# Intelligent Magnetic Shoes to Enable Astronauts Use Treadmills in Microgravity for Health Improvement

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## Abstract

Humans face health problems in microgravity. Extended space travels has adverse effects on astronauts because their heart function, bone density, muscles, blood flow, red blood cell production and the immune system are usually weakened. For well being, throughout their mission they need to be supplemented by strenuous workouts that increase mechanical stress on their bones and muscles such as running on treadmills. Unfortunately, it is not possible to walk or run on treadmills in microgravity as we do on Earth. Intelligent Magnetic Shoes (IMS) is a proposed new device which would enable astronauts to walk or run on treadmills for well being and improvement of their health. IMS helps in accessing on-Earth like movements on treadmills. IMS would be built of electronically inducible magnets incorporated in sport shoes. The treadmill conveyor strip is incorporated with iron metal strips to adsorb the magnetically charged IMS. The induction of magnetism in IMS should be managed by computerized intelligent program to attain modulation for versatile (slow/fast, short/long) paces and maximum comfort of the astronaut. Through the process of walking, IMS would be turned on in the leg that astronaut has in contact with conveyor strip, and it is off in the lifted leg. *Via* the intelligent software, start and end time, duration and magnitude of magnetic power enforcement (preferably similar to 1 *g* pull) is adjusted with the astronaut's paces on the treadmill. IMS, appropriate treadmills and all other necessary components are applicable in all present space stations such as International Space Station (ISS). Implementation of IMS engineered setup would be of a great help to improve humans health through his long-duration future voyages in outer space.

**Key words:** Intelligent Magnetic Shoes, IMS, ISS, space voyage, astronaut's health, microgravity

## *1. Introduction*

Human's health is adapted well to 1 *g* on Earth. Prolonged zero-*g* (more precisely, microgravity) environment has adverse effects on his well being physiology. Prolonged space travels in microgravity environment causes adverse effects in bone density, muscles, heart function, blood flow, red blood cell production and the immune system [1-5]. Astronauts experience such maladies both in space and upon return to 1 *g* on Earth. One of the worst repercussions is the continuous loss of bone mineral in space -at the rate of 1- 1.5% a month- especially from the hip and lower spine, a trend that if uncorrected over time could prevent long space voyages [6]. It appears that astronauts and future space travelers are at increased risks of suffering bone health due to microgravity, which raises serious problems for manned space exploration plans. These changes happen because astronauts aren't getting enough exercise [7]. Adequate care and attention have to be given to bring about measures to ensure their consistent performance with the support of healthy body [8-12]. Evaluation of feasible new ideas by space health-researchers is necessary to overcome the health problems of astronauts. Besides, as our knowledge increases, the men and women in orbit - and hopefully beyond - should have a more comfortable time in future. Implementation of IMS engineered setup would be of a great help to improve humans health through his long-duration future voyages in outer space.

## *2. Hypothesis*

Intelligent Magnetic Shoes (IMS) has not ever been reported. The hypothesis I propose here is that IMS would enable astronauts to walk or run on treadmills in microgravity for well being and improvement of their health. IMS helps in accessing on-Earth like movements on treadmills. IMS would be built of electronically inducible magnets incorporated in sport shoes. The treadmill conveyor strip would be incorporated with iron metal strips to adsorb the magnetically charged IMS.

The induction of magnetism in IMS should be managed by computerized intelligent program to attain modulation for versatile (slow/fast, short/long) paces and maximum comfort of the astronaut. Through the process of walking, IMS would be turned on in the leg that astronaut has in contact with conveyor strip, and it is off in the lifted leg. *Via* the intelligent software, start and end time, duration and magnitude of magnetic power enforcement (preferably similar to 1 *g* pull) is adjusted with the astronaut's paces on the treadmill. However, based on the expressed hypothesis, the detailed makeup for IMS should be designed and built by appropriate specialists. IMS, appropriate treadmills and all other necessary components seem to be applicable in all present space stations such as International Space Station (ISS).

### *3. Medical significance*

Physical exercises, specially running are well known to have positive effects on hardening of bones, heart function, strengthening of muscles and better overall performance. IMS helps in accessing on-Earth like movements on treadmills. Implementation of IMS would be of a great help to improve humans health through his long-duration future voyages in outer space.

### *4. Future testing*

Optimization of IMS design and expected performance should be assessed through appropriate aerospace engineering. Then, experiments in orbit both in short and prolonged periods of weightlessness would reveal its effectiveness on astronauts' health. Obviously IMS would have a remote control set that the running astronaut is able to adjust it for the performance he expects. Time and duration for using IMS should be evaluated and set by the astronauts' physicians.

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