



Multi-Purpose Crew Restraint Development



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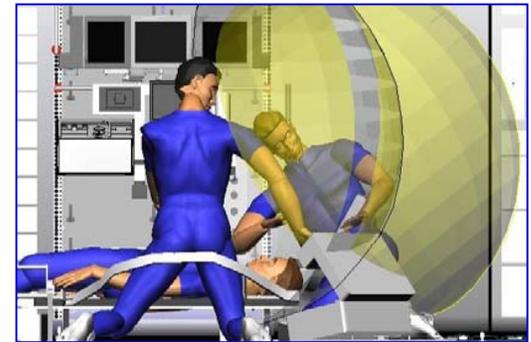
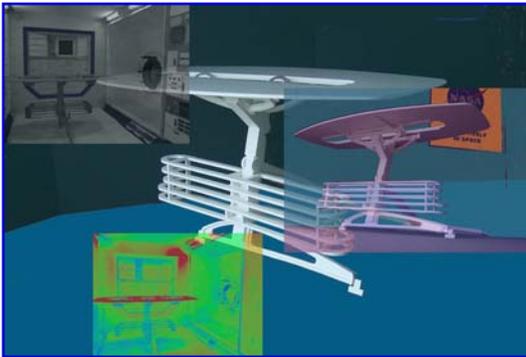
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Mobility Aids and Restraints – Why do we need them in 0-g?



- Translate, move and stow equipment, and provide stability and comfortable posture for precision or high force tasks
- Design challenge: adjustability to accommodate wide range of users versus simple design (ease of use)





Purpose



- Develop crew requirements and guidelines, and conceptual designs, for an ergonomically designed multi-purpose crew restraint.

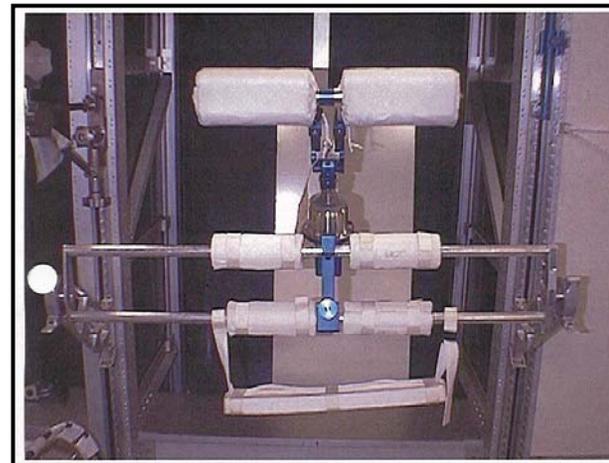




What is up there on ISS?



- A set of foot restraints
- Handrails
- Bungee cords
- Velcro, duct tape
- Flexible brackets





Planned Activities

- Identify an extensive list of IVA and EVA R&MA
 - Description of equipment
 - Equipment features
 - Picture reference
- Compile operational habitability evaluation/debrief information
 - Data from Skylab, Mir Phase I, Shuttle and ISS were reviewed
 - Debrief data collection of restraints from the Increment 3 crew
 - Investigate the potential of an In-Flight evaluation of current restraint systems



Focus Group Discussions



- Developed to identify “unique” tasks and areas of need
- Determine characteristics of “ideal” restraints
- Solicit ideas for R&MA Concepts
- Findings will assist in the development of restraint concept based on previous flight experience, the needs of future tasks, and crewmembers’ preference.





Focus Group Meetings

- Four sessions held thus far
 - Representatives: Training, Engineering, Human Factors, and Payloads, Systems Integration
- Crucial Discussion Questions
 - What current or future tasks would need a crew restraint?
 - What are the **Top 5 Characteristics** of an “Ideal” crew restraint?
 - What were the best and worst features of the restraints that you have used or developed?

