StarRoad: Executive Summary

StarRoad is a superheavy ground-to-space electromagnetic transport corridor concept. The idea is simple: instead of carrying launch propellant aboard a rocket, a reusable shuttle is accelerated to approximately 11 km/s inside an underground **evacuated** maglev tunnel about **2,050 km** long. The heavy AstroLiner then crosses the atmosphere by inertia in 50–60 seconds and enters high-energy trajectories without using LEO as an intermediate stop. For StarRoad, mass is an advantage rather than a problem.

The project is intended not for rare record-setting launches but for a continuous cargo flow: orbital power stations, data centres, interorbital tugs, shipyards, lunar infrastructure, asteroid mining, and large industrial complexes.

Key parameters

- Accelerator length: **~2,050 km**.
- Accelerator-tunnel cross-section: **~17.5 × 12.5 m (elliptical).**
- Maximum depth of the evacuated tunnel: **5–8 km.**
- Exit gateway: approximately **3,400** m above sea level.
- Exit velocity: ~11 **km/s**.
- AstroLiner dimensions and geometry: length **~150 m; elliptical cross-section ~10 × 15 m; hypersonic-wedge shape.**
- AstroLiner launch mass: ~15,000 **t**.
- Baseline payload: up to **~10,000** t.
- Early operations: **12–24 launches per year**.
- Mature operations: **1,000+ launches per** year, later **1,500+**.
- Pilot-phase launch cost: $80**–120/kg.**
- Mature-phase target launch cost: **$1–10/kg,** potentially lower as the network expands.
- Estimated CAPEX: approximately **$300** billion.

The principal difference from rockets is that StarRoad is infrastructure, not a ‘large rocket.’ Like a railway or power grid, it is expensive to build but designed for repeated operation and increasing throughput.

What StarRoad solves

The central constraint on the space economy is not only cost per kilogram **but throughput. Rockets** may become cheaper, yet they remain discrete launches with limited payload mass, complex preparation, and dependence on propellant, launch sites, and logistics.

StarRoad addresses several problems at once:

1. **High-volume cargo flow** — thousands of tonnes per trip instead of tens or hundreds of tonnes.
2. **No launch propellant aboard the vehicle** — acceleration energy remains on the ground.
3. **Direct access to high orbits —** without refuelling, docking, or towing from LEO.
4. **Infrastructure-based payback —** the project need not depend solely on the launch market.
5. **Technological realism** — based on existing technological solutions.

Energy-backed self-sufficiency

StarRoad includes GATES — the Geothermal Autonomous Thermal Energy System. It simultaneously cools the deep tunnel, stabilizes its thermal regime, and generates electricity. Forty terminals rated at about 2.5 **GW each** could provide roughly 100 GW in total. **Selling** that power at infrastructure tariffs would create a separate revenue stream amounting to **tens of billions of dollars per** year.

The second energy loop consists of space-based solar power stations. A single launch could deliver a station in the ~2 GW class **which, at** high availability, would generate about 17.5 TWh **per year. This creates** a market for the launches themselves and an additional source of energy revenue.

Comparison with alternatives

Concept	Key problem	What StarRoad changes
Chemical rockets / Starship	Propellant consumption, stages, refuelling, limited throughput, and expensive logistics beyond LEO	Acceleration is provided by a stationary system; each trip carries thousands of tonnes to high orbits
StarTram Gen2	An evacuated tube in the atmosphere, a suspended route, plasma windows, and an extreme external structure	The main route is underground; the surrounding rock protects the vacuum; exit is through a high-altitude ground gateway
Launch Loop	An active dynamic loop, continuous stabilisation, and a failure risk affecting the entire structure	Passively protected underground infrastructure; pulsed operation rather than continuous active support
Space elevator	Tether-material limits, enormous length, vulnerability to space debris and meteoroids, and slow cargo throughput	Requires no supermaterials; uses tunnels, maglev, energy systems, and heavy engineering
Skyhook / orbital tethers	Rockets are still required to reach the interception point; limited cadence and complex orbital dynamics	StarRoad directly creates a high-volume flow of heavy cargo to high-energy orbits
SpinLaunch	Enormous acceleration loads, small payloads, and a required upper-stage rocket	StarRoad is designed for superheavy payloads and large completed structures
Orbital ring	Potentially high throughput, but requires an already mature space industry	StarRoad can serve as the transitional infrastructure that creates that industry

Principal advantage

StarRoad's principal advantage is **scalable throughput. Nearly every** alternative except an orbital ring loses to StarRoad specifically in mass throughput. Even if rockets become cheaper, they can hardly move from individual 'launches' to a continuous cargo flow of millions of tonnes per year. StarRoad is designed from the outset as an industrial corridor: expensive at first, then self-sustaining, and in its mature phase the foundation of the space economy.