

# Building the First Orbiting Spaceport

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Lees-Kubota Lecture Hall



















Thermostabilized Foods











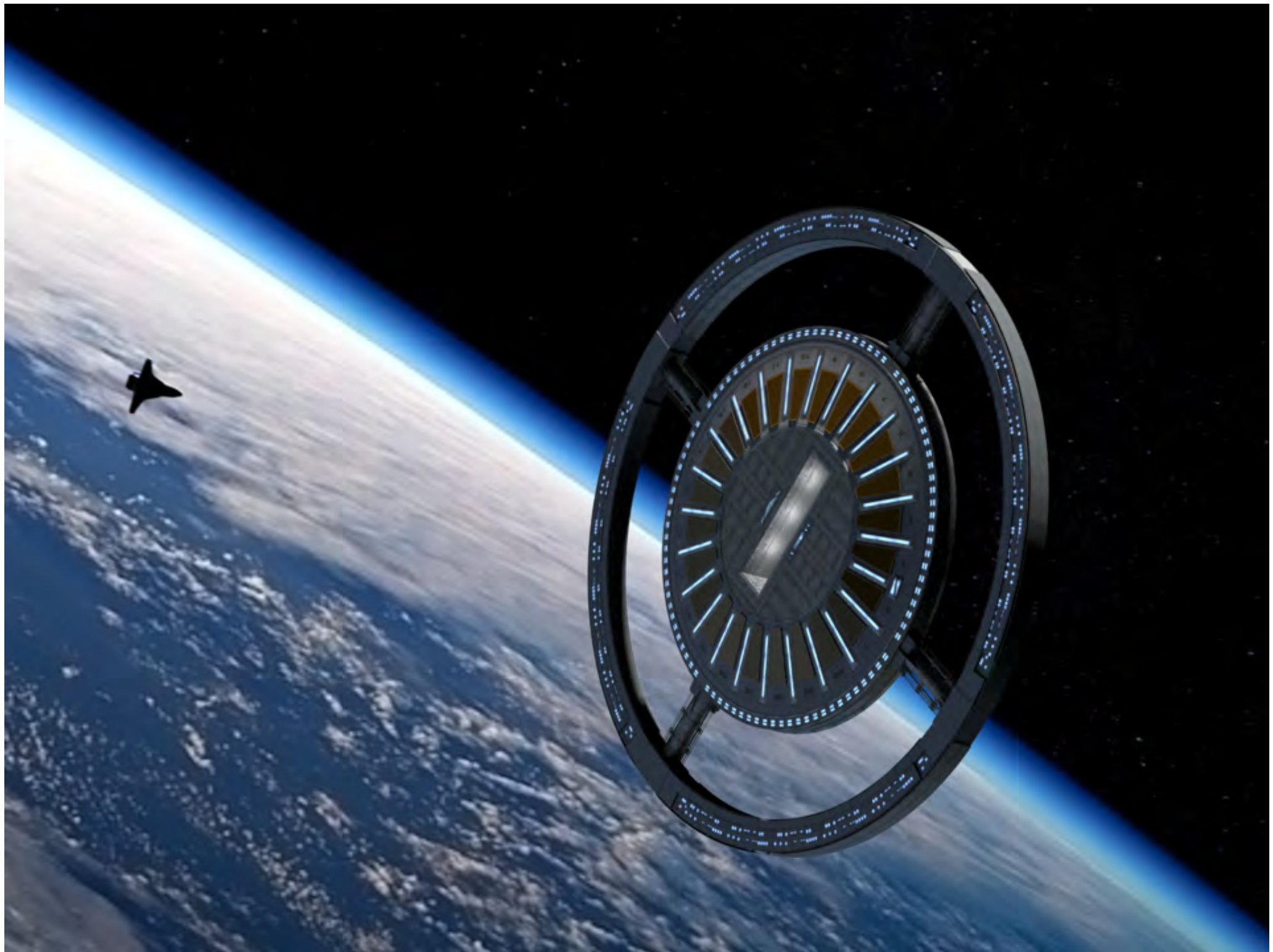












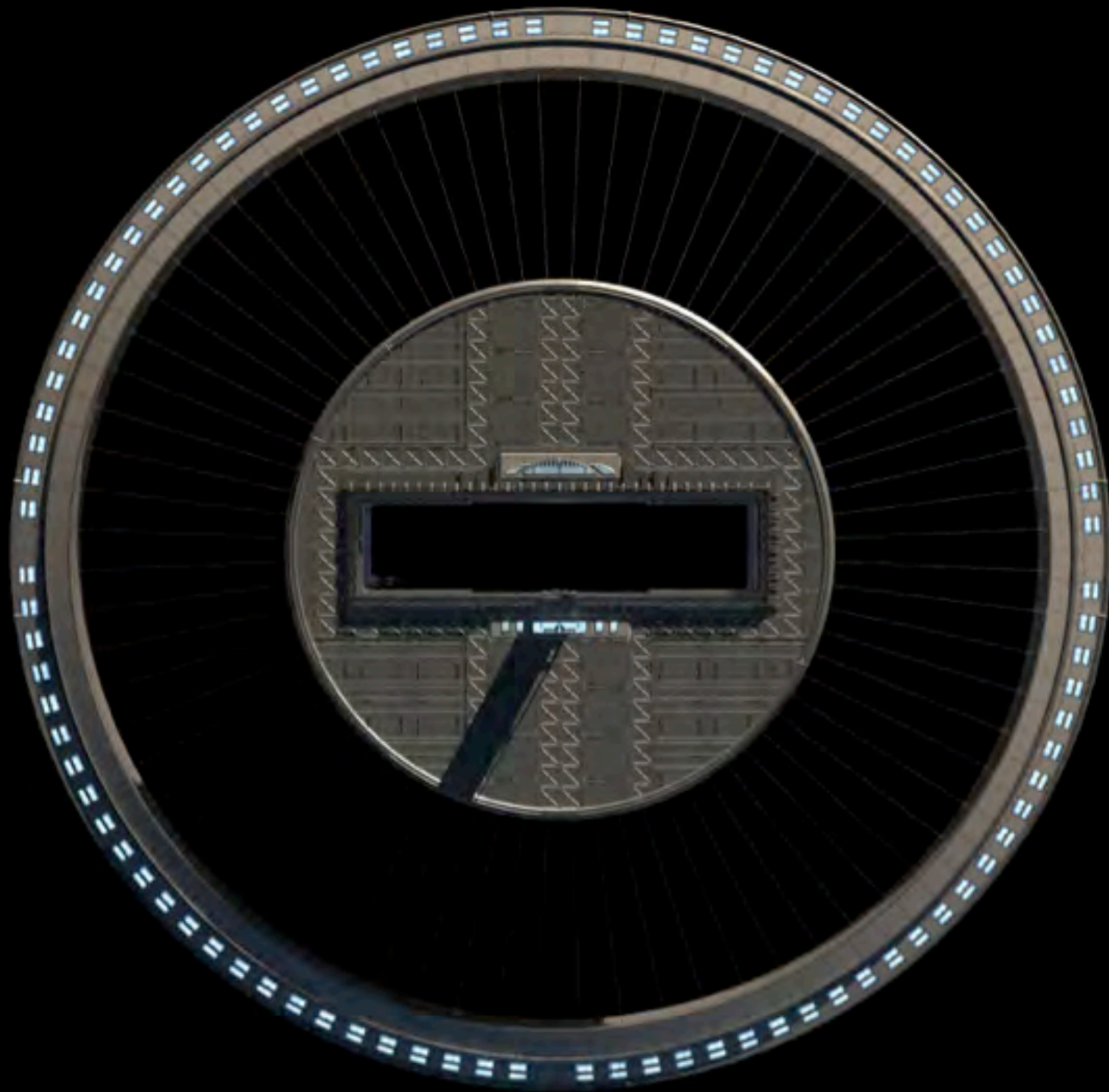


