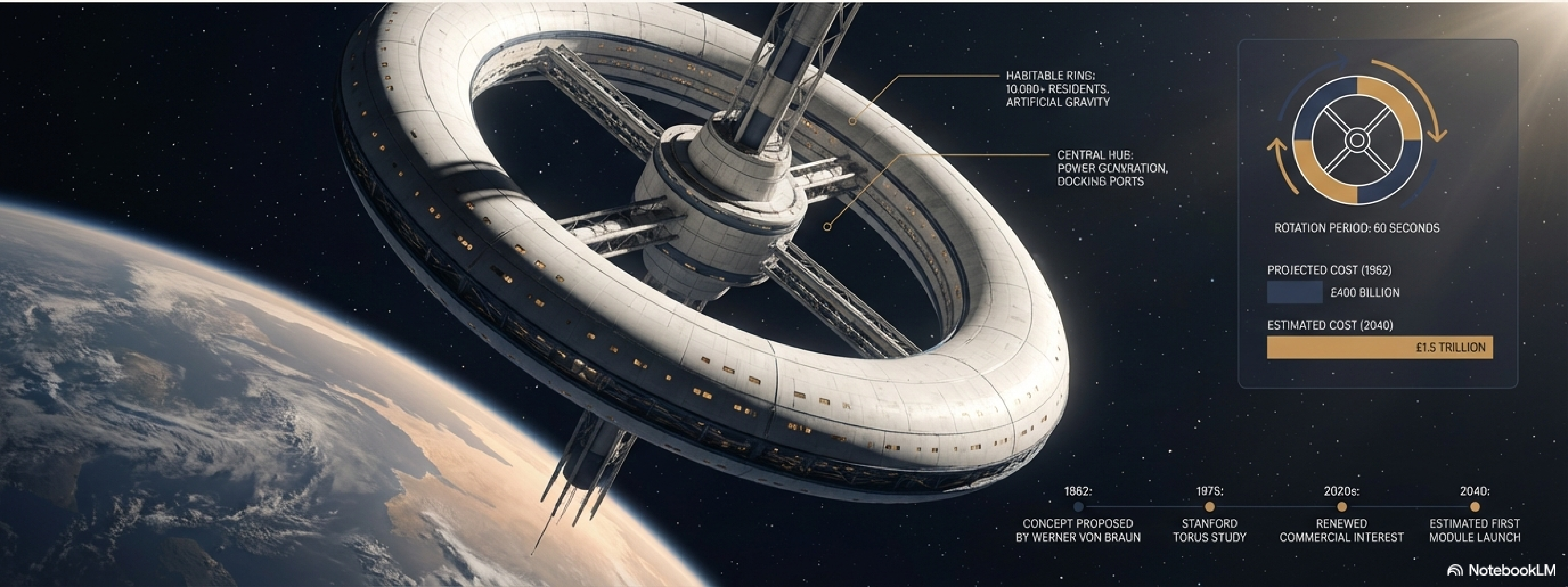
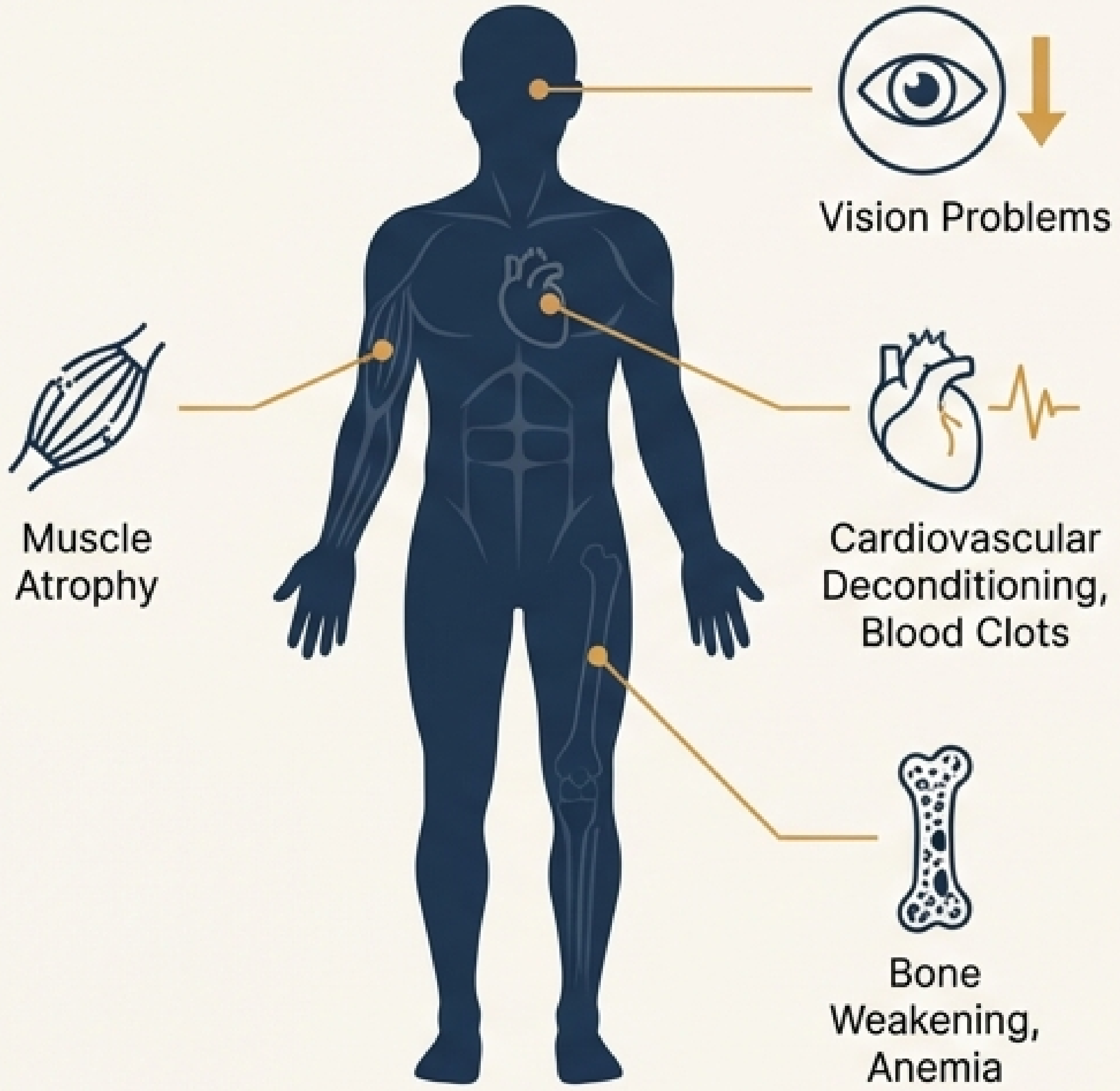
The Future We Were Promised

