Aegis Station

Civil Infrastructure for a Thriving Orbital Future
Master Dossier — v2.5 (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

Initial Fill Protocol:

- Rings remain **stationary** during initial fill
- Full shielding mass is loaded prior to spin-up
- Station structure is robust enough for full mass support without rotation

Top-offs and Maintenance:

- Performed while rings are spinning
- Uses synchronized cartridge loading to maintain inertial balance
- 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

7A. Radial Modules for Gravity Simulation

Aegis Station's fixed rotation rate generates a full 1g at the 347-meter outer floor level, with artificial gravity scaling linearly inward. This makes it possible to simulate lower-gravity environments by installing modular pressurized habitats **along radial booms or spokes extending from the rings toward the central hub**.

At the station's spin rate of ~1.61 RPM, the following gravity levels can be achieved at precise radii:

Environment	Simulated Gravity	Required Radius
Earth (1g)	9.81 m/s²	347 m
Mars (0.38g)	3.73 m/s²	~152 m
Moon (0.17g)	1.67 m/s²	~68 m

Modules mounted at these radii allow the study of partial gravity effects in a controlled, crew-accessible environment—**without constructing surface habitats on Mars or the Moon**.

Applications:

- Long-duration human physiology trials (muscle, bone, cardiovascular)
- Agricultural tests under Mars or lunar gravity
- Equipment development and fractional-G validation
- Pre-deployment testing for planetary settlement hardware

This architecture offers a significant research advantage over fixed-gravity surface bases and positions Aegis Station as a proving ground for future off-world living.

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