



# SEARCH

Station for Exploratory Analysis and Research Center for Humanity

2015-2016 AEROSPACE DESIGN TEAM  
Mechanical Engineering Department

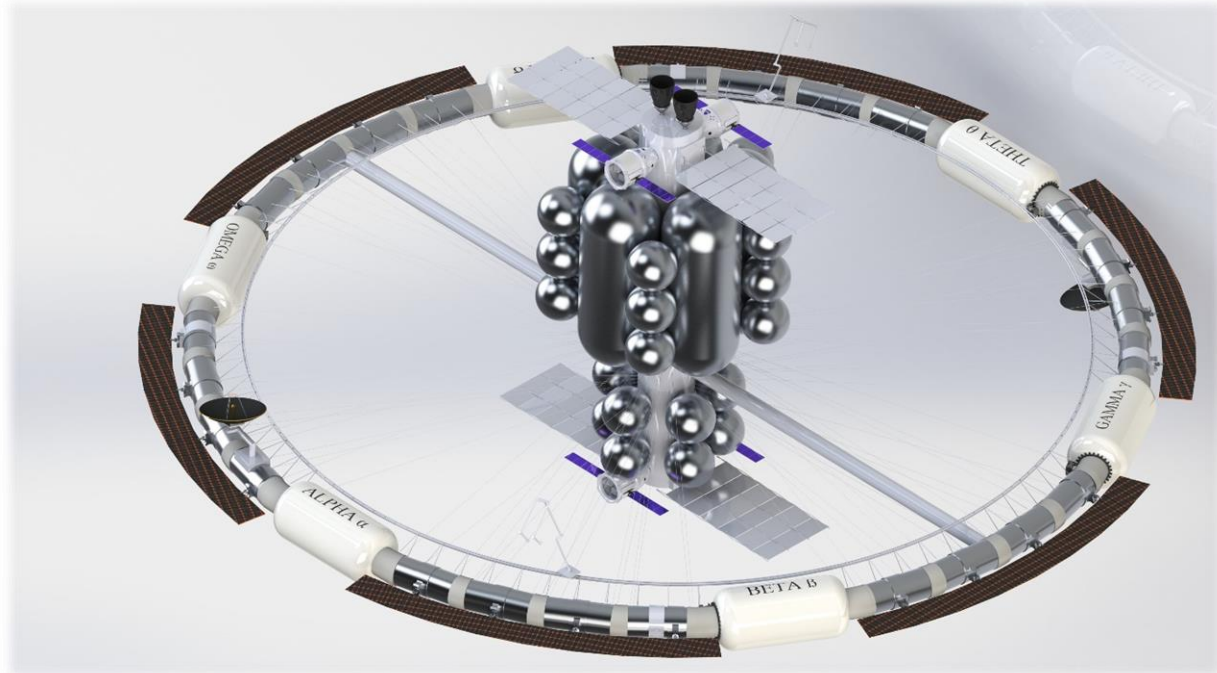
2

SEARCH

# Station for Exploratory Analysis and Research Center for Humanity (SEARCH)

3

- 16-24 People
- 30 Year Experiment
  - ▣ Earth-Resupply Independent
  - ▣ Non-Terrestrial Human Reproduction



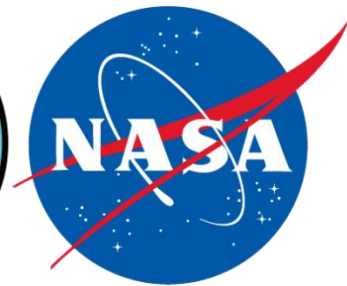
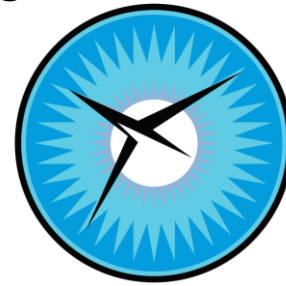
# RASC-AL