Why the most important idea in space exploration was left behind in 1962, and why it's finally coming back.

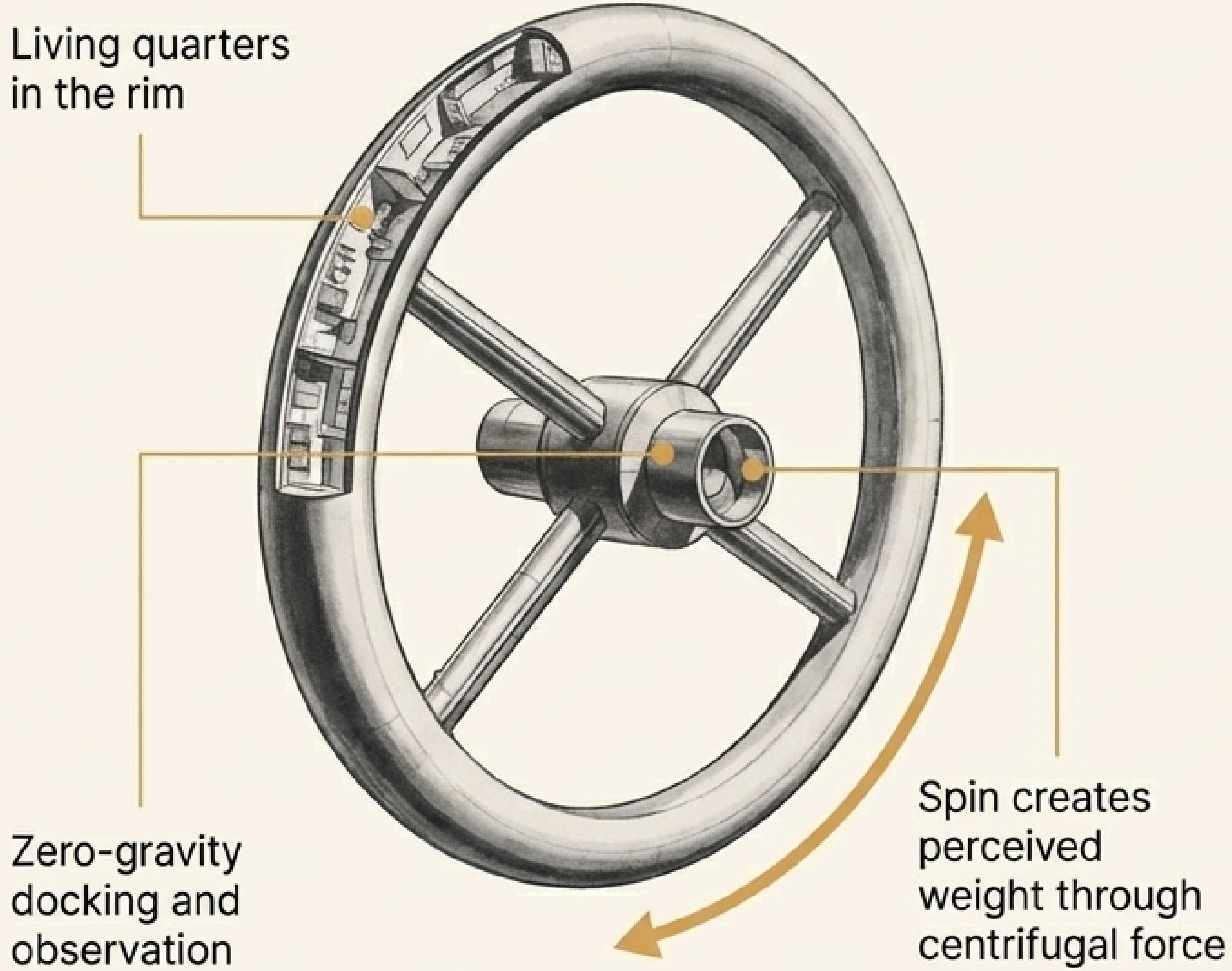


We Were Not Built for Weightlessness.