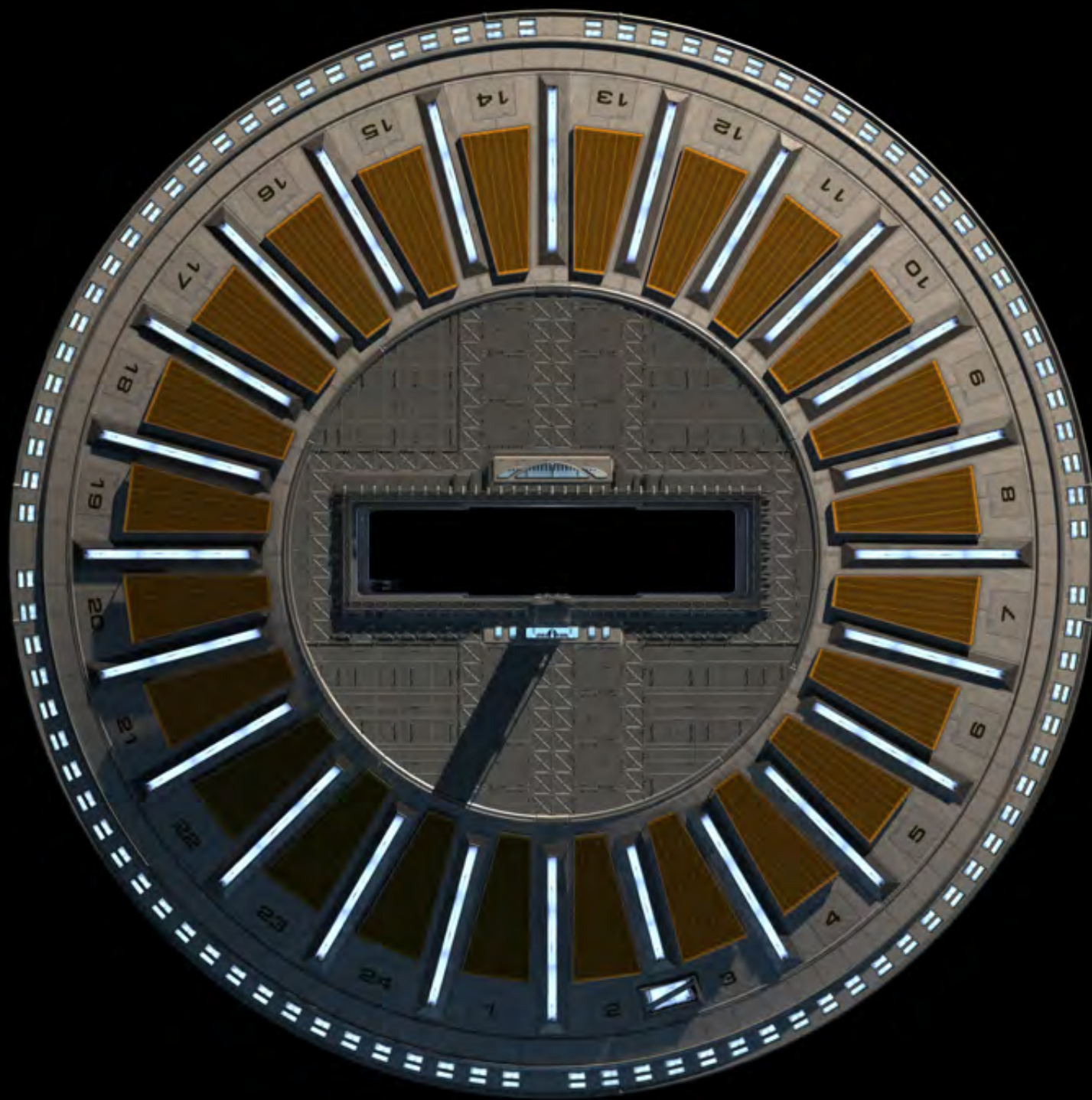




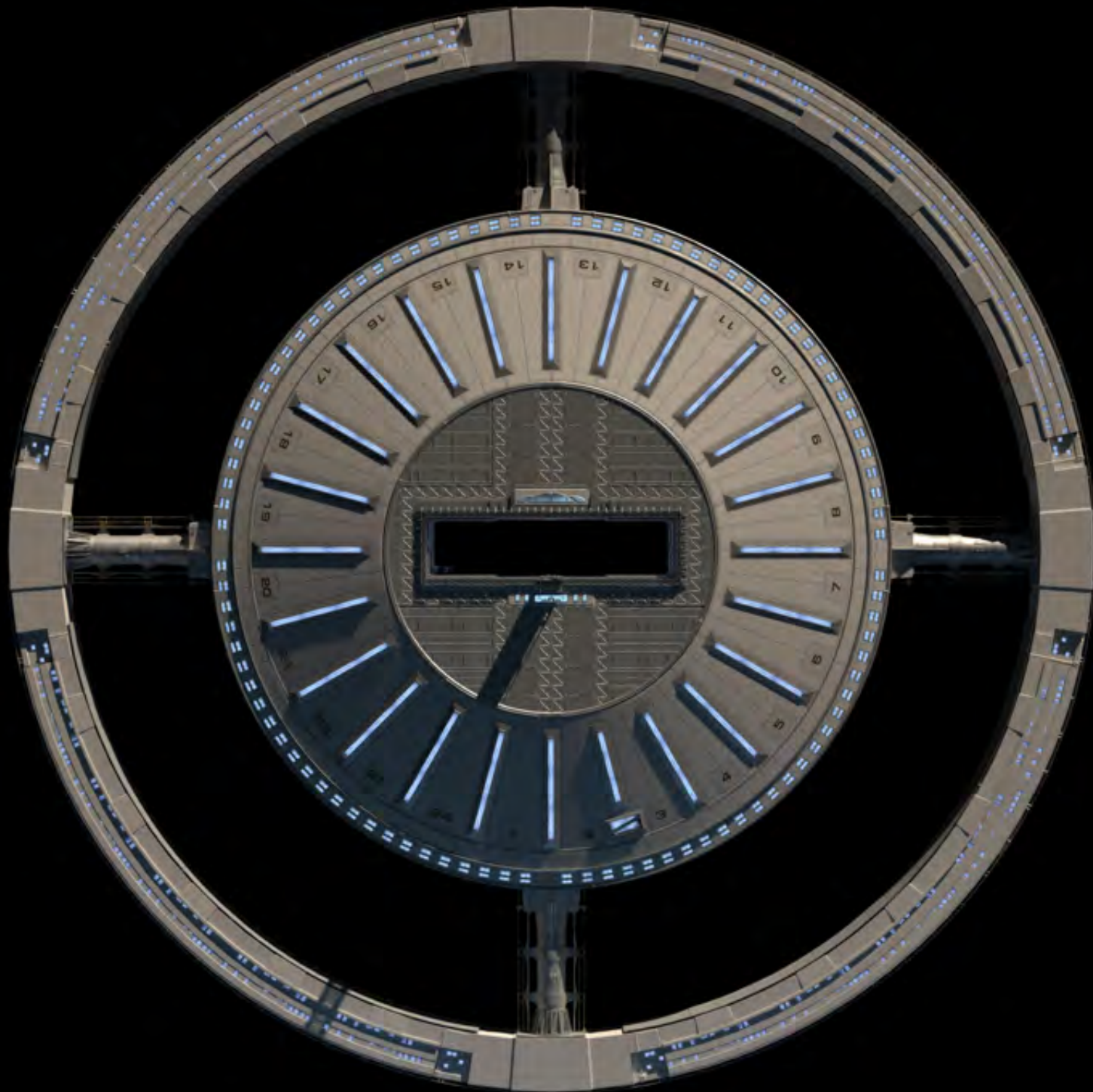


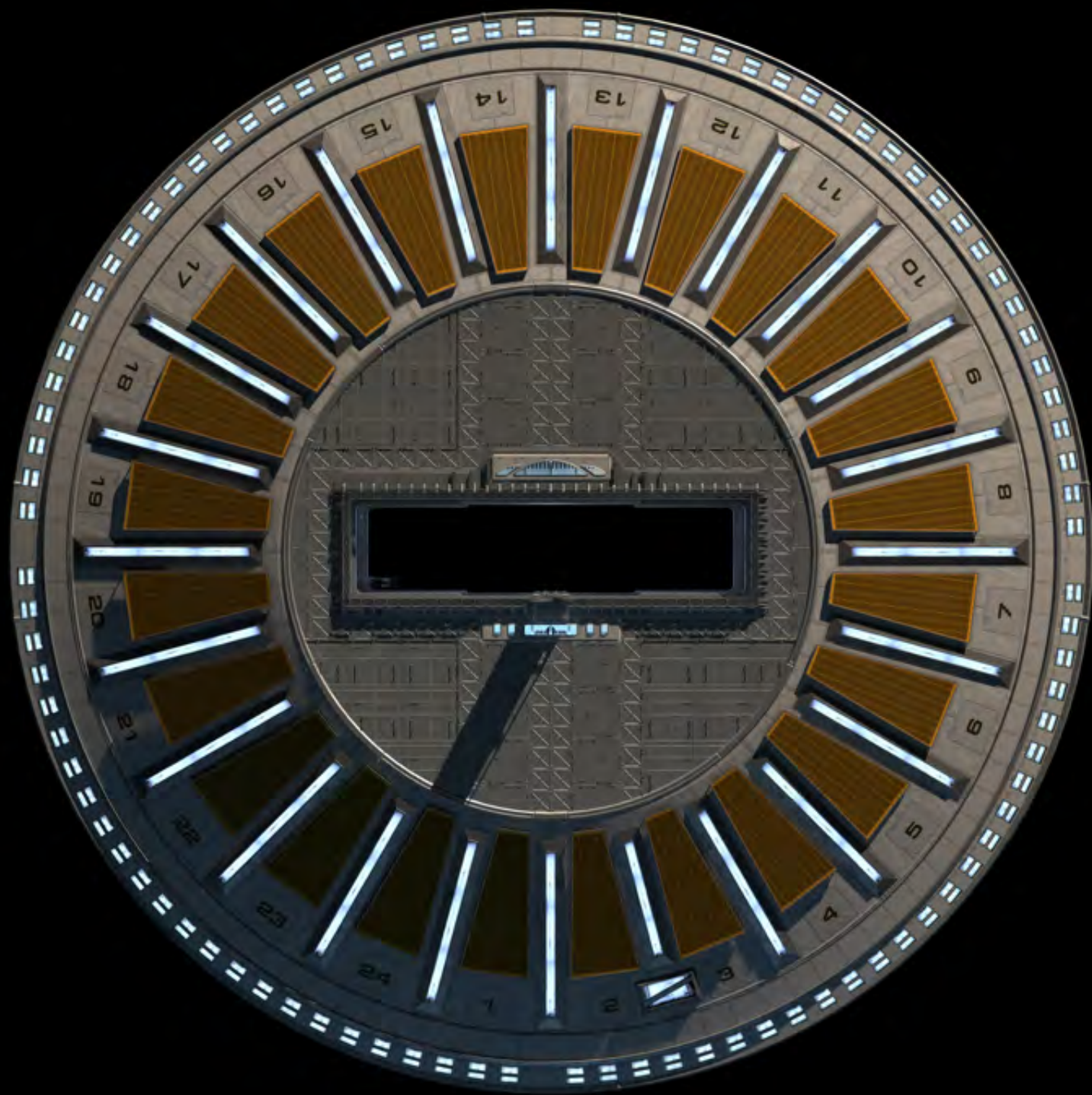




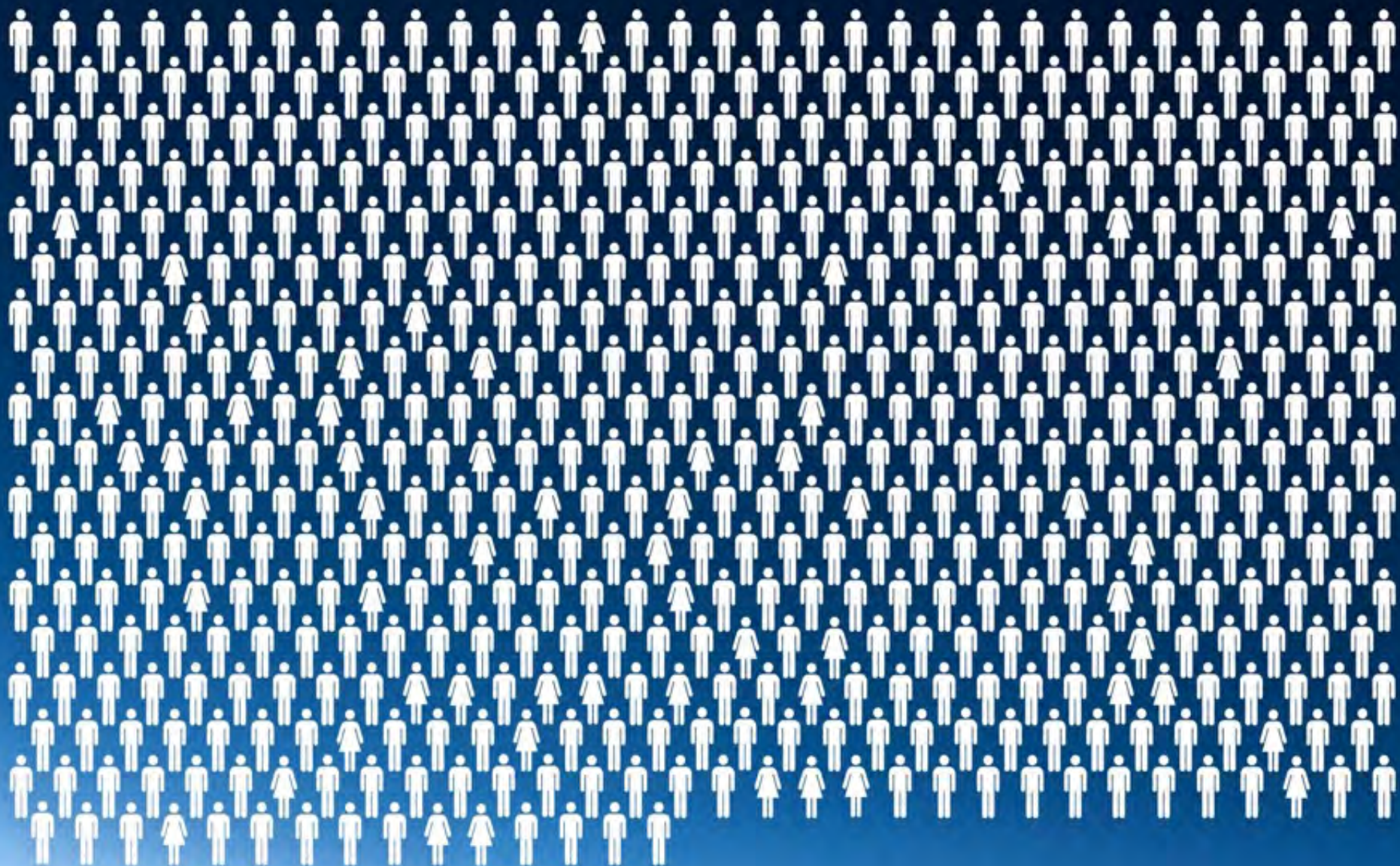












551 PEOPLE HAVE  
BEEN TO SPACE

It takes 3 essential things to build a Gateway Spaceport:

1. The Money – proper funding that is there every year, regardless of economic climate.
2. Advanced construction techniques and technology.
3. People with the will to build a Gateway





How to pay for it?















