going to go on with that motor. It's a shame that we had to jettison that, although we took some pictures of jettisoning. It seemed to me that this was not done correctly. Maybe that's what happens at the first of a mission when everybody is trying to get up to speed and get organized. Something slipped down the crack and I feel that this was one that did. If that had come up later in the mission we would have been much more careful, and considerate, and that wouldn't have occurred. We would have kept it in there and not had a problem. We would have tied it or not maneuvered it or something. We didn't do that right. I don't have any more to add to that, other than to say I wish we had done that differently.

Sl49: That was a EVA rig and we took it out on the first EVA. We brought one in at the end of the first day, didn't we Owen?

GARRIOTT No, on the second EVA we just folded it up and temporarily stowed it.

BEAN Well, we ended up bringing home two of them.

We brought in one sometime, and we brought in the second one on the last EVA. We came home with two sets, or a total of eight. It's a very straightforward experiment. All you had to do was mount it inside, carry it out, extend the panels, let them enjoy the Sun for a while, fold them up and bring them in. I thought we took good care of it. The first one we brought in from the deployment area, which was the minus-Z SAL, on E027. When we first got there we brought that item in and stowed it. That went well. When we went EVA next time, the plan had always been to take it out on the sunny side.

As you recall, when we flew up there it was sticking out the minus-Z SAL.

GARRIOTT Closed.

BEAN We took it out. It was easy to deploy, and it was a set of hardware that was invented at the last minute. I don't think it bothered the ATM experiments, at least we didn't think it did. And certainly didn't bother any of the ones that we

BEAN
(CONT'D)

could see, like the XUV MON, the H-alpha, or the WLC. The recovery was quite simple. I think one of the best things was the total design of 119. I assume that SL-4 crew is going to move that out there and let it stay out for a while. But I don't know.

GARRIOTT I don't know what their plans are.

BEAN I don't either. One thing to be careful about is once you bring those back in, they all look the same. It's important to mark the box that housed the exposed cassettes so you won't bring back one that has not been exposed.

SI83: We did that several times but we did it with a camera. Now that was fairly interesting to do because you were moving heavy objects around. It was simple. We ended up taking a lot of M151 data on it. We would set it up with M151, we would tear it down with M151 the same day. We did this for about 3 days in a row. We had the feeling that the M151/183 people had all sorts of film. The first time I ran it I felt that I did not have the onboard data system configured properly to get the data. I found out later that we were over a station real time, so it came out real well. Later on we ran it correctly - Jack ran it also - using just the motion picture film for it. I don't know what kind of data you can get from that. We were worried that the film

BEAN
(CONT'D)

itself would not - you couldn't hear the can 16-millimeter run nor could we see the little green light. We finally decided through a test, just pulling it off and looking at it, as we went through a simulated run, that indeed the frame was opening and closing correctly and that we probably are going to get some good data. That experiment operates on its own but you have a difficult time telling whether it's operating correctly or not. On S019, you open and close the shutter so you know when you did it; on that one you sort of hope that it's working correctly. All indications lead us now to believe that it is. We used a lot of different cameras because there was a desire to ensure that we had one that operated properly. On the SL-2 mission that thing hadn't worked correctly, and it looked to us like all these DACs worked properly, once we discovered how you could establish whether they did or not mainly taking them off and having them exposed.

T003 Inflight Aerosol Analysis: I thought that was relatively straightforward. The one thing that I worried about was on those cards. It wasn't always obvious what had occurred beforehand. Maybe when we did a T003 somebody had just washed his face and got all sorts of water around, or maybe next time they did a T003, with the same number, nobody washed for a couple of hours and the data was real low. In addition

BEAN
(CONT'D)

to having a minimum of places to write information on those cards and I just hope that the data is reducible to something that's meaningful. My proposal would be that the next crew use every other line when they mark down the data. There's plenty of cards up there - use one line for each data take, put down any significant observations that could be made, and I believe the data would come back a lot more meaningful than it is at the moment. You'd have a much better understanding of why you got some of those readings instead of just saying, "Funny, last time I did it I got a much different reading." We noticed that we did not do T003 sometimes when the schedule was buried in our detailed flight plan and was not on the general schedule. I would recommend that T003 always be marked on the general schedule with some comments over in the details. Realize that you will miss some of these because they are not as noticeable as something like ATM. If you don't do the ATM, somebody will tell you about it. How about T002, Jack?

LOUSMA

T002 Manual Nav Sightings: The stowage and unstowage was good. It was nice to have it located right by the window. I sued two batteries for the sextant. The reason they wore out was because I inadvertantly left the light on when I stowed it. They don't last very long. It's easy to do

LOUSMA
(CONT'D)

because it is a dim light. There are a couple of batteries that I left up there. It's really not necessary to have a light in it, you can use your flashlight. It's convenient to have the battery operational in it. I didn't always use the hood, but I always used the hood when it was necessary to bring a star down to the Earth horizon. You need to have as much dimming as you can get. If one of the other guys wanted the lights on upstairs then I would use the hood. You can get by with turning the lights down for doing the star to star, or star to Moon, or Moon to Moon. Those all worked good. The star charts were adequate for doing the job. As it turns out you can't see a much out that wardroom window as you would think you might be able to, because of the angles involved in looking around the sill. Whatever you look at has to be directly out the window. I'll just summarize this information quickly, because it's all been on channel A. That's where the debriefing ought to come from for the Follow-on crew. The training folks should have this information. If you get the wrong beta angle, the horizon isn't going to be in the field of view where you can use it for several days. The folks on the ground have to plan that for you. Sometimes the Moon that you're using is off at such angle that you can't get at it with the sextant. It has to be out of the front of the window. I noticed that the sextant gathers a lot more

LOUSMA
(CONT'D)

light than your naked eye does. It's difficult to locate your star fields in some cases for that very reason. You see a lot more through the sextant than you see with your naked eye. When you are looking for certain landmarks which you picked up with your naked eye and you are looking for them through the sextant, you can't find them because it's obliterated by all the other landmarks that you can see through the sextant that you can't see with your naked eye. That was a problem at times. The learning curve helps you a lot because as you look at a particular set of stars more and more through the sextant you get more acquainted with what you are actually looking for. It's easier as time goes on to identify them. You better give yourself plenty of time at first to orient yourself. The Earth horizon is very difficult to find. You really need to get the light down. You can't find it until you are well into the darkness period and you don't have it up to the end of the darkness period. It's obscured each end of the darkness period. If you have 30 minutes of darkness, maybe the total night horizon will be available for only 15 or 20 minutes. It's difficult to find. It's easier to find the airglow horizon. If somebody could figure out a way to use it instead of the Earth horizon, I think manual navigation sightings at night would be easier and more accurate. The stadimeter is only good in the center

LOUSMA
(CONT'D)

of the daylight pass. It is not useful for the entire daylight range. You'll want to use some filters when you're using the Moon because it will obliterate the star you are trying to put on its limb. You want the light of the Moon way down. I made a lot of other comments on channel A. There is a lot of T002. They don't accept the idea of doing two sightings during one period. Give them their 15 stars and don't give them 30 because it doesn't count twice. I use channel A all the time. I used the headset from the minus-Z SAL squawk box. I used the minus-Z SAL squawk box for making my marks. They all have to be time recorded except for the star to star ones. It's easier to put them on channel A, even for the star to star, although you could write those down. Make sure you have the window cover off. You'll know that the window cover isn't off because of the fouled-up zero bias settings that you get.

BEAN

T013: The stowage and unstowage was simple and straightforward. No comments. The suit fit well. No remarks there. The problem that we had with T013 was trying to get a run where the data recorder was on at the same time that the force measuring units, FMUs, were working. We ran that thing several times and were never completely satisfied with finding out what the results were. We would ask them how it went and the answer would be, "Well, we didn't get any data."

BEAN
(CONT'D)

We would say, "Well, why didn't you?" The answer was "Well, we had data up until you did the first pushoff." The question is what happened between the time that we did the first pushoff and the time we did the last count? We troubleshot that thing for a while and I think they finally decided a couple of the units weren't working right on FMU 2. I don't know what the plan is for this experiment on SL-4. It's in the same shape that it was when we ran it. They should be careful about repeating anything over and over again because there's no data. Without trying to figure out exactly why it seems to me that there is probably something fundamentally wrong with the wiring of the equipment that prevents you from getting the data. I had no other comments about that experiment other than it's easy to run, it's easy to rig out, and the cameras are easy to put in position and it is quite easy to move back and forth between the FMUs. I thought that was going to be one hard thing pre-flight but it turned out to be one of the easier. Those things could be all the way across the workshop from one another and you would probably get better data and in addition to that it would be just as easy to soar from one to another. They are so close that when you soar from one to the other you don't have much time to turn around and land feet to feet. You can when you are doing the maximum disturbance where Owen would

BEAN
(CONT'D)

set up the ATM on SI, pick out a point on the Sun put it on TV and Jack would soar between the food lockers and the lockers next to the film vault. I assumed that it moved the spacecraft around quite a bit. It is easy to time those both at pushoff time or time it so that you hit at the same time. It is important to decided what you are going to do for each case. You should try some pushoffs at the same time when you land at different times because the distance is different. You should try some others where you push off at different times but land at the same time. Also you should do some maneuvers here that are typical of what you really do at zero g. This means you don't push off too hard and it is probably not measureable on the equipment. You can do maximum efforts and you can do typical ones. It is important to let ground know on the tape which one you doing so they can use the data.

LOUSMA

The observer's job wasn't too tough. You can't go between the film wall and food locker. You have to go between the food locker and the lockers next to the film vault

T025: We didn't do a T025, although we used T025 hardware one time to do some gegenschein and zodiacal light photography. We installed T025 upside down in the airlock as requested and moved the occulting disk out of the way. The

LOUSMA
(CONT'D)

T025 hookup with the extention rod worked very well. If you - use that technique, make sure you get the DAC pushbutton cable hooked up. I only did it one time and I used my finger on the back of the camera. It is inconvenient to have to stand here for a long time. We hooked up the pushbutton cable and had it ready but they never asked us to do it again. I think your chances of ripping off extra exposures are less also by using that cable. The T025 hardware used to perform photograph at night worked per the checklist. If you get to do some T025 using that equipment, I think you will find that it works quite adequately. Another thing, on T025, the first thing left off in the procedures was to turn off the fire sensors. So the first thing that happened when I open the SAL was to fire off the siren.

End of section 14.4

14.5 EDUCATIONAL EXPERIMENTS

GARRIOTT ED11, Heat absorption: I don't know if we did that unless you fellows did it on EREP.

ED21, Libration Clouds: We wouldn't know about. I don't think we had a chance for it on our flight.

ED22, Objects in Mercury orbit: That's all tied up in the S052 data.

ED23, Quasars: That would have been tied up in S019.

ED25, X-Ray: We didn't get anything from Jupiter. We did look at it. We've one JJP 13 and I presume that the student will participate in possible interpretation of the film that comes back on S054 and S056.

ED26, UV from pulsars: That will be on S019 if it's there at all.

ED31, Bacteria and Spores: We didn't do.

ED32, In-vitro immunology: The little agar plates were inoculated and the growth of the rings in the immunized plates or in the injected plates were observed and photographs have been returned. I have not seen the developed prints but I hope there will be some useful information derived from it.

GARRIOTT
(CONT'D)

Now the agar tended to crack. I think it dried out in this very dry atmosphere and I'm not sure whether or not the agar behaved the way the people at Marshall and the student experimenter expected. Some additional testing would have been appropriate with those agar plates. Some additional assurance that there would be no gap develop between the artery and the little cellophane cover would have been a help. In some cases, it may have been that some of the antigen which was injected slipped between the little plastic cover and the agar which would mess up the ring growth, or the reaction ring growth. Some of those are going to show rings and there will be some of that information that is decipherable. The photographs were taken at intervals to show the growth of the ring.

ED41, Motor Sensory performance: We didn't do that on our flight.

ED52, Web formation: We have a lot of data on that. We have more data than contemplated in terms of photographs. But the actual time-lapse photography with the automatic trigger did not function. I went through the malfunction procedures and never managed to get it to work. The sensors apparently are completely broken. You can never get those sensors to trip. I think it would be worth considering on SL-4 to take an intervalometer.

GARRIOTT
(CONT'D)

All you need is an intervalometer to turn the lights on and take a few frames about every minute or 2 and let it run for several nights. I'm sure you would get the pictures of the construction of a web. We did not get the construction photography because the electronic box failed. We did get both spiders making webs and all of that is documented in still photography.

ED63, Cytoplasmic Streaming: We attempted that and I really cannot say I ever saw any streaming. It was performed here on Earth several times, so I believe I know what to look for and the hardware seems to work well. The little bottles when they were opened already had a faintly sulfurous odor. I assume that the plants were already dead at the time when the bottles with the plants were opened. You might want to do that one again on SL-4. I would spend extra time making sure you have a viable organism in that bottle and adequate plans for keeping the plant alive after it's in orbit.

ED72, Capillary study: We didn't do.

ED74, Moss measurement: We did it a couple of times and it works nicely.

ED76, Neutron analysis: That is in work at the moment. The sensors were all placed there by SL-2 and I guess SL-4 will bring them back.

GARRIOTT
(CONT'D)

ED78, Liquid motion: That thing apparently just failed. We took it apart to the point where we could unscrew it and see that the pressure had been released and the liquid was beginning to ooze out around the large nut which holds the two sections together. I think the pressure had already been released. We were never able to insert that screwdriver and repressurize the system as it should have been. There may have been a little diaphragm on one end. I'm not certain what the construction looked like but it looked as if diaphragm had already been broken. I would like to have the design explained to me by somebody who is familiar with the ED78 experiment. Then maybe we can provide a little extra information about just how it malfunctioned. Unfortunately, it never worked right. As far as experimental objectives are concerned, if the student is interested in the study of precession modes of liquid bubbles in zero g, our science demonstrations will give him adequate materials to study, even though the hardware for ED78 did not work correctly.

15.0 TRAINING

BEAN Crew station: Good.

BEAN Fidelity: I thought was good.

GARRIOTT Availability: There is one funny that popped up in our optics. It's about the only thing happened funny that never showed up in our training. We should find out what happened to our optics and see if we can't demonstrate that in the CMS.

BEAN That's a good point. The one thing that gave us the funny optics readings should be determined. That information is available from our conversations during rendezvous, and it should be checked out in the CSM. The only comment I have about availability is right at the last 3 weeks with the CSM. We had a doggone poor availability. We ended up during some of the sims not having the machinery run right. We had to cancel one and maybe more, I can't recall now, because the CSM just wouldn't perform. It performed pretty well earlier. I think Dave Scruggs made the comment once, it always performed when the chips were down. The chips weren't down and so it wasn't doing so great. Later on when the chips were down, it did better. It didn't hurt us because we were already trained, but still it is a shame. Anything else about the CMS?

LOUSMA The CM thruster noise is a lot louder than it turned out to be during actual entry. Sometimes it is so loud in there you can't hear anybody over the intercom, but we never had any trouble with communications at all. It's more like a little bump.

BEAN I think one of the best things that occurred later, on the mission is they got the out-the-window visual display correct so that we can use it for entry. They knew on one entry we were going to have to use out the window. They got it just right. I think this was great. Also that day they fixed it where it never went into night. It always had the day horizon. In my opinion, that's the way we - we should run the CMS all the time, just like it's in the daytime with a day horizon. If it's at night, you're just going to have to remember in flight to turn it down, at least you got a horizon. That occulting disk never quite works right. And certainly, if you just had something that you could practice with, it's better than nothing. My recommendation would be that you get that out-the-window horizon correct and just turn down so that the horizon is on all daytime.

