

SKYLAB MEDICAL EXPERIMENTS TEST

DETAILED TEST OBJECTIVE

I. EXPERIMENT/OPERATIONAL SYSTEM

- A. M074 - Specimen Mass Measurement
- B. Principal Coordinating Scientist - Paul C. Rambaut, ScD (NASA-MSD-DC-7)
- C. Principal Investigator - John Ord, Colonel, USAF (Brooks AFB)
W. Thornton, MD. NASA, MSC

II. PURPOSE AND BACKGROUND

A. Purpose of Experiment

To evaluate the man/machine interface and the hardware performance of the specimen mass measurement device in a ^{partially} simulated space environment.

B. Justification for Experiment

This item of Skylab Experiment Hardware is projected for daily use by each crewman during the Skylab mission. Its satisfactory functional performance is essential not only to the success of M074 Experiment, but to the acquisition of data, without which, Experiments M071, Mineral Balance, and M073, Bioassay of Body Fluids, will be lost. Therefore, the significance of this hardware item combined with the nature of some of the weighing specimens constitute the justification for M074 evaluation in the SMEAT chamber.

III. PARTICIPANTS

A. Number of crewmen required

All three (3) crewmen will participate.

A. Function of Each Crewman

Each crewman will measure his feces, vomitus, and unconsumed food. After measurement; feces, vomitus, and residual food will be passed out through the transfer lock to chamber personnel for comparative mass measurement on a conventional metric balance scale.

IV. FUNCTIONAL OBJECTIVES

FO1) Demonstrate ~~the~~ ^{non-gravimetric} mass measurement and ~~validate the theoretical performance~~ ^{investigate ^{crew} procedures & time lines}

^{involving} ~~of~~ the mass measuring device over a 56-day flight type use profile.

FO2) Perform periodic calibrations of the mass measurement device over a 56-day flight type use profile to ascertain long term stability and repeatability.

V. TEST CONDITIONS

A. Environmental Requirements

There are no environmental requirements beyond normal SMEAT conditions.

B. Crew Constraints

In the one-g environment, the SMMD is limited to measure a maximum mass of 500 grams as opposed to a maximum of 1000 grams in zero-g. Measurements of masses greater than 500 grams in one-g may make the device unusable by overstressing the plate-fulcra springs.

^{Appreciable Forces must not be applied to the ~~tray~~ tray}
~~Physical contact of the specimen tray by persons or objects ~~must be~~~~
^{when it is}
~~avoided during any time when the tray is free to oscillate to prevent~~
damage to the fulcra springs.

VI. HARDWARE REQUIREMENTS

A. Identification and Purpose of Hardware

One set of operable, flight type, specimen mass measurement hardware will be used to perform ^{non-gravimetric} mass measurement functions in one-g, to evaluate crew involvement ^{with} and ~~to validate the theoretical behavior of the device.~~

One item - S.M.M.D.

1. Specimen Mass Measurement Device - A spring supported oscillating tray for measuring the mass of objects.
2. Electronics Module - Electronics for timing the oscillating of the SMMD tray and for measuring and displaying the ambient temperature.
3. Calibration Masses - Three masses for calibrating the SMMD. These masses are 50, 100, and 250 grams.
4. Calibration Card - A reference card for converting the digital readings to mass.

Additional hardware items, not part of the "flight type" unit are:

1. Leveling Fixture - In a one-g environment, the SMMD must be set up on a fixture that will allow leveling of the unit to minimize the effects of gravity.

B. Identification and Purpose of GSE

A metric balance scale in the 0-1 Kg range will be used outside the chamber as a comparative check on the accuracy of the SMMD.

VII. CHAMBER INTERFACES

A. Stowage Requirements

The only stowage requirements will be for the calibration weights, a volume of approximately 216 cu. in. will suffice.

B. Special or Unique Interfaces

A physical mounting provision in the Head is suggested. There is only one unit planned for SMEAT as opposed to two (Wardroom and Waste Management Area) in the OWS. The recommendation to place the unit in the Head reflects a presumption that it will be more acceptable to carry unconsumed food to the Head for measurement than the inverse of this action. The mounting of the unit must be rigid to preclude accuracy degradation.

Power requirements during operation is a nominal $28 \begin{smallmatrix} +2 \\ -4 \end{smallmatrix}$ VDC. The SMMD will require no more than 10 watts average power and 25 watts peak power. Power is to be provided to the Electronics Module.

VIII. CREW TRAINING

A. Briefing Sessions Required

A single briefing of an estimated 1-hour duration will be required for the three crewman. The briefing shall be accomplished in the period between T-30 days and the start of the chamber test.

B. Training Sessions Required

A single training session in hardware familiarity shall be required for each crewman. The estimated time requirement is one hour. The crew training shall be completed in the period between T-30 days and the start of the chamber test.

IX. SCHEDULING REQUIREMENTS

A. Number of Performances

Four runs for each crewman each day; a total of 672 measurement runs over the 56-day chamber test. A calibration run shall be accomplished approximately every 10 days, or five (5) times during the confinement period.

B. Time of Performance

Measurement of unconsumed food, vomitus and feces shall be accomplished as soon as possible after the specimen is collected. Calibration runs can be accomplished at any convenient accommodatable period in the daily activity plan. Five (5) minutes are required for each specimen measurement and thirty (30) minutes for each calibration run.

X. DATA REQUIREMENTS

A. Experiment Measurement List

There is no experiment measurement list for this experiment.

B. Unique Measurements from the Experiment

There are no unique measurements required.

C. Data from other experiments

No data from other experiments is required.

D. Other requirements

All measurements and calibration data are logged by the operating crewman and voice transmitted to the chamber support team.

XI. FDF REQUIREMENTS

A time line of the daily activity will be required along with the inflight operation procedures and logbooks for recording data.

XII. DEVIATIONS FROM APPROVED SKYLAB EXPERIMENT

A. Only one unit will be employed as opposed to two in the Flight

Program. Therefore, the unit will receive more use during the test and will weigh both food and excrement.

B. The mounting orientation will be changed requiring the tray surface to be horizontal and a leveling fixture will be required.

C. Mass weight limitations will be limited to 500 grams.

D. All data will be voice reported real time to chamber support personnel as well as logged by the crewman. In the flight situation, voice report of calibration data only will be given while measurement data is logged for M071 and M073.