Without gravity, human bodies degrade. Long-term exposure leads to muscle atrophy, bone weakening, eye problems, anemia, and blood clots. Daily, hours-long exercise is required just to mitigate these effects. For humanity to truly live in space, we must solve for gravity.

An Idea as Inevitable as the Rising Sun.

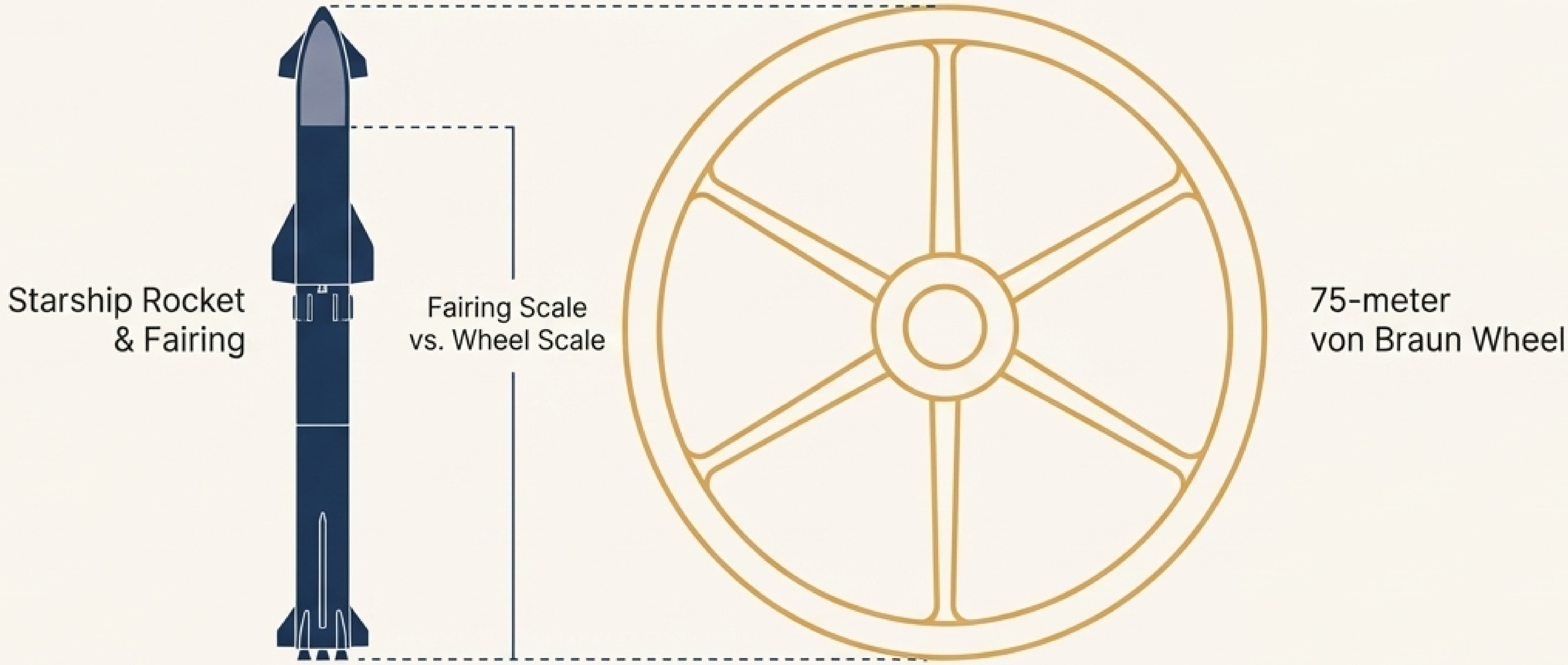


Early visionaries like Herman Potočnik (1929) and Wernher von Braun were convinced that rotating wheel stations were the key.

The concept is simple: humans live in the rim, and the wheel's spin induces a perceived weight through centrifugal force.

Key Data Callout: A 75-meter-diameter wheel spinning at ~5 revolutions per minute could simulate Earth-like gravity—a speed considered reasonable for astronaut comfort.