LOUSMA One thing they don't have in there is a night terminator horizon. The terminator horizon is what goofs up your attitude recognition out the window on the first burn. That's another

LOUSMA
(CONT'D)

reason for leaving the day one in there all the time. When you get to that occulted night, you don't even see it half the time because you got this terminator coming forward. I think the correction for that terminator should just be on your checklist. It'll say in the checklist with the little picture, 3 minutes prior to burn, terminator on the 20-degree horizon mark, horizon on the 30-degree mark or something like that. Then you'll have them both. Just ignoring the existence of it is not a good idea.

LOUSMA Skylab simulator: I think we mentioned a few items on the ATM video with regard to the S052 on our earlier debriefing.

GARRIOTT You thought the resolution was too high in the simulator?

LOUSMA Yes, it's a more grainy picture in the real world.

GARRIOTT 82B white light slit has a much wider line in the spacecraft than it does in the simulator. And also we can see sunspots much more clearly in the simulator than we can in the spacecraft.

LOUSMA Flares come through better in the real bird, than they do in the simulator.

GARRIOTT Yes, that's true.

LOUSMA I don't know if anybody ever mentioned the two CMG gimble angles read-out that are off-scale low in the real bird as

LOUSMA
(CONT'D)

compared to the simulator. They should be corrected. I'm sure that they got all these corrections up to date. The way it really turned out, I guess, it's good to have all that system training, but it seems to me like we're a little over trained in systems compared to what we really had to do in the real bird. We never had to worry about the system. We had enough information to handle the problem and from that standpoint, it was good to have gotten all that training on systems and simulator, but we seldom have ever put it to any practical use because all that stuff is worked by the ground.

BEAN

They should concentrate on doing ATM work and doing a little concentration on CMG problems or subthrusters or something like that.

GARRIOTT

CMGs? We didn't do a thing with them.

BEAN

I know it, but I think you should be ready in case you had to.

LOUSMA

I guess I'd suggest a downplay in ECS AND EPS, for more work on ATM, and attitude control

BEAN

The same thing with rapid DELTA-P. I don't think you need a lot on that either. I would tend to concentrate on the ATM and that's about it.

LOUSMA I thought it was good fidelity. The fact that the SLS did not look exactly as the spacecraft looked was of no consequences. The geometric location had no effect. I think the SLS was set up well in the past and all but all those concerns we had about the real one really didn't matter too much.

BEAN TRAINERS/lg.

LOUSMA OWS: I know was wondering if I'd have a funny feeling about walking on the OWS like I was in the real world again. But there's enough different about it to make me feel that I'm back in a trainer as opposed to being in a real one. I think maybe the tint of the paints are a little different.

GARRIOTT I thought it was pretty close. Looked like home to me.

LOUSMA Yes, but some of the things that are stored are not quite in the same places.

LOUSMA The big gray machine in the middle, and the red stuff all over the deck tends to make you think that there's something a little bit different about this one and the real one. I didn't have any flashbacks. On fidelity, I thought those guys did an outstanding job on all the trainers.

BEAN

I would recommend that they do look at the TV that we sent them and also the pictures, and get the simulator over here configured like orbit operations. The cameras out. The straps out. A little less neat than it is over there. I noticed that when we were over there last week, it was a little less neat. They had cameras and some spotmeters out. That's a step in the right direction. Get the equipment out and about, into the places where you used it. Make the system pretty much like you use day to day, instead of it all put away nice and neat like it - like it should be in the classic case there never is in real life. You should get out those little tape players and hang up on the ceiling and have a little music when they're working. Just try to get it in the configuration.

LOUSMA

They're working on that though because, if you go over there, you'll noticed that they got the little springs on the food locker doors just like we had in flight.

GARRIOTT

Another thing that I was going to suggest for Ed, Bill or maybe Jerry, if he doesn't feel too comfortable about all the storage locations. I was the lowest on our crew in terms of knowing where anything was by some significant margin. And I would have found it beneficial now to have taken an hour on maybe three occasions to take your trainer experts

GARRIOTT
(CONT'D)

and simply walk around the workshop and say, what's in there and there until you get a general survey as to where every thing is located. Most of the things are labeled but not everything is and some of them have been changed. Know where the food is and know what you got in the food locker that no longer has any food in them. Know where you find the sleep restraints. Know where you find all the tools. Know where you find the spotmeters, cameras DACs, film, and all that sort of stuff. Most of those things I know now and about half of those things I knew 2 months ago. It will save that Learning curve if you spend a little more time on the storage.

LOUSMA

I think one thing that the trainers don't give you the right feel for is the EREP, which we mentioned before. There's no way to put the whole EREP together. It works out better in the real bird. One thing that I neglected to mention in the tape recorder change-out is that when you do it in training, you take that little septum out and stick it in the little slot that is made for it in the tape recorder cover. Don't ever do that in real life because what is going to happen is you are accidentally going to bump that little septum and it's going to go floating off somewhere and you'll never find it. The smart thing to do is to put it in your pocket when you take it out of there. Then you know exactly where it is. Otherwise, it's going to get away. We found

LOUSMA
(CONT'D)

that happened a lot up there. Things seem to just disappear very easy. Usually they show up in a day or two but sometimes that isn't soon enough.

BEAN

One other thing that I think gives a slightly different feel is how easy it is to move around in that total forward/lower compartment. For example, during EVA prep, we always practiced carrying our TSBs up and attaching them to the food locker. Then, loading the TSBs there, I think, that is unnecessary. You should leave your own TSBs in your sleep compartment and then when the guy gets the UTCA, he can float down to the sleep compartment and stick them into the TSBs just as fast as he could ever go up there to find them on the wall. You've got to be careful because you're working one g, stashing things here and there for convenience. My opinion on most things is to just leave them right where they are at the moment and whenever you find something, you can float from one end of the cluster to the other in 15 seconds, or from the forward compartment to the sleep compartment in 2, 3, or 4 seconds, go ahead and put the gear right where it is. You probably should leave things stashed or stowed where they are and not worry about the. That's one thing that is a pleasure compared to trainer. It's just super easy to get everywhere.

LOUSMA It's super easy to get everywhere in there. It's so easy to get things out of the dome locker and it's just so easy to go anywhere in a flash to set things up. I think the trainer is misleading in that respect, sometimes.

SPEAKER Okay, how about the AM/MDA?

LOUSMA I never felt a tendency to try to orient myself as I would in one g. I never tried to get EREP at 6 o'clock like you do in the trainer. The fact that it's oriented one particular direction on the ground doesn't really make any difference.

BEAN I found that it was more convenient after being up there for about 4 or 5 days. Anytime I entered the MDA compartment, I'd rotate so that I was essentially head up in respect to the ATM panel. Then I knew where everything was located. If I went in there and didn't do that, it was kind of mystifying where all the objects were. So you got to where you would roll a certain direction as you went in the MDA and then the same thing occurred when you returned to the OWS. If you rolled a certain direction as you went through the lock compartment, then you come out through the overhead hatch, and you knew whether to break right or left or forward or backwards to end up over near the dome lockers or wherever you wanted to go. Otherwise, sometimes you end up in a part of the compartment where you didn't want to be.

LOUSMA I know often when you'd come back in the OWS, you'd stop and look to see where the minus-Z SAL was or wherever you wanted to go you just didn't automatically come through the hatch and zig in one direction or the other unless you came through at the same orientation all the time.

BEAN I think it would be worthwhile over there when they're running EREP to give them a short EREP pass where they never did anything over at the SLS but did it all right there. Have the clock running and I can't remember if the C&D runs in the trainer. Just put a clock there and have them run through the complete load; simulate how to get in their foot restraints and kind of stand there and run the whole thing in the AM/MDA including putting the film back without ever getting out of there, without going over to the other simulators, realizing the lights and things don't come on. But I noticed that you don't use the lights. You throw the switches on time, and hardly any of the EREP things give you any indication except maybe the 191 CAL. Stay right there and work in that one portion of the simulator through the whole pass. Someone might say, it looks like we're wasting time here. We've got 30 minutes set aside to throw switches. We know the switches don't do anything. Switches don't do anything over there the other simulator either, but yet you would get the feel of doing it all and working side by side. The guys in

BEAN
(CONT'D)

the VTS could practice looking out at the right time and keeping up with it and working together as a team. Whereas when you change positions, it sort of changes the perspective.

LOUSMA

Another thing that you don't get the feel of out of the STS, and it is something you do a lot of the time in flight, is looking out of the STS windows. In the trainers, you never knew what was out that particular window. It's really not important to know, but we find that's one thing you do initially in flight and you never do in training, that is to look out the window and try to find the right one.

BEAN

That's right. It should be pointed out that the number 1 window is really window 241.

BEAN

Command Module: I thought it was all straightforward. Nice and neat. Once again you sometimes get strapped into the problem of getting a lot of things and carrying them over to the command module because it's more convenient in one g. Where in zero g, it's just as easy to grab one or two items and zip on up to command module and stow them or not stow them or head on back. So I think if you tend to think of it as a much smaller vehicle than you see it over here in the trainer, then you are going to operate more like you do in real life. You tend not to collect everything together. You get a handful of things and go up, put them in and come by and get another handful - just the same as you would at home working from one room to another.

LOUSMA I wouldn't worry too much about really tucking things away when you do an integrated SIM with the command module one-g trainer because as soon as you find out where the stowage is, it's all going to change anyway. I'd stick it in a big bag and throw it on the floor and forget about it putting it away.

BEAN I think you got a real good point there, Jack. We did a lot of work going through stowage, moving things around, mounting them in the boxes neatly, and all that. When we got ready to do it both for launch and coming home, it was completely different. I think Jerry and crew ought not worry about that too much. Just allow plenty of time to figure it out real time and learn how to use the pictures and so forth but realize that when you launch it's going to be different. When they come home, it's going to be different. Don't spend a lot of time trying to learn how to mount each tape in its proper little holder because by the time you get ready to come home, they don't want tapes in those holders anyways. They moved the tapes over somewhere else.

GARRIOTT I thought it was a useful exercise whenever we did a rendezvous or something like that in the CMS to actually eat in there and do the strange things with our suits that we really were going to do. The other thing that I thought was helpful for me was every time you do a rendezvous SIM, hook up the

GARRIOTT
(CONT'D)

TV and the cameras and have the Hasselblad out where you think you are going to have it.

LOUSMA

Go through the whole camera routine because there's quite a bit of musical chair business on the right side over there with the TV and the cameras. It's useful to have that all psyched out beforehand.

LOUSMA

Material Processing Facility: We didn't have any of use for training with that trainer.

LOUSMA

Neutral Bouyancy Trainer; OWS, AM/MDA: Well, I thought that was great training over there at Marshall. You could over train in it, but everything was a lot easier in zero g than it was under water. If you can hack it under water, you can hack it in zero g for sure.

BEAN

The only thing I noticed different that ought to be changed was that one light that was on the STS in the FAS area interfered slightly with the boom package coming back. That ought to be reported. We have a picture that shows it; that ought to be put in the trainer.

GARRIOTT

You talking about the NRL thing?

BEAN

Yes.

GARRIOTT They already know about it, I think.

BEAN I know they do.

LOUSMA The hook is backward, too, the one by the EVA hatch. It is backwards in respect to flight article. We mentioned that when we were doing it. That was just a minor impact there when we went to do it.

BEAN And they also should rig up the place where the S230 are and leave them there. Put the sail up, install the clipboard that has the sail sample, and put up the sail sample that was mounted by Pete and his crew. All those things are sort of in their proper place.

LOUSMA The rate gyro cable should be in there, too, in case you have plans to wander in there and get interfered with it when they do something.

BEAN Good point. That ought to be in there so you see that you don't kick it and know where it is. That's a good suggestion. I don't think we made that one, but it ought to be made in there and kept in there. Any other things?

GARRIOTT I thought the most noticeable place that was awkward in zero g was when you come off the two-handrail position down to the

GARRIOTT
(CONT'D)

center work station. I noticed in the water tank it was difficult; you kind of dive in under there - something about the bouyance. Whereas in real life, you sort of appear there.

LOUSMA

You get there somehow, and suddenly you're there.

BEAN

CMPS: I think it's a real good thing and I don't know what we can add for Jerry and his crew because they are probably past that time. One thing that they should practice in there is breaking with quad out and that sort of thing. It might be interesting to better understand the situation that you have if you end up with one quad out on lateral translations, either Y or Z-axis, and to better understand how much breaking it takes to kill off the closing rate.

GARRIOTT

I think it's good for working with the computer through rendezvous programs and all that.

BEAN

It's a good thing. It's really a good device. I hope they don't park it and forget it. It ought to be still up for ASTP.

LOUSMA

EREP VTS: I thought the EREP VTS was a good simulator. I think you ought to put the haze in there when you get a chance. I think it's a good place to work out your techniques, find your check points, and decide how you're really going to do it when you get in flight and what

LOUSMA
(CONT'D)

you really use for checkpoints. I think you ought to try both ascending and descending just because they are a bit different. It's too bad that we don't have a little more training at the leading edge to all those sites because those are good cues as to knowing whether you're really on or not. I think that you need to go out and fly the real sites, particularly the tough ones. I'm glad we got that simulator. I think you ought to throw away the ERTS photos because they just don't look like the world. They are misleading if you got ERTS photos, it's not the way the place looks. Get real photos and get rid of those darn ERTS pictures.

BEAN

I agree with Jack. You ought to have nice, neat ones to learn on but after you learn those sites a little bit, you ought to come in there with a lot more haze and a lot more clouds than I noticed you had. Make sure the clouds look white or at least gray and the haze is really good haze. I never saw haze in the simulator as much as we saw in real life. And the first time we tried to take a site on a good hazy day, it was a new experience. I hadn't really appreciated how much degradation you had with good haze. There's no reason that simulator couldn't be made with extremely bad haze, i.e., even worse than you can possibly get. It might get you used to it. I don't

BEAN
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think it would hurt when they are running you through there not tell you about the fact that you're going to have a site that gives you enough haze where you can't get it. When you ran it in the simulator, you always were able to get the site. And in real life you're not able to and you ought to be able to handle both of those situations.

LOUSMA

I guess the disappointing thing about S191 for me was that we didn't get all of our sites. We just didn't get over them. The weather was a problem on occasion. We wish we had been able to use all the training we got on the sites. But the best idea is to learn them all as best you can. Know them like the back of your hand so it requires very little review when you get ready to operate because that's usually what you have, very little time to do it. On occasions you can see some of your sites out the wardroom window when you're flying over a particular area. Looking out the window is good to kind of refresh your memory as to how the site actually looks from space. So every opportunity you get to see the ERFP site out the wardroom window, is beneficial. Check the trainer runs to see how it looks different in the simulator or how it looks different when you flew it.

BEAN

I noticed that we were a lot more calm about getting our sites towards the end. Another reason was that you learn a few tricks up there about what to look for and you're able to find your sites much better. The ones I used mostly were not just look for the site itself but to look for the big picture. If I could see the picture, which I usually could because it was big enough, then go look at the location of the big picture where the site was. For example: Let's assume you're going to shoot a field at Phoenix. Instead of hunting the field, the first thing I looked for was Phoenix. Once I had Phoenix, I had to go relative to the salient features in Phoenix to find the site. So let's say it was something southwest of town. I'd find Phoenix, look southwest of town, and then maybe I'd have one or two checkpoints off Phoenix to that point so I could get it. First, I was more or less hunting that little field out in the middle of no where by the recognizable features of the field. I don't think that's the way to go. The way to go is to know the big picture and that's why I think Jack says to know it like the back of your hand. You got to know what the big picture looks like, you always see the - that, if the weather's good. Then you'll know relative to that big picture where your site is and you can find it much the same as coming over

BEAN
(CONT'D)

Houston. You don't just look for Ellington, you sort of look for Houston, then you know to look which side of town and which side of the Gulf freeway to find Ellington and then you usually find it. The technique was good there.