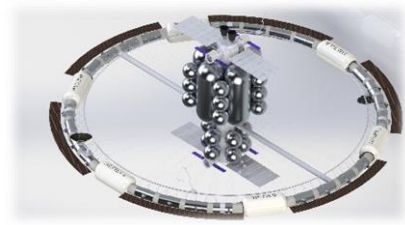
Revolutionary Aerospace Systems Concepts- Academic Linkage

4

- NIA / NASA
- Innovation and Feasibility
- Derive architecture for 16-24 people continuously living on 1 G space station
- 20-30 year timespan starting 2015
- NASA-Based budget

NATIONAL  
INSTITUTE OF  
AEROSPACE

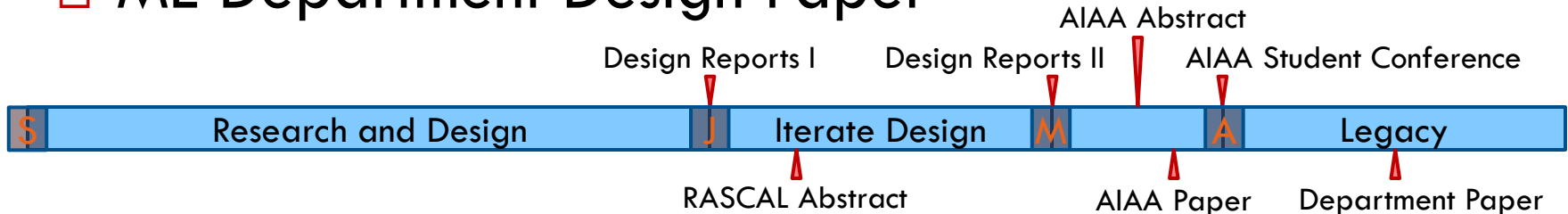


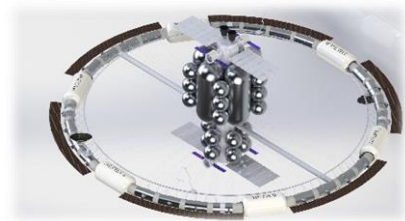


# Goals/ Deliverables

5

- Top-Level Design
- Calculations and verification in key subsystems
- RASCAL Abstract
- AIAA Student Conference Paper
- ME Department Design Paper

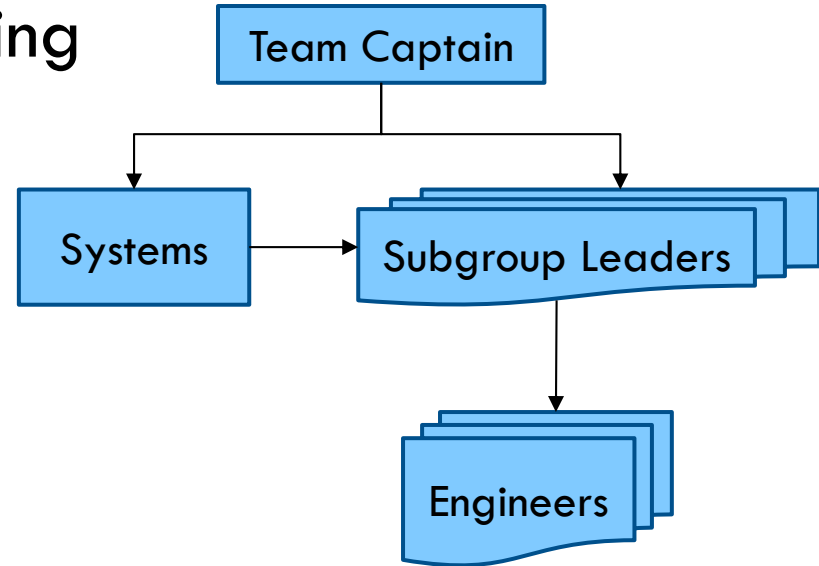


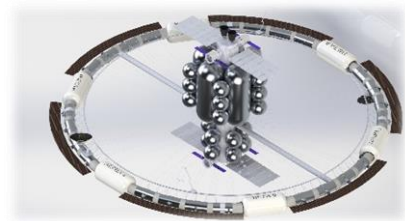


# Team

6

- 26 Mechanical Engineering Students
- Team Captain
- Subgroup Leaders
- 9 to 11 Subgroups

