



National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas
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Reply to Attn of:

CB

June 3, 1993

TO: SE/James H. Barnett
FROM: CB/William E. Thornton
SUBJECT: BMMD 1g Calibration

Dr. Schneider suggested the following comments on proposed BMMD 1g calibration be prepared for you.

Apparently some confusion exists over my inputs on the question of an 'all up' pre-flight calibration of the BMMD on SLS-2.

It is true that the 1g calibration curve cannot be used for weightlessness but a great deal can be obtained from a 1g calibration and I consider it an essential step in proper use of the BMMD on SLS-2 for the following reasons.

It is a verification that the unit is functional and that the plans and procedures are operational in flight configuration and vehicle. The device is sensitive to its environment and mounting and for that reason the calibration information may provide insight into handling of inflight data.

I have never yet seen such a procedure as this performed in its final setting that did not provide additional information for flight use and unique training for the crew.

If an ailinear calibration curve procedure is to be used with flight data this will provide a good exercise for evaluation of curve fit, etc. This is a valid point raised by Dr. Buckey for there is significant difference from machine to machine.

Going through some of the various pieces of information which can be derived from the proposed calibration and their value:

1. Zero mass data
 - A. Mean value will verify no gross distortions from mounting or other factors have occurred.
 - B. Distribution of data will give an important indication of BMMD sensor function.
2. Solid mass calibration (0, 30, and 60 lb. masses)
 - A. Mean values and slope of calibration curve will allow comparison with previous values and again indicate any serious correctable deviation pre-flight.

- B. Distribution of data, especially if a large number of data points are taken may, indicate source of and correction for inflight data resulting from the Spacelab environment.
 - C. Data distribution pre and inflight may aid in determination of inflight mechanical noise sources.
3. Human mass determination, like solid mass determination, may aid in detection and reduction of flight effects, subject motion and subject restraint.

My recommendation for the procedures are: The lightest subject should be used as a differential mass for the human plus solid mass calibration (Human data variation may make human calibration points of little value).

Apropos potential damage, unless the devices have been modified since original design, when the unit is mechanically locked it is well protected from damage by overloads. While novices should never be allowed to use this, properly instructed/supervised subjects do no damage.

With the unit in as near flight configuration as possible, 1g noise and vibration sources (NVS) and drafts removed and with any inflight NVS in operation, and the following performed:

- A standard flight calibration procedure performed by the crewmember who will perform it inflight plus:
- Add ten additional determinations to each calibration point.
- Perform mass determinations on the remaining six crew if possible or physical surrogates who have been instructed in its use per flight procedures.
- Add ten determinations to each data point.
- Treat first determinations as the calibration data set to be processed as such.
- Treat the total data sets, five above and ten added, as a separate data set for processing.

If glitches occur which can be corrected this should be done if time allows.

The above does not conflict with Dr. Buckley's proposed procedures, except that seven rather than ten subjects are used, but supplements it. The smaller amount of data required by Dr. Buckley's proposal should be first collected and kept separate from additional data which would be collected as an extension of the data set and added to the first collection i.e., there should be two separate data sets which will be handled separately.

Please do not hesitate to call me for clarification. I would be happy to participate in this final checkou for I am sure this device and it's use on SLS-2 can again provide unique data.

W. Thornton

William E. Thornton

cc:

SA/C. L. Huntoon

SA/H. J. Schneider