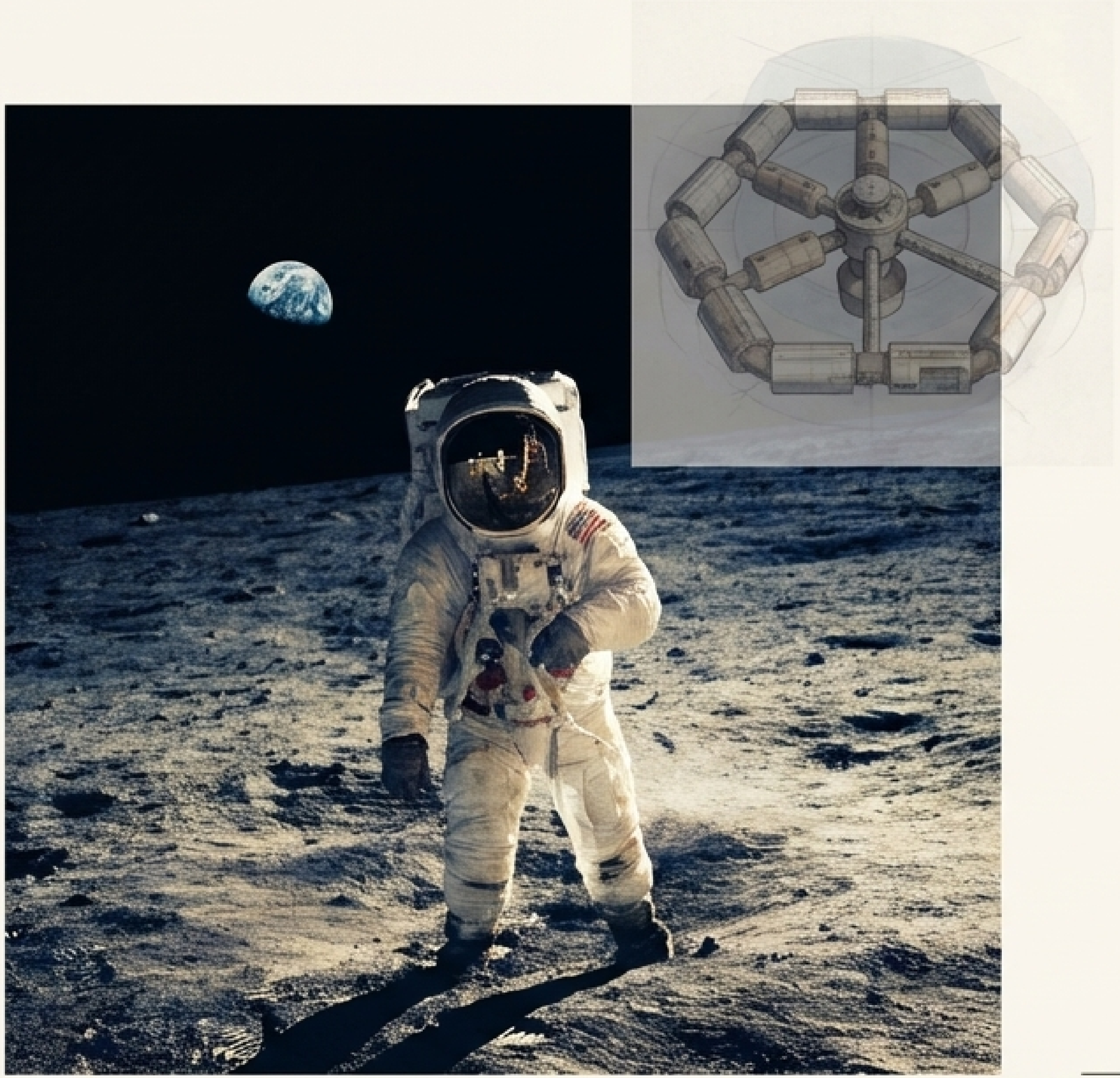
The Packing Problem: Fitting a Giant Wheel into a Slender Rocket.



Physics presents a paradox. For comfort, a rotating station must be large to spin slowly. But to reach orbit, rockets must must be slender. The largest structure ever built, the ISS, tackled this by launching dozens of small modules for in-space assembly—the “space Ikea” method. This approach is slow, expensive, and fundamentally unscalable.

A Moonshot Eclipsed the Dream.

In 1961, President Kennedy committed the US to a lunar landing. The singular focus, budget, and administrative weight of the Apollo program effectively killed the parallel pursuit of artificial gravity. Grand plans for rotating stations were shelved, and ambitions shrank to small, zero-gravity labs.



The Legacy of the Detour: A Ceiling on Ambition

America's first station, Skylab, launched on the last Saturn V in 1973. It was a three-person, short-stay outpost. This set the precedent for the next five decades of "tin can" stations, culminating in the ISS.

The ISS: Assembled from over 40 rocket launches, it supports a typical crew of only seven—a marginal increase over the first station, Salyut 1, in 1972.