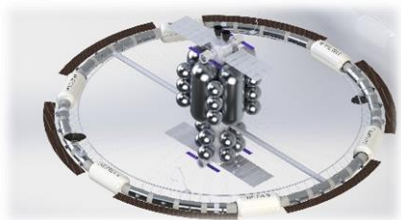




# Project Process

7

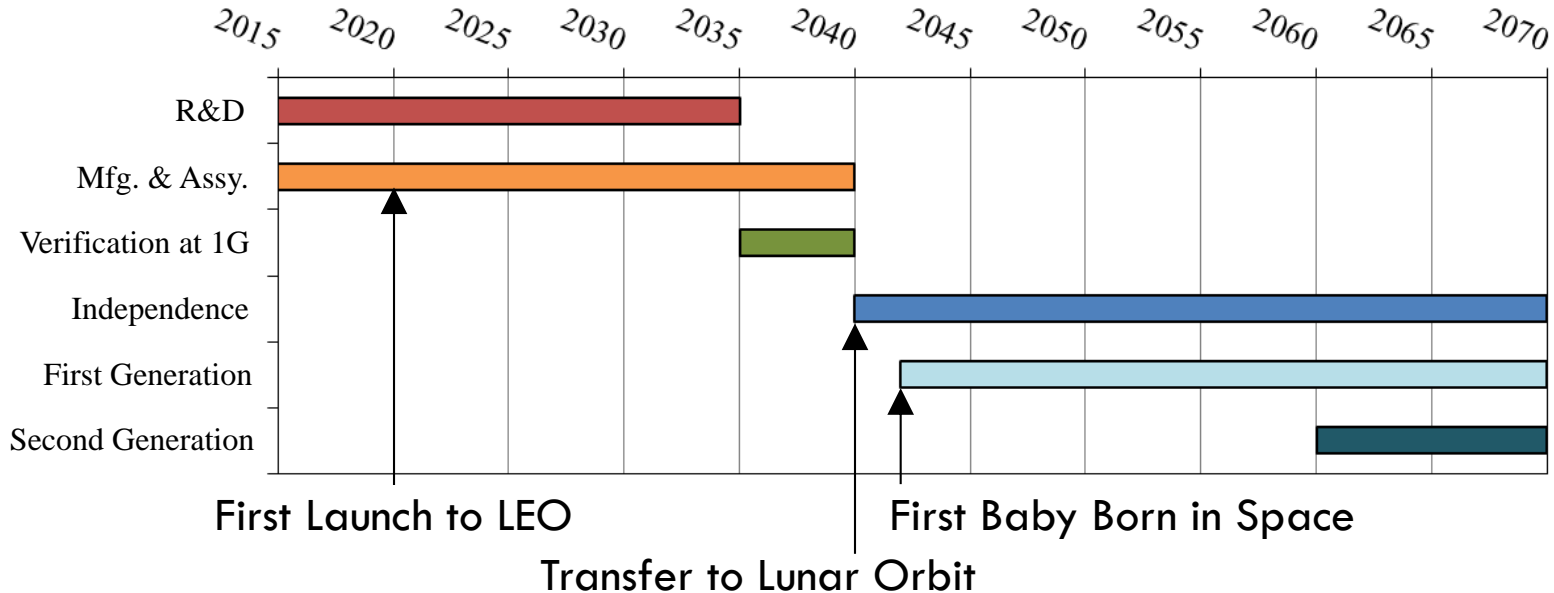
- Weekly presentation
  - ▣ Identified Constraints
  - ▣ Clarified Requirements
- Documentation
  - ▣ Progress Reports
  - ▣ Design Reports
- Industry Collaboration
  - ▣ Aerojet Rocketdyne
  - ▣ Boeing Spectrolab