LOUSMA

I noticed that the pictures that I used most in flight to find my sites were not the real close up pictures. They were mostly the photos that were taken kind of far out, like you see them at minimum zoom.

BEAN

How true!

GARRIOTT

Because unless there was some pointing detail that you had to remind yourself of, you could find the general area, then the site itself was evident. You knew right where to go to get it and right where to point. You knew where it was located if you could find the major checkpoints. There's no substitute for knowing the general area like the back of your hand. The other point is that the simulator is good for getting a perspective for the size of things. For example, one that I had which was easy was Lake Michigan. But this applies to all the other sites that are difficult. When I first saw Lake Michigan through minimum zoom, it was much smaller than I had anticipated and I was kind of wondering if that was some

GARRIOTT
(CONT'D)

other small lake rather than Lake Michigan. And the fact was, that it wasn't. It was just that I could see so much that it looked smaller than I had imagined in my mind. So what you ought to do is try to get a picture in your mind for using the simulator in regard to how big things look relative to each other at minimum zoom. Then you'll have a easier time when you zoom in finding those particular areas.

BEAN

That's a good point, Jack. I noticed that I tend to use the pictures that were the furthestest away also. Because that's sort of the same view you get looking through the VTS. If you study the closeup ones real hard and then look out the VTS, you couldn't find the closeup pictures. It just wasn't there. The only time you ever saw the closeup picture was when you had your site exactly boresighted and already zoomed in, and by then the problem was over. What I used the big ones for was saying to myself now once I zoom in, "Where do I want to be pointed?" But to acquire the target, I think the picture that are the furthestest away are much more useful. Also it's important to look at the size of the circles on those pictures so that you can kind of get a feel for your field of view or what you're going to see in your field of view. Because, if you're looking for an inlet on the

BEAN
(CONT'D)

bay or something like that, if you're not careful you'll be looking for a very big inlet because that's how it looks on the big pictures, when really at minimum zoom you're looking out and that inlet is a very small protuberance into the water. You can miss it because you're looking for something big. So there's a lot of technique in knowing which map to use and which picture to use. I notice that towards the end of EREP we had a lot more confidence that we were going to find it. We always found them towards the end, if they were available. Even if they were under clouds, we got them. You could get them right off the bat because you knew what size things to look for.

LOUSMA

I think that that we got better than 95 percent of the sites if they weren't covered by clouds. The only time we missed them was when they were covered by clouds and you just couldn't see them anyway.

BEAN

ATMSS: It doesn't exist anymore. It certainly was a useful tool. It helped us understand the way the ATMDC worked; how it fought. It helped us understand how you got into the system and made it go into Z-LV or attitude maneuvers. All these things were necessary to understand and they were complicated. They don't seem that way now but I can recall when we were doing it we were thoroughly

BEAN
(CONT'D)

mystified. Not only that, it tended to work out a lot of procedures that didn't exist at that time. It tended to find some bugs in the system that were changed later. I think that was an excellent simulator. It was run well. It wouldn't be of any use to us now because we've passed beyond that level of training. It certainly was good at the beginning of the program and I assume that they're going to have similar things in Shuttle so that they can start working out some of their software problems and also just getting the feel of how the computer wants to talk with you and work with you.

GARRICTT

CMS/SLS/trainer simulations: Minisims were some of the best sims we had. I think the one weak point, if there was any of the minisims, was the fact that the comm sometimes didn't work too well and neither did the caution and warning. In other words, you'd have a caution and warning go off in the SLS while you were over in the OWS. You were hesitant about walking all the way over to the SLS to find out what it was because most of the time it didn't amount to much of anything. It didn't have any implications as far as your mission was concerned. I would recommend for minisims that they eliminate malfunctions from the minisims. Just go ahead and run with perfect days because most of the times that we ran in flight were perfect days.

GARRIOTT
(CONT'D)

If you want to practice malfunctions, go over on the SLS and practice them or go over into the CMS. When you're trying to learn to integrate all these time lines together and learn to do EREP and then quit doing EREP and do some S019 you really don't need malfunctions. I don't think they add anything to the total picture.

LOUSMA

There were a few things that were kind of mysteries actually when we were going to go up and fly. One of them was the EREP thing, which worked out. We knew that we could work everything out. The other was the ATM TV down-link thing. It was a detail. It is a little mystery until you do it. The first time you do it, you do it right. The other thing that fits in here is the set up of the regular TV and the taking of TV pictures which we never really did during any of our minisims. I think it would have helped had we done some. It would have taken out some of the mystery. It actually was an easy thing to set up, but I think that it would have taken a little of the initial guess work out of it had we done it during the minisims.

BEAN

That's right. We should have done it earlier than we did. Every time we did it, it was a special event. It wasn't integrated in the other activities. A lot of this

BEAN
(CONT'D)

training is integrating one of these events with another and shifting from one to another with ease and I agree with Jack that we could stand a little bit more of that.

BEAN

Simulated Network Simulations: I didn't think we had near enough of those. Some were caused by the short time between SL-2 and ourselves. Others were caused by the fact that the CMS didn't work and still others were caused by the fact that the system didn't work over there in the Mission Control Center. But I felt that although we launched in good shape, we could have stood to have a few more rendezvous sims and a few more entry sims. Just think that's the best training that you can get. It helps put it all together. It gives you a good feeling of confidence. It gets both yourselves and Mission Control personnel all tuned up and ready to go. Definitely, we could have stood a few more of those.

GARRIOTT

Not so much from the on orbit type, right?

BEAN

On orbit: I think you get more from the first 2 days on orbit than you do from all the sims put together.

GARRIOTT

Just in talking with the flight controllers and MOCR lead personnel like the ATOM and the EGIL and the various other main desks there. I think a few discussions with

GARRIOTT
(CONT'D)

them as to how you work together are really what you need for the on orbit discussions, the rendezvous and the entry stuff as you described.

BEAN

Egress training, the pad, the tank, the mockup: I thought that was all useful and necessary and went well. Just do it the same way again. There's not a lot to say.

Fire Drill, (during flight): Excellent thing to do. We noticed when we pulled ours off that we didn't have some of our cards in the right place. Also, we noticed that when we did pull it off in flight and we got to the place where our cards were, they were still not in the same place relative to the hatches; and the hatches didn't work exactly as they did in the simulator. They did, but in zero g, we weren't always available with our feet in the right place. The attitude was just different. It took a little while to get oriented in there. I think a fire drill about day 3 or 4 or a rapid DELTA-P drill is worthwhile. I wouldn't take up more than 30 minutes of flight time doing it, but I think just doing one fire drill and doing one rapid DELTA-P drill will keep you for the rest of the time. It should be done early in the mission so that you have done it once and understand the situation.

BEAN
(CONT'D)

Planetarium: I don't think we needed it.

LOUSMA

I had the planetarium on T002. I did think it was helpful for that one shot in the AF planetarium. I thought was helpful in making me decide what techniques were best so that you didn't have to do so much experimenting out the window when you really got there.

BEAN

Simulator Training Plans: I'm not sure what that is. Dave Scruggs worked and he decided what you needed and all. I thought that was good. It seems to me that there's two ways to work it in training. One is you have the guys that are undergoing training invent a training plan and go along with it. The best way seemed to be a 50-50 mix. Some each week. Some CMS schedule was kinds of what we thought we needed and some CMS schedule was what the simulator guys thought we needed. The same things for the SLS and anything else. It's sort of a mix. You understand your problems, some of them, so you can address those and of course the fellows that are instructing understand where you are weak and where you are strong, sometimes even better than you do. So they can work on those areas. I think just the combination of both of you working together, you come out with a pretty good plan. The thing to remember though is that you've got changes

BEAN
CONT'D)

all along. So what is a good plan this week isn't going to be a good plan 3 weeks from now. Some of the things you thought were going to be difficult and you would be slow in, you caught onto real fast and you didn't need any work. Some of the things that you thought were going to be pretty simple, turned out to be difficult or it turns out that some of the things you thought were going to be simple, you never can quite get scheduled. So 3 weeks later, you're really further behind than you thought you were 3 weeks ago. It's just a constant effort to kind of keep tuned up. The biggest problem in training was trying to relate how much time you needed for each. For example, going to the water tank is fairly simple straightforward thing to do; but there's a lot of force being put on at any one moment to try to come up with a very nice water tank schedule and go to the water tank frequently. We were overtrained in EVA, which is okay, I guess; but there's other areas in which we were undertrained. For example, S019. If we had it to do over again, we would probably do one less water tank than we did, but we would tend to do more of the things that we did frequently. I think we tend to have more sessions where we threw out the garbage. We tend to have more sessions where we made our lunches. We tend to have more sessions where we ran S019.

BEAN
(CONT'D)

We had more sessions where we did the things that we did every single day because if you can get pretty handy at those you can save a lot of time. We spent, for example, a lot of time doing T020 over in the airbearing or 509 on the airbearing; I wouldn't even do those once now. What I'd do is get out in the middle of the workshop if I was going to be the subject. I would play like I had 509 on and Jack and I would go through a little routine where I would say, "Okay, I'm getting ready to start," and he'd say, "Okay, camera's on." I'd have a little switch mounted and I'd say, "Okay, my camera's on." In other words, I'd go through the sequence that you do there more than I would just getting on an airbearing and trying to learn to fly. The vehicle just isn't that hard to fly.

GARRIOTT I thought that the EVA training water tank was about right. It may be because I needed more training than you did.

BEAN I don't know. You did pretty good out there.

GARRIOTT I think that our amount of training was about right in order to do that.

LOUSMA I could have got by with less. We did the SAL pretty good with only a few times. We profited by the training that went before that. I think we were overtrained in the

LOUSMA
(CONT'D)

film replacement. I got a new way. Instead of using the clothesline, if you ever have to use it, the best thing to do is to tie the beauty onto the other guy and let him go down there and hand it to the guy who's replacing it. Instead of rigging up that clothesline and everything, I think it would be better to just lug it down there and give it to him. Just let the fast guy be the shuttle man.

GAR IOTT

It's easier to just carry that whole tree down there and back than it would be to bring the clothesline. Except that's not part of their usual routine. You send that down a package at a time.

BEAN

Experiment training: Experiment training was good, although I felt that we could have spent a little more time analyzing which one of the experiments we were going to do the most and then spending more time training on them. Experiments that we weren't going to do very much of, spend a little less time on them.

BEAN

EVA prep and post trainging: I thought we got about enough of that. It was much easier and much more fun in zero g. The best thing about that was the change which we did for the prep. I did a preprep the day before. I got a lot of work out of the way. I'd have hated to prep

BEAN
(CONF'D)

completely and then go EVA. You'd have been really beat at end of the day. I think you should realize that the EVAs take pretty much of all that day anyway. You just have to be careful and to be careful takes time. So trying to plan anything big on EVA day is just not the way to go. You should plan the EVA day and then some other things that you can either slip or do. Like ATM, and if you make it that's good, and if you don't that doesn't hurt you particularly.

EVA prep and post training: Was done the right way though. There's no substitute for doing it the way we did it.

LOUSMA Yes, it's a lot less nuisance and easier to do and the real burden of course is down here.

GARRIOTT EMU familiarization chamber training: Glad we had it.

BEAN Do you think that it helped you a lot?

GARRIOTT It gave me extra confidence and had we needed it, I think it would help.

LOUSMA I thought it was good to have it.

BEAN How about the fact that you finally went EVA in a configuration you hadn't tried in the chamber?

GARRIOTT Well, it wasn't much different. We still used the PCU and everything. So that was essentially what the training was all about.

LOUSMA It's like any systems training, I think. The fact that you trained with familiar equipment enabled you to understand and perform and off nominal situations for which you hadn't trained much.

GARRIOTT As far as our operation was concerned, we didn't have any difference in the method of operation. We just didn't happen to have any water.

BEAN My only comment there is, I'd like to use my flight suit. I'd like to pick out my flight suit earlier and then make sure that when I went through those chamber training sessions that I had the flight suit I was going to use there. I felt like I didn't have enough hours on my flight suit.

GARRIOTT Mockups and stowage training: I thought I should have had 1 hour sessions, about 3 of them, earlier to become more familiar with that stuff.

BEAN You're talking about general stowage around the spacecraft as opposed to stowage for launch and entry.

GARRIOTT Yes.

BEAN I agree. I think that we could have used some general stowage training for work during the day to learn where everything was, like the urine bags and the bags for the vacuum cleaner. Things that we're using on a day-to-day basis. Where's our food and what sequence do we go through in our food. I don't think that a lot of times people here know that and that's why we don't get that training.

LOUSMA I did a lot of that on the spacecraft $C^2 F^2$. I thought that that helped a whole lot. Obviously these guys can't do it, but just to be able to go through all the dome lockers and all the lockers in the spacecraft and where they were stowed was helpful.

BEAN Knowing where those things are.

LOUSMA I didn't have much trouble finding anything.

BEAN It also allows you to know what's on board and sometimes you're doing work with something that you have on board that's even better. I don't think you should spend much time doing launch and entry stowage until right at the very end and then, right at the very end, you look over what Elmer Taylor has come up with in the way of launch

stowage and you just accept it. He's going to do a good job and you really don't have to know too much. I found out that off-loading that thing in activation, that I was sometimes hampered by the fact that I remembered launch stowage being such and such wasn't that way anymore. It was some other way. If I hadn't known how it used to be, I think I could just go by the book.

LOUSMA You didn't have to forget so much.

BEAN That's right. You didn't know what to forget. It was so much different.

Photography and camera training: I thought that was one of our weaker areas. We seemed to have to relearn all that stuff when we got there in the way of settings, where to put the cameras, how to handle them.

LOUSMA It took us several days before we got the cameras out. I think the reason was because we just weren't as familiar with them. We weren't ready to learn something brand new, when we weren't feeling well. We would have been more familiar with the cameras if we would have gotten them right out.

BEAN I think that's a good point.

GARRIOTT We didn't want to fool with them.

LOUSMA As soon as we started working them, then it was nothing.

GARRIOTT We didn't have time either. Every little bit of time we had, we had to spend on activation because we were far behind in it already. And I thought the time element was an important one.

BEAN They need to relook at this activation for example. I think maybe photography and camera activation should be moved up into the earlier parts of activation. There's so much activation that you can put off and then you've got the things out and you can take pictures with them when you feel like it.

LOUSMA Here's one thing I think they should all practice one time before they go and we never did it, in the sequence. They all should do their postsleep activities just the way they're going to do it. Get up, do the urine things, or get the cameras out or go get the teleprinter paper, load the film magazines or whatever. You know, we snapped into it real quick, but I think it's a clear kind of mystery for them. That's just one of the areas right there. I don't ever remember going to the trainer or the film vault and

LOUSMA
(CONT'D)

getting three cameras out and setting them where we wanted them and getting them ready. Had we done that, we probably would have done it quicker.

BEAN

That and maybe we should leave the cameras out of the simulator and the guys should take pictures out the window using those little cards to sort of get in the habit. We never did in training.

One of the things we never did in training was loll around the trainer with nothing to do. Just take pictures out the window and do anything else that we ever did.

LOUSMA

What do you want to practice that for? We never did any of that in the spacecraft either.

GARRIOTT

Yes, we did.

LOUSMA

Loll around with nothing to do, tell me about that some more.

BEAN

We did alot of it. We laid around there and we'd crawl up there and we'd look out the window for a while and then somebody would go get on the bike and bike a little while. Somebody else would go get in his bunk and sleep.

LOUSMA One thing we had out and I used quite a bit at first, particularly in finding camera settings, was that spotmeter. I used that about every picture at first until I could tell what to use. I never did use the little cue card. I always used the spotmeter.

GARRIOTT It matched the cue card most of the time, didn't it?

