#### **Gradient One: Full Mission Dossier**

Aegis Station Infrastructure LLC June 2025

### **Mission Overview**

**Gradient One** is a full-scale, human-rated orbital platform designed to validate artificial gravity for long-duration space habitation. It features a rigid 350-meter truss boom with a single torussegment pressurized pod at the boom tip, rotating at ~1.6 RPM to produce 1g at the pod floor. This geometry directly mirrors Aegis Station, enabling the first meaningful testing of real gravitational environments in orbit.

Gradient One is the first artificial gravity structure built not as a demo — but as the **first floor** of orbital infrastructure with Earth-equivalent gravity.

## **Technical Specifications**

#### **Spin Architecture**

- Truss Length: 350 meters (rigid, segmented)
- **Spin Rate:** ~1.6 RPM
- Resulting Gravity:
  - 1.00g at floor (r = 350m)
  - ~0.86g at ceiling (80m diameter pod)
- Counterbalance: Inert or mirrored pod at opposite end for mass balance

#### **Pressurized Crew Pod**

- **Type:** Torus-segment (Aegis-Station matching cross-section)
- Arc Radius: 350 meters
- **Tube Diameter:** 80 meters
- Arc Span: 5 degrees (~30.6 meters of curved walking floor)
- **Crew Capacity:** 1–2 astronauts
- **Duration:** 30–90 day missions

- Access: EVA-only baseline (pressurized tunnel interface reserved)
- Life Support: Modular ISS-grade ECLSS, water/CO2 loop, sleep station, galley

#### Systems & Operations

- **Spin System:** Electric motors + passive stabilization
- **Power:** Solar array + battery backup
- **Comms:** Starlink, UHF/S-band backup
- Instrumentation:
  - Motion tracking
  - Gait analysis sensors
  - Vestibular and spatial orientation modules
  - Environmental monitoring (air, fluids, particles)
  - Internal/external video telemetry

### **Optional Add-ons (Not included in baseline budget):**

- Pressurized transfer tunnel (~\$40M add-on)
- Moon/Mars g-level pods (future expansion)
- Long-duration radiation shielding

### Cost Breakdown (Target Budget: \$65M-67M)

Category	Description	Cost (Est.)
Design & Management	Mission planning, feasibility, simulations	\$6M
Truss Boom	Segmented rigid boom structure	\$15M
Counterweight System	Structural ballast or dummy pod	\$3M
Pressurized Pod	5° torus segment + outfitting	\$12M- 14M
Spin System	Motors, control software, bearings	\$5M
EVA Access System	Handrails, tethers, dual airlocks	\$5M

Total		\$65M- 67M
Launch & Assembly	Falcon 9 x2 or Starship cargo + orbital ops	\$8M
Science Payloads	Sensors, cameras, tracking modules	\$2M
Life Support	ECLSS, atmosphere, water, consumables	\$6M
Power & Comms	Solar, battery, antenna	\$3M

### **Strategic Rationale**

- First full-scale test of artificial gravity in human spaceflight history
- Only system designed to match real orbital station architecture (Aegis)
- Validates fundamental assumptions about life in spin-generated gravity
- Enables expansion to additional pods, tunnels, or even full rings
- Positioned as a modular precursor to permanent orbital infrastructure

Gradient One is not a simulation. It is a structural and physiological milestone. It's the first place in orbit where a human will walk on a real, curved, gravity floor.

# Contact

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