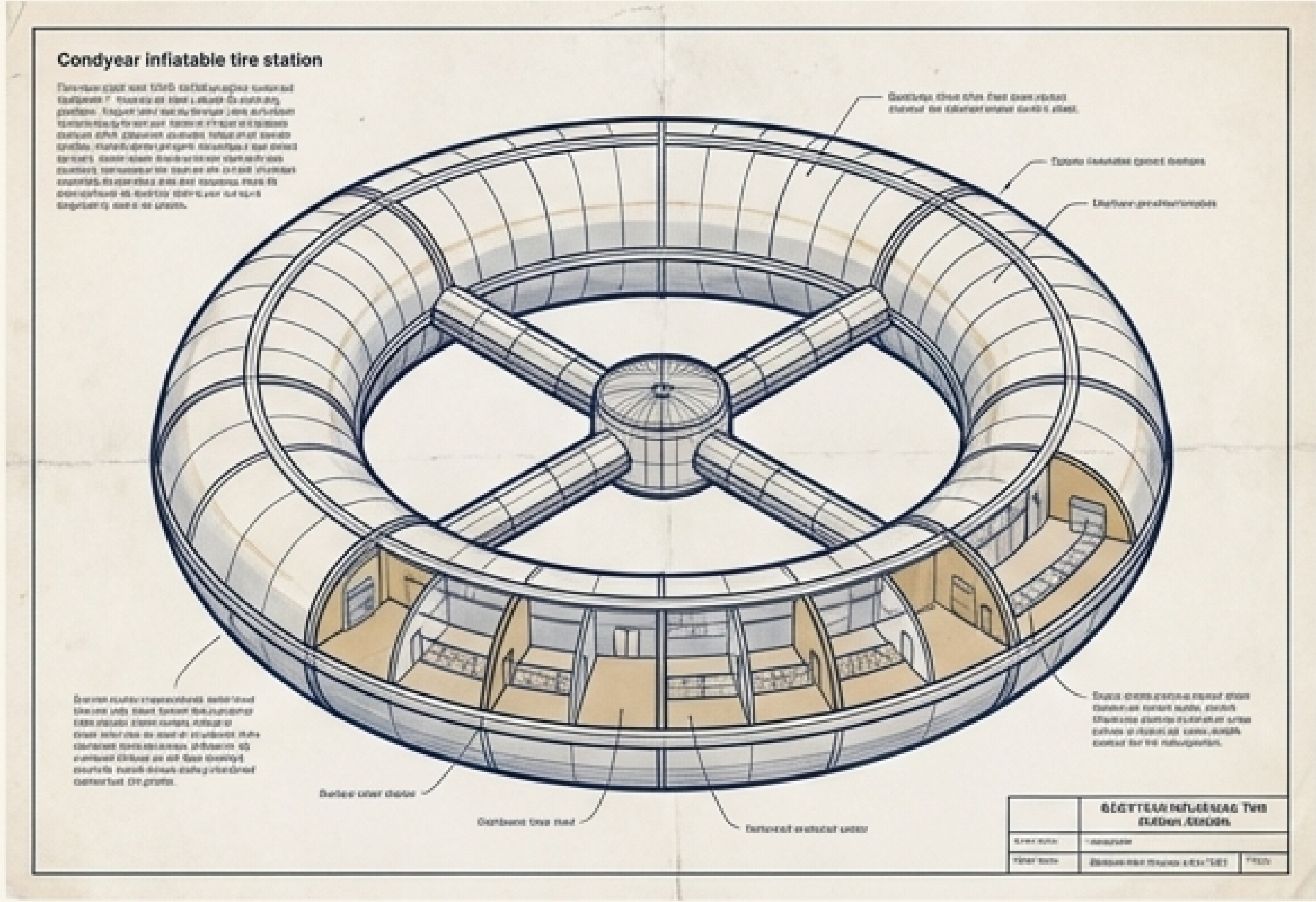
ISS

1972: Salyut 1 (Crew: 3)

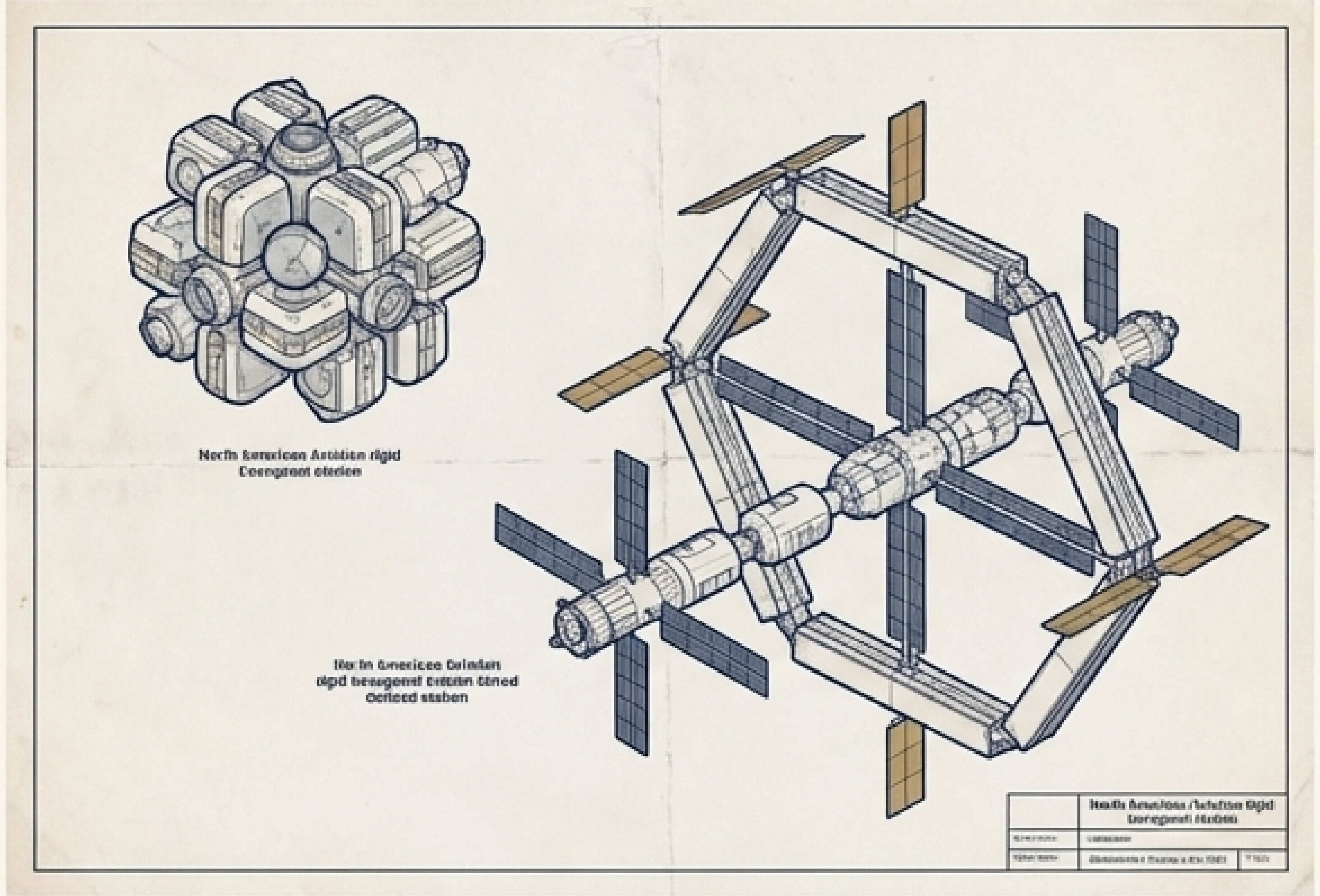
1973: Skylab (Crew: 3)

