DOCUMENT CONTROL NO. 71-33

DETAILED TEST OBJECTIVE (DTO) APPROVAL SHEET

TITLE Stereometric Body Volume Measurement

Paul Rambaut — 6/12/72

Principal Coordinating Scientist — Date

E. D. Mudd — 6/12/72

Division Chief — Date

Chairman, SMEAT Steering Committee — Date

THIS DTO WAS APPROVED BY THE SMEAT Steering Committee

ON _____.

SKYLAB MEDICAL EXPERIMENTS ALTITUDE TEST

DETAILED TEST OBJECTIVE

I. EXPERIMENT/OPERATIONAL SYSTEM

A. Title - Stereometric Body Volume Measurement

B. Principal Coordinating Scientist - P. C. Rambaut, Sc.D

C. Principal Investigator - R. E. Herron, Ph.D.

II. PURPOSE AND BACKGROUND

A. Purpose of Experiment

To compute total body and limb volumes and body and limb volume distribution curves to assess cardiovascular, neuromuscular, and nutritional changes resulting from the 56 day SMEAT test.

B. Justification for Experiment

One of the most revealing parameters of nutritional condition is body density which can be derived from measurements of body mass and total body volume. Stereometric analyses will yield necessary body volume data to make density measurements possible.

Girth measurements before and after extended bedrest studies on normal subjects have revealed a decrease in muscle bulk for the largest part of the four extremeties below elbow and knee. Stereometric analysis of body and limb volumes and body and limb volume distribution curves are valuable for studying the operation of physiological restorative processes, the influence of physical activity patterns, and nutritional regimens. Evaluation of the cardiovascular system is aided by measurement of volume changes of body parts.

III. PARTICIPANTS

A. Number of Crewmen Required

All 3 crewmembers will participate

B. Function of Each Crewman

To have a stereometric body volume measurement taken

IV. FUNCTIONAL OBJECTIVES

FO1 The acquisition of measurable pre- and postflight stereometric records.

V. TEST CONDITIONS

A. Environmental Requirements

None

B. Crew Constraints

None

VI. HARDWARE REQUIREMENTS

A. Identification and Purpose of Hardware

None required in the chamber

B. Identification and Purpose of GSE

Identification	Purpose
1. Camera and flash projector (2)	Taking stereometric human body form measurements
2. Camera stands (2)	For supporting the cameras
3. Control cage (1)	For providing a reference plane of the subject
4. Transport cases	For storing and transporting the basic equipment

VII. CHAMBER INTERFACES

None

VIII. CREW TRAINING

A. Briefing Sessions Required

One 30 minute briefing session will acquaint the crew with the procedures prior to taking the stereometric pictures.

B. Training Sessions Required

None

IX. SCHEDULING REQUIREMENTS

A. Pre-test

T-15 and T-5

B. In-chamber

None

C Post-test

R+0, R+3 and R+6

X. DATA REQUIREMENTS

A. Experiment Measurements List

Body and limb volume measurements obtained from front and rear view stereometric images with specially designed cameras. These data will be analyzed to yield total body and limb volumes, and body and limb volume distribution curves. A comprehensive three-dimensional optical analog of each individuals body form is contained in a set of stereopairs (pairs of photographs which can be projected stereoscopically). Each optical analog is a precise three-dimensional model of the individuals body form which can be measured in many ways.

B. Unique Measurements to SMEAT

None

C. Data from other Experiments

None

X. DATA REQUIREMENTS (Cont'd)

D. Computer Requirements

Computation of three-dimensional coordinate data about body form for segmental and total volumes, surface areas and other quantitative parameters. A digital computer linked to a numerically controlled (N/C) automatic plotter is used to compile profiles, cross-sections and contour maps of selected regions of the body.

XI. FDF REQUIREMENTS

None

XII. DEVIATIONS FROM APPROVED SKYLAB EXPERIMENT

This entire experiment is unique to SMEAT

STEREOMETRIC BODY VOLUME MEASUREMENT

PURPOSE

To measure effect of SMEAT on segmented body volume and total body density

PROCEDURE

Twice pretest (T-15, T-5) and 3 times posttest (R+0, R+3, R+6) obtain stereometric images of each astronaut (5 minutes)

Automatically compute contour maps, cross sections, and volumes

JUSTIFICATION

Knowledge of the density of material lost from the body gives information relative to the identity of that material, i.e., lean body mass, andipose tissue fluid