0560418

**ADMIT  
ONE**

0560418







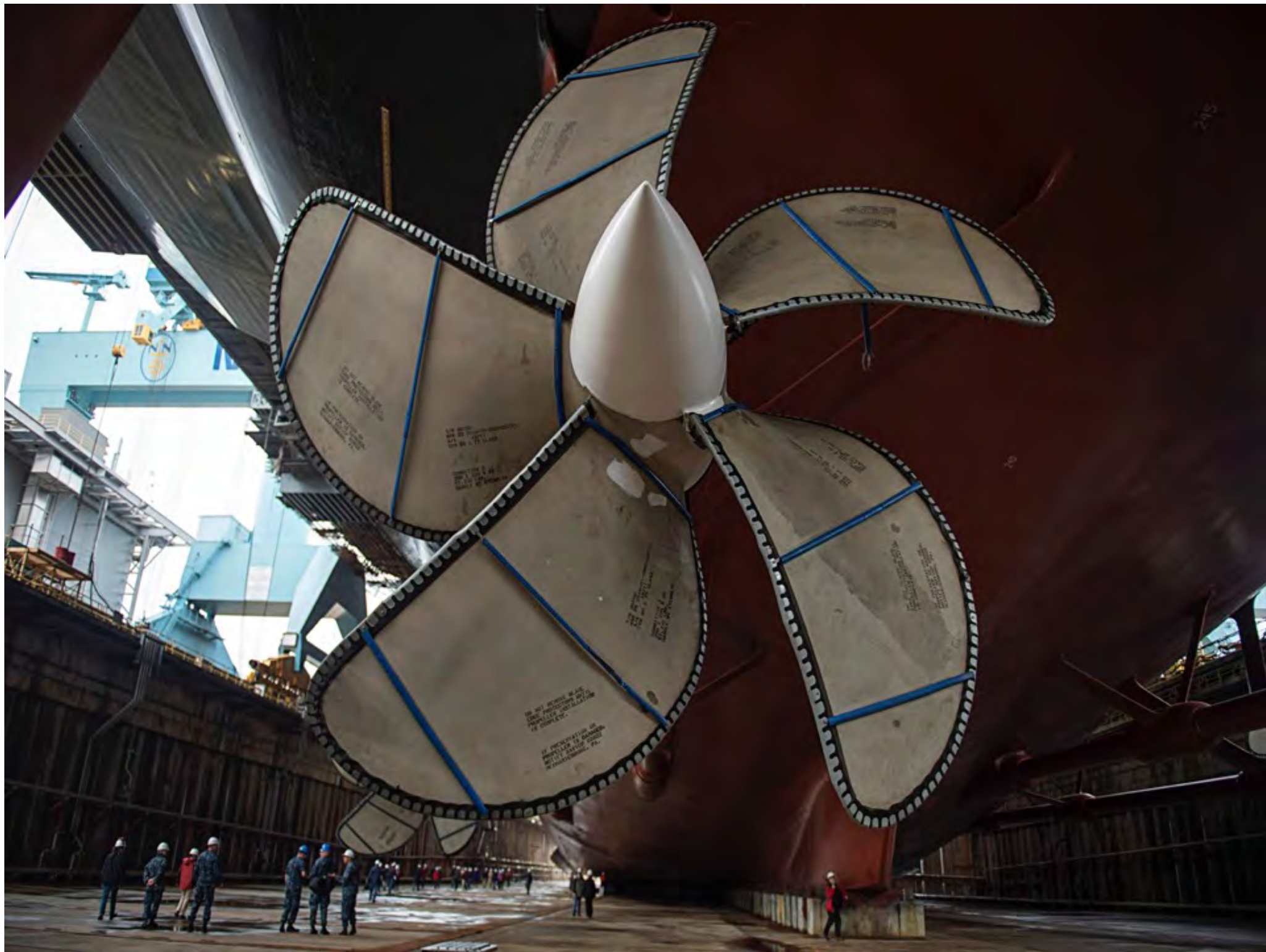




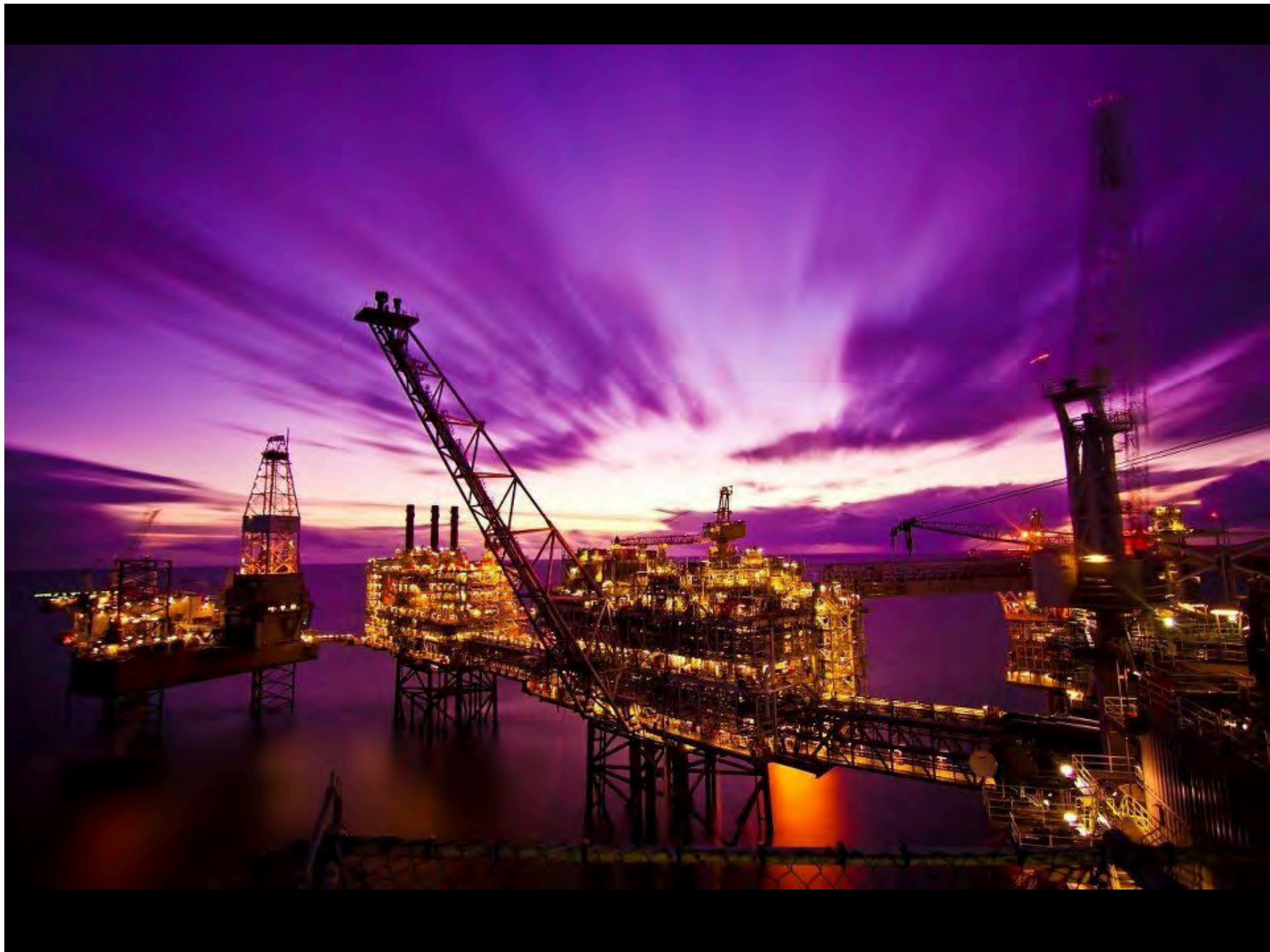


Is this creative financing?





















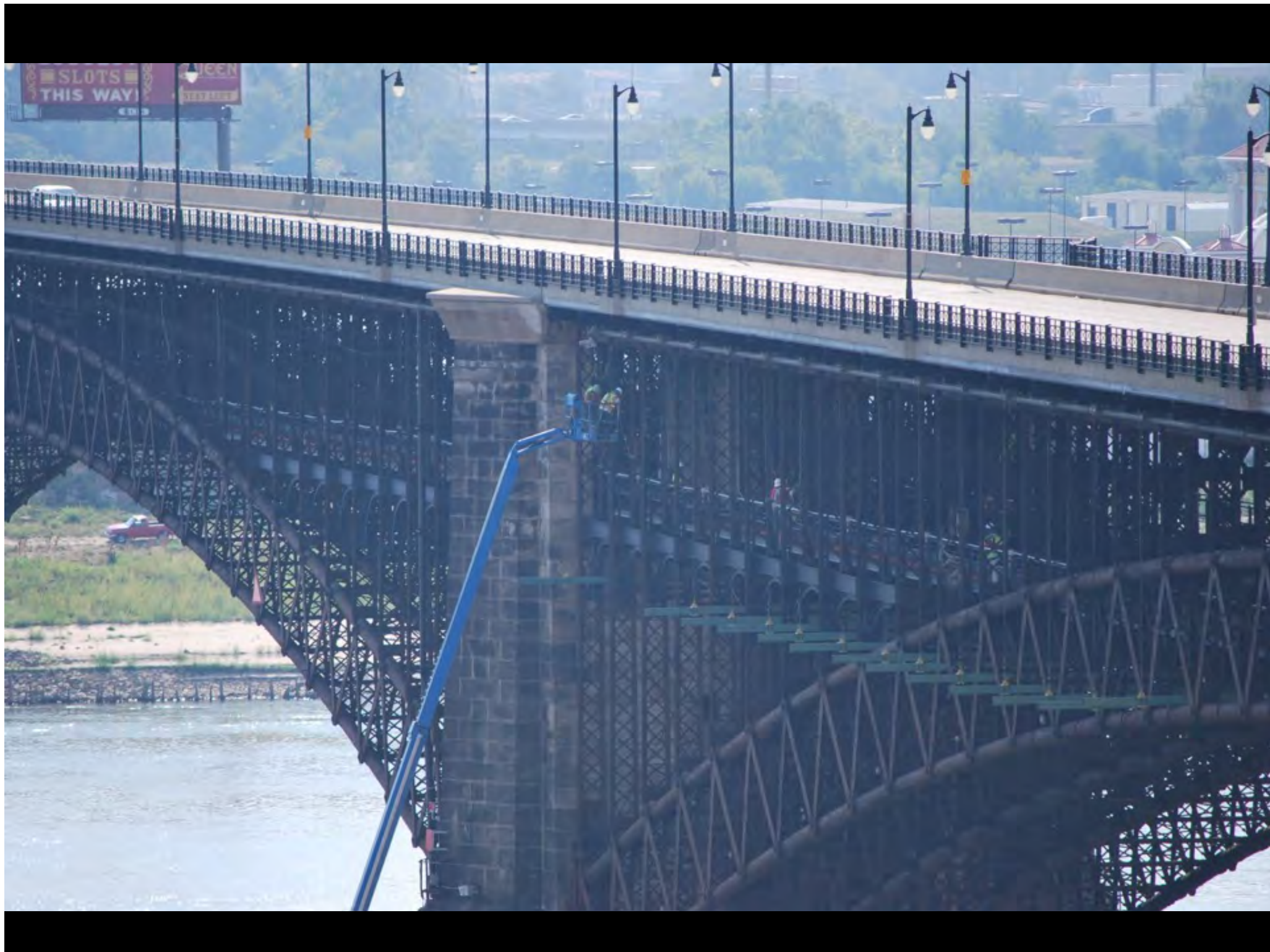




THE ERECTION. THE RIBS COMPLETED AND THE ROADWAYS BEGUN.



