NotebookLM

A Forgotten Solution From a Bolder Era.



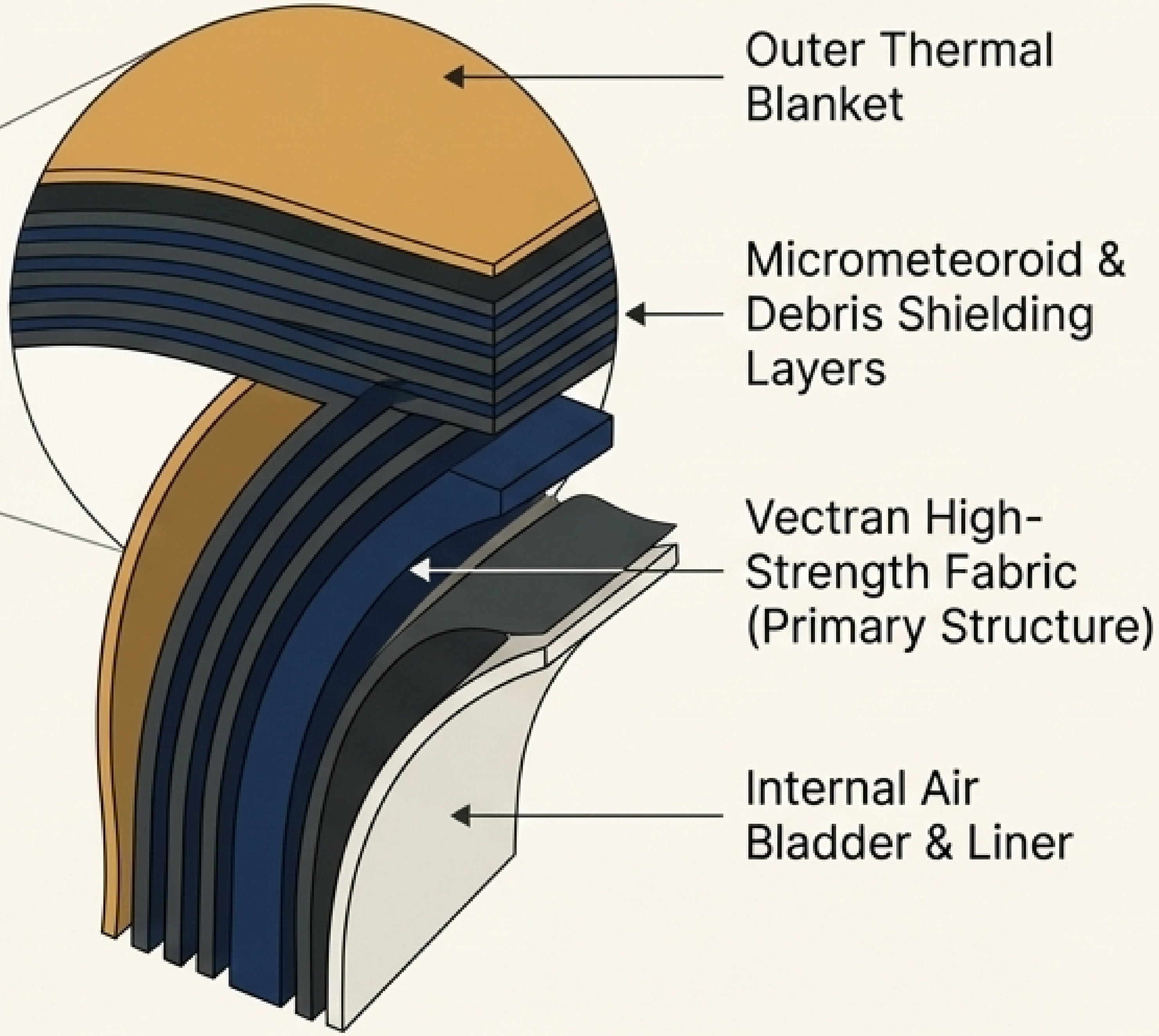
Concept 1: The Inflatable Tire



Concept 2: The Deployable Hexagon

Between 1959 and 1962, NASA Langley explored ‘unitized’ structures that solved the packing problem. Their two main prototypes: a large inflatable “tire” and a rigid, foldable hexagon that deployed automatically in orbit. The ideas were ingenious, but the materials science of the era wasn’t ready.

