

Rewrite 10/23/85

Garn Report: Height Girth measurements

Background

Positional variations in height from supine to upright and vs. and slow decreases in height from arising through the course of the day have been noted for some time. () ()

Difficulties with fitting some subjects into their space suits in flight and on the moon also were noted.

Changes in height with ^{weightlessness} were first documented on Skylab Mission 4, and again demonstrated on the Apollo Soyuz Test Project (ASTP). Supine and upright height variations on earth, the time course of these changes and with varying loads, were investigated by Thornton and others.

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A series of unflight changes were also studied on the Shuttle missions resulting in an added inch to the spacesuit torso length.

Results of the studies are consistent; the intervertebral discs expand or compress with changing load in a biphasic fashion. There is an immediate change in height with load followed by a slower change with a time constant of hours.

While the magnitude of such changes is fairly well established for weightlessness their time course was unknown; this was studied as follows.

Procedures and operations. In a fully erect position with his back against a wall, ^{and} in bare feet and exerting downward pressure with his hands, the subject maintained solid contact with the floor. A square jig was placed against the wall with its top just touching the subject's vertex. An index mark was made on the wall. Pre- and postflight measurements were made in a similar fashion and the changes were measured to $\frac{1}{16}$ of an inch.

Garns Height Gerth

Results and analysis. The data are tabulated in Table 1 and plotted in figure 2. The model proposed by the author, and independently by Kazarian, predicts an exponential increase in height under the circumstances. When plotted in semi-logarithmic fashion with a time constant ($\frac{1}{k}$ point) of hours, all but one of the points follow such a curve.

Comments. This was the first opportunity to follow the time course of height changes in weightlessness and the results were consistent with the theory of the phenomenon. The absolute value of change of 1.5 inches was not unusual.

It would seem reasonable to extend this measurement to a population large enough to be statistically significant. Should it ever become necessary to accurately allow for such changes, an accurate prediction

might be achieved by studying the correlation of inflight to 1g changes in the same subject.