



# TRANSCENDED SPACE

## From Stasis to Interstellar Habitation

Space navigation has always held its place in popular culture. From the Space Odyssey debut to Area 51, our fascination with traveling the greater unknown has become a global inspiration. Beyond Sci-Fi, modern research shows this may actually be possible, balancing stasis with habitation. How can advances in material technology, enclosed ecosystems, and bio-chemistry create design solutions for sustainable living in space? This design suggests photon propulsion and modern cryogenics may pave the way for galactic missions in the future.

### Tech Theories



#### Tsiolkovsky's Rotating Station

The Russian designer's model uses a rotating component to create artificial gravity at the circumference. Airlocks, a closed eco system, and solar panels will be implemented throughout the circular cavity. Currently, this is a more feasible option for long range travel and would suit the needs of a small crew that will remain on board the duration of the trip.



#### Alcubierre Drive Theory

Developed by Mexican physicist, the theory states that if an energy density field lower than that of a vacuum is created, a forward suction will propel a craft faster than the speed of light. The problem with this is that the elements required to create negative mass cannot all be obtained on earth. Therefore, scientists have categorized this as a speculative theory.



Hibernation chambers in *Alien*

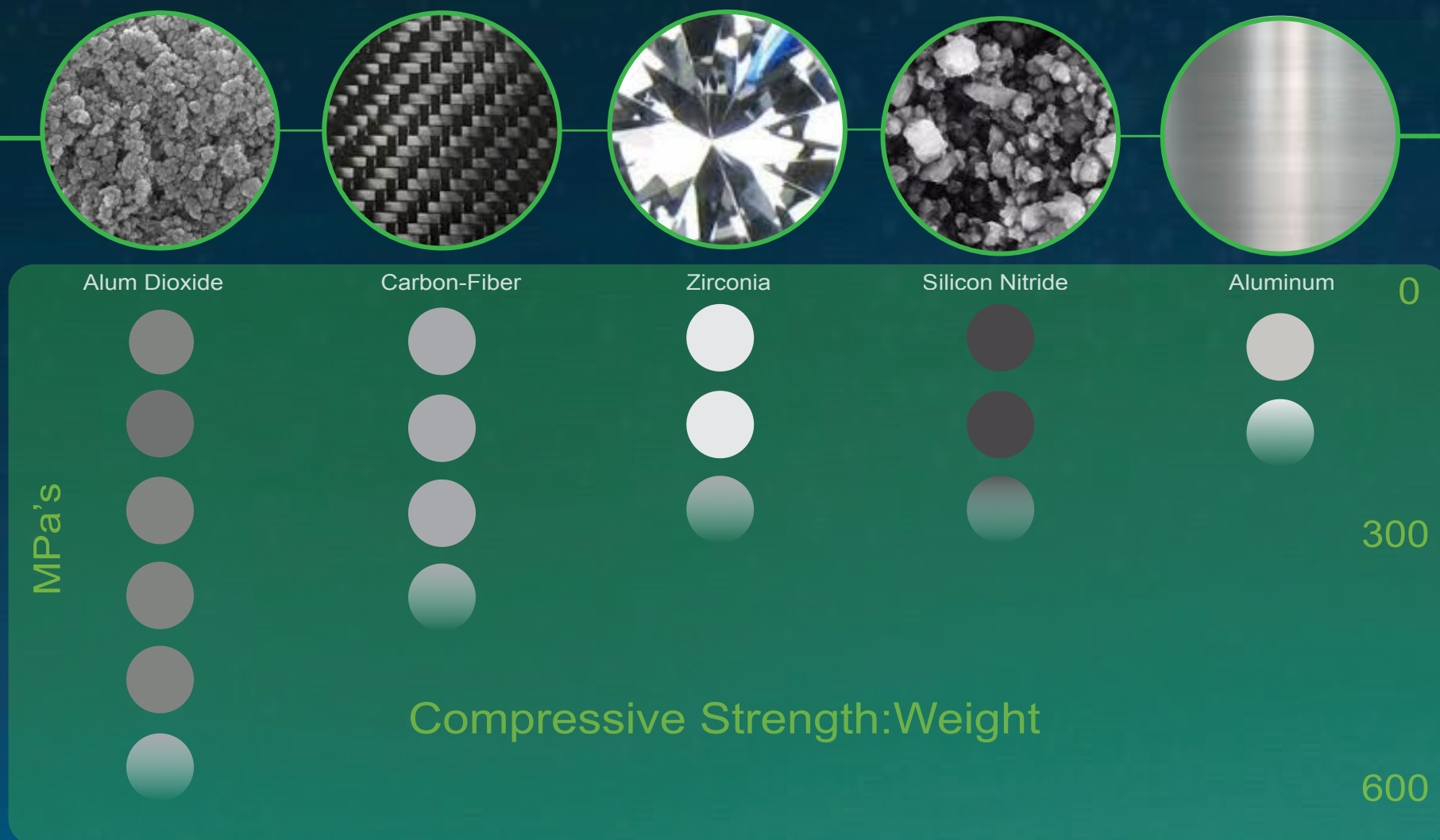
#### The Speed of Photon Propulsion

Breakthrough Starshot, led by NASA's P. Warden, is a program dedicated to the exploration of photon propulsion. High power lasers beam a photon array, which then bounces off a panel at 20% the speed of light. Though extremely fast and efficient for our system, farther systems may still require months or even years of travel.



### Construction and Materials

Spacecraft can be designed much differently than structures on earth, given the nature of a vacuum. In a zero gravity environment, a structure does not need to support its own weight. Many of the robotic arms utilized in space stations would not be able to operate under a downward force. This allows for designers to make use of heavier, more durable materials. Carbon fiber and Aluminum oxide are currently leading elements in the space craft industry due to their high compressive strength to weight ratio. Carbon-carbon and fibrous insulation tiles are used for exterior panels to protect the interior from extreme temperatures caused by traveling at high speeds. Below are the various current speed thresholds for man-made objects relative to known velocities in physics.

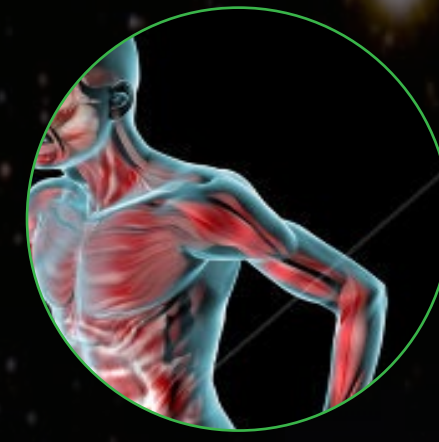


### Sustainable Environment: The Closed Ecosystem



Each element here plays a part in a craft's biotic system. Plants are used to absorb CO2 emissions from the animals (people) and circulate oxygen. Microorganisms are responsible for decomposing wastes.

Light is the biggest struggle in maintaining an outer space ecosystem. Advanced blue led lights are most effective in mimicking properties off the sun (thus regulating circadian rhythm) while stimulating plant growth. Water is reused on the ship via filtration systems, and the atmosphere is circulated both mechanically and biologically (plantlife).



Muscles begin to atrophy as they no longer lift their own weight



Minimal gravity causes disruptions in the proprioceptive systems (awareness of extremities)