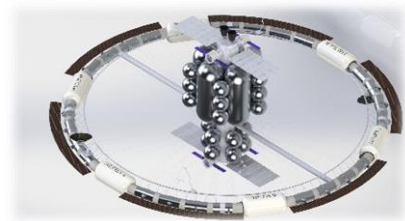
# Design

8

## □ 55-year Mission



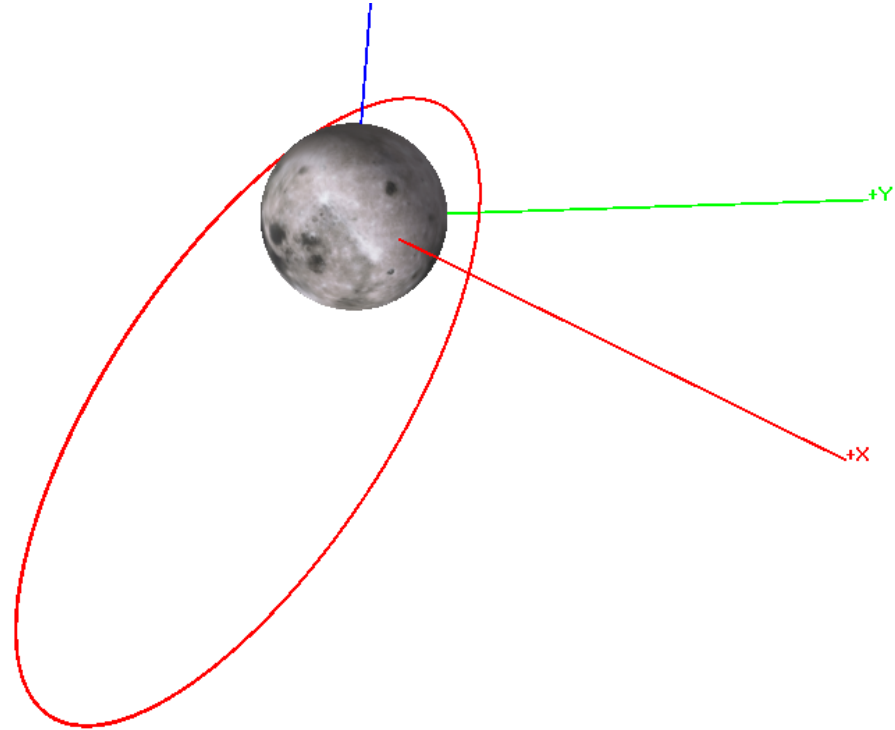


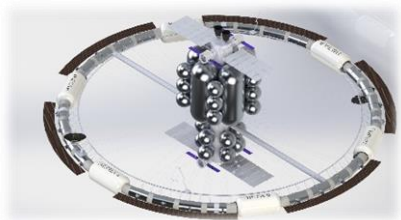


# Design

9

- 1G Method
- Lunar Orbit
  - ▣ Innovation
  - ▣ Stability
  - ▣ Secondary Missions