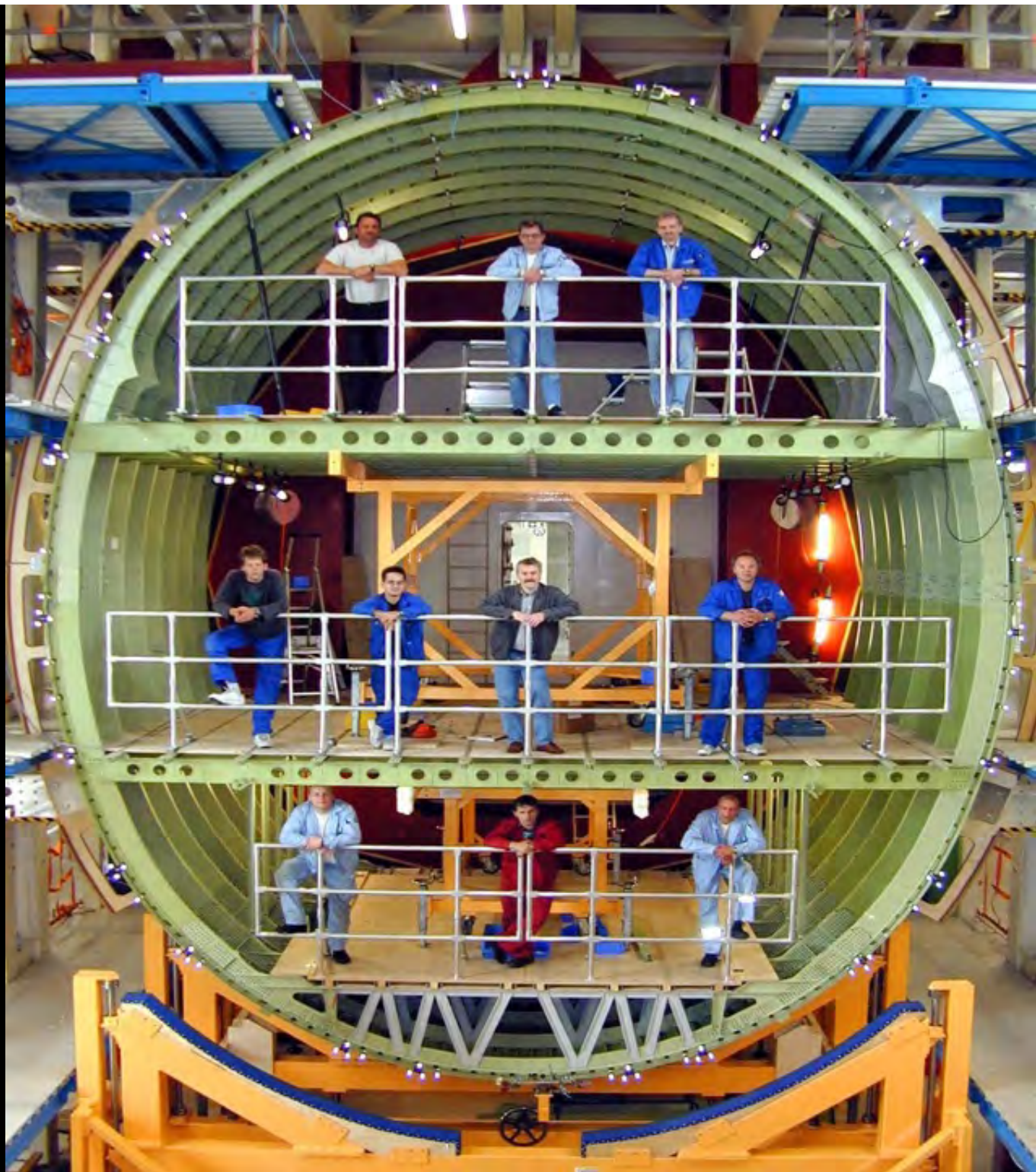


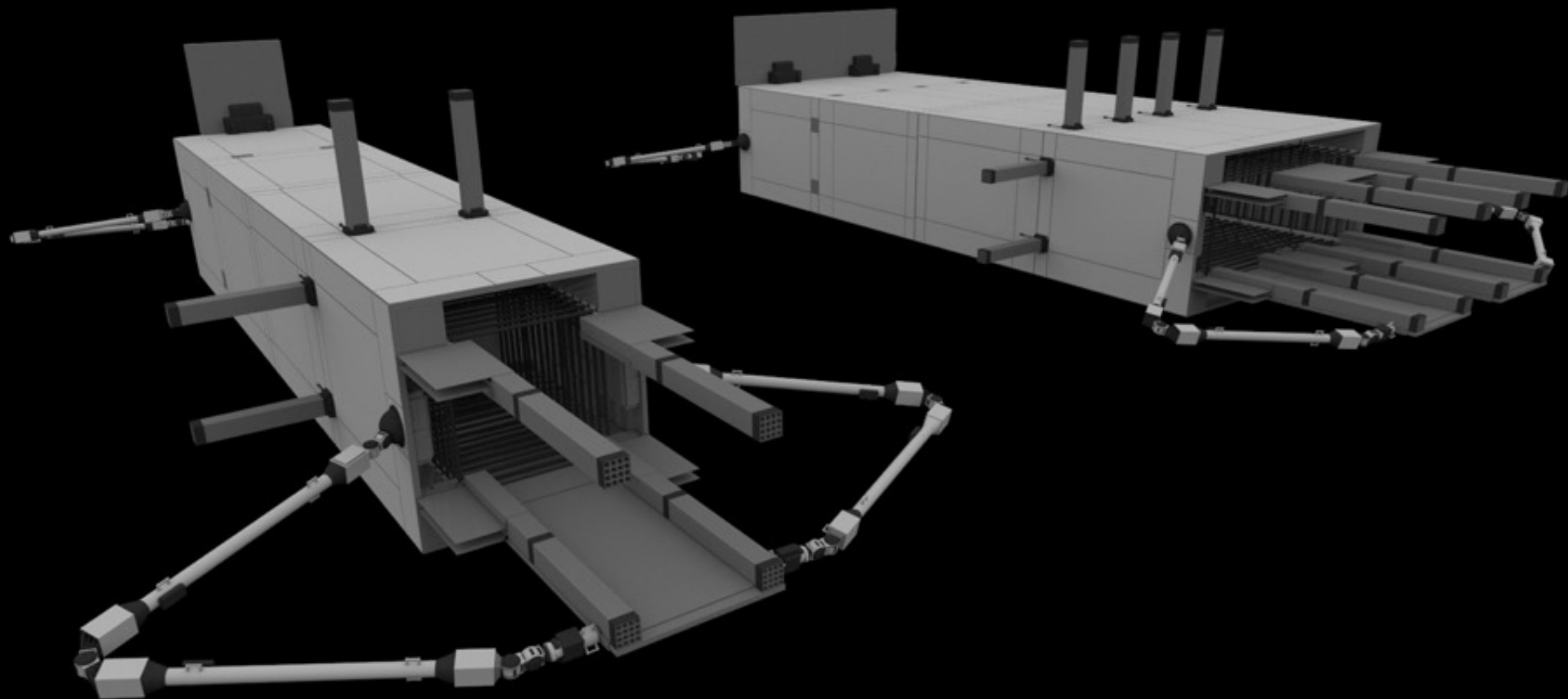
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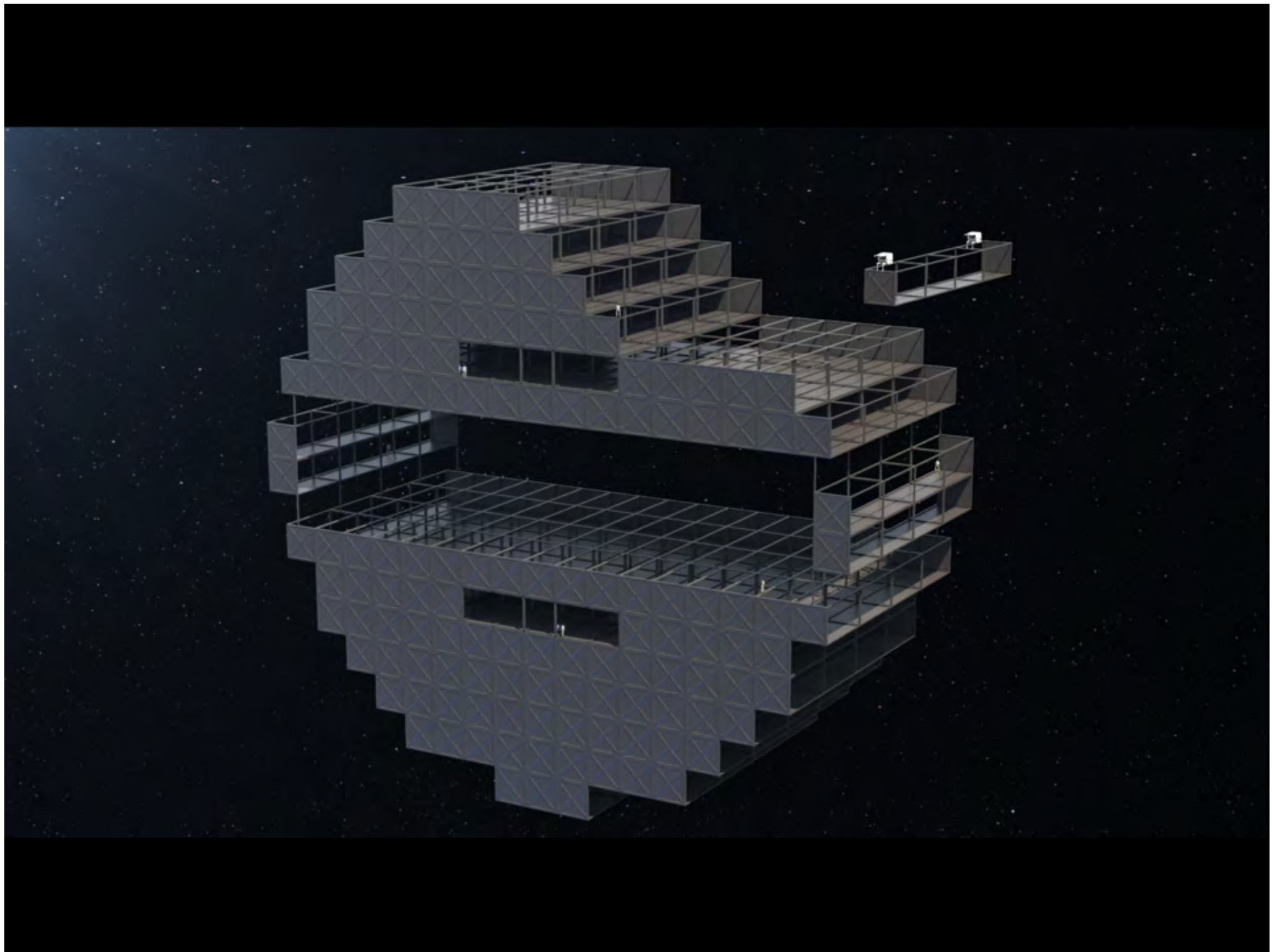


