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NASA

AUG 06 1990

Reply to Attn of SD/90-201

TO: SD5/Mike Greenisen

FROM: SD/William E. Thornton

SUBJECT: Treadmill (M.K.I) Studies

A brief review of a very small amount of data from the KC-135 treadmill studies clarifies a number of points including my reason for suspecting a very low frequency resonance in the treadmill/Kistler recording system. Apparently some of same difficulties that have been encountered in flight were also encountered on the zero g runs ie. it appears that the bungees had two problems. The first is that they are not being adjusted to provide an equivalent body weight. In the case of one subject with body weight of approximately 160 pounds the summed bungee multiplied by a conservative angle on the bungees would have provided a vertical force of only 112 pounds. This in turn does not allow the subject to come close to the kinds of inertial forces produced in running on earth and in this case his peak forces were only 1.7 x 1 g. body weight. A second problem in running with reduced forces is that the ground contact time is extended and this is clearly indicated by his barely reaching clearance of the tread. Another problem which has been encountered with flight bungees is that they hang up on the pulleys such that large changes in force are produced during the normal gait cycle. Changes of almost 25% force were encountered in the bungees when they should be in 5% range. Under these circumstances a resonant condition between body mass and the bungees will occur which will be at the approximate frequency of stepping. This may also have affected the normal biomechanics. We are going to look at some video tapes and also look at some of the calibrations to verify this.

In the future the procedures should be altered to insure that; (1) the bungees can move freely over the entire length and (2) that they are loaded to equivalent 1g weight. Another major problem in the relatively short periods of weightlessness on KC-135 parabolas will be getting the treadmill up to speed during the period of weightlessness. To be valid the runs must be made hands off ie not holding the bar. Prior to the next flight with this equipment we should sit down and review all these aspects and any others that may come up.

W. Thornton

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cc.
SD/C. Sawin