



## Bio-Medical

### Stationary Apparatus Would Apply Forces of Walking to Feet

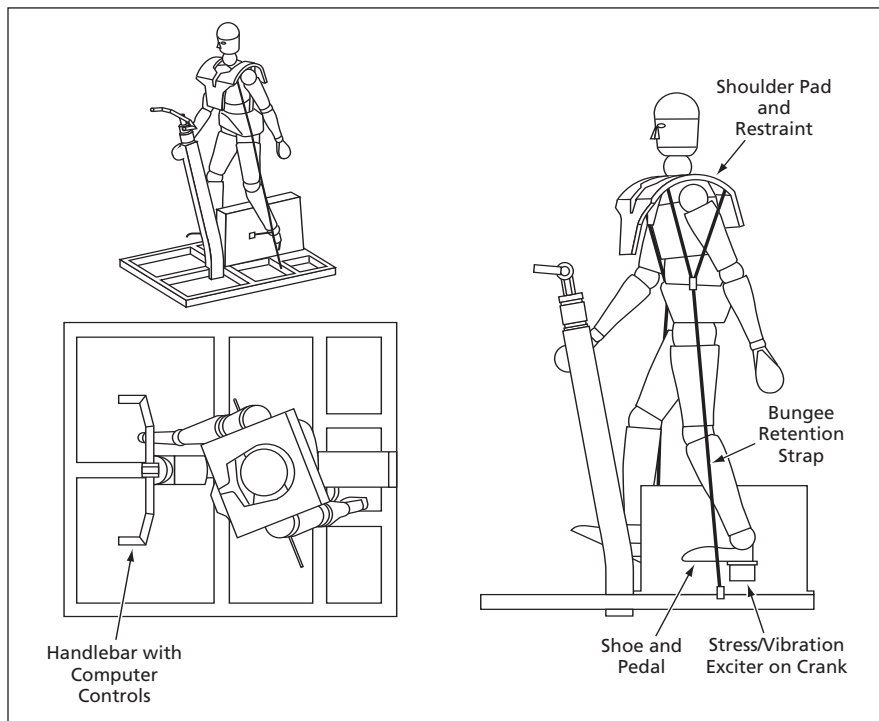
The forces would be tailored to prevent loss of bone density.

*Goddard Space Flight Center, Greenbelt, Maryland*

A proposed apparatus would apply controlled cyclic forces to both feet for the purpose of preventing the loss of bone density in a human subject whose bones are not subjected daily to the mechanical loads of normal activity in normal Earth gravitation. The apparatus was conceived for use by astronauts on long missions in outer space; it could also be used by bedridden patients on Earth, including patients too weak to generate the necessary forces by their own efforts.

The apparatus (see figure) would be a modified version of a bicyclelike exercise machine, called the cycle ergometer with vibration isolation system (CEVIS), now aboard the International Space Station. Attached to each CEVIS pedal would be a computer-controlled stress/vibration exciter connected to the heel portion of a special-purpose pedal. The user would wear custom shoes that would amount to standard bicycle shoes equipped with cleats for secure attachment of the balls of the feet to the special-purpose pedals.

If possible, prior to use of the apparatus, the human subject would wear a portable network of recording accelerometers, while walking, jogging, and running. The information thus gathered would be fed to the computer, wherein it would be used to make the exciters apply forces and vibrations closely approximating the forces and vibrations experienced by that individual during normal exercise. It is anticipated that like the forces applied to bones during natural exercise,



An Exercise Machine would include computer-controlled stress-vibration exciters that would apply forces substituting for normal exercise forces to stimulate bones.

these artificial forces would stimulate the production of osteoblasts (bone-forming cells), as needed to prevent or retard loss of bone mass.

In addition to helping to prevent deterioration of bones, the apparatus could be used in treating a person already suffering from osteoporosis. For this purpose, the magnitude of the applied forces could be reduced, if necessary, to a level

at which weak hip and leg bones would still be stimulated to produce osteoblasts without exposing them to the full stresses of walking and thereby risking fracture.

*This work was done by Jessica Hauss, John Wood, Jason Budinoff, and Michael Correia of Goddard Space Flight Center and Rudolf Albrecht of ESA. Further information is contained in a TSP (see page 1). GSC-14700-1*

### Instrument Would Detect and Collect Biological Aerosols

Samples would be quickly collected on substrates that would be analyzed automatically.

*Marshall Space Flight Center, Alabama*

A proposed compact, portable instrument would sample micron-sized airborne particles, would discriminate between biological ones (e.g., bacteria) and nonbiological ones (e.g., dust particles), and would collect the detected bi-

ological particles for further analysis. The instrument is intended to satisfy a growing need for means of rapid, inexpensive collection of bioaerosols in a variety of indoor and outdoor settings. Purposes that could be served by such

collection include detecting airborne pathogens inside buildings and their ventilation systems, measuring concentrations of airborne biological contaminants around municipal waste-processing facilities, monitoring airborne