LOUSMA I don't know if it did or not, but I figured the spotmeter was right.

GARRIOTT I just got a couple of the numbers memorized. The Hasselblad is 250 in f/8. And it works.

LOUSMA Planning of training and training program: I thought we were very well organized trainingwise. I think that we had super training. There was nothing they could tell us that we didn't know something about or know how to go about doing.

BEAN Or we had had it and forgotten it. There were very few things that they brought up that we didn't know about, even if we couldn't pull it off.

LOUSMA I really can't think of much of anything that we hadn't done in training. But if there was anything, we always knew about it and how to go about doing it, where the stuff

LOUSMA
(CONT'D)

was located, where the checklist was or how to begin. So
I think that was all training.

BEAN

Training went well. I wouldn't bitch about the training
program. Most of the training came off just as planned and
on schedule. I think the training program should be a
combination of the fellows being trained with an input and
the fellows training you and you sort of meet somewhere.
Some weeks you do more of what the fellows who training
you think you need; other times you do more of what you
think you need. But hopefully, by the time you get ready
to launch, you both agree and you zip down to the wire with
everything going smoothly.

BEAN

I recommend the 15-minute meeting every morning and is
Jerry Carr doing that?

SPEAKER

I don't know.

BEAN

That's a good thing, because it helps you get in mind what's
going on that day. Each day is brand new and you get there
and find out that there was one or two loose ends that got
cleaned up. It got a little bit tough there the last
few days when we were in hibernation. We were kind of
locked into a schedule that wasn't very variable.

16.0 EMU SYSTEMS

LOUSMA PGA Fit and Operations: I think I picked the right suit down there. I liked the fit of my suit very well. There were no adjustments that had to be made and I felt very comfortable in it. I noticed that, during the first EVA, my fingers got very sore. We did a lot of handwork and it was a long EVA and I noticed water down in the fingers and that they were sore and I got hangnails. They were sore maybe for a couple of days. I couldn't grip anything real hard with my fingers. All my fingertips were very tender.

LOUSMA I liked my suit very well. It was a good fit and was comfortable all the time.

BEAN I appreciated the extra effort of our suit monitor, the fellow in charge of keeping up with your equipment and knowing where it is at all times. I appreciate the effort that he went through to allow us to run our flight suits in the CMS towards the end so we could get some time on them. My only comment is that I think we ought to define our flight suits earlier, the one we're going to use, and then try to use them as much as we possibly can to try to get some time on them, particularly if you run into any of the chamber runs. Did you run the chamber with your flight suit?

LOUSMA I believe I did.

GARRIOTT I can't remember for sure.

LOUSMA I'm glad they took up the lining in the legs of my suit because it really made it a lot easier to don in zero g.

GARRIOTT I thought mine fit very well. I wouldn't have wanted to change any of the adjustments. My hands got very tired but that's not a problem with the suit fit. It's just the design of those EVA gloves. It's unfortunate that they can't be made any better. But my hands were just as tired and as beaten up as yours were, sort of darkened around the nails for 2 or 3 days; less so after the second EVA, and even less after the third EVA. The tiring thing about the whole EVA was your hands.

BEAN Biomed Instrumentation: No comments there.

LCG: My LCG leaked and I looked at it very closely and thought it was the seal in the suit, so I took the O-ring out and looked at it, lubricated it, and put it back. It didn't leak much, but every time I used it, which was twice, there would be maybe half a cup of water that was kind of splashed on the front of my suit and right near the area there. We brought the LCG back for check, but I don't hold much hopes that there's going to be a big leak. I suspect it's

BEAN
(CONT'D)

just a small one. It's the first LCG I've ever had that leaked. Everything else worked well. We left our other LCGs up there unopened. Jerry ought to have a lot of LCGs if he needs them.

BEAN

SEVA Operations: The inside of the SEVA that was going to go on you had a scratched-up look, Owen, so I tried to smooth it out even though I knew that it was the UV coating. Apparently there's just no way to fair it in, so to speak, even though that SEVA could probably be used for EVA. We went ahead and swapped it out and used the backup which was nice and neat. I guess the thing we ought to mention to Jerry is to be careful of those, not to let anything touch the inside. One of the things that can touch the inside quite easily is the little bag that holds the PCU deflector. If that bag is not put in there right, it rubs the inside of the SEVA and causes the coating to rub off. Maybe that's where it occurred to begin with; I don't know. But in any event, I wouldn't take any spares. I think there's plenty of them on board. If they had to use the one that's a little bit disturbed, it will probably work great.

BEAN

EMU Maintenance Kits: We've got all sorts of supplies left in it. It works great.

BEAN
(CONT'D)

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

BEAN

Antifog: Antifog went well.

GARRIOTT

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

BEAN

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

LCUSMA

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

GARRIOTT

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

LOUSMA I was not really tired from the EVA, although I was feeling hungry. If I had had to be out there much longer, I sure could have used a little nourishment. The stuff is available. I don't know why they don't get a chance to use it. They're going to be up for that length of time, because obviously nourishment is a part of performance.

BEAN ALSA PGA Performance: Pressurization and ventilation: I think you've got to be careful when you're using the PCU when you go between DELTA-P and absolute, that you go the full way. Because if you don't go completely to DELTA-P, then you're not going to be able to pass the SOP check.

GARRIOTT Which I didn't.

BEAN It was just fortunate that we found that was the problem. These suits and PCU are simple and work well. Then there is no reason to believe you're going to have any problems. The first thing to do if you do have a pressurization problem or a suit leak is to start checking your connectors because it's probably the way you put something on. You just snapped it on or you got something like your LCG caught in the wristing or something like that. So if it - you do have any problems, check all the positions of the selector valves on the PCU and SOP. Check all the connectors and that's probably going to solve the problem.

GARRIOTT You know why I didn't want to go all the way. You don't want to go all the way all of a sudden or you'll be pressurized too rapidly. That's the reason I had left it short.

BEAN You can keep your finger on it and then when you finally get up, then shove it all the way over to DELTA-P. Ventilation was good. Central cooling and circulation were great. You might want to say something about that rig you worked out with in the MDA, Jack.

LOUSMA Yes. You use the little vacuum cleaner and hose arrangement for air cooling in the MDA as EVA-3 without water cooling. It turned out that the cooling is marginal although it does the job if you don't fool around too much. Instead of blowing, it pulls the suction on your suit. That was sort of surprise at first and sometimes you have to kind of move around in the suit to get a little air going through there. Otherwise it will do a lot of suction but not much air ventilation. That system doesn't work but you can't move around a whole lot. I noticed a little pin that I had taped under the vacuum unit to keep the microswitch depressed wanted to keep coming out. Every once in a while, I had to look at it to make sure it was really running. I use a normal kind of communication as much as you would for EREP. Just a headset hooked up to the SIA. That's about all I've got to say about that unit. It's easy to put together and it worked provided you don't do too much work.

LOUSMA Foot Restraints: I thought the EVA foot restraints were adequate for doing the job. Both the ones outdoors and inside pretty well fit my feet. What'd you think, Owen?

GARRIOTT I was the one who had the most problems in the water tank and I didn't notice any problems over here. Particularly in the FAS area, I had to kick in and out an awful lot to reach the thing that I needed to reach, back or front, or wherever. I managed to get in and out without any real difficulties.

LOUSMA Communications: Communications worked quite well. You might want to make sure that you turn the VOX sensitivity up to a point where you don't have to shout to be heard.

GARRIOTT I guess you adjusted it every time, didn't you?

LOUSMA Once in a while.

17.0 EXTRAVEHICULAR ACTIVITY

17.1 EVA OPERATIONS

GARRIOTT Boom Operation: It boomed along just perfectly with no problems of any kind. I'll mention again about the NRL Sun-end tree. When you pass it back and forth, it's got to go with the foot toward the FAS or AIRLOCK, any way you want to describe it. Or else it will not pass or get over that light fixture. That was already called down.

LCJSMA As EV-3 looking through the STS window on the Sun-end boom, I noticed some little regularly spaced marks on the side of the boom. It looked like maybe a drive mechanism was putting a little crease in it or put a mark on it. There is no reason to suspect it won't keep running just like it has in the past. The boom operation is good.

LOUSMA Clothesline Operation: We didn't use it. I got the impression that you would shuttle a man back and forth with the packages instead of pulling out the clothesline if you had a boom problem.

LOUSMA Handrails/Foot Restraints: I've got no question about that. I knew when I was working in the FAS and I wasn't required to be in a foot restraint. I like to get out of the foot restraint and kind of get myself up to the sitting position on the edge

LOUSMA
(CONT'D)

of the workshop to look at the view. Otherwise, you can only see the back of the ATM. From my waist up was above the circumference part of the edge of the workshop. You can look all over, you can look back there aft towards the sail and see the aft end of the workshop. It's a spectacular view. When you're inside, it feels like you're looking outside from a train window. But when you're outdoors, it makes you feel like you're sitting on the locomotive steaming down the track at a high rate of speed. It gives you a super feeling you don't have inside. That was my operation in the FAS in the foot restraints - as little as possible and out looking around as much as possible. I didn't see anything sharp that you could ding your suit on. I didn't see anything dangerous or likely to foul your suit on.

GARRIOTT They were adequate handrails and worked good.

LOUSMA LSU Management: That really wasn't too much of a problem. We just did it like the checklist said. It was easier to clamp that umbilical in zero g than it is in the water tank.

GARRIOTT Those darn umbilicals are still too large.

BEAN They are. That's funny. They kept saying they're going to be great. They never have been. They still clamped, worked.

LOUSMA But not like they should.

BEAN I noticed that even in zero g every string didn't get tangled up, although it would swing around and interlace some. It never got in knots. That's helpful with the umbilical too. Zero g prevents things from dragging against one another and from making little knots. So, it can sort of swing behind you; it doesn't get into any trouble everytime it touches something. When it does, it immediately rebounds from it. It just stays out of the way. One of the nice things that occurs in zero g is that the umbilicals tend to mind themselves and not get into trouble.

LOUSMA Lighting: Lighting was more than adequate. Plenty of light to work by.

BEAN We didn't try to take any of those latches off.

GARRIOTT No, I did.

BEAN We had a problem one time. Somehow we had lighting everywhere except on the Sun end. Then we came over to ground, they did something, and then we had lighting on the Sun end thereafter. They never revealed exactly what went on. I guess if SL-4 doesn't have any lighting someplace, they should inform the ground. Maybe they have a command capability because thereafter it all seemed to work well.

LOUSMA I remember when there was enough good light out there to get a good TV picture. So there's plenty of light at night.

BEAN The TV set kind of crumped out on us there because of the temperature. I assume that before SL-4 goes, they need to add a little more insulation so they can take it outside.

GARRIOTT That's a big impact upon their payload.

BEAN Maybe they can just take up a little thermal blanket. It seems it would be an advantage to have TV. It sure makes it more enjoyable to the people on the ground, to see what's going on.

LOUSMA It's easy to set up. You got to make sure that you have the lens all the way closed before you start to operate it. When you do, just barely crack that lens because it doesn't take much open lens to get a reasonably good picture. I think f/22 is too wide open, so it's just barely cracked.

GARRIOTT Very sensitive to that adjustment, isn't it?

LOUSMA That's correct. It's very sensitive to the lens aperture. You want to make sure that you don't move it too much. There's only one piece of sail material up there now.

BEAN We brought in one and returned it. The other one is still there. I assume that SL-4 will bring it back in. All they have to do is float up and grab it and bring it in.

LOUSMA It's on one of those clipboards. It's also I might add taped on the back of it. So you might want to bring the whole clipboard in.

BEAN If you bring it in on the universal mount, it will have something to clip to inside the airlock, so I assume that's the way they're going to do it.

LOUSMA S149 EVA bracket worked well after they decided that they wanted to rig it backwards instead of frontwards. It depends on who puts it up as to where it really gets. You want to make sure if you're tall that you don't put it somewhere a short person can't get it. I thought that was a good bracket. Although it's kind of loose and sloppy, it does the job.

GARRIOTT Worked fine.

BEAN T025 bracket and S020 brackets were fine. They had us remove them again to put the experiments back in their boxes. The SL-4 crew won't have any trouble detaching them and taking them outside and making them work. It looked good to me.

LOUSMA S230 clips: We have two of those on the drums out. They're placed the way you want them. They're well cleaned before you took them up there. We were careful not to touch them so as to contaminate them while we were using them. I had to juggle the position on one of them a little bit to clip it on the barrel without interfering with some of the nuts and bolts that held the barrel together. They were still within the envelope that Don wanted it to be in. So, the 230 clips are intact out there.

LOUSMA Ground loops for the twin pole: We engaged all the grommets. I checked them as they went past me as best I could. Late in the mission, we noticed that one of them had popped off. We did notice prior to the EVA that they did like to have a set of their own; the inside diameter was shorter than the outside diameter, and they wanted to stay that way. They didn't want to stretch when it rolled. It had a preferred orientation. So it turns out that when you rolled it into the threads where you wanted to be, it wasn't started at exactly the right place. It didn't make one complete revolution. It had a tendency to want to go back to its original set, but the fact that it was down there in the threads kept it from doing so. Except in the case of this one visible out the STS window. One day we looked out near the end of the mission and noticed that it had rolled back and that the screw

LOUSMA
(CONT'D)

head had also vibrated to the open position. The only thing that was holding the pole together was the over-center lock device inside which we think is enough to do the job now. But on close inspection, I went out there and looked at it, and apparently the thermal environment had caused it to pop back; it was actually broken.

BEAN

It was split. It ended up hanging up around the poles. When I reached up there to grab it and to bring it in, it just kind of popped off there and went floating out into space. So we went over to the SL-2 sail sample area, got a piece of tape off there, screwed the nut back into position and taped it. It looked to us like all the nuts were fully closed; and, except for that one, the grommets were in place. On that one, the tapes is holding the nut closed, so everything is back like it was supposed to be. That was the only thing that I noticed that was out of position.

LOUSMA

That happened late in the mission. I don't think an EVA umbilical could have bumped that either because it seems like it was enough out of the way of the umbilical path so that it couldn't of happened.

BEAN

It couldn't have broken it anyway.

LOUSMA

Gyro Six Pack: We got that hooked up with little, if any, difficulty due to the good work of the folks on the ground, particularly Rusty. We had no problem identifying which connectors are which. We had good photos on board to take care of that. We were able to find the proper numbers and the proper locations with no difficulty at all. The only minor difficulty was making the first connection up in the MDA area. Sitting on the side of the MDA, it turns out that everytime I got the connector hooked up to the panel, I felt that I had to use a tool to do a good job. I would get the tool all hooked up and by that time I would either float loose or the connector had floated loose from the cannon plug. I couldn't seem to get everything all fixed into place at one time. I just adjusted my position to the point where I was immovable, which after I was able to get one hand on the connector one on the tool to hold it in place while I turned it. Then it popped right into place and I was able to verify that all the over center pins came through the slots. The rest of the connections were in fact easier than that one. There was no problem at all to hook it up. We strung it in behind some of the struts and beams so that it would be out of the way. So, that connection went pretty much as advertised. Actually, we had spare time and there was a lot of waiting-around time to complete the job. On all the connectors, I was able to verify that the pins went in the slots.

