

SPACE LIFE SCIENCES SYMPOSIUM (A1)
Multidisciplinary Space Life Sciences Research (8)Author: Prof. Satoshi Iwase
Aichi Medical University, Japan, s_iwase@nifty.comSHORT RADIUS CENTRIFUGE WITH EXERCISE IS EFFECTIVE TO PREVENT SPACEFLIGHT
DECONDITIONING CAUSED BY 10 DAYS OF HEAD-DOWN BEDREST IN HUMANS.**Abstract**

Satoshi Iwase¹, Naoki Nishimura¹, Junichi Sugeno³, William Paloski⁴, Laurence Young⁵, Jack J.W.A. van Loon⁶, Floris Wuyts⁷, Gilles Clément⁸, Jörn Rittweger⁹, Rupert Gerzer⁹, James Lackner¹⁰, Kunihiko Tanaka², and Tadaaki Mano² 1) Department of Physiology, School of Medicine, Aichi Medical University, Nagakute 480-1195, Japan, 2) Gifu university of Medical Sciences, Seki, JP, 3) Sugiyama Jogakuin University, Nagoya, JP, 4) Univ. Houston, Houston, US, 5) Massachusetts Institute of Technology, Cambridge, US, 6) ACTA, VU-Univ, Amsterdam, NL 7) Univ. Antwerp, BE, 8) International Space University, Illkirch, FR, 9) DLR, DE, 10) Brandeis University, South St, Waltham, MA, US.

The purpose of the present study is to verify the effectiveness of improved short radius centrifuge for the prevention of spaceflight deconditioning in humans. We manufactured the short radius centrifuge (SRC) as an improved version of the rod-like SRC with ergometric and resistive exercises, which is the same dimension as proposed for the AGREE project (Artificial GRavity with Ergometric Exercise Project) in the International Space Station according to the design by ESTEC engineers. The subjects will be accommodated range from 4th percentile Japanese female to the 95th percentile American male. A momentum compensation device (counter rotating mass) will be included. Human factors engineering judgment will be used to allow the subjects to pedal in a comfortable position for a prolonged time. The rotation rate will be 60 rpm (360 deg/sec) at maximum to provide 1.2 g at the heart level, when the distance from the rotating axis to the heart is 30 cm. A circular cycle ergometer and a footrest will be considered in the preliminary design. The possibility to accommodate additional exercise devices shall be investigated in a preliminary design phase. ECG, beat-to-beat BP, EMG of the main muscles, eye position by video, force on each foot and buttocks restraint, and facial expression by infrared ray video will be monitored during rotation. Gravity level and exercise load will be controlled by the subject, showing the G-level, centrifuge velocity, ergometric load, and heart rate through the video monitor. This facility will be verified by ground-based experiment of the bedrest study. The results of how this facility prevent the spaceflight deconditioning will be described.