Pressure changes in eye socket causing vision discrepancies

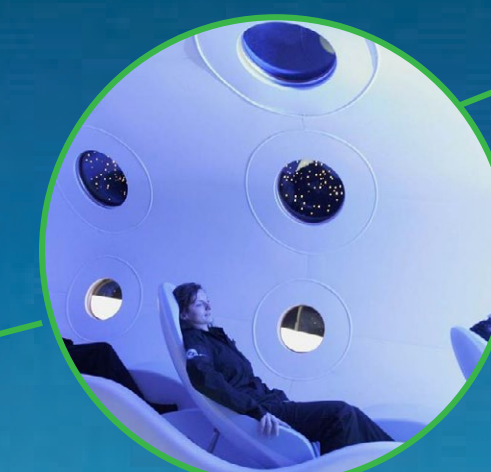
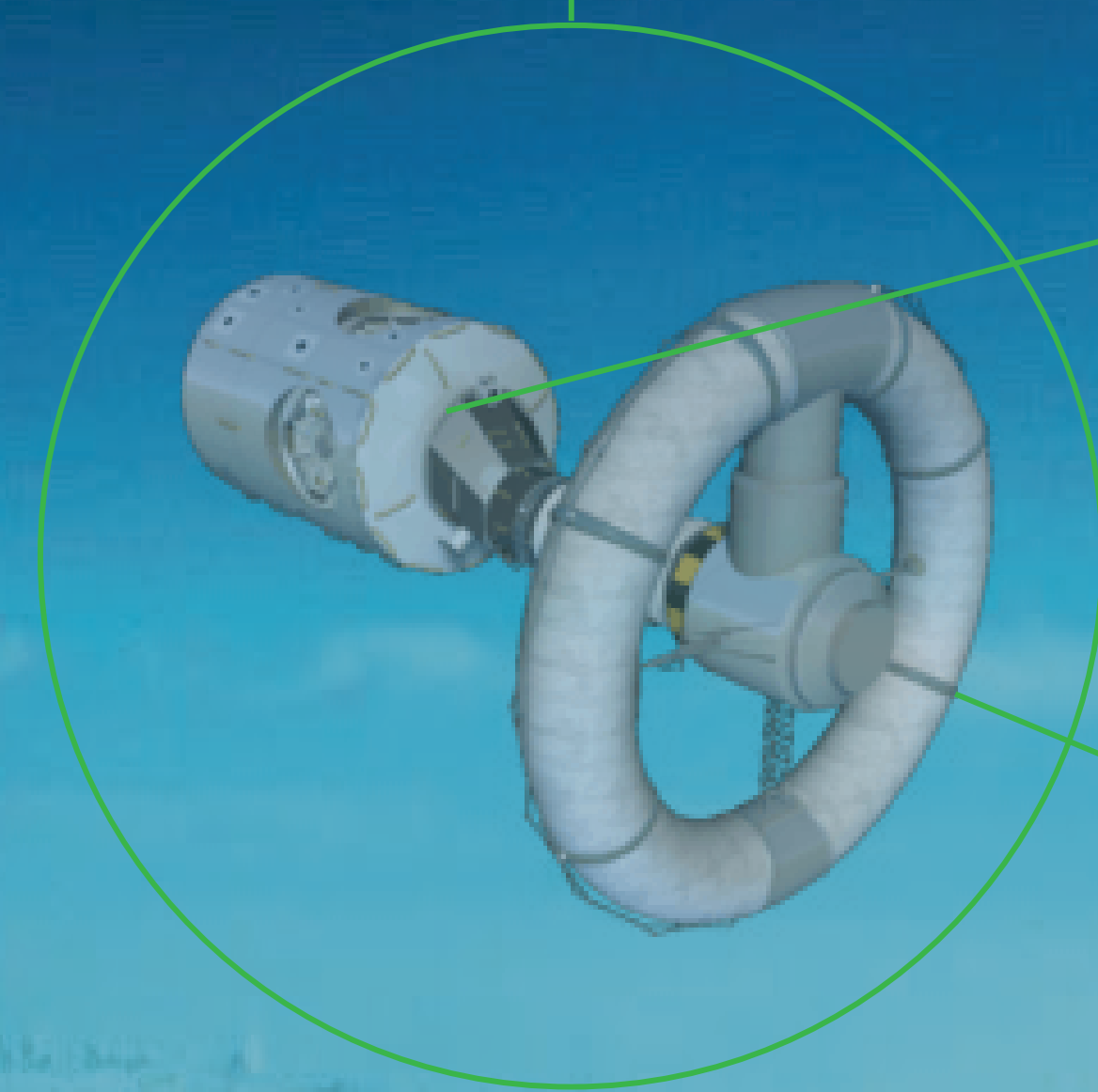
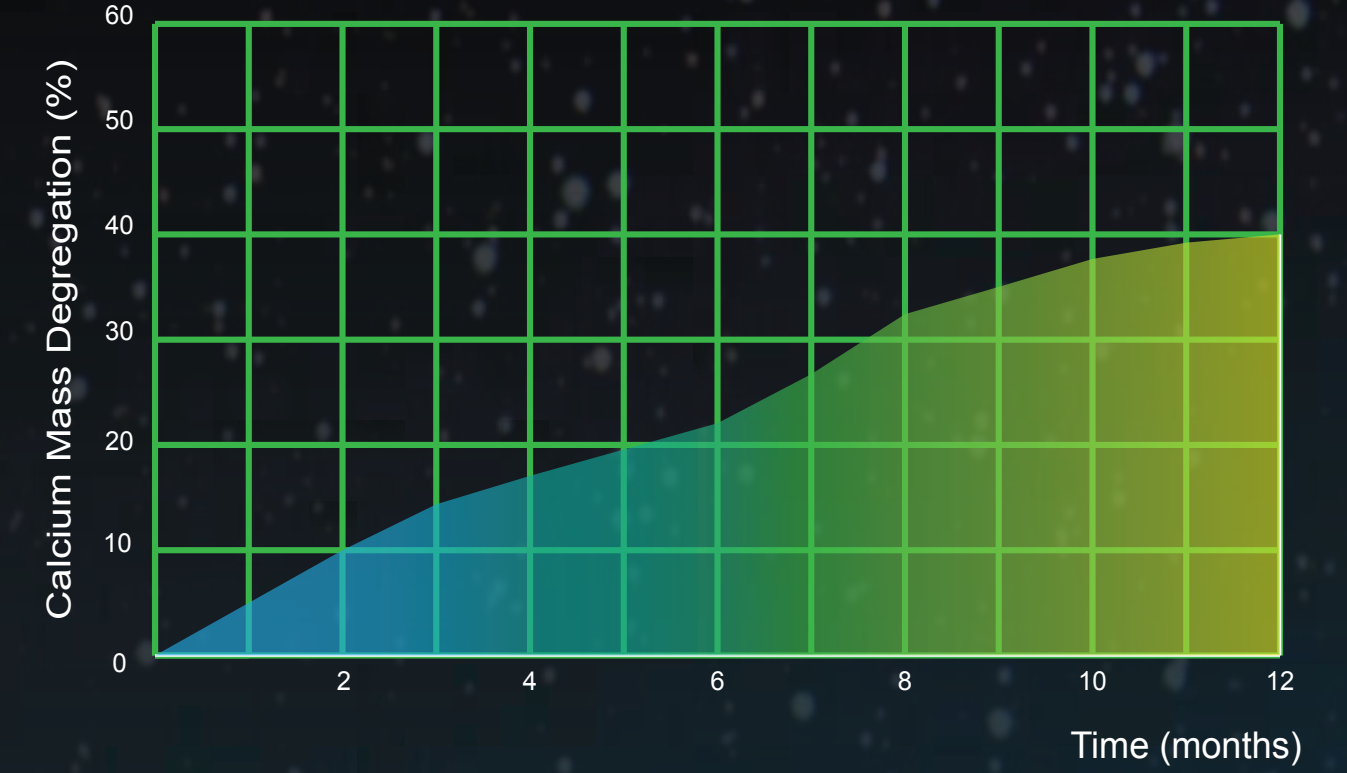
#### Weightlessness, the Body, & an Alternative for Travel

