

Cost Estimation for Test Project on Earth and First Building Project on Mars

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Abstract

This document provides approximate cost estimates for constructing a prototype on Earth and the first rubber-glass building on Mars. Estimates include materials, assembly, transport, and certification with contingencies for unforeseen challenges.

To provide reasonable cost estimations for both the **Test Project on Earth** and the **First Building Project on Mars**, we'll make assumptions about costs related to materials, assembly, transport (in the case of Mars), and certification. These estimates will focus on medium-range costs with the necessary contingencies for unforeseen challenges. All costs are in USD and assume current technology and prices.

1. Test Project on Earth

This project will involve building a full-scale prototype on Earth to test materials and certify the structural integrity and engineering of the rubber-glass house. This project would exclude interiors but would serve as the basis for validating the Mars design.

Estimated Costs for Earth-based Test Project:

- **Silicone rubber and additives:**
 - Cost: ~\$50,000
 - Comments: Materials sourced locally, includes prototyping and slight overages for testing.
- **Titanium/Inconel frame:**
 - Cost: ~\$175,000

- Comments: Titanium and Inconel are expensive, but Earth-based manufacturing benefits from established supply chains and technologies.
- **Borosilicate glass (with insulation):**
 - Cost: ~\$450,000
 - Comments: Pricing is slightly lower than Mars due to ease of local fabrication.
- **Solar panels for the roof:**
 - Cost: ~\$200,000
 - Comments: Standard high-efficiency solar panels, including some custom work for design integration.
- **Airlock (Titanium/Inconel & Borosilicate):**
 - Cost: ~\$120,000
 - Comments: Prototyping a functional airlock to simulate Martian conditions.
- **Manufacturing and assembly on Earth:**
 - Cost: ~\$300,000
 - Comments: Includes labor, equipment, and custom engineering solutions. Could be cheaper if using automated or prefabricated methods.
- **Testing, certification, and validation (Earth environment):**
 - Cost: ~\$400,000
 - Comments: Extensive testing, including structural integrity, thermal resistance, airtightness, and durability.
- **Interior (medium-range budget for labs, living spaces, etc.):**
 - Cost: ~\$200,000
 - Comments: Basic interior build-out, equivalent to a medium-range, concrete-based setup.

Total Estimated Cost for Earth Test Project: ~\$1,895,000

2. First Building Project on Mars (Including Transport)

This includes building the structure on Mars with all necessary transportation and construction considerations. All costs assume current transportation costs to Mars and exclude the interiors, which would be addressed separately.

Estimated Costs for Mars Project (Excluding Interiors):

- **Silicone rubber and additives (local production potential):**

- Cost: ~\$75,000
- Comments: If silicone rubber can be partially manufactured from Martian resources, this cost could decrease. Otherwise, transport of this material would increase the cost significantly.
- **Titanium/Inconel frame (including transport):**
 - Material cost: ~\$175,000
 - Transport cost: ~\$10,000,000
 - Comments: Given the high weight of these materials, transportation would dominate the cost. The price assumes SpaceX or a comparable provider offering lower-cost Mars missions (\$2,700/kg).
- **Borosilicate glass (including transport):**
 - Material cost: ~\$500,000
 - Transport cost: ~\$27,000,000
 - Comments: Borosilicate glass is heavy, and transporting 10,000 kg at ~\$2,700/kg results in substantial costs.
- **Solar panels (including transport):**
 - Material cost: ~\$200,000
 - Transport cost: ~\$2,000,000
 - Comments: Solar panels are lighter than glass but still expensive to transport in large quantities. There may be opportunities to produce some materials locally on Mars in the future.
- **Airlock (including transport):**
 - Material cost: ~\$120,000
 - Transport cost: ~\$2,700,000
 - Comments: The airlock is a crucial element that must be transported in a durable form. The cost reflects its weight and specialized nature.
- **Manufacturing and assembly on Mars (robotics and human assistance):**
 - Cost: ~\$2,000,000
 - Comments: Includes costs for deploying robotic construction teams, supervision, and other logistical challenges unique to Mars.
- **Interior (excluded from transport):**
 - Cost: ~\$300,000
 - Comments: This is an estimate for fitting out interiors with medium-range construction, similar to what you might expect from typical

Earth-based housing, adjusted for Martian conditions.

**Total Estimated Cost for First Mars Project (Excluding Interiors):
~\$44,870,000**

Breakdown Comparison

Cost Category	Earth Test Project	First Mars Project (Including Transport)
Silicone Rubber & Additives	~\$50,000	~\$75,000
Titanium/Inconel Frame	~\$175,000	~\$10,175,000
Borosilicate Glass	~\$450,000	~\$27,500,000
Solar Panels	~\$200,000	~\$2,200,000
Airlock	~\$120,000	~\$2,820,000
Manufacturing & Assembly	~\$300,000	~\$2,000,000
Testing & Certification	~\$400,000	~\$300,000
Interior (medium-range)	~\$200,000	~\$300,000 (excluded from transport)
Total	~\$1,895,000	~\$44,870,000

Conclusion:

1. **Earth Test Project (~\$1.9 million):**

This project involves creating a prototype on Earth to certify the materials, design, and processes. It's an essential step to de-risk the larger Mars mission and fine-tune the construction methods and materials.

2. **First Mars Building (~\$44.9 million):**

The significant cost comes from the transportation of heavy materials like titanium, Inconel, and borosilicate glass. As transportation costs drop and more materials can be sourced locally on Mars, these costs could decrease, but current estimates place transportation as the overwhelming expense.

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