Aegis Station

Civil Infrastructure for a Thriving Orbital Future
Master Dossier — v2.4 (1g Configuration, Final Specs)

1. Vision

Aegis Station is a modular, shielded, rotating space habitat designed for construction in lunar orbit using attainable technology and lunar-derived water. It provides Earthlike living conditions through full artificial gravity and radiation protection, forming the backbone of a permanent human presence beyond Earth.

2. Strategic Value

- **Full radiation shielding** using local lunar water
- **Artificial 1g gravity** through rotational spin
- **Massive usable volume** per ring for living, working, and growing
- **Triple redundancy:** three independent rings
- **In-space logistics node** for lunar surface, orbit, and cislunar operations

3. Final Specifications

- **Ring centerline radius:** 300 meters
- **Tube radius (torus):** 50 meters (full diameter: 100 meters)
- **Outer hull radius:** 350 meters
- **Shielding water thickness:** 3 meters (from 347 to 350 m radius)
- **Habitable volume:** 0 to 347 meters inward from axis
- **Floor height (target gravity):** ~347 meters
- **Target gravity:** ~1g
- **Spin rate:** ~1.61 RPM

- **Number of rings:** 3
- **Ring spacing:** 200 meters
- **Central hub length:** 650 meters

4. Shield Architecture

- **Shielding material:** Lunar-sourced water
- **Water layer thickness:** 3 meters, flush against outer hull
- **Total shield volume:** ~3.3 million m^3 (~1,320 Olympic swimming pools)
- **Total shield mass:** ~3.3 million metric tons
- **Compartmentalization:** 5 radial zones per ring
- **Vertical segmentation:** Suppresses slosh and improves resilience
- **Active circulation:** Supports life support, heat dissipation, biosecurity
- **Dynamic monitoring:** Filters, sensors, and flow control systems

5. Shield Fill Operations

- **Tank format:** Modular 45-ton sealed water cartridges
- **Fleet size:** 45 dedicated lunar tankers
- **Payload per tanker:** 45 metric tons
- **Conveyance system:** External unpressurized cartridge delivery
- **Loading:** Cartridges are inserted into rotating vestibules (5 per ring)
- **Spin-synchronized draining:** Centripetal flow into ring reservoirs
- **Daily throughput:** ~2,025 metric tons/day
- **Target fill duration:** ~4.5 years for complete shield

6. Construction and Deployment

Phase 1 – Dry Assembly:

- Launch and assemble rings in lunar orbit with no water mass
- Install shield bladders and plumbing
- Integrate core utilities, docking arms, and central spine

Phase 2 – Shield Fill & Spin-Up:

- Deliver water via tanker cartridges
- Fill all three rings before initiating spin
- Bring station to full 1g at 347m floor height
- Begin activation of life support, utilities, and transport systems

Mass Totals:

- Dry structure per ring: ~120,000 metric tons
- Shield mass per ring: ~1.1 million metric tons
- **Water-to-structure mass ratio:** ~27:1

7. Central Hub Applications

- **Length:** 650 meters (non-rotating)
- **Docking arms:** Extend from both ends, keep ring area clear
- **Pressurized transit pods:** Move crew/cargo to and from rings
- **Manual egress corridors:** Shielded backup routes between rings and hub
- **Zero-G workspaces:** Labs, foundries, hydroponics, fabrication
- **Modular add-ons:** Expandable docking for mission-specific modules

8. Habitat Interior and Zoning

- **Usable volume per ring:** >1 million m^3
- **Floor construction:** Multilevel decks stacked inward toward hub

- **Gravity profile:** ~1g at floor, tapers slightly inward
- **Zoning areas:**
  - Residential blocks
  - Hydroponics and food systems
  - Industrial decks
  - Parks and social spaces
  - Medical and emergency areas
- **Combustion policy:** Open flame allowed only in hardened fire shelter modules

9. Emergency Preparedness

- **Three-ring isolation:** Any ring can be sealed without compromising station function
- **Redundant life support:** Designed for 3× population load
- **Compartmentalized shielding:** Local failures don't compromise total radiation protection
- **AHID drones:** Perform automated hull and micrometeoroid inspection
- **Escape logistics:** Transit pods can move personnel quickly between rings and hub

10. Logistics Chain and Support Hardware

- **Tanker fleet (shield fill phase):** 45 tankers @ 45-ton payloads
- **Post-fill repurposing:** Resupply, depot missions, fuel delivery
- **Support Vehicles:**
  - **Luna–Aegis Shuttle:** Reusable short-range lunar lander (2–6 crew + cargo)
  - **Aegis-Class Rover:** Pressurized surface scout and prospecting platform
  - **Earth–Aegis Long-Hauler:** Modular interorbital transport for passengers and cargo

11. Replicability and Growth

- Aegis Stations can be built anywhere local water is accessible
- Mars orbit, Deimos, or icy moons become feasible staging grounds
- Compatible with asteroid water mining and deep space operations
- Aegis-type installations can form the backbone of future interplanetary civilization

12. Open Engineering Topics

- Slosh dynamics under rotational fill
- Segment fault handling and fluid rerouting
- Coriolis forces on large-volume water flow
- Long-term microbial suppression inside shield
- Mass asymmetry during partial fill stages
- Spin-up resonance under fluid mass