17.2 EVA PREP PROCEDURES

- LOUSMA Suit Donning: Suit donning is easier in zero g than it is in one g. The only thing that is more difficult is that it's tougher to get the outer zipper zipped around the back.
- GARRIOTT It helps to hook the donning hook before you try to zip it around the back. That will assist in bringing the two edges together.
- BEAN Also, it helps if you get the guy to lean, and he must lean significantly harder since he doesn't have gravity helping him, at zero g as in one g. Also, the guy that's running the zipper can kind of pull the two parts of the zipper together before he zips it. He'll find that he can do it better also. It's easier once you get the hang of the fact that you're going to have to do a little more bending.
- LOUSMA ALSA checklist: I thought the checklist did the job right. It was a good idea to do as much of the prep as possible the night before the EVA. The whole prep and post was much easier in zero g than it was in one g. The suited translation between the workshop and the airlock was no problem at all.
- BEAN They should take a look at this defogging and see if it's possible to defog the night before, and if that would be acceptable. Then go ahead and defog the night before and put all

BEAN
(CONT'D)

the rest of your equipment that you do in the morning, get that completed because the things that you tend to do next day seem to me like they almost hinged on just the defogging procedure. Try to move still more into the prep, out of the prep.

GARRIOTT

I was also lubricating the zippers and that was a job that takes as much time as the defogging. If you move one, you should move the other.

LOUSMA

Timeline: We were always getting out the door later than the ground always planned, so the planning should be changed.

Comm checks: Worked okay.

BEAN

Coordination with ground: Once again, this is where it's nice to have that little schematic out of the EVA book posted in the command module so that somebody's not getting VOX keying or enough volume. You know which one of those knobs to move. It's quite simple with the schematic. Coordination with the ground during the EVA was no different than it was during normal operations.

Hatch operations for EVA: All hatches worked as expected, except you might want to take a better look at the workshop hatch and see how it works because it's something you don't

BEAN
(CONT'D)

get much training with prior to flight. It just works a little differently than the other hatches. In the prep, when you depress the lock compartment, you'll gather ice on the screen that's been installed. You shouldn't wait until it gets down to 0.3 psi before you remove the screen, because usually the screen fills completely with ice and it doesn't depress easily. So I would recommend that when it gets down to about 1 psi or less, that you go ahead and remove the screen. Also, it might be worth while, once you do remove the screen, to sort of keep your hand over the screen. Otherwise the ice sublimates partially weakens it, and it'll fracture and break off, and it will go right out the regular vent. You have to be fairly careful there, although when it does go out, it doesn't look like it gives you much of a problem.

LOUSMA You want to make sure you have a clear airlock, because everything eventually migrates over to that repress valve.

BEAN You want to keep your eye on it and keep away the pieces of paper and the like that could conceivably go out and maybe jam your valve.

17.3 EVA POST PROCEDURES

LOUSMA AM repress: That works according to the checklist, too. Once you get into the airlock, after repressing, and sniff around a little bit, why it's got a funny, hot smell that's not normally there.

BEAN Sort of like a burned paint odor or burned insulation.

LOUSMA It's probably because you brought some things in there that were pretty hot.

Moisture in the suits: I never noticed a whole lot of moisture in the suits, although we always went through the total suit drying procedure. The three little hangers that you hang your LCGs and FCSs on are already installed in the blue water tank ring, right above the suit donning station. You just hook up the suit dryer, and turn it on, and let it blow away; and be sure to keep the dome locker door to that suit dryer open so it doesn't overheat. We let our suits dry for 24 hours and then moved them up in to the MDA.

BEAN Some of those long, thin bologna like desiccants won't allow you to close the fecal drawer. If you don't have anything in the fecal dryer, and you close the door, that little black metal plate that the fecal would stand on sort of moves up, pressing near the top vent inside the drawer. Then, when the door closes, you will hear a slight vacuum sound, as the vacuum is pulled on the door, when you move the lever to the vacuum door position. Normally when you put the fecal in there, the same things happen, except of course, the little tray does not go completely to the top of the enclosure any more because the fecal bag is in the way. So it sort of tends

BEAN
(CONT'D)

to hold the fecal bag up against the top of the chamber. But when you close the door and move the little lever, you'll hear a kind of vacuum sound and you'll know you're putting a vacuum on the fecal bag. Now when you put in the bottom drawers, those long, white balognalike desiccants, you will push down on the door, that little tray inside the compartment, when you close the door and move the lever, you don't get a vacuum pulled inside the compartment. Now, the only way you realize this is that you don't hear that little characteristic sound, and if you tug on the door, the door will come open a little, showing that there is not a vacuum. Now what occurs in this case is that you don't get a good drying and you also leak atmosphere out. Not fast and not critically, but enough so that it is noticeable. The ones that are on the top of these desiccants are the ones that the SL-4 crew should use. And if they put them in there, to be sure that they check, to make sure that the door has a good vacuum seal before they wonder off, and set the timer and leave. You put it in, close the door and as you move the lever, listen for a little vacuum sound. Then try the door and see if it can be easily pulled out. If it cannot, you're okay. So set the timer and go on. If it flunks this, the sound, or the fact that the door will open without a lot of effort, then you probably haven't got

BEAN
(CONT'D)

a good vacuum in there and you need to go back and do it again. We've got a couple of desiccant lengths that won't fit and they're marked with red tape. It's probable that there are others around there, but hopefully the ones that you pick out right at the top of the sacks will be the ones we used and will be acceptable.

17.4 TWIN POLE SUNSHADE

LOUSMA

Erection of the twin pole: The first problem we had was the elastic that hold the poles down on the racks got stuck in between the knurled knob and the shoulder of the pole. So we worked those out and got them out so that Owen was able to move the pole sections from the rack. That took a little doing. We were lucky that we had a few extra poles because we probably couldn't have gotten all of them out of there anyway very easily. The problem is putting the plates out there that had the clothesline on them, was that the hook that's right outside the EVA hatch is positioned 180 degrees (rotation by the shaft) out from the way it is in the neutral buoyancy trainer. It points the wrong way. The open part points toward the hatch and we were hoping that it would point away from the hatch as it does in the trainer, but it doesn't. There was one other thing that was backwards from the way it was in the trainer.

GARRIOTT It's that tree that goes to the Sun end. It must be placed on the Sun end boom in such a way that the foot is toward the MDA or ATM. In that direction, rather than away. Because if it's not toward the MDA and ATM, the tree will hit one of the light fixtures on the edge of the FAS and cannot get by it. It will stall the motor, as well as bang up the tree and the EVA light. So just make sure you put it on in the right orientation.

LOUSMA Owen had put the poles together on the twin pole and shot it out in my direction and when it got long enough for me to hold onto, I'd hold it in my left hand and hold one of the ropes in my left hand and the other rope in my right hand, all the time watching the pole to make sure that it didn't rotate so that the rope twisted. Also checking each set of knurled knobs and grommets that went past, to make sure they were all inserted properly and that they were secure. When we got the one section of pole made, Owen passed it out to me, and I took about a minute or two to swing it the 90 degrees that was required to mount it into baseplate which I did with no problem; no difficulty in coning. Owen was watching the pole so that there was no problem with the oscillation. We felt that we could have gotten a good oscillation going if we wanted to, but we always moved it slow enough so that it didn't

TOUSMA
(CONT'D)

tend to oscillate. The second pole was made in likewise fashion. It was also mounted. We had one difficulty and that was one loop of rope around the pole that did not permit one rope to go up one side of the pole and one rope down the other side. We puzzled with that for a while and finally came up with the solution that we were going to have to take the pole out and send it back to Owen and break it somewhere near the end and make one loop around the rope. That's what we did. We reinstalled the pole and it worked perfectly. I noticed that I had to cycle one of the ropes around about 180 degrees in order to get the loops lined up, so that you could get the right one coming to you first. We hooked the sail up and started to deploy the sail and it didn't want to go out too much. One reason it didn't was because the poles were stuck together on the trailing edge. We had to pull it back in and manually unstuck the accordion poles that were stuck with glue on the undersides. Each pole was sticking to its neighbor. Apparently the glue hadn't cured or the long stowage period had caused it to stick together. We solved that problem. Then we noticed as we deployed it, that it still didn't want to unfold very much. So we had to repeat the same procedure for the whole width of the sail a couple of times as we sent it out, noticing that the center seam was stuck to some of the accordion poles in the middle. So

LOUSMA
(CONT'D)

in that manner deployed the sail a little way, and just unstuck all the accordian poles to make sure they were all free to unfurl as they went out. We had the same problem with the leading edge. It was glued on the inner side and had to be unstuck a little bit. But it came apart readily and we ran it out to the end of the poles. It didn't have any tendency to pull the poles together but it seemed to me that the sail was a little bit too big for the poles. Nonetheless, we got it out there and set about hooking up the reefing lines. We got those hooked up to the proper places, and then noticed that after doing so, tightening down the reefing lines, that after having laid the sail down on the parasol, there was still significant angle to the accordian fold on the leading edge. It looked to me like the sail had deployed more in a trapezoid fashion than in a rectangular fashion and that we just didn't have a wide enough place to hook the reefing lines. Al commented, on the last EVA, that apparently the accordian fold had come out of it somewhat. Apparently the Sun had caused it to spread a little more than it was initially. It was not spread taut like a flat sheet as we had envisioned it might be. It was more of a loose fitting cover than anything else. As we rotated it down on top of the parasol, which had a bulge in one leading corner, it just kind of flattened out neatly and assumed the position that it wanted to all along,

LOUSMA
(CONT'D)

and pressed the poles down so that they were touching the workshop at the trailing edge and about 10 to 12 inches above the workshop at the leading edge. The only difference we notice is that one grommet came off. Another observation is that the sail coloration was starting to turn brown on the second EVA, and I don't know what its coloration was on the third EVA. That was the twin pole deployment. SL-4 will have to work around that thing when they are performing their EVAs.

17.5 EVA - GENERAL

LOUSMA

The rest of the EVA came off pretty nominal. It took 6-1/2 hours on the first one and the only thing we noticed later was, after we got our gloves off, our fingers were pretty sore for a couple of days, right on the fingertips. This was due to all the action with them, I guess.

BEAN

Do you have anything to say about the second EVA that was significantly different and might be useful.

CARRIOTT

The only comment I could make is we hadn't practiced that one. We had good procedures sent up, they had been practice on the ground, we had time to think it through and understand it. I don't think it was easy for Jack to do it but it certainly wasn't that difficult. He just followed through the procedures very carefully and did the job. It gave me the feeling that

GARRIOTT
(CONT'D)

anything that you can do in the water tank in the way of simulating zero-g EVA work, we could sure learn to do in real life EVA probably easier. That's a good index.

LOUSMA

The only comment I have on the EVA is don't let them rush you and don't get in a hurry. Don't get in a position where you might have to rush. Go up there and take your time. If you have a question, be sure to stop and think it over. If you get in a rush up there you are going to get into trouble. If you take your time and work methodically, you're going to do pretty well.

BEAN

Let me make some comments about the third EVA and the cooling. I felt that the air cooling was certainly adequate. It would have been nicer to have water cooling, but all you have to do is work at a slightly reduced level and you will be just as happy as if you had water. The procedures to dump umbilicals and the PCUs were straightforward. I would recommend the one in the book using that water purge fitting, and use one of those big purge fittings like the wardroom. It allows more air to come in the hose and dumps that much faster. My feeling would be if you ended up with the ability to have water cooling it would probably be nice to have it. If it turns out you don't, it's nice to get in your suit without having the LCG on. It's also straightforward to be in your suit, not working hard, and have air cooling. Either way is good. You get lots of work done. You just have to work at a slower rate.

18.0 FLIGHT EQUIPMENT

18.1 CSM

LOUSMA We mentioned the couch problem.

BEAN We will recommend that you don't take another Hasselblad along but take along a 35-millimeter that you can use on orbit for this low-light-level film and the 35 will still give you the information you want for docking and undocking. Then you'll have an extra camera body with film for use on a day-to-day basis. Clothing and related equipment we've already discussed. Why don't you talk about the tools, Jack?

LOUSMA I thought the tools fit together like a bunch of cheap tinker-toys in most cases. Although we were able to do the job with them, they weren't the kind of tools you'd want to have at home. There were some tools we didn't have that we thought we needed. One was a hacksaw, one was a hand drill, another was some kind of epoxy. We think we also need a whet stone and a file. These are the additional items that we'd recommend to take along. We think we ought to have them because there were times when we could have used them. I think the general idea of taking along only the tools that you know you will need is a poor philosophy. You need other tools for the unforeseen circumstances which occur in flight.

BEAN That's a fact.

LOUSMA We have discussed the fact that you need another camera body so you can have this low-light-level film on hand. We have suggested that it be the CSM camera.

BEAN I think you want to provide time during activation to get your cameras out and get them in position. Then they are out for the rest of the time and usable.

LOUSMA Have you ever heard the possibility of not having to put them back in the vault?

BEAN Yes, that's a good suggestion.

Flight data file: I thought the flight data files, both the CSM and the SWS, were excellent.

18.2 SWS

LOUSMA Foot restraints in waste management and wardroom.

BEAN The foot restraints in the waste management compartment are still not very good but you can stay in there and do the job. You would have to say that it's not mandatory that they be changed but at the same time, it's still not very good. If you had it to do over again, you'd need to revise them. I don't think Jerry wants to take any extra weight or anything

BEAN
(CONT'D)

else up there to revise the ones that are there now. I'd go ahead and accept it and just say it's a bad show. If we ever rebuilt that compartment, rebuild it so it has triangles on the floor. I don't think the head gets any dirtier or difficult to clean than the eating compartment. They could have made the floor in the head just exactly like the one in the eating compartment. It wouldn't have made much difference. You get water drops around but that doesn't make any difference. You don't throw around anything else. Certainly urine doesn't go any further and no fecal matter ever seems to get loose. I think they could have constructed that compartment pretty much the same as the others, with the exception they would have to seal it off so they could pull a good suction on it for fan purposes. As far as flooring is concerned they should have had a regular triangular floor.

LOUSMA

My tendency in both compartments was to use the straps for barefooted or stocking-footed operation and to use the triangle in the wardroom when I had my triangle shoes on. I don't think it's reasonable to try to modify the ones in the waste management compartment. You will only make it worse. They are no good for triangle shoes the way they are. I don't think they can be modified to be useful for triangle shoes. It's just a bad design. There isn't anything you can do to fix it.

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 Hardware kit, nuts and bolts: Good addition. We used a couple. It's important to have some spares on board. They did a good job of determining which ones to take. I would recommend the next time we carry up the best possible stainless steel nuts and bolts in all cases and not go up with some stainless steel, some aluminum, and whatever else. It's enough trouble and expense to carry them up there so we should get the strongest that's available.

LOJSMA We busted an aluminum one. We thought it would work better than it did. We replaced it with a steel one.

BEAN Wardroom window coupling for moisture removal: I'll discuss that one. We used the fitting which is still present on the wardroom window. We pulled the vacuum on it and it works dandy. It cleans out almost all the spot that's right in the middle of the window. During the next week or so it'll slowly get moisture in it again. It needed another pumpdown. We felt that maybe the moisture is coming in through that other fitting that is finger tight. It might be of interest to see if you can put some more torque on that fitting and if you can try to tighten it down a little bit more. Maybe it would be more desirable to pull it out, inspect it and

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.

GARRIOTT
(CONT'D)

The wardroom window cover is right beside that and over the TV locker. Then just screw it on. At first focus, it about 6 inches. The real problem is the fact that its depth of field is probably half a centimeter. If you really need it, that's the way to look. You can use it if you have a science demonstration for little wiggly fishes or spider webs and that sort of thing. It's a dandy thing to keep in mind.

BEAN It might be good for medical uses.

GARRIOTT That's right. If you take a look at some of that good TV that came from mission 2, the SL-4 crew can find out how they can use it.

LOUSMA It seems to me it takes a long time to set it up because it has that bad depth of field and there is never a good place to put it. You always have to move the subject because the camera has to be set in a rigid position.

GARRIOTT That's true.

LOUSMA The handheld microphone didn't work.

BEAN We made a makeshift one by taping one of those lightweight headsets onto something.

LOUSMA You need a handheld microphone because you'll look pretty dumb going around those Snoopy caps all the time.

