



X1

NASA's X1 robotic exoskeleton, which may someday help astronauts stay healthier in space, also has the added benefit of assisting people living with paraplegia here on Earth.

NASA and The Florida Institute for Human and Machine Cognition (IHMC) of Pensacola, FL, with the help of engineers from Oceanering Space Systems of Houston, jointly developed the system as part of NASA's Game Changing Development Program. Derived from NASA's Robonaut 2 (R2) project and IHMC's Mina exoskeleton, the 57-pound device is a robot that a human can wear over his or her body either to assist or inhibit movement in leg joints.

NASA is examining the potential for the X1 as an exercise device to improve crew health both aboard the International Space Station (ISS) and during future long-duration missions to an asteroid or Mars. While significantly reducing use of valuable space and mass resources, X1 could potentially

replicate common crew exercises, which are vital to keeping astronauts healthy in microgravity by combating muscle atrophy and bone density loss. Potential future applications include strength augmentation and assistance for astronauts during both spacewalks and surface exploration. In addition, the device has the ability to measure, record and stream back real-time data to flight controllers on Earth, giving doctors better feedback on the impact of the crew's exercise regimen.

The Tech

X1 is derived from technologies developed under the R2 program, inheriting the safety architecture that was built into the robot along with many of the same actuators and motor control mechanisms. Each joint is able to provide real time data feedback, relaying information like position, velocity, acceleration, force and torque. The X1's primary structure and body connection draw their design from IHMC's Mina exoskeleton.



Specifications

- Materials:
 - Aluminum,
 - Ortho Fabric,
 - Carbon Fiber
- Weight: 57 lbs.
- Height of Subject:
 - 5% Female to
 - 95% Male
- Degrees of Freedom:
 - 4 powered,
 - 6 passive
- Real-time Data:
 - Joint Position,
 - Joint Speed,
 - Joint Acceleration,
 - Joint Torque,
 - Joint Current

Applications

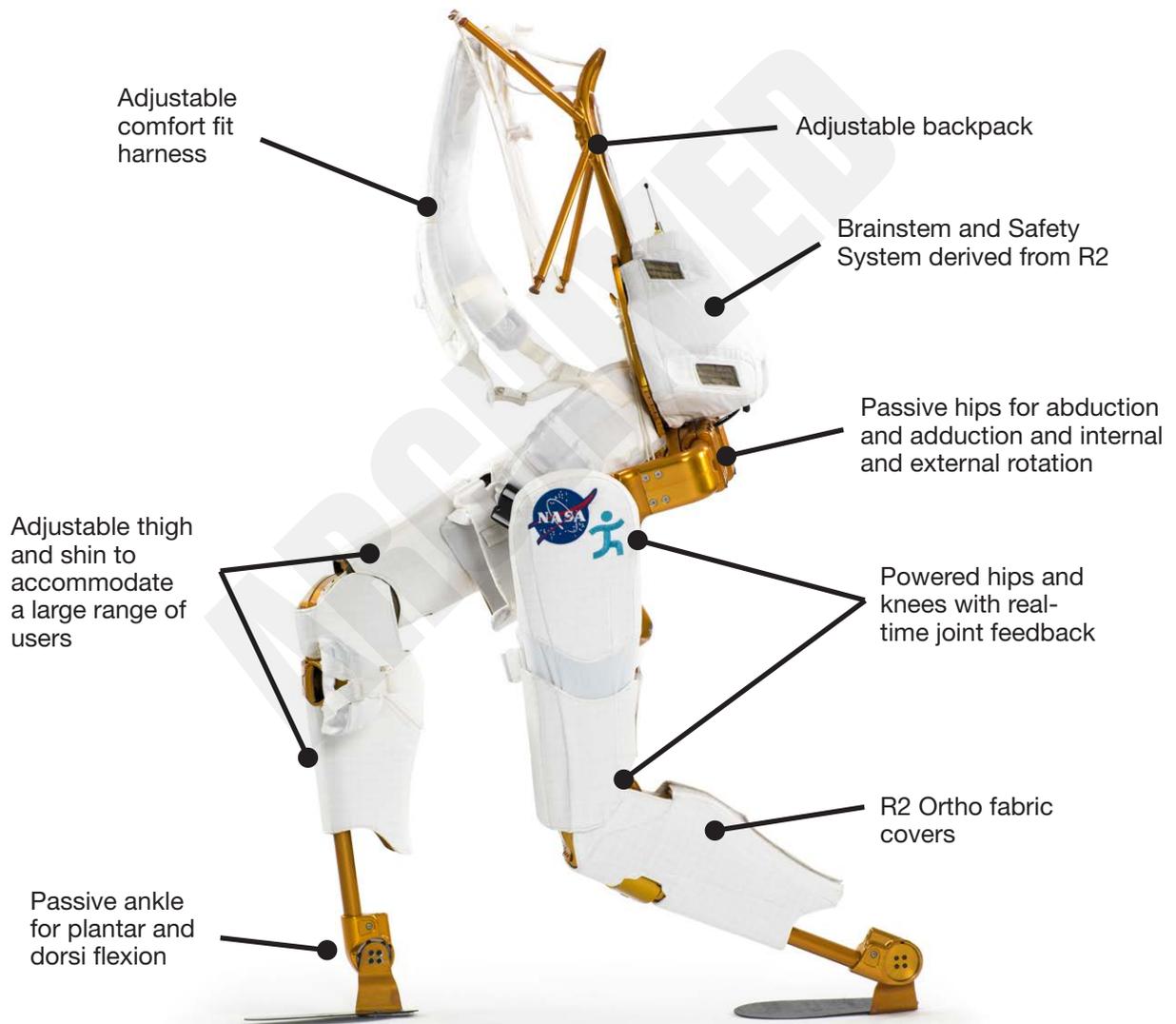
The X1 exoskeleton comes with the ability to augment the capabilities for those in space as well as here on Earth. As an exercise device, it could assess muscle strength of long duration space flyers in order to tailor an exercise regimen to each astronaut's needs. This would also provide physicians on the ground with invaluable data on a crew member's progression during their time in microgravity. Engineers are currently exploring methods to use the device for exercise for future missions to deep space where storage and mass availability are restricted. X1 also could provide a robotic power boost to astronauts as they work on the surface of distant planetary bodies, providing additional force when needed during surface exploration and improving the ability to carry extra loads in a reduced gravity environment.

Here on Earth, applications include rehabilitation, gait modification and offloading large amounts of weight from the wearer. It also has the potential to assist those with limited mobility, such as persons with lower extremity paralysis.

The Future

X1 currently is in a research and development phase, where the primary focus is design, evaluation and improvement of the technology. Future development is looking to incorporate more active joints for greater control and mobility as well as building upon the device's potential to enhance the wearer's strength.

<http://er.jsc.nasa.gov/ER4/>



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