# Design

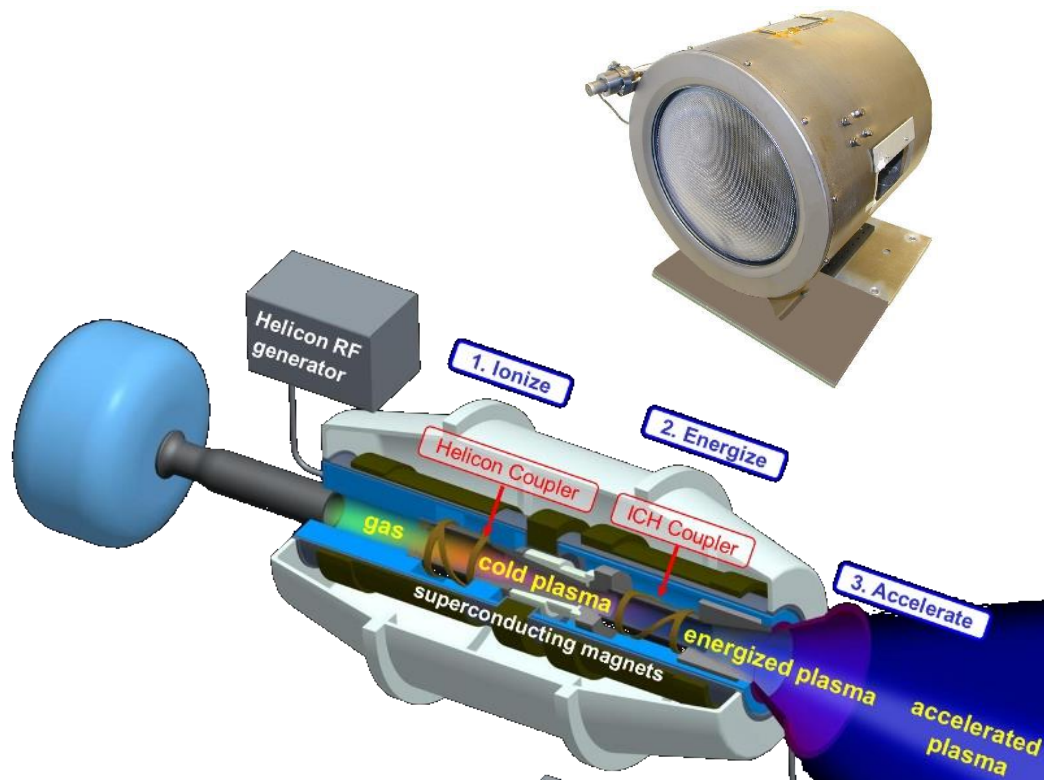
10

## □ Rotation and Orbital Maintenance

▣ MR-107N

▣ NSTAR

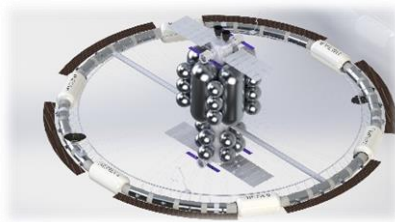
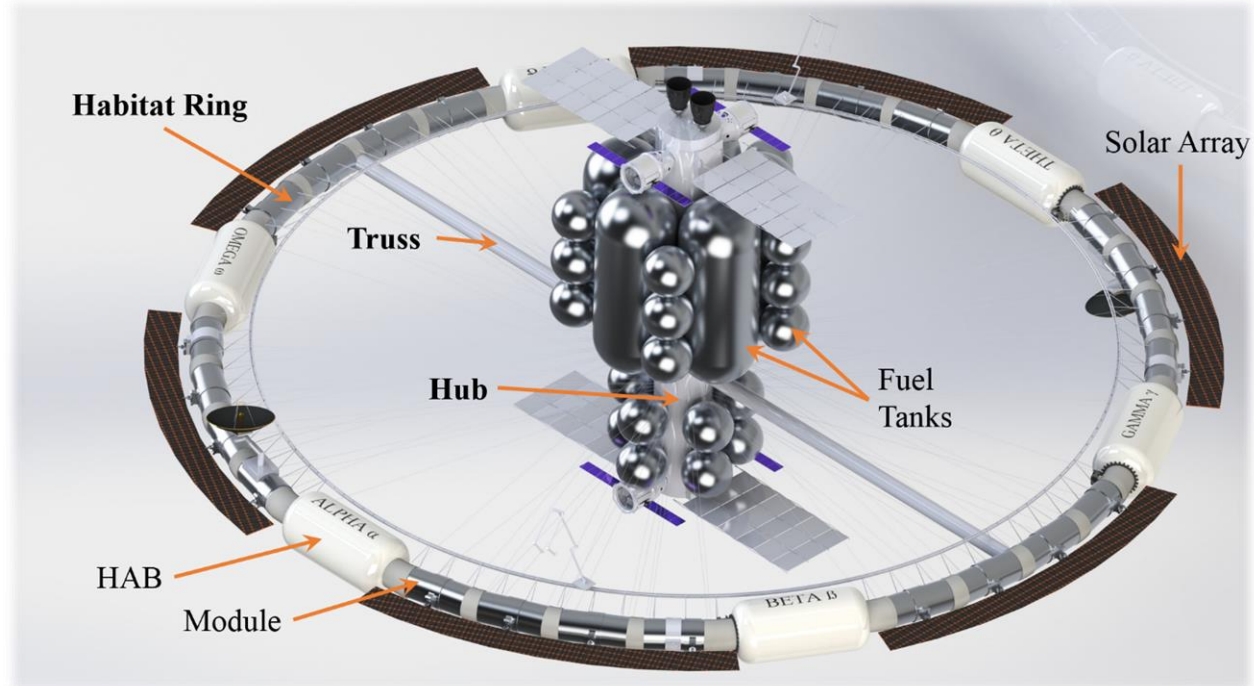
▣ VASIMR

