Biomed Results - Shuttle

Exercise

Studies on Skylab demonstrated the need for inflight exercise which would:

1. Impose metabolic loads sufficient to maintain cardio respiratory capacity
2. Impose force loads on the upper body to maintain strength
3. Impose large periodic loads on the locomotor system to maintain leg and back strength and endurance.

While a cycle ergometer could provide aerobic exercise, its peak force loads are small. A treadmill can meet both force and aerobic requirements simultaneously, and this became my first priority, however little effort was being spent on exercise for missions of 7 days or less. in preparation

Shuttle Treadmill (STm)

A small grant from Ft. Ops. was obtained ~~c~~ a very restrictive set of requirements to design, prototype and build a flight STm. Requirements included assembly/disassembly without tools for stowage in a single locker and no external power.

Henry Whitemore met the requirements & a unit which in spite of its small size supported full stride walking, jogging or running from 1½ to 8+ mph with a minimum grade of 5½ % under truncal loads of 40-220 lbs from a bungee loaded harness. Metal treads were noisy but reliable. Speed control and metabolic loading were equal to a 1 g professional treadmill.[2]

Jogging in Place In this 1 g this activity produced force and metabolic loads similar to jogging. (measured) It was being considered as a contingency exercise in the absence of a tread mill. Hardware consisted of the bungee loaded STm harness & standard deck connectors.

Shuttle Rowing Machine Rowing imposes significant leg and large trunk, arm and shoulder force loading producing metabolic loads which can be greater than those in running.

In the absence of body weight to support, a rowing machine for weightlessness consists of only a load apparatus & attached shoes, a cord and handle. A prototype was designed, built, tested and demonstrate a performance equal to the best 1 g machines.

Advanced Tread Mill Major limitation of the STm were lack of recorded instrumentation for key parameters and tread noise. A unit covering these deficiencies was designed[2], prototyped and tested[3]. Sts measured and stored in powered or unpowered operation which parameters included speed, effective grade, foot/tread forces, truncal force load, heart rate, time and I.D. of usage all of which are necessary to in flight usage. Force loading was active and constant and treads were quiet. Reliability was

U.S. Pat. No. 5,242,339

demonstrated by several weeks of scheduled use by a group of competitive runners.

As space station ~~boost~~ approached reality preparations were made to flight test the components of a 'gym' on Shuttle flights. An efficient computer controlled servo "weight machine" ~~weighing~~ weighing a few pounds but producing exactly simulated 1g weights of 5 to 200+ pounds was designed and a model demonstrated.

In flight experience & exercise

Capt. Young devised ~~the~~ an exercise on the first reentry which remains undocumented S.O.P.

Noting the perceived heaviness of brake

pedals he repeatedly actuated them prior to touch down, rapidly regaining leg reduced strength. This ~~was~~ neuromuscular inhibition induced by reduced force loads in weightlessness.

The second exercise (documented) on Shuttle was STS 2's Cdr. jogging in place to demonstrate its feasibility.

The STm was first flown on STS-3 and remained a stardard flight equipment item until —. It use was never adequately regulated or documented to properly evaluate effects of it usage.

The treadmill was flown twice

and its employment reccomended by crew but no data was obtained.

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