

A Large Human Centrifuge for Exploration and Exploratory Research

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The presentation reports on the initiation and status of the Altered Gravity Platform, AGP. The AGP serves as a research platform both in preparation for the human space exploration initiative as well as a facility for basic science questions. Space flight causes a multitude of physiological problems, many of which are due to gravity level transitions. Going from Earth's gravity to microgravity generates fluid shifts, space motion sickness, cardiovascular deconditioning etc., but returning into a gravity environment puts the astronauts similarly under stress. Prolonged stay in microgravity provokes additional deleterious changes like bone loss, muscle atrophy, or specific psychological stresses. To prepare for future manned space exploration missions, we should look into the feasibility of a platform for countermeasure research against the deleterious effects of g-level transitions. AGP is a large rotating facility (diameter > 150 m), where increased gravity levels (e.g. 1.01 to 1.5g) can be generated, from short, transit simulations to prolonged stays of weeks or even months. On this platform, facilities are built where a crew of 6 to 8 humans can live autonomously. Adaptation from 1g to higher g levels can be studied extensively and monitored continuously. Conversely, re-adaptation back to 1g, after a prolonged period of altered g can also be investigated. Study of the physiological and psychological adaptation to g-level changes will provide the scientific community with instrumental and fundamental knowledge to better define and predict the ultimate countermeasures that are needed for future successful manned space exploration missions to e.g. Mars. During an AGP study the appropriate and necessary scientific, operational and engineering inputs will be obtained from individual scientific top experts in Europe and beyond. The initial approach for the AGP was to provide an altered gravity environment. However, Moon or Mars habitats might not have an Earth like atmosphere with ~ 1013 hPa pressure and a 21% O₂ fraction. The AGP might additionally be used as closed research platform to explore altered environments as well. In addition to such a closed environment the AGP could also be applied as test bed for Life Support Systems currently under development. Finally, such a large rotating platform could also be applied as Coriolis platform for research on e.g. tornados.

Because so many different science and engineering issues are involved, a multidisciplinary approach is crucial. But like the ISS, it is a unique laboratory to investigate human behavior to altered environmental conditions, and as such advances science in general and in particular for future spaceflight.