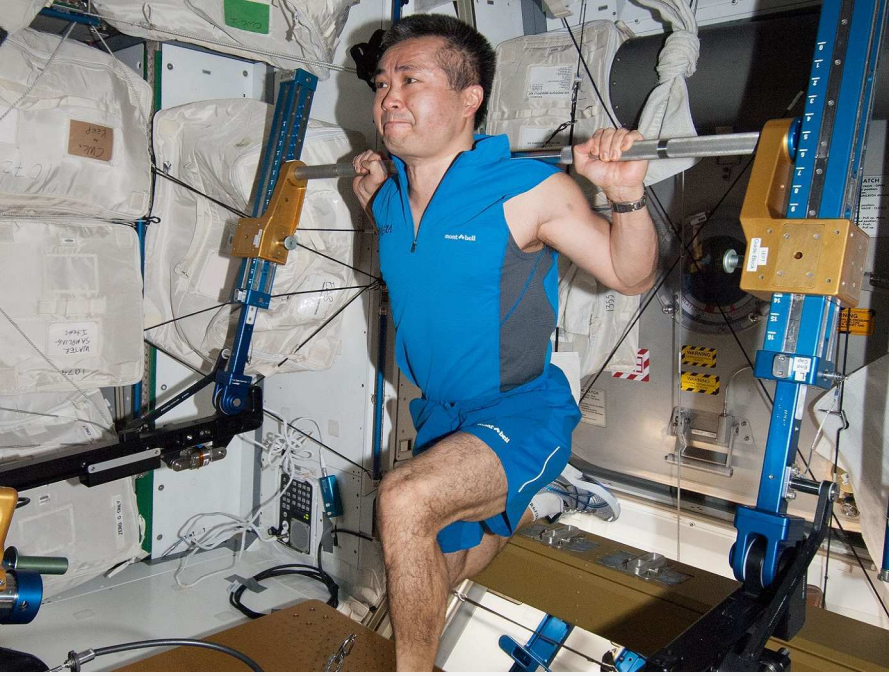


National Aeronautics and Space Administration

technology solution

Health, Medicine and Biotechnology

The International Space Station Advanced Resistive Exercise Device

Astronauts on the International Space Station maintain their health in the absence of gravity

A person who is inactive for an extended period of time (such as when they have a long illness) loses strength, as well as muscle and bone mass. Astronauts on the International Space Station (ISS) face similar risks, because bones and muscles begin to atrophy in the absence of gravity. Resistive exercise, where the musculoskeletal system bears weight, has been shown to mitigate these effects. But just lifting weights, as we do on Earth, does not work without gravity.

Engineers at the NASA Johnson Space Center (JSC) have developed a special resistive exercise device for astronauts on the ISS to follow a personalized exercise plan in the microgravity environment of Low-Earth-Orbit. The Advanced Resistive Exercise Device (ARED) has the capability to exercise all of the major muscle groups, focusing on squats, dead lifts, and calf raises, and helps the crew maintain their strength and endurance. NASA-JSC is looking to license this technology for commercial Earth and space applications.

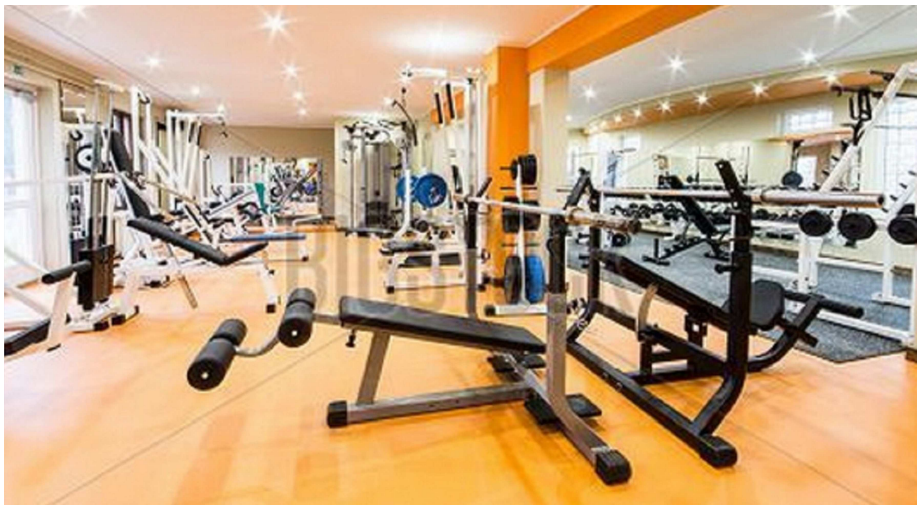
BENEFITS

- Compact: Designed to operate in a small amount of floor space.
- Effective: Exercises are designed to give maximum benefit in a minimum of time.
- Durable: Designed to operate for over 15 years, or 11 million cycles.
- Flexible: Can be used by a wide range of human body sizes, and in different gravitational environments (microgravity, Earth, etc.).
- Programmable: Astronauts may use pre-programmed exercise prescriptions, general exercise programs, or create their own. The user interface is easy to operate and automatically records data for later analysis.

THE TECHNOLOGY

The ARED is a mechanically simple, but robust device. It employs vacuum cylinders to provide a constant resistance, while flywheel assemblies provide a variable resistance. The variable resistance supplied by the flywheel assemblies is designed to mimic the inertial forces generated when lifting free weights on Earth. It is not dependent on gravity to operate, but can operate in Earth gravity as well as microgravity. It was flown to the ISS on Space Shuttle mission STS-126 in November 2008. It is designed to last at least 15 years, with a total life of over 11.2 million cycles. The ARED accommodates a wide range of body types and sizes. There is also a touch screen that makes it easier for an astronaut to follow a personalized prescribed exercise plan. A crewmember may select any exercise from their prescription or choose other available exercises. The crew performs their exercises using either a lift bar or a cable assembly. Resistive load can be adjusted between 0 and 600+ pounds for bar-related exercises and up to 150 pounds for cable-related exercises.

This NASA Technology is available for your company to license and develop into a commercial product. NASA does not manufacture products for commercial sale.



Without gravity, none of these exercise machines work.

APPLICATIONS

The technology has several potential applications:

- More robust exercise equipment
- Physical therapy
- Clinical diagnosis
- Athletic training and performance
- Wellness promotion and education

PUBLICATIONS

Patent No: 7,462,141

Loehr JA, Lee SM, English KL, Sibonga JD, Smith SM, Spiering BA, Hagan RD. Musculoskeletal adaptations to training with the advanced resistive exercise device. Medicine and Science in Sports and Exercise. 2011; 43(1): 146-156. DOI: 10.1249/MSS.0b013e3181e4f161. PMID: 20473227.

More Information

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NP-2015-05-1762-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

MSC-23805-1
MSC-TOPS-59