

## 2-Way Memo

fater  
Ray McKinney, DEY

DATE OF MESSAGE

March 14, 1973

DATE OF REPLY

## INSTRUCTIONS

Use routing symbols whenever possible.

## SENDER:

Forward original and one copy.  
Conserve space.

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Reply below the message, keep  
one copy, return one copy.

To:

KA/Kenneth S. Kleinknecht

FOLD

USE BRIEF, INFORMAL LANGUAGE

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As you know, the present urine system requirement to support experiment MO71/MO73 calls for an onboard volume determination of  $\pm 15$  percent, with the prime method for volume determination being use of a LiCl tracer upon return of a sample to JSC. It is required that the returned urine sample be one which was obtained from a homogeneous mixture of urine and LiCl.

If a homogeneous mixture is obtained, it is believed by some that chemical analysis of the returned sample can establish the daily urine volume to an accuracy of  $\pm 2$  percent, which is what is called out in the experiments requirements document for MO71/MO73. Tests to date at MDAC-W, using several different mixing techniques, have not demonstrated that a homogeneous mixture can be obtained; and it appears that accuracies on the order of from 7 to 8 percent are the best we can expect right now from the LiCl method at volumes of approximately 1500 to 2000 ml. Lower volumes indicate even greater in-accuracies. Additional tests are underway at JSC in an effort to improve these accuracies or define the limits of the errors to be expected.

One of the methods considered some time ago for determine urine volume was use of the onboard mass measuring devices in the OWS. In practice, it simply amounts to an onorbit determination of the weight of the urine pool and subsequent determination of the specific gravity of the urine from the return sample. With this data the volume of the pool is derived. The advantage to this system is the high accuracy which can be obtained. High accuracy is only achievable if the affects of sloshing can be overcome, which is essentially what has previously "shot down" the onboard weighing technique. However, the recently redesigned urine system now places the pooling bag in a metal box and constrains it with a pressure plate. With the sloshing problem now eliminated, I resurrected the weighing idea.

From:

OPTIONAL FORM 27  
OCTOBER 1962

GSA FPMR (41 CFR) 101-11.6

1. TO BE RETURNED BY ADDRESSEE



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Don Robinson (GE), at my request, arranged through Ray McKinney (DE4) for tests using the BMMD in the trainer. Urine pooling bags containing an accurately known weight of water were obtained from Dick Sauer (LSD). I was out of town on the day the test was run, but it was performed by Don Robinson and Dr. Thornton. Dr. Thornton had been advised of what we were investigating and was anxious to help. In fact, Dr. Thornton reduced all the data and wrote up a small report which is attached. This test verified that onorbit determination of the weight of urine, with high accuracy, is feasible using the BMMD. However, there is a drawback to using this technique and that is crew time. It is more time consuming to take the pooling bag to the BMMD, weight it, and return it to the waste management compartment for sampling than to use the existing method; but no accurate time checks have been made. It took 30 minutes to weight the three bags, but no attempt was made to optimize time. Some experimentation was involved to arrive at the correct procedures for weighing. There is no way to compare the weighing time with that needed for the presently planned mixing method since testing is still underway to finalize the mixing time and technique. Even though the "delta time" is not yet available, there is no doubt that weighing will take longer. Onorbit time is extremely critical; therefore, I cannot recommend that we switch to a weighing method using the BMMD unless LSD were to indicate that the accuracies which are anticipated from the LiCL tracer are not adequate to yield acceptable MO71/MO73 data. However, I do not believe the idea should be totally abandoned.

I would like to recommend that the accuracy of the LiCL tracer method be checked by an onorbit weighing of two or three urine pooling bags during SL-2 mission. It would be nice to have some assurance that medical con-

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clusions which are to be drawn from MO71/MO73 volume data are not being biased by inaccurate volumes. This assurance can be gained by checking urine volumes obtained from onorbit weighing against that determined from analysis of LiCL tracer for the same urine pool. The high accuracy of weighing will provide an excellent standard for comparison only if error is consistent. The length of time required for these checks could procedurally be reduced. The tare weight of the pooling bag and box can be determined prior to launch, and a filled bag can be weighed at the same time the BMMD is being used to determine body mass. A suggested procedure would be as follows:

- a. The astronaut weighs himself holding the urine box (the urine box, pooling bag, and 24-hour pool).
- b. The astronaut weighs himself without the urine box.
- c. The difference in weight is the weight of the urine box, pooling bag, and 24-hour pool.
- d. Subtract the tare weight, and urine weight is obtained.

This technique would have to be evaluated in the trainer and many details worked out, but I believe it is feasible.

I have taken no action on this recommendation pending presenting it to you, which is what I have tried to do in this memorandum. I would like to see the onorbit weighing method tried on SL-2, based on the fact that we should

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UNITED STATES GOVERNMENT

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be sure the volume data being obtained for M071/M073 are accurate enough to yield valid medical conclusions. Incorrect conclusions could be applied to the design of future spacecraft, and unnecessary penalties incurred as a result. Even more basic is the fact that the \$50,000,000 spent on the urine system should not be an investment to yield questionable results.

From:

John C. O'Laughlin  
for  
KW/Frederick Peters

cc:

CR/W. Thornton