When considering the possibility of long-term habitation in space, designers first understand how minimal gravity affects the body over extended periods of time. The exertion performed against gravity by our body's core muscles is what keeps us in shape; without this there are detrimental consequences.

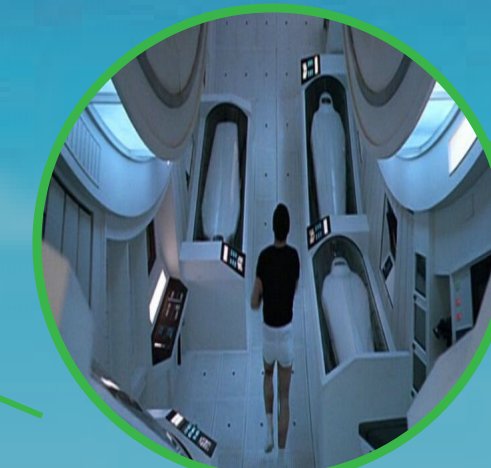
#### Advantages of Cryogenics

The negative bodily effects associated with space missions lead scientists to believe a state of suspended animation might be preferable. This technology involves lowering one's body temperature to a hypothermic state (60 degrees F) and feeding an intravenous mixture of calcium, proteins, and amino acids to preserve muscle tissue. This procedure also proves to be economical. A recent NASA study found a cryogenic trip to Mars would require only 220 tons of cargo versus 440. This will return save millions in cargo expenditures over time.

#### Bone Damage In Weightless Environment over Time



Entrepreneur Richard Branson (Space Ship2) develops porthole windows to provide views and create unique experience



Artificial gravity, narrow, blue light therapy, bulkhead storage



Comfortable suborbital recliners minimize the effects of extreme downward force during takeoff while providing comfort and relaxation



Specific species of plant life line the bulkheads to recycle CO2



Viewing "deck" aboard ISS Cupola



Bio-regenerative food systems -prototype

