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FUTURE COMMERCIAL HUMAN SPACE PROGRAM FOR PEOPLE WITH LOWER LIMB  
DISABILITIES

**Abstract**

The end of operation of the International Space Station (ISS) marks the beginning of the new era of space development to socialize Low Earth Orbit (LEO), Moon, and Mars for next a few decades. The current space program allows only six healthy astronauts to live and work in LEO. The growth of the private space sector, however, becomes more and more reliable and affordable to access to LEO. The advent of new space vehicles and space stations will trigger to develop new commercial human space program scheme, expanding an opportunity to spend a lifetime in space to many people being a tourist or a commercial crew. In such an era, it will be inevitable to open the gate for people with certain lower limb disabilities (LLD) disabilities to live and work in a space being a crew member or a visitor. Many astronauts testified that legs are not necessarily involved in moving in 0-g conditions, and they used mostly to stabilize body posture during working, eating and performing hygiene activities. Therefore, in 0-g conditions healthy individuals with LLD may perform and operate at the same level as people without LLD. It indicates that people with LLD can expand their activities in 0-g conditions because they do not need a wheelchair in daily life.

This paper depicts an affordable mission architecture to realize that people with impaired legs go to LEO station and return Earth safely. The project identified expected potential constraints and physiological change caused by the environment in each mission profile; launch, in-orbit, re-entry, and landing. Those who have impaired legs cannot perform an emergency process by themselves using conservative space vehicles like capsule or space shuttle. The interior architecture of a space station and special equipment such as body restraint equipment, hygiene system, and exercise equipment need to be modified to support them. This project introduces future researches including ergonomic posture analysis in neutral buoyancy environment and new interior design of a space vehicle and a space station. Those researches will propose recommendations how to adapt people with impaired legs to space vehicles and stations to realize comfortable life in space and perform emergency actions properly.