INTERPLANETARY HABITATION
DESIGNING FOR LIFE ON MARS

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Abstract:

How can architecture adapt the complex engineering systems of a Mars colony to sustainable human life?

Migration and travel has evolved from the dawn of humanity to the automotive and flight industries of current times. Now interplanetary travel is on the forefront of technological innovation.

Innovation is created by those who dream farther forward than current society can understand, and it is necessary to push the boundaries of technology to make the impossible practical. Thinking ahead to design for future interplanetary migration is a needed step to compel the world forward, as well as architecture and its boundaries therein.

Building Title: Mars Station 1
Typology: Planetary Colonization
Site: Home Plate, Gusev Crater, Mars

The Primary goal of this Thesis is to practically design a Martian colony in which a building can combine the following requirements for sustainable life on the Martian surface.

Efficiency in Construction, Materiality, Transportation, Storage, & Functionality Systems

Aesthetics in Historical Connection, Design Hierarchy

Immediate Life Support in Radiation & Environmental Protection

Life Longevity in Medical, Physical, & Psychosomatic Health Systems

Comfortability in Residency, & Workspace
Migration

Trajectory
“We are building the first ship, the first Mars or interplanetary ship (BFR Rocket), right now. I think we’ll be able to do short flights, short up and down flights, sometime in the first half of next year (2019).” - Elon Musk
Interplanetary Rockets

Current & Past Mars Mission Compatible:
- NASA Saturn V at $1.16 Billion per launch
- SpaceX Falcon Heavy at $90 Million per launch

Promising Future Mars Mission Compatible
- SpaceX BFR at $34 Million per launch
- SpaceX ITS at $43 Million per launch
- Blue Origin New Glenn (pricing uncertain)
Mars One is a company looking to use current technology to stage privatized missions to Mars.
NASA is primarily working to further research into Mars & deep space for discovery and technological development.
The United Arab Emirates, is currently working on a 100 year migration plan & simulations, with a leisurely timeline
Relativity

Relativity Space is an innovative startup working to develop factories to entirely 3D print Rockets for various companies.
Historical Influences
Cosmology & The Sphere

Pantheon of ancient Rome.

Cénotaphe à Newton Design By Étienne-Louis Boullée
Comparison to Pantheon aesthetic

Pantheon Plan, Section, & Elevations

Mars Design Plan & Elevation
Amphitheater Design Influence

Theatre of Dionysus in Athens

Conrad Prebys Amphitheater at Indiana University
Dome Design Influence

Reichstag, Berlin

Pantheon, Rome

Library, University of Chicago

1781, Project Design for The Paris Opera
Necessities for Life on Mars
Necessities for longevity on Earth

Total necessities for longevity on Mars

- Food
- Water
- Shelter
- Clothing
- Radiation Protection
- Physical Therapy
- Enhanced Gravity
- Physiological Support

BASIC HUMAN NEEDS
Oxygen, Food, & Water

Electrolysis Oxygen Production

Water Purification  Food Production
Environmental Shelter & Radiation Protection

Earth’s atmosphere protects life here organically, but on Mars we need to build protection.

Humans can allow for a maximum of 2 hours of exterior daylight radiation exposure, per day on Mars surface.
Gravity & Pressurization

Gravity: 100%
1 Moon, & Many Satellites
Substantial Atmosphere
Mostly Oceanic Surface

Gravity: 38%
2 Moons, & 2 NASA Satellites
Weak Atmosphere
Little Flowing Water & Ice
Avg Temp: -67 F
Temp High: 68 F
Physiological & Psychological Support

Medical Facility Plan
Construction Process
3D Printed Concrete Construction
Steel Alloys & Minimal Material Design

Steel Decking / Concrete Composite Flooring (3D Printed Concrete)
Construction Diagraming
Site: Gusev Crater

Site is replicable at any point along the Martian equatorial surface.
HVAC & Pressurization System
Level G

Ground Floor Atrium Space
Levels 3 & 4 Interior Residence

Levels 1-4 Interior Lounge