**SESSION NAME:**

# Bone Scans Using X-ray Densitometry

| Experiment ID(s): | M006 | | | | |
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## PROTOCOL

Preflight and postflight x-rays were made of the lateral aspect of one foot and the posterior-anterior aspect of one hand of each Gemini 4, 5, and 7 astronauts and the Apollo 7 and 8 astronauts. Different x-ray units were used preflight, on the recovery ship immediately postflight, and on follow-up tests. In all instances the machines output was adjusted to produce a tabletop beam quality equal to that of the x-ray unit used at the Manned Spacecraft Center in Houston.
<P>
Subjects laid flat on their backs with a flat pillow under their heads. They were covered entirely with leaded rubber sheeting except for the small part of the anatomy being x-rayed.
<P>
The x-ray of the hand was taken while the subject was flat on his back. Afterwards, he was turned slightly to his left to position the left foot. All radiographs were exposed in cardholders using Kodak Industrial AA film, which had a very fine grain film. Bone mass measurements using the exposed x-ray film was performed at the Texas Woman's University, Denton, Texas.
<P>
The os calcis, talus, capitate, phalanx 5-2, and phalanx 4-2 were measured in the Gemini 4 astronauts.<BR>
The os calcis, talus, capitate, radius, phalanx 5-2, and phalanx 4-2 were measured in the Gemini 5 astronauts.<BR>
The os calcis, talus, capitate, phalanx 5-2, and phalanx 4-2 were measured in the Gemini 7 astronauts.
The os calcis, talus, capitate, radius, ulna, phalanx 5-2, and phalanx 4-2 were measured in the Apollo 7 and 8 astronauts.<END>

### Session Constraints

### Parameters Measured

Bone density : os calcis
Bone density : phalanx 4-2
Bone density : phalanx 5-2
Bone density : talus
Bone mass : capitate
Bone mass : os calcis
Bone mass : phalanx 4-2
Bone mass : phalanx 5-2
Bone mass : talus
Bone mineral change : capitate
Bone mineral change : central talus
Bone mineral change : distal talus
Bone mineral change : os calcis
Bone mineral change : phalanx 4-5
Bone mineral change : phalanx 5-2
Bone mineral change : radius
Bone mineral change : ulna
Bone x-ray : phalanx 4-2
Bone x-ray : phalanx 5-2
Calcium output: excretia
Dietary intake : calcium
X-ray absorption : capitate
X-ray absorption : os calcis
X-ray absorption : phalanx 4-2
X-ray absorption : phalanx 5-2
X-ray absorption : radius
X-ray absorption : talus