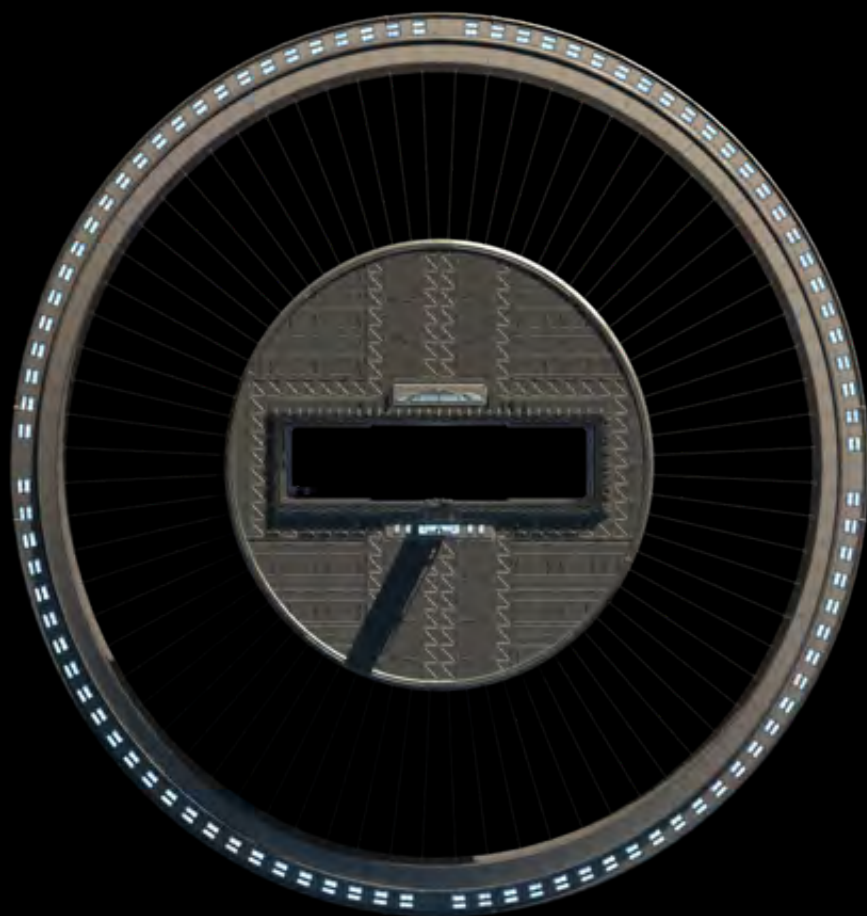




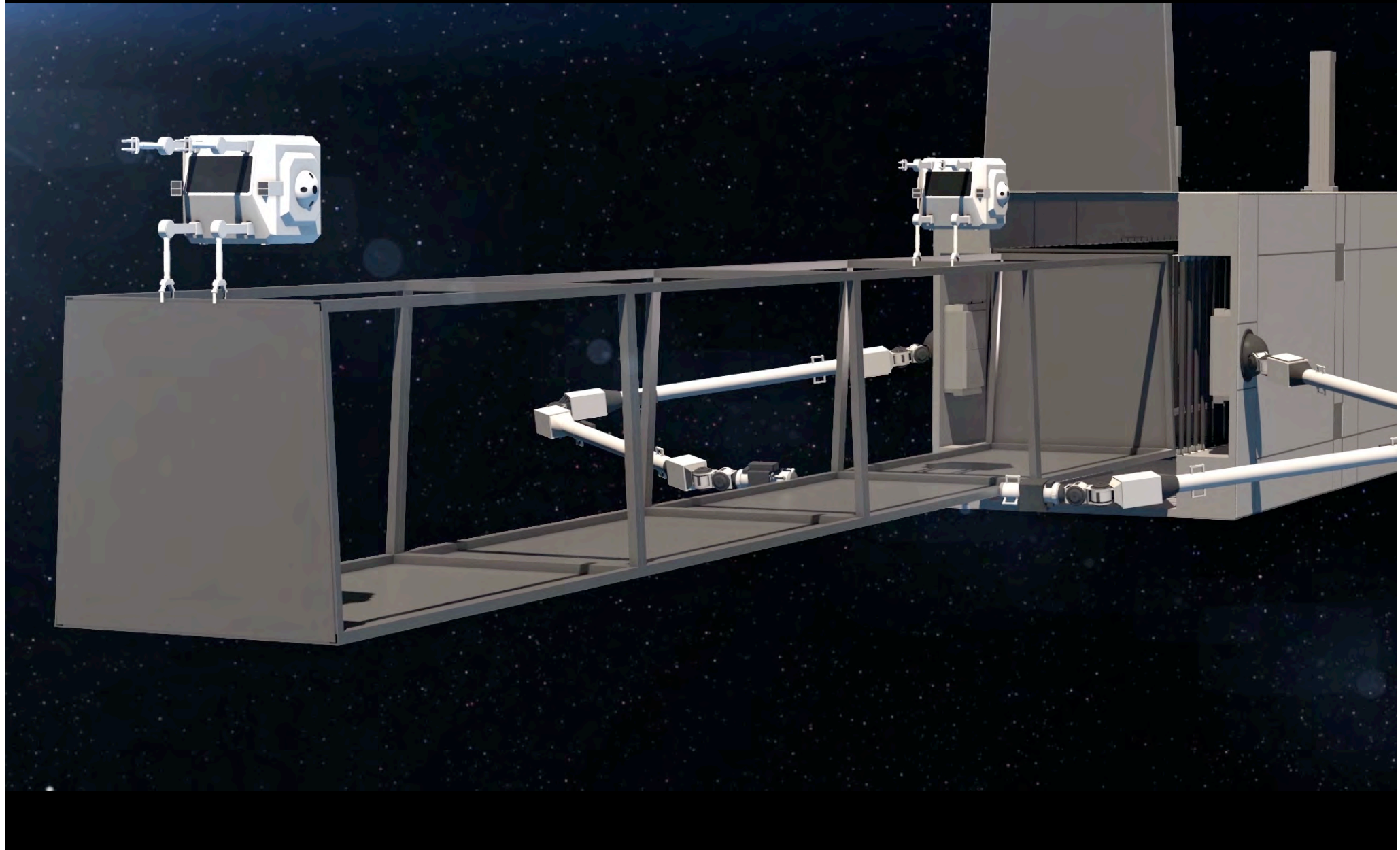


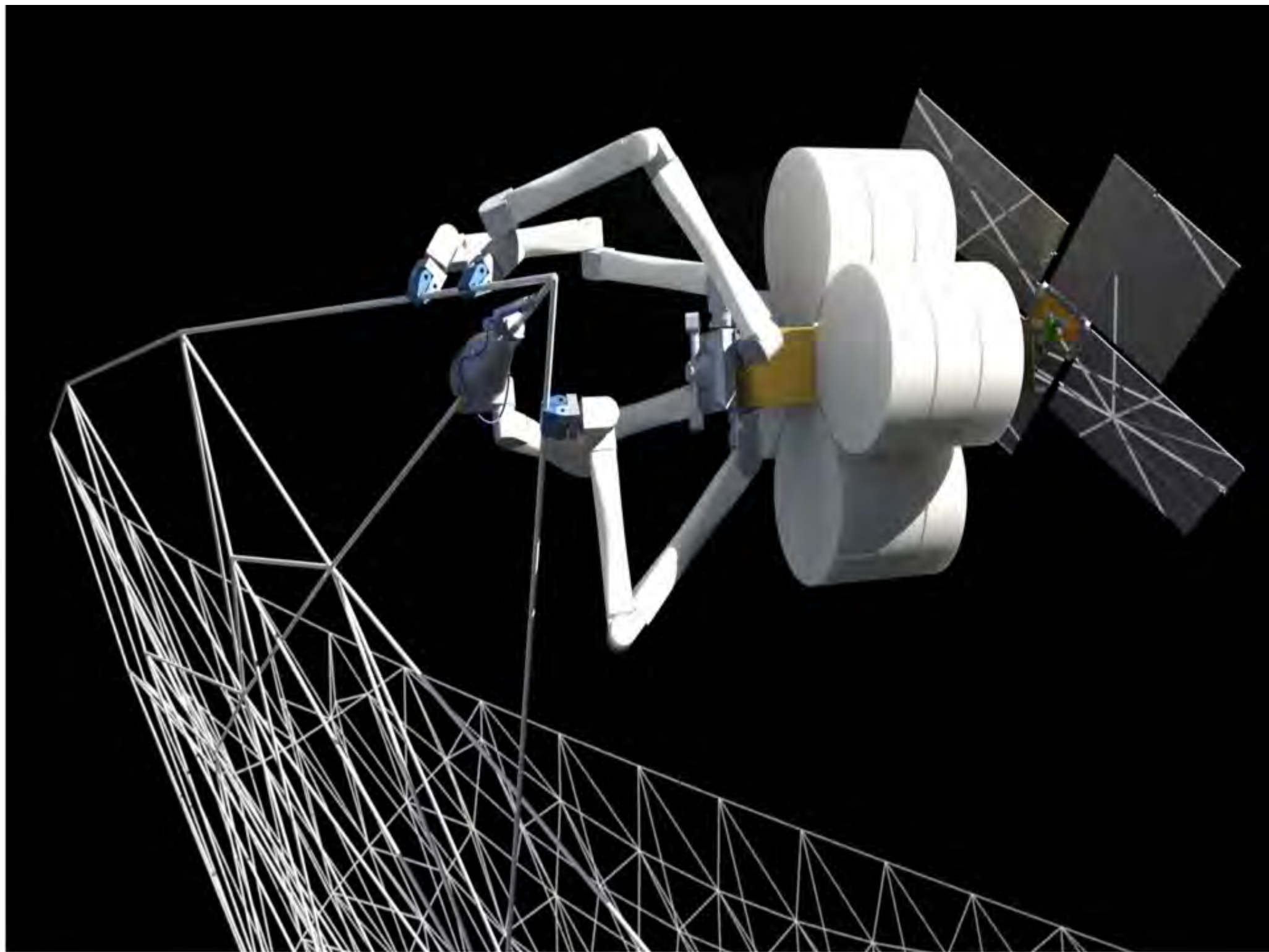


















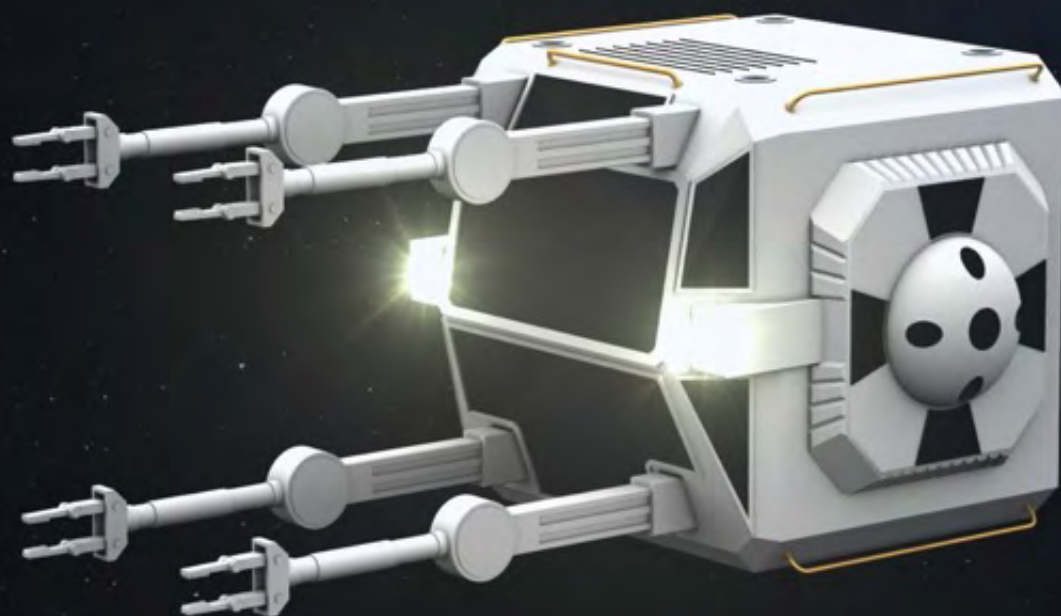














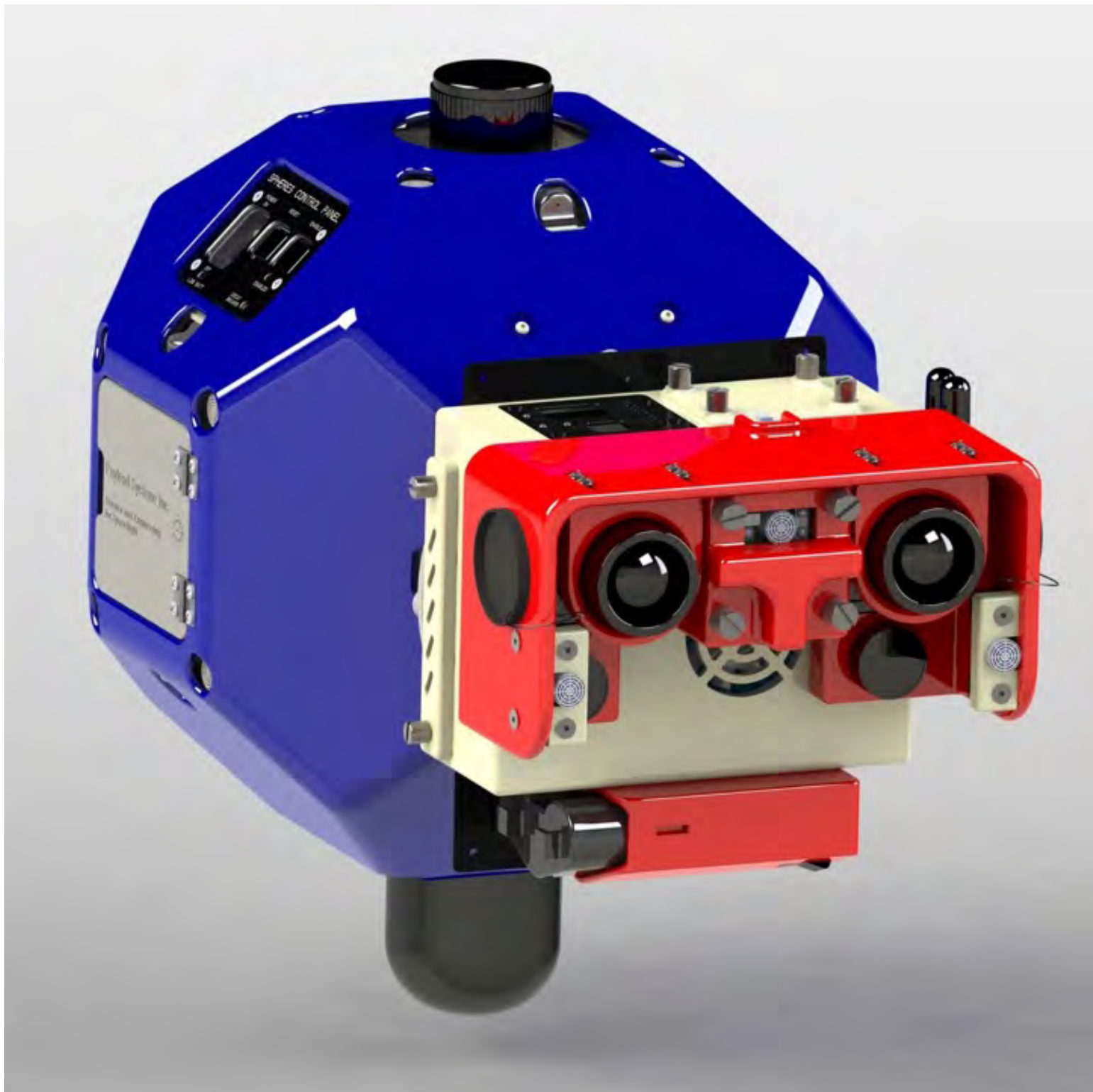
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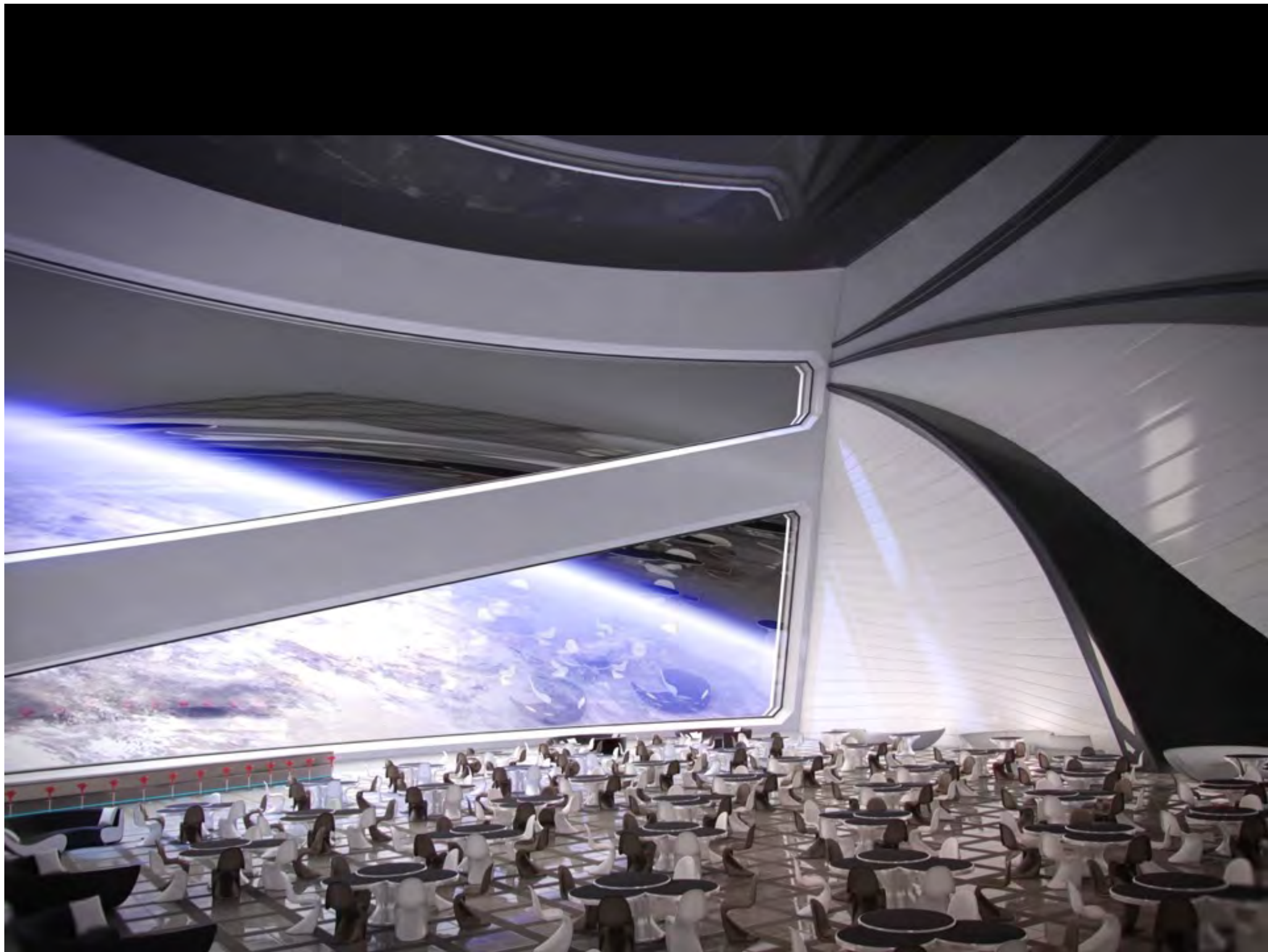
Do you want to work in space?











# Gateway Technical Aspects



- **Highest-level goals: what are we trying to accomplish?**
- **System requirements flow from goals**
  - “Form Follows Function” (Louis Sullivan)
- **Physical realities set some requirements and influence others**
- **Build in accommodation for obvious extensions**



# High-Level Requirements from Goals



- **Artificial Gravity**
  - How Much? Lunar?  $\frac{1}{4}$  gee? Mars?  $\frac{1}{2}$  gee?
  - Little is known about gravity magnitude needed to prevent long-term health issues
  - Opportunity for groundbreaking research on the Gateway
- **Provide for human survival and comfort needs**
  - Air (Pressure? Composition?)
  - Water (Distribution system? Recycling?)
  - Food
  - Living quarters
- **Avoid designs that induce space-related illnesses**
  - Limits on rotation rates
  - Radiation shielding