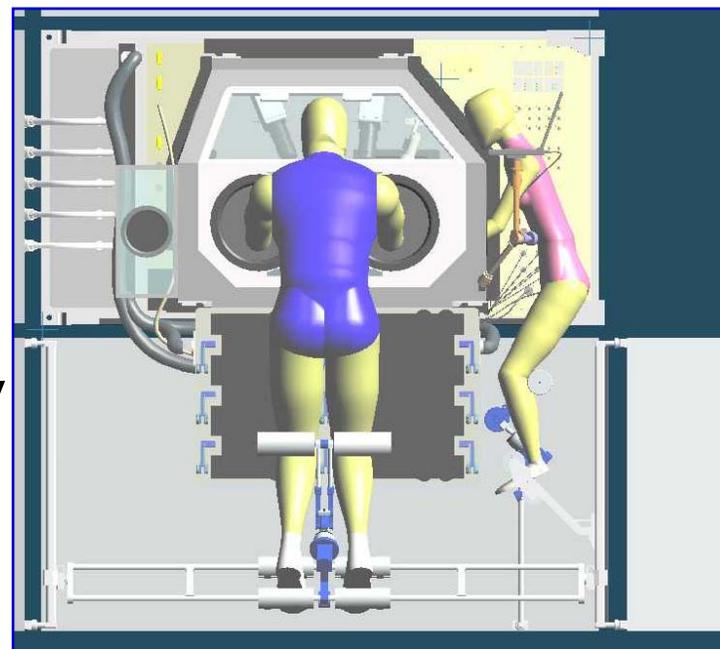


Focus Group Preliminary Findings



Tasks that MAY need RMA

- Glovebox\Robotic Operations
 - Fine motor
 - Repetitive
 - Long period of time
- Maintenance
 - Move large masses
 - Quick transition from stationary to mobile
 - Hands-free
- Crew Medical Care
 - Clearance for defib
 - Upper body restraining



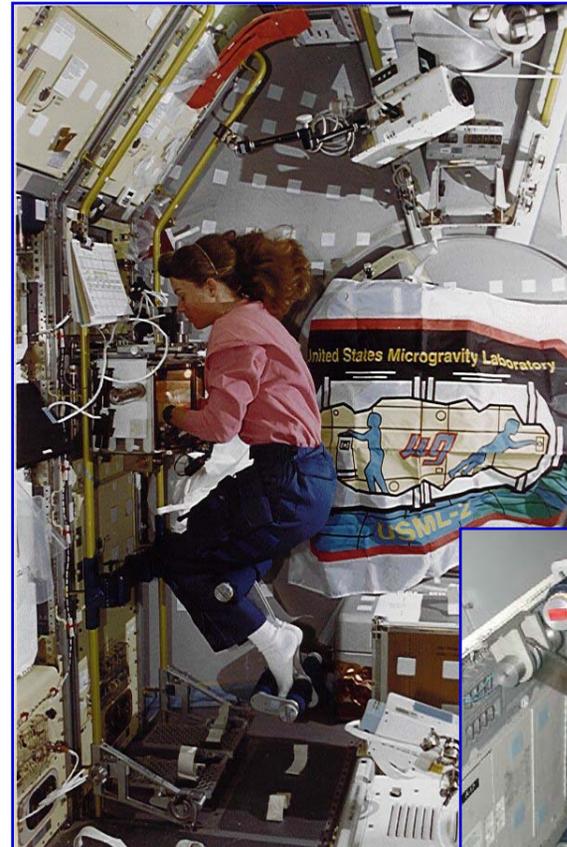


Focus Group Preliminary



Top 5 Characteristics

- **Simplicity of Design**
 - Minimal parts for assembly
 - Instantaneous attach & disengage
- **Comfort**
- **Easy to Use & Adjust**
- **Stability & Durability**
- **Flexibility for Range of Task**





What are the Next Steps?

- Develop New Crew Restraint Concepts
- Evaluate concepts
 - Crew reviews
 - Human modeling
 - KC-135 tests
- Develop Refined List of Crew Restraint Requirements

