

JUNE 18, 1974

Dr. Thornton

5.2.16 M172, Body Mass Measurement

- 5.2.16.1 Functional Objectives - The objectives of experiment M172 were (1) to demonstrate mass measurement without gravity, (2) to validate behavior of the body mass measurement device (BMMD) and (3) to support M071/M073 experiments requiring mass determination.

Experiment Description

The body mass measurement system used a linear spring mass pendulum device to measure mass based on the inertial properties of mass. This device measured and recorded the time associated with the period of a plate-fulcra spring support pendulum that had a fixed displacement.

The mass was accelerated uniformly by a repeatable restoring force set into the plate-fulcra springs and three periods of a pendulum were timed. Known masses were measured and a calibration nomograph was developed to determine the mass of a crewman.

- 5.2.16.2 Concept - A device incorporating a linear spring mass pendulum was employed to measure mass based on the "inertial properties of mass". This device measured and recorded the time associated with the period of a plate-fulcra spring-supported pendulum with a fixed displacement. The mass was uniformly accelerated by a repeatable restoring force set into the plate-fulcra springs. Three periods of a pendulum were timed. This device had a minimum response to gravitational force, but this was eliminated in orbital flight by recalibration with the same known masses used preflight.

- 5.2.16.3 Key Personnel - Principal Coordinating Scientist

Michel, E.L., M.S., Johnson Space Center,
Houston, Texas

Principal Investigator

Thornton, W.E., M.D., Johnson Space Center,
Houston, Texas

- 5.2.16.4 Experiment Performance Data - The M172 experiment consisted of calibrating the BMMD with specific items aboard the spacecraft periodically during each mission. The crewmen's masses were measured daily.

| | <u>SL-2</u> | <u>SL-3</u> | <u>SL-4</u> |
|---------------------------|-------------|-------------|-------------|
| Inflight Calibrations | 4 | 3 | 3 |
| Special Tests | | 20 | |
| Routine Mass Measurements | 28 | 56 | 84 |

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5.2.16.4.1 Preflight Data

- A. Final KSC Checkout - This final checkout verified the operational status of the BMMD.
- B. Preflight Calibration Data - During the preflight period the BMMD was calibrated a number of times with specific items that were later onboard the spacecraft. These items were later used for inflight calibrations.

5.2.16.4.2 Inflight Data

- A. Inflight Calibration Data - The BMMD was calibrated inflight with the same items used in preflight. These measurements were used to provide a correction factor for the gravitational force effects in the preflight measurements.
- B. Routine Mass Measurements - These routine measurements were each crewman's daily mass measurement. The mass measurements were recorded and voiced down during the evening report.
- C. Crew Comments - Crew comments on the BMMD performance were recorded on the dump tapes as part of the M487 experiment.
- D. Special Tests - A number of special tests including: BMMD Repeatability, BMMD Cal. Mass Stability, BMMD Subject Repeatability, BMMD Subject Stability Test, M171 PR-1 and PR-2 tests.

5.2.16.4.3 Postflight Data

- A. Crew Comments - Crew comments on the SMMD operation and performance are part of the Crew Technical Debriefing on each mission.

5.2.16.4.4 Postflight Reports

- A. Principal Investigator's M172 Final Report - In preparation.
- B. Principal Investigator's Special M172 Studies - in preparation.

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5.2.3 M074, Specimen Mass Measurement

- 5.2.3.1 Functional Objectives - The objectives of experiment M074 were to demonstrate mass measurement accuracy without gravity, to validate theoretical behavior of the device to measure fluids as well as solids, and to support M071/M073 experiments requiring mass determination.

Experiment Description

The Specimen Mass Measurement Device (SMMD) used a linear spring pendulum. Measurement of mass was based on the inertial properties of mass. The device measured and recorded the time associated with the period of the plate - fulcrum spring - supported pendulum that has a fixed displacement.

The restrained mass to be measured was accelerated uniformly by a repeatable restoring force set into the plate-fulcrum springs. Three periods of a pendulum were timed. The spring period was measured electro-optically. The measurement was displayed electronically and was converted to a direct mass readout.

- 5.2.3.2 Concept - The SMMD incorporated a linear spring mass pendulum to measure mass based on the inertial properties of mass. This device measured and recorded the time associated with the period of a plate-fulcrum spring supported pendulum with a fixed displacement. The masses to be measured were uniformly accelerated by a repeatable restoring force set into the plate-fulcrum springs, and three periods of a pendulum were timed. Known masses were measured and a nomograph developed which could be used to determine the mass of other objects. This device had a minimum response to gravitational force which was eliminated in orbital flight by recalibration with the same known masses as used pre-flight.

- 5.2.3.3 Key Personnel - Principal Coordinating Scientist:

Whittle, M.W., M.D. Squadron Leader,
Royal Air Force

Principal Investigator:

Thornton, W.E., M.D., Johnson Space Center,
Houston, Texas

- 5.2.3.4 Experiment Performance Data - The M074 experiment consisted of calibrating the SMMD with specified weight periodically during each Skylab mission as follows:

| | <u>SL-2</u> | <u>SL-3</u> | <u>SL-4</u> |
|----------------------|-------------|-------------|-------------|
| Inflight Calibration | 5 | 5 | 6 |
| Special Tests | | 2 | |

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5.2.3.4.1 Preflight Data

- A. Formal KSC Checkout - This checkout verified SMMD operational status performed final pre launch calibration.
- B. Preflight Calibration Data - During preflight the SMMD was calibrated a number of times with a standard set of masses. These masses were later used in flight calibration.

5.2.3.4.2 Inflight Data

- A. Calibration Data - The SMMD was calibrated inflight with the same standard set of masses used in preflight calibrations. These measurements were used to provide a corrective factor for the gravitational force effects on the preflight measurements.
- B. Food Residue Data - Food not completely consumed by a crewman during the mission was measured with SMMD and recorded.
- C. Fecal Data - Each fecal deposit with wipes was measured with the SMMD and recorded during the mission.
- D. Special Tests - Tests were performed to measure the SMMD repeatability.
- E. Crew Comments - SMMD operation crew comments were recorded on the dump tapes as part of the M487 experiment.

5.2.3.4.3 Postflight Data

- A. Crew Comments - SMMD operation crew comments and performance are part of the Crew Technical Debriefings for each mission.

5.2.3.4.4 Postflight Reports

- A. Principal Investigator's Special M074 Studies - In preparation.
- B. Principal Investigator's M074 Final Report