BEAN For all that TV you would like a handheld mike. I think if we'd taken the trouble to tape up the rig that we used for the press conference and keep it that way it might have been a usable thing.

GARRIOTT I thought you did a real nice job with it. I thought you had it hung on the CCU - on the umbilical cable.

BEAN Somehow we taped it on the CCU. We can look at the TV and see how we did it.

GARRIOTT It was a real nice job. The tape incidentally was necessary to keep it from rattling. If you just have the lightweight headset in your hand, all those pieces will rattle together and it'll make a loud annoying noise. If it's taped down together the way Al did it for our press conference, it's a nice relatively quiet and convenient microphone.

LOUSMA It is very sensitive to distance from your mouth, however, so you have to be careful about that. Next is the HP35 calculator.

GARRIOTT It is presently stowed above the ATM panel in a little pouch with Velcro. I really didn't make much use of it on the flight. I tried it out a couple of times to make sure that it was all working correctly and it was. I did not use it on JOP 13 because there was only one opportunity. It might have saved a little bit of time, but I felt that the long-hand multiplication was more reliable. It has not found any great uses yet, but it is standing by waiting for the first requirement.

19.0 FLIGHT DATA FILE

19.1 CSM

BEAN I had no remarks on all the CSM data. I thought it was good, it covered the job, the changes they sent up were easy to put in; and, generally speaking, I don't think we needed anything, or had more than we needed.

LOUSMA I agree. I think we really psyched them out before we went. We had more information there than we used, but I don't think we had too much.

19.2 SWS

BEAN The way they were sending changes to the books later in the flight where you had less writing and more cutting and pasting was a good idea. They're going to need more Scotch tape on their mission than we had on ours. We were nearing the end of our next-to-last roll. I think they should have better Scotch tape. They should get some regular tape like we use and not try to get this - I don't know if it's fireproof, but it sure was a lot tougher and wasn't as good as the regular frosty tape. If they could take up Scotch brand frosty tape with dispensers, it would be a lot better. The changes to the checklist were ample and I would recommend that we come up with some sort of desk set that would fit over one of the food trays with a lid on it. The CDR does enough

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

BEAN
(CONT'D)

using that card and not the book. I don't think you need the changes for both when they come up on the teleprinter, but only the changes that fit the card or the book for the item that you're using. If you had a change for ops, you would send it up on the card and call it S019 cue card change. If you had a change for something else, you would just change the book. One thing that's important is to make those formats and those changes pretty much the same. A couple of times when they sent up changes, most of the time they did that, it worked well. Every once in a while, you would get a change that told you the answer and it said replace such and such, page such and such, column such and such with that. You can figure it out but it made you wonder if you put in the change correctly.

LOUSMA

Recommended improvements with EREP site books, Earth, and U.S. maps: We kept one world slider map by the wardroom window, and one in the EREP area. We kept the little U.S. map in the EREP area. We also kept the more detailed world book by the wardroom window. We marked our special handheld photography sites on the one by the wardroom window, so we would know when we were going to pass over them. All the maps were very useful. We didn't have enough maps. To look for more details on the ground, we needed more detailed maps. You might as well plan to take more detailed maps along with

LOUSMA
(CONT'D)

you and I understand you are getting a book up for that. I used the U.S. map with the little orbital slider and the time counter on it to good advantage when I was looking around for some extra VTS sites. Using the little slider, I could figure out what time I was going to be over those sites and when to start looking for them. All these charts and maps were used to good advantage. I would suggest that you get more detailed maps.

BEAN

They ought to practice marking their orbital map with the sites using the technique they plan to use in the flight. So when they get there, they can either take up a new orbital map (which I don't think is necessary, but certainly could be done) or have a good simple numbering system that they're using with the ground.

19.4 FLIGHT PLANNING/PDF

BEAN

Most of them don't deal particularly with the flight data file. We've already discussed about opening up the activation so that you eat and sleep and exercise on time. Eliminating some of the deactivation from the last day so that you can get off the booster and get home without being so doggone tired. All those things would reflect back into the checklist, but don't really apply in this category. Let me mention something else about the flight plan. Every week we got an

BEAN
(CONT'D)

update to anomalies. Those were good. The only comment I have is when they send them up add a few extra pages. Have the page that the anomalies are on, then have a couple of blank pages, add the next set of anomalies and a couple of blank pages. You end up finding some blank pages to put in the book. You might as well put them in the book at the start. The biggest suggestions I have is get rid of those little plastic couplers over the top of the rings on all the flight data file. The little rings don't come off. I don't think anybody has lost a little ring accidentally. Everytime we tried to open those rings to do something with the flight data file, we had to push off the little plastic cuff links. We don't use the little plastic cuff links on Earth and we don't have any trouble. Even if the ring were to come off, it isn't the end of the world. You have all sorts of spares up there. Get rid of those little plastic cuff links and you'll be able to handle your flight data file much better. We never ever used the little flight plan information that told you when the next site was coming up. We always just did whatever the ground said. So, why not just eliminate that completely? It doesn't help you. It's not that accurate, and it's something you carry onboard.

BEAN
(CONT'D)

We got the anomaly report, we got the main criteria, which were excellent and ought to be continued. But I would eliminate the - the little gouge on station acquisitions and day-nights. Day-nights you look out the window and station contacts, you can look out the window if you want or you can trust what the ground is. There's no reason to have them onboard. And, course, the SAA reports, forget them; we didn't use them, and I don't think they're useful, now, that we've been up here.

19.5 PREFLIGHT SUPPORT

LOUSMA

Okay, now we'll discuss the flight data files as far as preflight support was concerned: Its availability, its proper updating, coordination, the change control system, real-time procedures change, anything that has to do with preflight.

We exercised all those systems.

BEAN

We did. The problem we got into was mostly with Jim Bilodeau's group. The comments beforehand were something of this order. Don't worry about the flight data file. We're going to have a certain cut-off date and any changes you make before that date will be okay. Then what happened in real life was that somebody decided that wasn't true, so everytime you started to make a change, there was a big harangue and you'd say "Well, now wait a minute, I haven't had a chance to look over

BEAN
(CONT'D)

this onboard data yet, and get it organized like I would like." I think everybody must realize that we work together with the SL-2 crew for a long time, but when it came down to the last 2 months, we quit impacting any of their onboard data because we wanted them to have it just like they wanted. It is such an important item that you really need to get it exactly like you want it even though some of it may be arbitrary and strictly personal preference. Those things are important when you're trying to get a mission underway. Particularly, something as important as a checklist. I think we had a little hastling around there for a while trying to establish whether or not we had a couple of review cycles where we could change something. Let's take the TV book. We made some comments about the TV book that we had never seen and the first time we saw it and wanted to make some changes, there was a big flap over whether or not we could change it. It seems to me that since we're all trying to fly the best possible mission, and for some of the things I said a little bit earlier, these changes ought to be put in there. If the time is running out, I think it would be incumbent upon the controllers of the checklist books to get a review copy to you early enough for you to review it and make the changes. Back to that TV thing. On Friday, I received the book. After working hours, I took the book home, read it, made changes and called Dave Brooks in Monday morning before working hours.

BEAN
(CONT'D)

I told him the changes and he told me it was too late to get them in. Something is wrong with a system like that and it needs to be modified in some way. There certainly ought to be time to look at the book, the first copy for sure; make any changes that you need, and then have it redone. Now, the interesting thing is, after all this flapping around, it got done anyway. It appears to me that we could save a lot of flapping around and a lot of extra discussions if we just went ahead and did it right the first time. Some of this was a misunderstanding, but I think a lot of it is the fact that the book managers received instructions from a little bit higher up not to make changes, to discourage changes; so the minute they come to see you with the book they are spring loaded to say you can't have anything. That isn't the way we ought to operate. I thought that was one of the more distasteful parts of the prelaunch operations and I'd like to point out that it was done anyway, and it would have been easier to do it with a smile on everybody's face and get it done. It had to be done the hard way and there's no reason for that.

20.0 VISUAL SIGHTINGS

LOUSMA Let's talk about visual sightings. Any comments on countdown. You saw your way to the booster or you didn't see that. Visual sighting no problem there.

BEAN You might want to talk about the visual sightings on that orbit when Owen and Jack saw the satellite.

LOUSMA Yes, let's go through countdown. Any visual sightings on countdown that were significant? We saw the swing arm go away and all that kind of thing.

Powered Flight: I watched the booster protector cover go off and lots of flashes and debris and everything in every separation, but that's all normal. During orbit: -

GARRIOTT Do you want to talk about that satellite?

LOUSMA I saw a couple of satellites that appeared like a satellite would on the Earth. I saw one that was not like one you would see on Earth, so why don't you mention it.

GARRIOTT Okay, about a week or 10 days before recovery and we were still waiting for information to be supplied to us about the identification. Jack first noticed this rather large red star out the wardroom window. Upon close examination, it was much brighter than Jupiter or any of the other planets. It had

GARRIOTT
(CONT'D)

a reddish hue to it, even though it was well above the horizon. The light from the Sun was not passing close to the Earth's limb at the time. We observed it for about 10 minutes prior to sunset. It was slowly rotating because it had a variation in brightness with a 10-second period. As I was saying, we observed it for about 10 minutes, until we went into darkness, and it also followed us into darkness about 5-seconds later. From the 5- to 10-second delay in it's disappearance we surmised that it was not more than 30 to 50 nautical miles from our location. From it's original position in the wardroom window, it did not move more than 10 or 20 degrees over the 10 minutes or so that we watched it. It's orbit was very close to that of our own. We never saw it on any - earlier or succeeding orbits and we'd be quite interested in having its identification established. It's all debriefed in terms of time on channel A, so the precise timing and location can be picked up from there.

LOUSMA

Okay, other visual sightings was the one out the wardroom window. That sunrise or sunset which finally led us to the RCS leak in the command module. It disappeared like thousands and thousands of stars out there; all of them different sizes and drifting along the X-axis. The one that we already mentioned. The one right after insertion where we saw the leak in the same manner of the RCS streaming towards

LOUSMA
(CONT'D)

the plus X. We noticed when we shut off that quad, the leakage diminished. At one time, we saw what appeared to be a frozen conical shape the same size as the RCS thruster, drift by the window, and appeared like the little cone of ice that came out of the thruster.

GARRIOTT

We also saw lots of aurora out of a variety of our windows from time to time. Those are all discussed elsewhere, principally, channel A. We also noticed that we could see an occasional sunrise or sunset from the wardroom window, at the end of an EREP pass, when the attitude happened to be just right, upon returning to solar inertial. We could see sunrise from that window. There are some rather interesting transitions from blue to white to blue before it turns dark black. In the sunrise and or sunset, this is only visible within about 20 degrees of the Sun and these are debriefed on channel A and may be related to either layers or pollutants or some sort of variability in the upper stratosphere.

LOUSMA

Another thing you'll find out very rapidly on the next mission is that the Earth is completely black for a long time, while you're still lit up or you get lit up there a long time before the Earth turns light and that's one good cue for the guy who has to operate the ATM. He can look out

LOUSMA
(CONT'D)

and see if there's any light on the solar array or on the discone antenna out the wardroom window, and if there is no light, he doesn't have to worry too much about the ATM.

GARRIOTT

He also used his watch, of course.

LOUSMA

Yes, but that's a good clue if you're in a rush doing other things. Okay, any visual sightings during entry? Yes, we saw the docking ring and the probe going off in the distance. We also saw the apex cover go and then Al saw it coming down the left side when we were on the chutes.

BEAN

It had its own little chute, and it was whistling down about 300 yards away.

LOUSMA

We saw the other events out the rendezvous window that occurred during entry, and they are all spectacular. We mentioned, I think, the fire ball that had its own unique little shape and part of it showed up on the entry photos, but not the whole thing.

Landing and Recovery: Visual sightings - we saw a lot of water and we saw the frogmen immediately when they came up. He looked in the windows and we gave him a thumbs up.

BEAN

We saw some dye markers that looked like it had come out even though we didn't blow the dye marker. It looked like some had come out and made the water light green.

LOUSMA Sure had. The dye marker had deployed itself to some degree. We saw the chutes land in the water with a few air pockets in them. We saw the helicopters and the frogmen climb over the spacecraft and finally one time as I crested the wave, we saw the New Orleans out there, 2 or 3 miles away steaming towards us. Any other sightings that would be worth reporting for visual sightings?

BEAN No.

21.0 PREMISSION PLANNING

LOUSMA Mission plan; Flight plan; spacecraft changes; procedure changes; mission rules and techniques.

BEAN That covers it, doesn't it?

LOUSMA Premission planning: I think we've discussed the Flight Plan a good deal and the comments we had toward activation and deactivation.

BEAN I don't think we have anything new to add right there, that we haven't covered in a different section.

LOUSMA How about spacecraft changes?

GARRIOTT You might check the plumbing.

22.0 MISSION CONTROL

BEAN GO/NO-GO; Updates; Consumables.

LOUSMA Consumables, you don't need them up there, Al.

BEAN I know. We kept getting them, but we didn't need them.

Jerry can decide if he wants them.

Have we discussed the - the medical conferences and the VHF?

Communications: Excellent, as far as needed. It's nice to be talking to your family and a couple of times a week is nice. More would be even better. It's important to give those guys notice in Mission Control that you want to talk that day, so they can set it up. That's one of the nicest things on a day-to-day basis you have that helps you feel like you're not too far away. And I think it also is some help to the wife so she doesn't feel like she's carrying the ball down here completely by herself. The comm was good for a while on those personal comms and then it got bad about three-quarters of the mission and we could hardly get anything, except Owen always seemed to get his and then at the end it got better again. I'm hoping that they're able to do that much better for SL-4 than they were for us, even though it was acceptable some of the times with us.

BEAN
(CONT'D)

The medical conferences were excellent, even though you don't have much to say sometimes. It's still nice to have them drop in and then you know if you have any questions to ask about your physical condition, results of tests, you can do it. Also, information can come up to let you know that sensors aren't on quite as well or you can ask him some techniques, or while you're doing some different medical tests, or they can give you some clues maybe on how to better do some of the special tests they're sending up. It seems to me that that's a good thing, as is the scientific conferences. The science conferences on the day off are excellent and they emphasize what is going on the next week and how they think you could improve the data you're taking. They're much better than when they talk about the results that you got unless those results somehow are applicable to what you're doing next week. It's a good time for the PIs and the boys in the backroom to give you some tips from watching you and what they've learned, how you might improve your observing technique and/or what they would like to have you do as a result of changes in priorities of things as a result of things that you already have done.

23.0 HUMAN FACTORS

23.1 PREFLIGHT

LOUSMA Preflight health stabilization and control program: I thought it was an excellent program. Even if you weren't trying to get medical data, the advantages of keeping us out of the main trend of diseases and bugs and germs makes it a worthwhile thing. I don't think you can move in a backup crewman at the last minute and have them do quite as good a job as the prime crewmen because there are so many things right towards the end that are directed and designed for the prime crewman. Also, he's sent in there with a team and it's much better to have the original team. Preflight health stabilization went well and it's certainly a worthwhile endeavor even for a flight that hasn't got in mind a lot of medical results.

LOUSMA Preflight medical care.

BEAN I didn't need any.

LOUSMA Preflight time for exercise, rest, and sleep.

BEAN Plenty of time.

Sometimes there was no desire on the part of the crewman to exercise.

LOUSMA Medical debriefing, exams. I think one of the medical check-ups we had prior to flight that didn't amount to much was the skin sensitivity test. They stuck these deals on our backs for one weekend.

I didn't mind having them but you can't very well expect a guy to go home and sit on his rear end in the hot summer and not move for 2 days. Mine just came off right away; I kept sticking it back on but they won't stay. I don't think that was a very good test and a good time to do it wasn't selected either. That ought to be improved without constraining the guy to change his normal habits.