Enabler #1: The Material Revolution

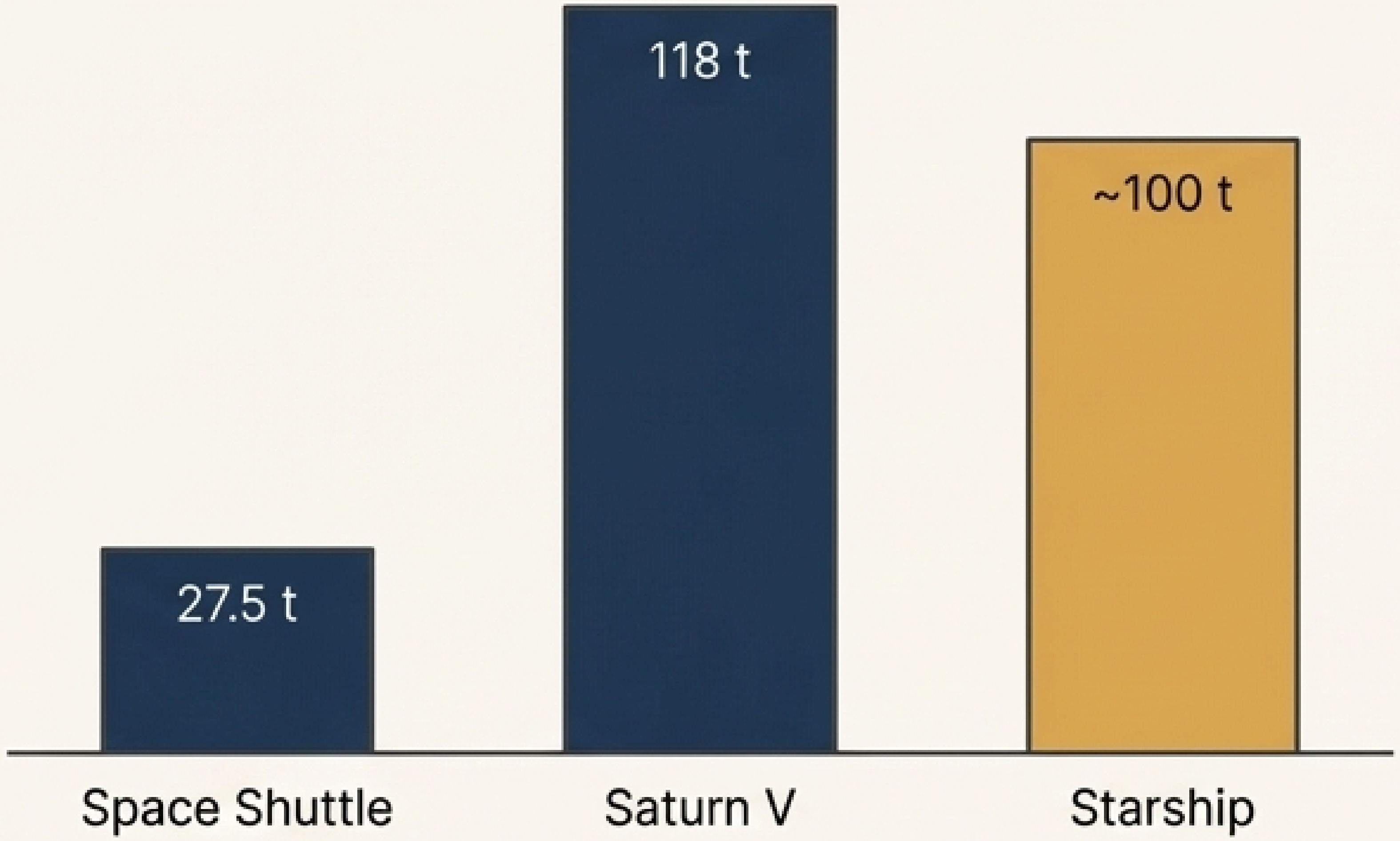


Fifty years of materials science has changed everything. The BEAM module, on the ISS since 2016, is made from high-strength flexible fabrics like Vectran. It has proven ***more resistant*** to micrometeorites and orbital debris than the ISS's metallic modules, while also offering superior thermal and radiation protection.