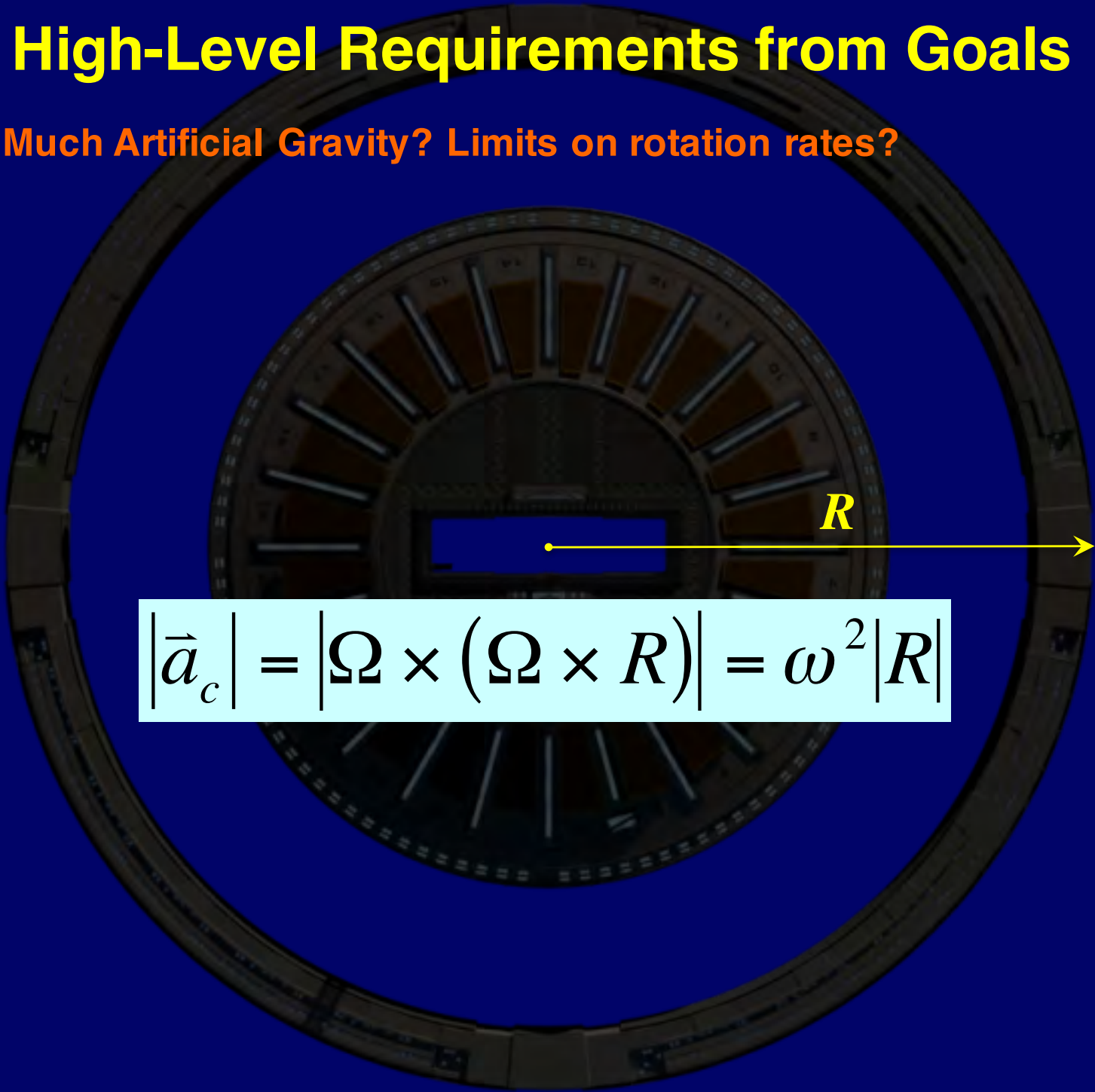
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# High-Level Requirements from Goals

- How Much Artificial Gravity? Limits on rotation rates?



A diagram of a rotating space station, resembling a torus or a large wheel, with a central hub and radial spokes. A yellow arrow points from the center to the outer rim, labeled with the letter  $R$  in yellow. The entire diagram is set against a dark blue background.

$$|\vec{a}_c| = |\Omega \times (\Omega \times R)| = \omega^2 |R|$$

# High-Level Requirements from Goals

- How Much Artificial Gravity? Limits on rotation rates?



A diagram of a rotating space station, represented as a large circular ring with a smaller inner ring. A yellow arrow points from the center to the outer ring, labeled with the letter R.

$R$

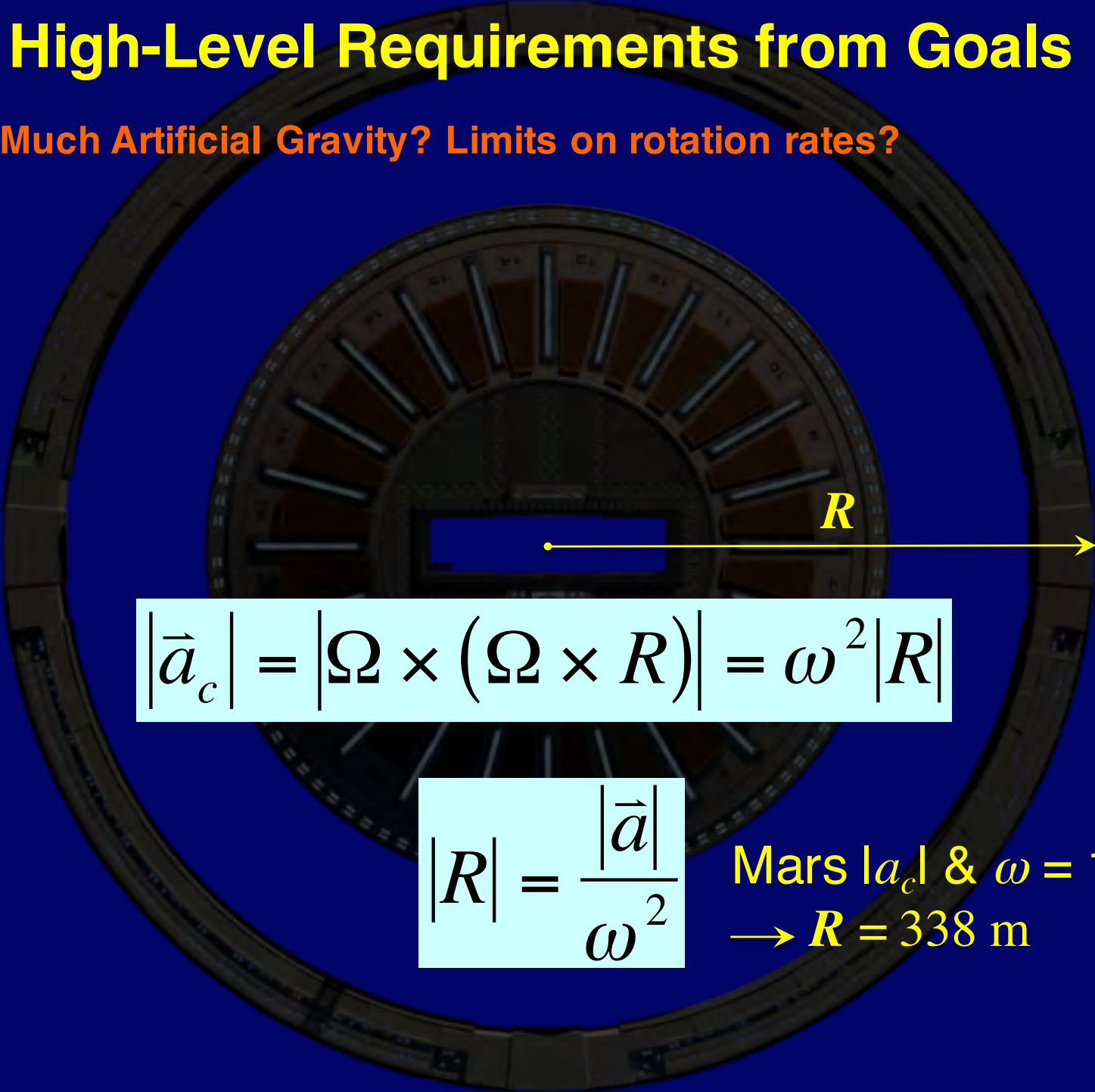
$$|\vec{a}_c| = |\Omega \times (\Omega \times R)| = \omega^2 |R|$$

$$|R| = \frac{|\vec{a}|}{\omega^2}$$



# High-Level Requirements from Goals

- How Much Artificial Gravity? Limits on rotation rates?



A diagram of a rotating space station segment, shown as a large circular ring with internal structural details. A yellow arrow points from the center to the outer edge, labeled with the variable  $R$ , representing the radius.

$$|\vec{a}_c| = |\Omega \times (\Omega \times R)| = \omega^2 |R|$$

$$|R| = \frac{|\vec{a}|}{\omega^2}$$

Mars  $|a_c|$  &  $\omega = 1$  RPM?  
 $\rightarrow R = 338$  m

# High-Level Requirements from Physical Realities



- **Orbit option limits**

- **Altitude**

- Lower → less energy for launches, but more atmospheric drag
    - Higher → less atmospheric drag, but higher energy for launches and more intense radiation

- **Inclination**

- Equatorial → less energy for launches, but long eclipses
    - Sun-synchronous ( $i \sim 97^\circ$ ) → continuous sunlight option, but high launch energy
    - Intermediate?

- **Mitigate orbital debris collision hazard**



# Accommodate Extensions



- **Wide range of other potential uses**
  - **Science, research**
    - Human
    - Animal, plant
    - On-orbit assembly and testing of large, complex spacecraft
    - On-orbit servicing of upper stages for high-energy trajectories
  - **Exploration**
    - Large, complex spacecraft & re-usable upper stages
    - Waypoint for travel to more distant destinations
  - **Industry**
    - On-orbit manufacturing requiring low-gee environment
    - Use of extraterrestrial materials
  - **Commercial**
    - Entertainment and advertising industries
    - Athletics
- **Gateway provides infrastructure for these activities**





“Falcon Heavy is the world’s most powerful rocket, With the ability to lift into orbit a 737 jetliner loaded with passengers, crew, luggage and fuel.

- Elon Musk







*If you can dream it, you can do it.*  
*- Walt Disney*