BEAN Preflight eating habits and amount of food consumption.

No change, I thought we continued right on into zero g with the same eating habits we had to begin.

GARRIOTT My wife looks at the food that I eat here both preflight and postflight, and she believes that I eat more at home when I'm on my normal home-cooked diet.

I'm inclined to think that she's probably right. I did tend to lose a little weight inflight and I did have to supplement my diet inflight. I think that it was just a bit skimpy and also angles too much toward carbohydrates and sweets instead of protein. We could have done better with earlier tests,

GARRIOTT
(CONT'D)

from a standpoint of getting our menu adjusted better. Also we needed greater flexibility on sorts of foods and better limits on minerals and protein that we could use.

BEAN

I think one of the things that would be helpful is to make sure that if there's any foods you don't like before your launch or any that you even marginally don't like, get them cut out of your menu and have a substitute made before you launch. You're not going to like those things much better when you get up there on a day-to-day basis. Something that can squeak 'by here will probably tend to bug you and you might as well get it cleared up to begin with. That way you can start off with a menu you might be able to make it through on. You shouldn't be particularly shy about changing it or requesting change because the idea is to keep happy and healthy up there and eating and food are certainly some of the happy points of the day. It's very difficult to stay on the diet day after day, but if you know that you have the best available and that options are up for change if you really need them, it helps you stay there and do it right.

GARRIOTT

Incidentally, Jack and I just tried the tuna salad today at lunch which was a one of the things we had to reject when we were up in flight. Now we had three samples, one of which was in flight canned that we returned to Earth and the other

GARRIOTT
(CONT'D)

two were samples retained down here. The two that were retained down here we both evaluated independently as bad. The one that was inflight we took first and I evaluated it as awful, just terrible, could not be eaten. I can't imagine anybody finding it acceptable and it does appear that the stuff inflight was even worse. Apparently there was something that was affected by the high heat in that tuna salad and I sure wouldn't plan on anybody using it or eating it again unless they have a pretty strong stomach.

23.2 FLIGHT

BEAN Flight Appetite; Food Preference: We've already just discussed that partly.

LOUSMA Let me tell you about preflight a little bit. I think the salads, cokes, and things you get preflight and postflight are a good addition and I didn't realize how much I appreciated them until I got back.

BEAN Also the emphasis of taking those items that are different and eating them a lot preflight and postflight more than necessary to minimize eating of your actual diet as much as possible until flight helps breakup the time. Otherwise you end up about twice as long as the basic foods. Another thing that would be nice for example in the salads would be to get a little more dressing on them. It's pretty skimpy.

BEAN
(CONT'D) For some reason you just barely have enough dressing to cover about half the lettuce leafs and that's it.

LOUSMA Put more butter on the potatoes.

BEAN That's right. You need more butter, you need more dressing; somehow we always seem to be operating on the low end of the pole instead of the upper end.

LOUSMA Put more steak in the can. I notice the ice cream is really skimpy in the cans.

BEAN It looks like it has been melted.

LOUSMA It's part ice and ice cream and the cans are not full. The preflight and postflight ice cream is substandard.

GARRIOTT Mine is chocolate and it sure is good.

BEAN Appetite Inflight Verses 3 weeks Preflight: In my own opinion there was not much difference in our appetites inflight and preflight and the diets were originally set up on a basis of 300 calories less in flight. As a result of that reduction I ended up having to supplement my diet with peanuts and peanut butter and butter cookies and so on. I think the 300 calorie reduction should not have been there.

LOUSMA My appetite was about the same in flight as it was preflight and I'm glad I had the big diet I had. It was just the right size for me. I never remember too many times when I felt hungry in flight nor had the hungries, but I always was ready to eat the next meal. I seldom remember any times when I had more than I wanted to eat except when in the early days when I wasn't feeling very well. I usually supplemented every day with additional items, for instance, just because I wanted a little more to eat. There's apparent noticeable difference in food taste in flight and preflight. I didn't seem to mind that tunafish too much preflight, but in flight I thought it was intolerable and it is now.

GARRIOTT That's not your change of taste, that's apparently the change in the tunafish based upon our results today.

LOUSMA It must be because it sure is lousy stuff. I think that if I had to do over again that I would probably have a filet every night instead of every other night. I never got tired of that filet; I always looked forward having it and I could live on steak every night for one heck of a long time. The roast beef in flight is much better than the preflight and postflight roast beef. The pre- and postflight roast beef is crummy stuff. I had some the night before and it just tough as ever but if I was going to have anything other

LOUSMA
(CONT'D)

than filet inflight, I'd pick the roast beef. The size of the food portions was about right. Most of the food is pretty bland. There were some items that I didn't like particularly well or didn't taste like they ought to. One was the butterscotch pudding. It tasted like a blob.

BEAN It was good though.

LOUSMA Some people like it. I would just as soon not have it.

GARRIOTT Roast beef? You mean prime rib?

LOUSMA Prime rib. That's what I mean. The most acceptable foods were obviously the filet, the roast beef and the ice cream. I liked the strawberries okay up there.

BEAN I found they had much more acid taste and seemed to be darker in color as if they had aged. Back on the ground they were a nice cherry red and had a nice sweet taste. I assume there has been some degradation due to temperature.

LOUSMA I think they do have a brighter red color on the ground. The same thing is true of the apricots. The ones up there are brown.

The ones on the ground are orange like apricots usually look. I guess except for the foods that I had mentioned as being noticeably bad, the other were either pretty much blah or

average and some of them I liked particularly well.

GARRIOTT I also think a change of taste occurred on the pork loin.
Jack apparently liked it.

LOUSMA The pork loin was great!

GARRIOTT I just didn't like it more and I had to cut that out as well.
He didn't like the bread and I thought the bread was satisfactory.

LOUSMA I think the bread was lousy. Everytime I had the bread I tried to figure out a good way to get it down without tasting it. It was too hard, too dense, and it had a bad smell and bad taste.

GARRIOTT I ate as much bread as I could along with some peanut butter.
I found that the peanut butter was a very good protein supplement along with the peanuts and I used them fairly frequently. I liked the peach ambrosia pretty well and the pea soup and potato soup was good.

BEAN I thought the chicken and rice was especially good. That was one of better items we rehydrated. If we let it sit around, it didn't taste like it had ever been dehydrated. It was very good. It was one of my favorite ones particularly if you could get a little Tobasco on it. The thing that made a lot of this food more palatable was the spice you could put on it. I don't know if all those spices got on

BEAN
(CONT'D)

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

LOUSMA

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

LOUSMA

The meat was very bad.

GARRIOTT

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

LOUSMA

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

BEAN

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

TOUSMA

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

LOUSMA

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

BEAN

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

GARRIOTT

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

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

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

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

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

BEAK
(CONT'D)

can make it a little hotter, either with a screwdriver or hand controlled but not err so much on the cool side. I particularly didn't like the chili there because the chili was always luke warm. There's one kind of latch I consider unacceptable on the spacecraft. That's the kind you use to hold down the lid on the EREF C&D, or the hold down lid on the SOL9 AMS and optical canister boxes. Those things don't have any friction in the hinges. You've got about four dial latches on each of those lids. You've got to make sure you hold all those dial latches. They are unacceptable. You got to make sure you hold them all down, otherwise you can't get the lid open.

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

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

LOUSMA When you get a food can out of the frozen locker and try to take the lid off to cook it, the temperature has made it such that the first thing that happens is the snap breaks off and you can't get the lid off. So you got to let the cans warm up after you get them out of the freezer before you take the lid off. I only cooked steak about an hour or hour and a half. It was a lot better, juicier that way. If you don't eat that steak in a hurry after you break the little membrane, it's all dried out because it is such a dry atmosphere. It dries out your meat very quickly. You have to get with it if you really want to have a good steak.

BEAN Water flavor: I didn't notice any, did you? I could tell it when I drank water out of the water gun. But when I mixed it with the food or had it in a drink, I couldn't determine if it really had a flavor. It seemed to be acceptable.

LOUSMA I didn't think there was any unusual amount of gas in the water, did you?

GARRIOTT I didn't notice any. I thought the flavor was the same. I didn't notice any at all.

LOUSMA I used the big spoon. The rest of the tools seemed to work quite well.

BEAN Opening Cans: One thing still puzzles me about those cans. We opened all sorts of cans up there, and several times my hands slipped and ran down the edge of the can, and if it had been any of those cans at home, it would have cut the heck out of it, yet those cans never cut me. So I'm not sure exactly how they designed them, but some way they are made so that the edges aren't just that sharp. I just had incredible luck in rubbing against them and didn't cut myself.

LOUSMA You want to be careful about leaving these little metal filings, we mentioned before, getting in your food. I noticed two times when I took the lid off, there was a little metal curlicue, sharp-pointed filing came off and was lying on the food. So if you ate one of those things it might scratch your insides a little bit.

BEAN Both the diced peaches and the dried apricots, when I ate them, several times I bit down on a nice little peach seed in there somewhere. Apparently, in those two items, you have a potential for breaking or chipping your teeth. I would suggest when you eat either of them that you be very careful.

BEAN Consumption from Cans: It worked great.

LOUSMA Food Waste Stowage: Function of the Germicidal Tablet: I don't think we ever used it. Use of germicidal tablets was zero.

BEAN

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

LOUSMA

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

LOUSMA
(CONT'D)

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

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

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

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

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

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

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

BEAN
(CONT'D)

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

BEAN
(CONT'D)

begins to start down, he should start drinking more water to keep it up. Try to find out what his preflight level is and make an effort to keep that baby at least that high. If it start going low, start drinking even though you don't want to; it might help you out.

LOUSMA

The only other time I can remember being thirsty was just before entry, where we sat in the command module for so long and it was hot and humid. We each had three extra drinks plus what we had with our meal, but that still wasn't enough.

BEAN

I think that idea of getting three extra drinks is an excellent one. You shouldn't wait until the end of the mission to set those drinks aside. That ought to be something that's planned and set aside. I think maybe three is a marginal amount, particularly if you are going to spend as much time in there as we did. If you are going to spend something like half the time which is all you really need to, then it is probably enough. But having extra drinks along with you even if you don't use them and you land on the water and don't drink all the drinks, it's still a good thing because it allows you to have some good quick water. You don't have to use the

BEAN
(CONT'D)

water that's been standing up there which might make you a little bit sick, although it tasted pretty good.

LOUSMA

Work-Rest Sleep; Difficulty Going to Sleep; Duration and Adequacy; Restraints; Sleep Period Programming; Disturbances.

BEAN

Easy to go to sleep. I think that it got tough right there at the end when we started shifting our rhythm around. It seems to me that the crew up there is the one that can best judge whether or not they'd like to get up late or get up early or change their circadian rhythm because a lot of that is just personal preference. We recommended that we did not shift, but we went ahead and shifted. We went along with the game and tried to make it work, but just moving back a couple of hours, two or three times end up that you are not able to go to sleep. Sleep time comes and you are not sleepy and you know you better get to sleep because you are going to have to get up 2 hours early. Now maybe it would be easier to shift the other direction so that you went to sleep late because, sure enough, when you did go to sleep late you would tend to go drop right off to sleep and you might sleep later in the morning. It may be more difficult to move the go-to-sleep-early direction than it is the go-to-sleep-late direction.

BEAN
(CONT'D)

It would appear to me if Jerry can possibly do it, first of all they ought to be the guys to decide whether it is easier for them because of their own personal characteristics to change their circadian rhythm or if they just want to get up 1 day, or how. For us, we would have been much better off just to hold what we had, until the last day, and get up early and do it. Go to bed early like Owen says and take a sleeping pill that 1 day. You'd go to bed and you'd get up and you'd feel pretty good.

LOUISMA

I think, in general, we all slept pretty good when we got to sleep. We needed 6 to 7 hours of sleep to feel right. The sleep restraints, I thought, worked quite well. Temperature in the workshop has a good deal to do with how well you sleep and how quickly you get to sleep. When the Beta is somewhere around zero, that's the best sleeping. We had to pull up the outer blanket sometimes for that, otherwise it's a little bit warm sometimes. I like to keep maximum ventilation going through my compartment, to keep it cool. When it gets real hot, you can sleep outside the bag and hold yourself in with the straps if you want. Usually during the night, it gets cool enough so you wake up and you want to get warmed up a little bit.

LOUSMA
(CONT'D)

Sleep Period Programming: You should go to sleep at the same time every night and don't ever waver from it; don't let them get you in a place where you're not going to sleep on time and don't try to exercise or eat just prior to going to sleep because it makes it difficult to go to sleep at that time. There aren't too many disturbances in sleeping. There are noises that will probably wake you up though, if your ears are tuned to them. One is the ground dumping O₂ through the system, up in the STS area. You ought to ask them to hold off on that and ask them only to do it during the daytime. The urine blower comes on and it will wake you up, particularly if you are near wakefulness anyway.

Exercise; Frequency, Duration, Quality, Exerciser, Muscular Soreness, Perspiration. We exercised religiously every day. I think we all had a protocol that we wanted to go through and a goal that we were shooting for each day. It was relatively constant, I varied mine sometimes just to see if I could get some more in. I noticed that pedaling over 10,000 watt/minutes a day was more than I really wanted to and more than I felt good doing, and so my feelings of well being diminished. Therefore I stabilized around 8500 watt/minutes a day. The hour and a half that is left for it is right, except that I would

LOUSMA
(CONT'D)

like to do it all during one period of time. I found myself getting little bits of exercise now and then, whenever I could. Sometimes I'd exercise a little bit, four or five times a day, whenever I had time. One thing that seems to suffer is your exercise period when you get behind in your activities or you get in a hurry to get some other things done. The quality was good exercise and I thought the exerciser (Mark I) we had was a good device to have aboard. I'm sure that you can improve on that somewhat but you ought to try to use it. I didn't have any muscular soreness during the flight after the first few days. I had initial muscular soreness because my muscles were just not used to being there. I didn't really have a soreness but I like to stretch out my back muscles and leg muscles, particularly early in the flight. Postflight, I have no muscular soreness except my calfs are quite sore and I got shin splints. I noticed after I ran the other day, that my leg soreness was greater and maybe I shouldn't have done that.

We didn't like to perspire anymore than we needed to because we felt that we were losing minerals that we wanted to keep, so we rigged up a fan that is at the present time pointed at the bike. You didn't perspire too much

LOUSMA
(CONT'D)

when you had the fan going. Either the fan kept the perspiration evaporating so you didn't notice it, or else it kept you cool so that you didn't perspire so much. Anyway, if you don't have that fan going, you can feel this blanket of heat building up around your body; particularly around your head and it doesn't go away because there is obviously no convective movement there. You just suddenly feel like you have been wrapped in a blanket of heat.

BEAN

Somehow you seem to get to a level where you think you're maintaining your physical fitness but not overworking or spending too much time. It seems to be intuitive because everybody had a different level, and I guess it's just enough so that you sweat and your heart beats fast for 15 or 20 minutes. Once it does that you kind of feel like maybe that's enough for today. Now, whether you get to be in better shape, if you did twice as much, or you'd be in the same shape if you did half as much, I don't have the slightest idea. It seems that all of us got a level that we were satisfied with. We would do that level and once we did it, we were real happy the rest of the day. If we somehow didn't get to that level that day, I felt like I was falling behind. An experiment needs to be performed

BEAN
(CONT'D)

that is a little more accurate than just subjective observations, but nevertheless, SL-4 will probably drop into some groove and find a level that they want.

Jack's point that you can exercise too much is probably a good one because it takes out energy, salts, minerals, and it just takes time. There is some level that you need to get to and maybe you get it and then go along for 4 or 5 days and see if you still feel good. If you do, it's not a bad level. A lot of it is psychological, perhaps.