### Hardware Used

Bone Densitometer Assembly
Aluminum Alloy Wedge
X-ray

# DATA COLLECTION TIMETABLE

| Payload ID | Scheduled Day | Actual Day | Actual Date | Grouped Subjects | Actual Subjects |
|---|---|---|---|---|---|
| Gemini 4 | | L-9 | 22 MAY 1965 | 2 subjects | Gemini 4 command pilot<br>Gemini 4 pilot |
| Gemini 4 | | L-3 | 31 MAY 1965 | 2 subjects | Gemini 4 command pilot<br>Gemini 4 pilot |
| Gemini 4 | | L-0 | 3 JUN 1965 | 2 subjects | Gemini 4 command pilot<br>Gemini 4 pilot |
| Gemini 4 | | R+0 | 7 JUN 1965 | 2 subjects | Gemini 4 command pilot<br>Gemini 4 pilot |
| Gemini 4 | | R+16 | 22 JUN 1965 | 2 subjects | Gemini 4 command pilot<br>Gemini 4 pilot |
| Gemini 4 | | R+50 | 26 JUL 1965 | 2 subjects | Gemini 4 command pilot<br>Gemini 4 pilot |
| Gemini 5 | | L-10 | 11 AUG 1965 | 2 subjects | Gemini 5 command pilot<br>Gemini 5 pilot |
| Gemini 5 | | L-4 | 17 AUG 1965 | 2 subjects | Gemini 5 command pilot<br>Gemini 5 pilot |
| Gemini 5 | | L-2 | 19 AUG 1965 | 2 subjects | Gemini 5 command pilot<br>Gemini 5 pilot |
| Gemini 5 | | L-0 | 21 AUG 1965 | 2 subjects | Gemini 5 command pilot<br>Gemini 5 pilot |
| Gemini 5 | | R+0 | 29 AUG 1965 | 2 subjects | Gemini 5 command pilot<br>Gemini 5 pilot |
| Gemini 5 | | R+1 | 30 AUG 1965 | 2 subjects | Gemini 5 command pilot<br>Gemini 5 pilot |
| Gemini 5 | | R+10 | 7 SEP 1965 | 2 subjects | Gemini 5 command pilot<br>Gemini 5 pilot |
| Gemini 5 | | R+58 | 25 OCT 1965 | 2 subjects | Gemini 5 command pilot<br>Gemini 5 pilot |
| Gemini 7 | | L-10 | 25 NOV 1965 | 2 subjects | Gemini 7 command pilot<br>Gemini 7 pilot |
| Gemini 7 | | L-3 | 1 DEC 1965 | 2 subjects | Gemini 7 command pilot<br>Gemini 7 pilot |
| Gemini 7 | | L-0 | 4 DEC 1965 | 2 subjects | Gemini 7 command pilot<br>Gemini 7 pilot |
| Gemini 7 | | R+0 | 18 DEC 1965 | 2 subjects | Gemini 7 command pilot<br>Gemini 7 pilot |
| Gemini 7 | | R+1 | 19 DEC 1965 | 2 subjects | Gemini 7 command pilot<br>Gemini 7 pilot |
| Gemini 7 | | R+11 | 29 DEC 1965 | 2 subjects | Gemini 7 command pilot<br>Gemini 7 pilot |
| Gemini 7 | | R+47 | 3 FEB 1966 | 2 subjects | Gemini 7 command pilot<br>Gemini 7 pilot |
| Apollo 7 | | L-0 | 11 OCT 1968 | 3 subjects | Apollo 7 commander<br>Apollo 7 lunar module |
| Apollo 7 | | R+0 | 21 OCT 1968 | 3 subjects | Apollo 7 commander<br>Apollo 7 lunar module |
| Apollo 8 | | L-0 | 21 DEC 1968 | 3 subjects | Apollo 8 commander<br>Apollo 8 lunar module |
| Apollo 8 | | R+0 | 27 DEC 1968 | 3 subjects | Apollo 8 commander<br>Apollo 8 lunar module |

**SESSION NAME:**

# Measurement of Dietary Intake

| Experiment ID(s): | M005 | M007 | M006 | | |
|---|---|---|---|---|---|

## PROTOCOL

### Session Constraints

| Parameters Measured | Hardware Used |
|---|---|

**SESSION NAME:**

# Os Calcis Measurement in Bedrest Subjects

| Experiment ID(s): | M006 | | | | |
|---|---|---|---|---|---|

## PROTOCOL

The radiographs made on the Gemini astronauts consisted of exposures of the foot in lateral projection. For purposes of comparison of bone mass losses during orbital flight and during bedrest, the central os calcis was x-rayed and measured by the densitometer assembly in the same location.<END>

## Session Constraints

During the bedrest period, the subjects remained recumbent in a horizontal position throughout the study. They bathed in bed, and had their teeth brushed and all other hygienic needs cared for by trained orderlies. The subjects had available a television set in a stationary position which could be adjusted by remote control, and they read by means of glasses equipped with prismatic lenses. The subjects were spoon fed by dietitians on the study.<END>

### Parameters Measured

Bone mass: os calcis

### Hardware Used

Bone Densitometer Assembly
Aluminum Alloy Wedge
X-ray