Senior Design Project Data Sheet

Project #	Project Name	Project Track	Project Family
P19127	X-Hab Deployable Crew Lock Structure	Aerospace Systems	Aerospace Systems
Start Term	**Team Guide**	**Project Sponsor**	**Doc. Revision**
2181	Russell Phelps	Boeing/Multidisciplinary Senior Design	

Project Description

Project Background:

Airlocks are used to transition astronauts from a habitable environment to the vacuum of space. Generally, these are fixed, rigid structures that are built onto sides of space stations. However, NASA is researching ideas on soft-structures for use on the Lunar Orbital Platform-Gateway (LOP-G). These airlocks will be more versatile than current fixed models, as they will allow the airlock to be collapsed into the side of the station, thus being easier to send into space due to the major decrease in rigid, breakable parts. These airlocks are also used during ground-training simulation for astronauts soon to be in space. Development of inflatable structures will expand the arsenal of technology available for use in space, furthering NASA's research on soft, deployable structures, and help open space-travel to increasingly advanced opportunities.

Problem Statement:

The objective of this project is to create a first generation, ⅙ scaled crew-lock prototype intended for theoretical use on the Lunar Orbital Platform-Gateway. The system must be capable of controlled inflation & deflation, and maintain a rigid structure while undergoing pressure changes equivalent to those experienced in space. The structure must also be controllable both within the airlock and within the LOP-G, hold two astronauts, and contain all mandatory crew-lock features such as stowable handrails and internal & external attachment points for equipment, crew tethers, and outfitting. The final product should be capable of integrating with the LOP-G hatch and comply with (scaled) NASA requirements for a pressure vessel in an outer space environment.

Objectives/Scope:

- Create a structure that can remain rigid and withstand the pressures of space while pressurizing/depressurizing the interior.
- Utilize inflatable, soft-structure technology.
- Contain all elements that are required within a traditional rigid airlock, such that the soft-structure airlock does not have any shortcomings.

Deliverables:

- Inflates/deflates in a repeatable geometric pattern.
- Holds two astronauts
- ⅙ scaled prototype
- Withstand anticipated pressure changes
- Has internal/external attachment points
- Contains stowable handrails

Expected Project Benefits:

- Reduce space occupied by an airlock when it is not in use
- Enhance NASA's database of soft-structure airlock designs & concepts

Core Team Members:

- Jake Van Cuyck (EE)
- Michael Garcia (ME)
- James Grace (ME)
- Ethan Griswold (BME)
- Brandon Lau (ID)
- Justin Law (ME)
- Matty Putnam (IE)
- Tajbid Rahman (EE)

Strategy & Approach

Assumptions & Constraints:

1. Crew-lock will need to deflate to as small a size as possible
2. The hatch design & dimension specs will be approximated as closely as possible to currently existing models
3. Crew-lock size will be approximated by referencing current airlock dimensions and considering astronaut ergonomic needs (in terms of space available)
4. The airlock frame can be any shape/design, so long as it fulfills all customer requirements.

Issues & Risks:

- Maintaining repeatable, controlled pressure change and preventing air leakage
- Creating an electrical system that supports all required systems without fail
- Ensuring consistent and symmetric crew lock deployment
- Designing a hatch that can be manually sealed/unsealed in the event that electrical functions fail