LOUSMA

It seem to me that the level you set has to be based on your heart rate, too. I tried to pick a fairly high heart rate of 150 for a sustained period of time, then I'd raise the level up to 260 and 300 watts for periods of time at the end of every exercise period to get my heart rate up to 175. I felt that after doing that, which I started about half way through the mission, the other levels were easier to maintain. The fact is, if you have enough time, you can sit on that bike and pedal it all day at some comfortable level, and run it about 100,000 watts a day if you want. But there comes a point where you have to pick a high enough level that wears you out in a hurry and permits you to get whatever exercise you need in the time you have to do it. Usually about 30 minutes of pedaling was about all I had time to do. I think the other guys were about the same.

BEAN I noticed that the front of my thighs were much larger when I got back to Earth than they were before we went. So actually I developed some thigh muscles that weren't present prior to flight.

GARRIOTT In my own case, I wanted to do it all in one segment, mostly for clean up economy, but also I hated to do it two or three times a day. I'd normally try to just work through one power level for 30 minutes. I started out at 150 watts, then up to 160 later in the mission, then up to about 170 later in the mission. My experience is rather like Jack's, and after doing that for a while, my heart rate would normally get up to about 160 to 65 at the end of that 30-minute interval. I did find that I probably should have been doing a little bit of sprinting in the workout, instead of just all endurance work. So, for the later half to third of the flight, I did alter it a little bit and on some days jump it on up to 200 or 225 for 5 minutes or so, and get my heart rate on upwards to 180. Some of these were also done at the end of the 170 protocol, so that they would have information provided to the ground. As Jack said a moment ago, I did find that after a few sprints, the endurance work became a little bit easier. It's really the same sort of thing that you'd find on a

GARRIOTT
(CONT'D)

track. If you were trying to develop your endurance there, you don't want to do all endurance training but do some interval work, as it's called, in which you will jog, sprint jog, sprint to cycle your heart rate up and down. It looks like the same thing is true on the bicycle as people who are training for track find also.

BEAN

Comment about the Mark I, II, or III?

GARRIOTT

Yes, muscle soreness; I never exercised to the point where I had any significant muscle soreness. In doing Mark I work, to begin with, I did find that my chest muscles were a little bit sore. It was in the exercise. After four or five times on that it disappeared. I ended up doing sort of a standard routine up there with - about 60 A's, B's, and Delta's each. Sometimes jumping up to 90 A's, because I felt the Alpha's probably stretched my legs a little bit better and would be the best sort of work. Also, Bill Thornton suggested that as many as 40 or 50 ought to be good for conditioning. So, doing 60 or 90 should have been adequate. I don't know whether it was or not, but probably did help some. I did the Mark I simply because it provided extra load to the legs, in terms of pounds whereas the bicycle, even at the higher power settings, apparently did not put the extra or adequate force on the legs.

Perspiration: I always perspired rather heavily. As a matter of fact, there weren't any BMMO run measurements to indicate how much water I was losing. I would take a 30-minute run of the bicycle and would normally sweat between 1 and 1-1/2 pounds of water. Towards the end of the flight I did leave the fan on me, which of course evaporated the water more quickly but presumably did result in some more rapid cooling and so perhaps my water loss was diminished down somewhat. Nevertheless I did perspire heavily, and that ought to be a factor in any estimates on water balance that I might have. It wouldn't surprise me to see easily a pound a day, on the average.

BRAN

Let me say some more about exercise. I guess I was the only guy that used the Mark II and the Mark III very much. I tried to use the Mark II for 10 minutes a day and toward the end I got a little bored with that and just used it for 5 minutes. Essentially I think it does provide some variety up there; it's certainly not as good an exerciser as the Mark I. Since it is a device that you pull up on and it returns. The Mark II, is the spring-type of device. I think it did increase my back and arm strength somewhat. But coming back to Earth I found that it is not the thing that suffers. It looks like the thing that suffers the

BEAN
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most is probably your leg strength and some of your neck. I'd have to recommend more work to be done on the legs and then require a little bit more work to be done on the neck. I guess maybe putting the Mark I, behind your head and moving your head up and down, and giving your neck muscles some load. That was one of the sore points. I don't really know why with all that Mark I work we still had sore calves. All I can guess is that the muscles we were using were the top of the thighs and not using the calves nearly as much. Maybe this incline plane is going to work the calves, but if it doesn't work out, there needs to be some thought given to the exercisers so that you can end up getting your calves exercised. One other thing we've noticed since we've come home is our joints don't seem to be as oiled as they used to be. They get stiff and they go over center a little bit. They just kind of ached a little bit. I don't know how we can end up keeping our joints in shape unless we come up with something that we can sort of bounce up and down on. It seems to me that it would be worth giving some thought. Also, how to keep our joints limber and able to absorb the shock of running so that when you get home they are not like a kind of a rusty hinge. They need to keep in trim.

GARRIOTT Inflight Oral Hygiene: I had no mouth discomforts. The brushing frequency of sorts was only once a day. I never used any toothpaste the whole time I was in orbit. We weren't supposed to swallow it.

BEAN No baths and no toothpaste!

GARRIOTT I never wanted to go to the trouble of finding some empty bag to go spit it into. So, I just brushed my teeth with water and a toothbrush and apparently that was satisfactory based upon the reports coming back from our good friend Dr. Bill Frome.

Dental Floss: I used three or four times as required when I thought I had some food caught between a couple of teeth. I thought the toothbrush was adequate and was appropriate for massage of the gums, which is essentially the main purpose of brushing, anyway, and particularly the way I was using it.

Sunglasses; other Eye Protecting Devices: I never took them out of their pocket. I didn't need them. I never had any problem without the sunglasses in regard to visibility of instruments and controls. No unexpected visual phenomena relating to the eye such as focusing or double vision. I never noticed any change from preflight to spaceflight

GARRIOTT
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in terms of eye performance. No change during rapid acceleration and deceleration.

BEAN

I used the toothbrush and the NASA dent and went around and spit the thing out in that bag. Did it twice a day. I would have much preferred to can the NASA dent and used some regular toothpaste. I would recommend that the SL-4 crew just take up a small tube of their favorite toothpaste, not swallow it, just spit it out and drink a nice drink of water. I enjoyed the toothbrushing everyday. It tasted good and I felt like it was doing a good job. I used dental floss at all times twice a day. That worked okay too, just like it does on Earth.

LOUSMA

I had no mouth discomfort. I brushed twice a day with the NASA dent. I used the dental floss. It worked in space just like it does on Earth. I never felt like the Nasa dent was getting my teeth clean, but I guess it was doing all right. The NASA dent, of course, was made to swallow. We were requested not to swallow it. I never used my sunglasses up there. The only time I thought I might have used them was looking out the wardroom windows, when there was lots of clouds down below, with Sun reflecting off of them. Otherwise, I didn't need them at all.

GARRICTT Medical Kits: Adequate Quantity of Medication and Supplies:

There must be an adequate quantity up there, the only problem is knowing exactly where it is. The packaging was adequate; particularly the stuff that comes in a little white suitcase, as is like the for example, 40 syringes and the microbio supplies. Anything in there is fine. Anything that had been transferred to the topical drug drawers and things of that nature are fine. The actual inventory of what's on board, and where to find this or that, is not in such good shape, I don't believe. I think a good inventory exists because I went to a lot of trouble to make all the transfers that were requested from the ground and to provide them inventories as to just where everything was. As an example, one of the very few things that we ever did need was a Scop/dex. We wanted to take a few pack with us at the end of the flight and they were not out, in the topical drug drawer, or anyplace. It turned out to be easier to go up and get them from the command module supply than it was to find in there in the CWS. I know we did have Scop/dex from the SL-2 supply; however, one of the messages from the ground requested that we take it out of those drawers and place into another can and stick it over into one of the empty lockers in the wardroom. Now, at this point, there has been so much shifting around between what was launched in the workshop, what was then

GARRIOTT
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resupplied in SL-2, what Kerwin moved around , and then what I moved around at the request from the ground. It's really a problem to know exactly where everything is. I think it would be a very good idea for our medical people to make a very thorough listing of exactly what is located where, and to provide this on a couple of sheets to be sent up in the SL-4 checklist. Also, there was never anything, that I can tell, in the activation procedures which called for me to open up the SL-3 drug kit and move any stuff around. The only thing I got in the way of changing stuff is what came up on the teleprinter. So I think that it was not handled very well, in terms of what should be moved where and where things are presently located. I think we're in a good position now to regroup, to make a good list of where everything is located and to have that list supplied well before launch of the SL-4 crew. Then, in addition, as a part of the activation or late activation phase, it could be anything out to day 5 or 10, have in their checklist, what movements they need to make. It was just not that clear to me.

BEAN

I got the impression that the drug kit never was fully activated, so that it would be like a doctor's office, where if you needed a pill, you went to where the book told you

to go to get the pill. It was a little bit like moving in and not taking anything out of boxes because you don't think you're really going to need them this time anyhow. And it certainly would be better if SL-4 moved in, and put the proper pills in the proper drawers per the checklist, and then took all those redundant pills and collected it all together in one compartment and closed the door. Then when somebody said, "How about a Scop/dex?" you can go right to the book, and then right to the drawer and the Scop/dex is there. It just never was an operational mode as far as I could see, even though we really didn't need it too much. Same thing occurred when we wanted to get a Seconal to go to sleep. You knew you had Seconal somewhere, but we never could put our finger on them. So, we ended up going over to the command module to get the Seconal.

LOUSMA

I had one medical problem. I had a sty on the upper lid of my left eye. I noticed it when there was a little bit of pain there. I searched around and finally found Neosporum ophthalmic ointment and put that on the eye, talked to the ground about it, and they thought that was all right also. It was gone in a couple of days. It never did develop into anything that was unmanageable. There is one item in all that medical stuff that we don't have, and I think we

LOUSMA
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need, and that is iodine. I had a couple of cuts up there, mostly on my hands. When your hands sweat, they just don't seem to heal very well up there. What I really wanted to have for that and for the hangnails that developed, and didn't seem to heal either, was some iodine. I noticed when I put iodine on those kinds of things at home, they dry up; the infection goes away, and they get well.

BEAN

Housekeeping: We're going to go over the housekeeping book and try to redefine some of the times and also some of the cycles. Some of the housekeeping you do more frequently, but a lot of it you do less frequently. This will probably help the the SL-4 crew. It will be up to Crew Procedures to search us out with the book, ask us to do it, and we'll be glad to do it.

Shaving: no remarks here.

LOUSMA

There was a head in the shaver when I went up there that was kind of dull. I used two more. It takes about one head every 28 days. The wind-up shaver I used was quick, although it doesn't do a very good job. You miss one hair and it never gets cut with that little shaver, so by the end of the week you got lots of long hairs that the shaver won't get. So once a week I used the safety razor to cut those off.

BEAN Concerning the personal hygiene resupply kits: Both resupply kits, the one that was launched in there and it has "old" written on there or something like that, in pink, and then the one that we brought up has "new" written on it. Everything looked good. The only thing I noticed that could have been in short supply was razor heads. They should take a quick inventory to make sure that those windup razors have at least a head for every 28 days for each of the guys up there.

LOUSMA I think you'd probably need three of them for the mission. One every 2 weeks would be your best bet.

BEAN They are light and ought to be looked at to see what's there now and then, enough additional taken up to provide one every couple of weeks. The rest of the kit looks like you've got tons of everything else.

GARRIOTT I'd encourage the use of the Alpha Keri lotion. I used one whole tube of it while I was up there. In that dry atmosphere I rubbed a little on my lips because my lips had a tendency to get chapped. I also tried to get some all around on my face, hands, and arms occasionally. I think that Alpha Keri really helped holding down some of the skin dryness; lips, nose, face, arms, hands, anywhere.

LOUSMA I had a split lip that I got about 10 days prior to entry. I kept putting stuff on there and it kept cracking and bleeding all the time. It never did get well; I should have used it.

BEAN My fingers got in awful bad shape. I had hang nails, they dried out and cracked. I started using Alpha Keri Lotion but it was too late. I believe if you applied it daily particularly to your hands and maybe some on your lips just before you go to bed then you could keep from getting behind the curve. Once your skin dries out, it then appears to take a long time to recover. That ought to be part of your daily personal hygiene routine. I had a swelling under my arm a couple of times, a little node. I don't know why I had it. I assumed may be the deodorant so I quit using it. That didn't seem to help it because a second one came. I started wearing a looser shirt, Jack's undershirts instead of my own. That felt better but it didn't seem to help it. I not sure it just wasn't the environment up there. Perhaps the chemical content of the food. Actually it was very healthy up there. We had a total of 180-mandays and nobody had a cold, nobody had diarrhea, nobody had anything to speak of. It's healthy up there if you can keep your eating sleeping habits correct.

One other problem I had, much more than Jack and Owen, is the membranes in my nose didn't like that dry environment. When I first got up there it bled a lot, not in the sense that you can't stop the bleeding. But everytime you sneeze or blow your nose, a lot of dry blood was put out on my tissue. That improved after about a month. But it never really got back in the condition my nose is in right now where I can blow it and it comes up relatively clean. If you are sensitive to that, you can use some of the nasal emollient. I think that helps a bit. I didn't bother doing it, but if you did I think you could cut down the problems there also.

24.0 OPERATIONAL DTO'S

GARRIOTT We had a DTO to determine the threshold at which the star tracker would lock on. I think that turned out to be useful. It worked out well. I'm glad that we ran it. We talked about it before launch and the pad came up just right. It did give us a better idea what stars would be useful for our JOP 13. It resulted in our changing the spacecraft attitude. It probably was important in finally performing successfully the one good JOP 13 that we did. So I'm glad we did that. It did show that we had to look pretty hard to get a pretty bright star for it to be of value.

LOUSMA The diffusion experiment came up just a few days before entry. The procedure was to put some water in a test tube, put some cotton packing in, then put some tea on the top of it and let it diffuse well. The tea would never get through the cotton. After a while, they told me to do it my own way. That's what I did, took the cotton out, put the tea on the top, so there were air bubbles between the tea and the water. Then I used the syringe to suck the air out which drew the tea down into the water and made an interface. The diffusion experiment began and we got pictures of that.

LCUSMA
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The other experiment melting of the ice cube that had been made inside of the vitamin plastic container. I took the plastic off and hung the thing up in front of the camera, let it melt, and took pictures of it melting. They asked me to take some with shower soap. I touched the water glob with it. It appeared to me that what the soap did was to very rapidly disperse itself around the outside of the water glob. After that I kind of did my own thing with that thing. I don't think any of the soap went inside the water glob. I'm not sure it happened very fast. It just seemed to lap it up. It went somewhere, probably around the outside of the water glob. I sort of fooled around with that water glob a little bit. I injected it with some grape juice to watch it to see how the grape juice would diffuse through the water. Later on, I blew some air into it. I just noticed, as I blew air into the water glob, instead of filling it with one big bubble, it filled it with millions of smaller bubbles, which would disperse themselves around inside the water glob. They just built up in size and as the concentration of those air bubbles increased inside the water glob, ultimately the little air bubbles would come to the surface, pop off but the the water glob would remain intact. You could see that the frequency of popping air bubbles was proportional some

LOUSMA
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way to the number of air bubbles that were inside. It appeared that there wasn't enough surface tension with that soap around the outside of the water bubble, that it acted as a little membrane and held the whole thing together. Owen's experience with that water glob was that, when he shot air into it, one or two big air pockets in the thing finally burst. That was not my experience. It seemed like the soap was causing the whole thing to kind of hang together. After oscillating around a little bit the water and air combination touched something and it immediately climbed all over that, which ended it. The experience I had with those two experiments was kind of interesting. Probably a lot of other little experiments like that could be devised to show some fairly interesting phenomena.