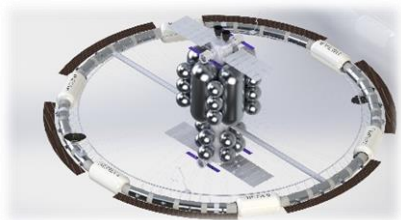


# Design

11

- Structures
  - ▣ Modules
  - ▣ HABs
  - ▣ Truss/Elevator
  - ▣ Stabilization Cables
- Assembly
  - ▣ LEO
  - ▣ ISS platform

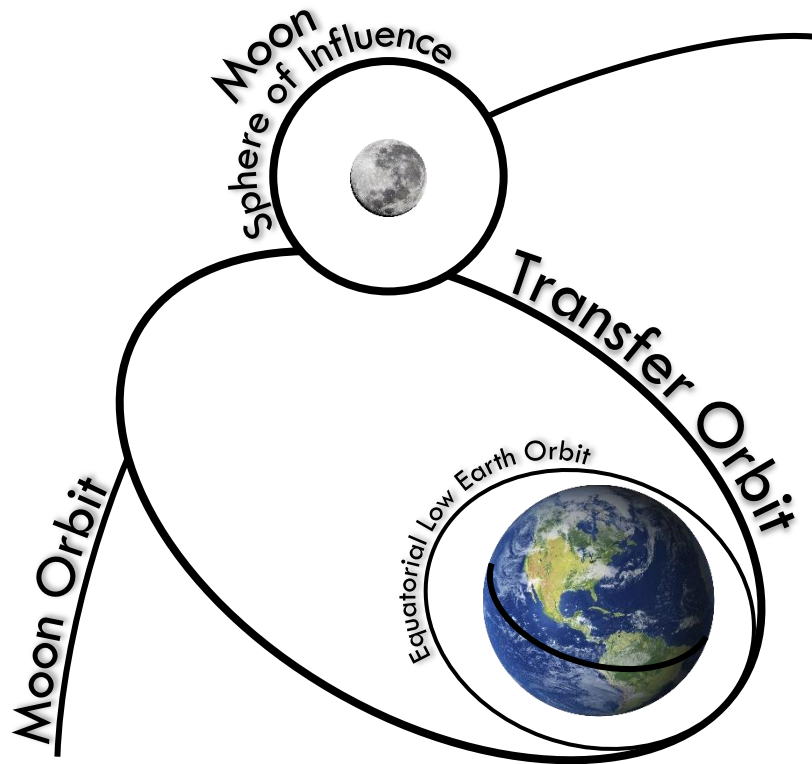


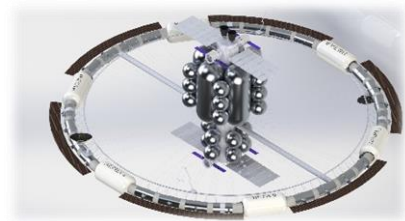


# Design

12

- Hohmann Transfer
  - ▣ TOF: 183 days
- Propulsion
  - ▣ RL-10s
  - ▣ Fuel
    - LOX: 2.7 million kg
    - LH<sub>2</sub>: 0.5 million kg

