**INITIAL APPLICATION PART 2**

1. **Abstract:**

Current knowledge of human habitation in partial-gravity is limited to six brief sorties to the lunar surface. As interest in human exploration and longer-term habitation of the Moon and Mars increases, methods must be created to better understand how to design a living environment for humans in differing gravity levels. Mars mission costs, for example, can be greatly reduced if a common habitat design can be used for both microgravity transit and partial gravity surface habitation. To rapidly mature a habitat design compatible with multiple gravity conditions, low fidelity simulations will be conducted in the Neutral Buoyancy Research Facility at the University of Maryland. The subject and the test hardware will be ballasted to Lunar, Mars, and microgravity conditions. Basic variable-gravity biomechanics tests will be conducted by examining the optimal slope and step spacing of access stairways between different habitat levels. To increase simulation fidelity, the test subjects were equipped with long hoses to nearby air tanks to provide more realistic dynamics, and full-face masks to allow them to talk with each other and with a simulated ground control. Test subject motion and body kinematic data will be collected throughout the simulation by a sixteen-camera motion capture system and motion tracking markers. Results provide the most realistic dynamic simulation of partial-gravity habitat operations available without air or space flight.  
  
Subject’s rights shall be protected with confidential data collection and minimized risks.

1. **Subject Selection:**
2. **Recruitment:**   
   The investigators will seek participants, via email, who have experience with or interest in partial gravity studies, in particular, habitat design. The participants will only include adults. The collected data will only include the task completion times, survey results, and recorded motion capture data. The surveys are the NASA Task Load Index and Cooper Harper Rating index.
3. **Eligibility Criteria:**   
   Subjects must be healthy individuals above 18 years of age. The participants must be approved divers by the University of Maryland Diving Control Board and be eligible to dive in the Neutral Buoyancy Research Facility. They must be able to walk and swim on their own without any type of aid such as crutches. They must have vision that is either 20/20 or corrected to 20/20. Experience with or interest in habitat design is preferred.
4. **Rationale:**   
   This research is a study into the advantages or disadvantages of tread spacing and overall slope of a staircase. It would be helpful if the participants already have an understanding about the capabilities and constraints involved in habitat design and various gravity levels.
5. **Enrollment Numbers:** In order to get a statistically reasonable number, this experiment hopes to enroll somewhere between 2-5 adult subjects.
6. **Rationale for Enrollment Numbers**: Enrollment numbers are low based on the limited number of approved divers on the UMD DSO list.
7. **Procedures:**

The procedures involve climbing stairs in a lab environment and climbing while wearing dive weights in the Neutral Buoyancy Research Facility (underwater). Iterations will be done to measure the impact of stair tread spacing and different weighted gravity levels (Martian (0.38 earth gravity) and Lunar (0.16 earth gravity).  
  
To demonstrate eligibility for the task each subject will ascend three flights of stairs and perform 5 swimming laps in the tank. As an approved diver by the UMD Diving control Board, each diver has an Open Water Certification, First Aid Training, and additional safety trainings. The subject and safety divers should each have these trainings up to date and logged, or else the dive will be canceled. If participants are screened out their data/information will be destroyed.  
  
The researchers will first explain the tasks and go through all unfamiliar equipment. This includes the safety debrief showing how to remove the weight vest for under water use and how to attach and detach from the fall arrestor (dry land and under water). Safety belts will be chosen to ensure correct fit. This briefing will be done before every control scheme change.  
  
For each setup, the participant will ascend and descend the stairs and the time to complete each task will be recorded as well as motion capture data. The motion capture tracks the lower body with a focus on hip, knee, and ankle. Each trial will consist of ascending and descending 3-4 times and the total test time will not exceed 1.5 hours with breaks every half hour. The out of water testing will follow the same procedure and not exceed 1.5 hours with breaks every half hour.  
  
After each trial the participant will be asked to answer questions such as: “Rate Physical Demand on a 1-10 scale”, “Rate Mental Demand on a 1-10 scale”, “Rate Performance on a 1-10 scale” (1 is low/poor; 10 is high/well)

1. **Risks:**

Since this task involves climbing, a fall arrestor and safety belt will be used to avoid injury. For underwater tests, typical dive safety will be observed with an additional safety diver focusing solely on the test subject and their safety line. To reduce the likely hood of fatigue, subjects will be told to rest between ascent and descent trials. Subjects may also take a break or quit the test at any time at their sole discretion. . Each tread has a high friction surface so chances of falling or slipping are minimal.

1. **Benefits:**

There are no direct personal benefits from participating in this research.   
  
This research is meant to provide empirical data to the user on the impact of tread spacing on and staircase angle at various gravity levels.

1. **Confidentiality:**

Any potential loss of confidentiality will be minimized by storing data in a secured office on a password-protected computer. No personal data will be collected or stored. The only collected data will be task times, the results from the NASA Task Load Index and Cooper Harper Rating, and motion capture data.  
  
Your name will not be included on the surveys and other collected data; a code will be placed on the surveys and other collected data; through the use of an identification key, the researcher will be able to link our survey to your identity; and only the researchers will have access to the identification key.  
  
When the data is no longer needed it will be destroyed.

1. **Consent Process:**

Researchers will obtain consent with a written consent form. One researcher will explain the research project and explain the consent form to each potential participant. The consent process will be conducted privately in a secured lab space. Participants will read and sign the consent form before participating in any experiment or filling out any surveys.   
  
The researchers are seeking to recruit participants who have experience with habitat design and scuba diving.   
  
No part of this study involves deception.   
  
All research participants will receive a copy of the consent form for their records.

1. **Conflict of Interest:**

No conflict of interest.

1. **HIPAA Compliance:**

Not applicable.

1. **Research Outside of the United States:**

Not applicable.

1. **Research Involving Prisoners:**

Not applicable.

1. **SUPPORTING DOCUMENTS**

Your Initial Application must include a **completed Initial Application Part 1 (On-Line Document),** the information required in items 1-11 above, and all relevant supporting documents including: consent forms, letters sent to recruit participants, questionnaires completed by participants, and any other material that will be presented, viewed or read to human subject participants.

**The consent forms in your approved IRBNet PACKAGE must be used. When creating or editing your consent form, please provide the most recent IRBNet package number at the bottom, right corner of the consent form. This ensures you are using the most “up-to-date” version of the form.**

**To find your IRBNet package number, go to the MY PROJECTS tab and click on the title of your project. In the PROJECT OVERVIEW page, your IRBNet package number will be listed at the top, next to your project title.**