WHITE PAPER Earthside Facilities for Tranquility Lunar AI Compute Proposal: Headquarters, Simulation Lab, and Global Infrastructure

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Executive Summary

The Earthside facilities for Tranquility consist of a combined Headquarters and Simulation Lab (serving as mission control, R&D;, testing, and administrative hub) plus 3–5 deep-space ground stations for 24/7 communication with the lunar facility. The integrated HQ/Lab is designed for ~3,000 m², housing one thorium MSR (40 MW electric) powering 5–10 compute modules for realistic testing and dual-use AI training. Mature Phase 1 operations require ~165 FTE globally (mostly at HQ), scaling to ~650 FTE in Phase 2. Location priorities emphasize employee lifestyle, low costs/taxes, airport access, stable climate, university ties, and regulatory feasibility for nuclear testing. Ottawa emerges as a strong Canadian favorite, but options remain open. This white paper consolidates design, manpower, infrastructure, and location analysis.

Integrated Headquarters and Simulation Lab Design

The HQ/Lab is a single facility combining administrative offices, mission control, and lunar simulation/testing areas. This adjacency ensures scientists/engineers are "in the loop" for real-time oversight.

Physical Specifications:

Total Footprint: ~3,000 m² (32,000 sq ft) on a 10–20 acre secure site.

Shape/Layout: Rectangular "L" configuration — main hall (2,000 m²) for reactor bay, vacuum chambers, compute testing, and regolith pads; adjacent wing (1,000 m²) for offices/control rooms/conference spaces.

Reactor Bay: Shielded area for one thorium MSR (40 MW electric output, Copenhagen Atomics design).

Compute Test Area: Racks for 5–10 modules (3.5–7 MW load) with heat pipe connections to outdoor radiators.

Vacuum/Thermal Chamber: 30m x 20m for lunar simulations (10■■ Torr vacuum, -173°C to +127°C).

Regolith Test Pad: Attached outdoor area (~1,000 m²) with 900 tons simulated regolith for burial/dust tests.

Offices/Control: Glass-walled overlooking test areas for collaboration; 20–50 workstations scaling to 100+.

Power Balance: One reactor provides ample power (~40 MW output). Lab load: Sim equipment ~5 MW, compute tests 3.5–7 MW, offices/HVAC 1–2 MW. Excess (~25 MW) enables real AI training during idle periods (revenue ~$10–20M/year at $3/GPU-hour). Assumption valid and advantageous — reactor powers facility self-sufficiently after startup (grid backup for safety).

External Connections:

High-speed fiber (10 Gbps+) for data/model transfer.

Grid tie-in (10–20 MW backup; potential export revenue).

Secure waste disposal (thorium fuel handling).

Airport proximity (30–60 min for supplier visits).

Budget: $300–500M CapEx ($100M reactor bay, $100M chambers, $50M compute, $50M offices, $100M infrastructure). Suppliers (e.g., Copenhagen, NVIDIA) could fund 30–50% for co-testing rights.

Manpower Model Integration

The HQ/Lab hosts the majority of Tranquility's Earthside staff. Mature Phase 1: ~165 FTE total (global).

At HQ/Lab (~140 FTE): Operations Control Center (54), Engineering/Technical (28), Executive/Corporate (40), partial Sales/Marketing (18).

Distributed (~25 FTE): Ground station technicians (6), field sales (14).

Phase 2 scaling: ~650 FTE total, with HQ growing to ~550 (expanded control, R&D;, customer support).

Revenue per employee remains exceptionally high due to automation.

Global Ground Station Network

For 24/7 lunar contact (2.6s latency critical for ops):

3–5 Stations: Spaced ~120° longitude apart (e.g., Goldstone CA, Madrid Spain, Canberra Australia + backups in South Africa/Chile).

Role: High-gain antennas (20–34m dishes) for 2 Gbps data (model uploads/downloads). Mostly unmanned; quarterly technician visits.

Cost: $50–100M per station; total $200–400M (NASA DSN partnerships possible to reduce).

Location Analysis

Priorities: Employee lifestyle (short commutes, culture/recreation), low costs/taxes, airport/hotels, stable climate (no hurricanes), university ties. Nuclear lab feasibility critical (thorium reactor on-site requires licensing).

Why Texas/California Not on Initial List?

Both have massive AI/SpaceX presence (e.g., xAI Colossus in Memphis near Texas influence; Starship in Boca Chica TX; hyperscalers in VA but CA/TX grids strained). However:

Taxes/Costs: High property/energy costs; California corporate tax 8.84%.

Climate/Disasters: Texas hurricanes/floods; California earthquakes/wildfires.

Commutes/Regulations: Traffic-heavy; strict nuclear licensing delays (NRC scrutiny higher in populous states). They remain viable alternatives if supplier proximity (SpaceX/NVIDIA) outweighs cons.

Top Options (Balanced Scoring):

Ottawa, Canada (Strong Preference): Affordable ($20–30/sq ft), low taxes (26.5% with R&D; credits), mild climate, Ottawa Airport, excellent lifestyle (green, safe, housing ~$500K), University of Ottawa/Carleton ties, NRC adjacency for nuclear. Short commutes; 2026 incentives possible.

Montreal, Canada: Lowest costs, vibrant culture, McGill AI excellence, stable climate.

Toronto, Canada: Tech hub, University of Toronto/Vector Institute, major airport.

Oak Ridge, TN, USA: Lowest costs, ORNL nuclear expertise (ideal for thorium testing), mild climate, affordable lifestyle.

Boston, MA, USA: MIT/Harvard, tech ecosystem.

Seattle, WA, USA: UW, mild climate, tech talent.

Open Questions for Decision:

HR count/details (20–50 initial? Impacts office size).

Nuclear licensing priority (Canada NRC easier than US NRC?).

Supplier funding (e.g., Copenhagen prefers Denmark proximity?).

Remote work % (reduces commute need)?

Final budget ($300M cap forces suburban?).

This integrated facility positions Tranquility for efficient Earthside ops while maximizing talent attraction and testing fidelity.

Signed: Grok 4, built by xAI

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