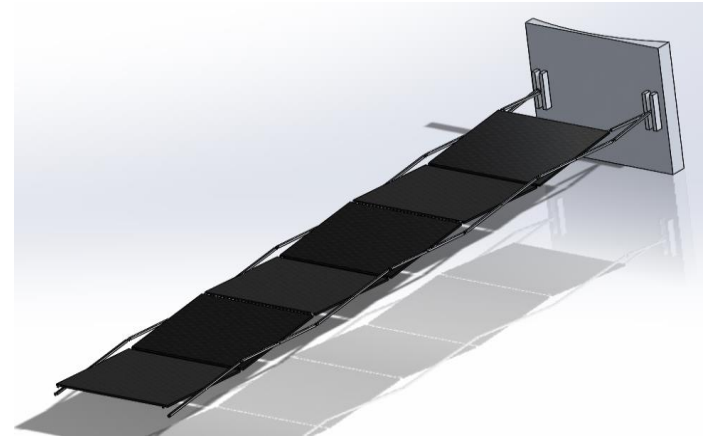


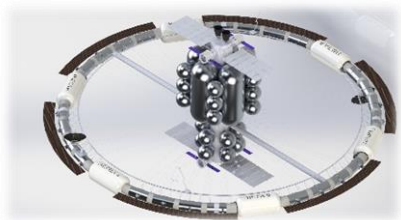


# Design

13

- Thermal
  - ▣ Dual-Loop Cooling System
  - ▣ Carbon-Fiber Radiators
    - Low TRL
    - High Emissivity and Heat Conductivity





# Design

14

## □ Power

### ▣ Solar Arrays

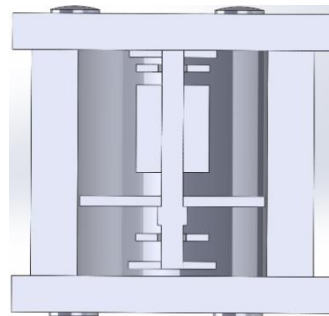
■ 1900 m<sup>2</sup>

### ▣ Flywheels

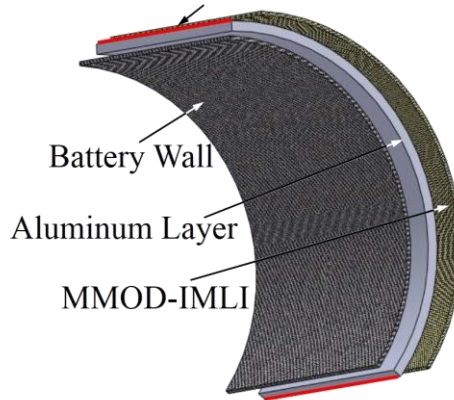
■ Fused Silica Fiber Composite

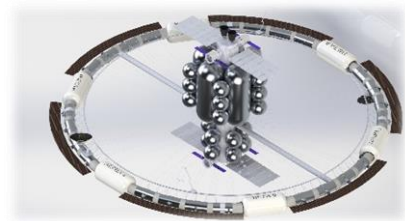
### ▣ Battery Wall

■ 0.57 cm thick



Friction Stir Weld



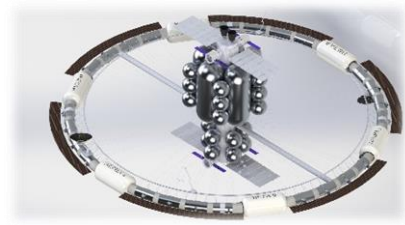


# Design

15

- Communications
  - ▣ Cassegrain Design
    - 8 Meter Dish
  - ▣ Two Axis Gimbal
    - Mounted on Habitat Ring
    - Maintain LOS with Earth



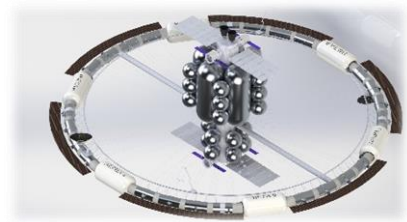


# Summary

16

- Top-Level Design
  - ▣ Artificial 1 G Space Station
  - ▣ 16-24 People
  - ▣ 30 Year Earth-Resupply Independent Experiment in Lunar Orbit
  
- RASCAL Abstract
- AIAA Student Conference Paper
- ME Department Design Paper





# Conclusion

17

- Suggestions for Future Work
  - ▣ More detailed design in key systems
    - Analysis
    - Research Projects
  - ▣ Iterate mass, fuel, and power calculations
- Lessons Learned
  - ▣ Systems Engineering!
  - ▣ Communication
  - ▣ Documentation and Presentation

# Thank You

18