Enabler #2: The Launch Revolution

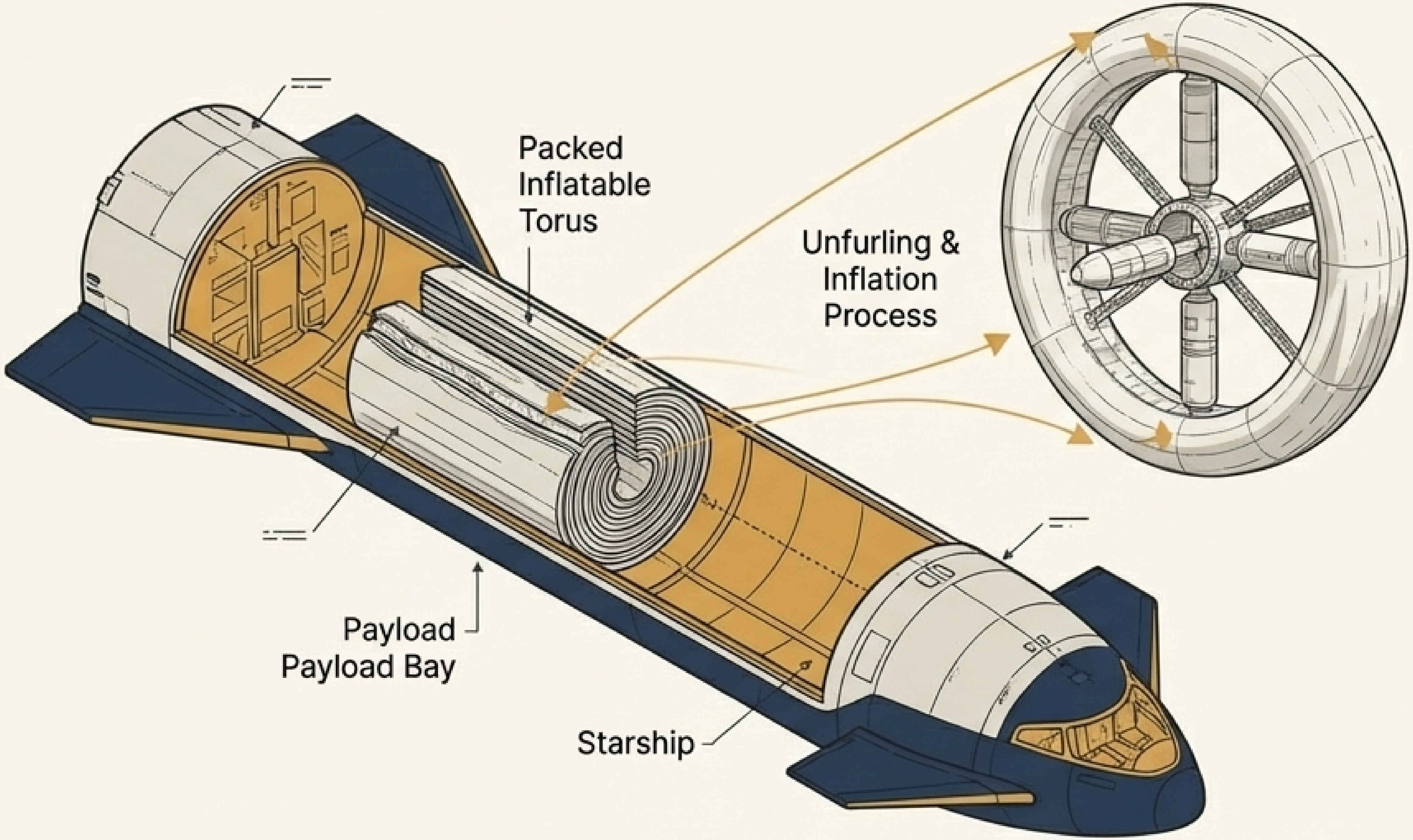
SpaceX Starship liftoff, demonstrating heavy-lift capability.

Payload to Low Earth Orbit (tonnes)



For the first time since the Saturn V, we are on the cusp of having a launcher with the volume and mass capacity to realize ambitious structures. Starship's ability to lift ~100 tonnes to orbit completely changes the engineering and economic equation for large space habitats.

The von Braun Wheel Now Fits in a Starship



The numbers now work. A 75-meter diameter wheel station (6,650 cubic meters) could have a fabric hull mass as low as 28 tonnes if optimized for a low-debris environment. This fits easily within Starship's 100-tonne capacity, leaving ample mass for systems and shielding.

Data Callout:

An additional 8 tonnes of compressed air would be needed to inflate the structure and create an Earth-like atmosphere inside.

From Living in Volume to Building on Floor Area.

In zero-gravity, we measure comfort and utility in cubic meters (volume), as astronauts use all three dimensions.

With artificial gravity, a clear ‘up-down’ orientation emerges. The meaningful metric becomes **square meters of mooutr becomes square meters of floor area**—just as we use square footage for terrestrial living spaces.

This is the crucial mental shift for building off-world civilizations.

The Commercial Case and the Path Forward

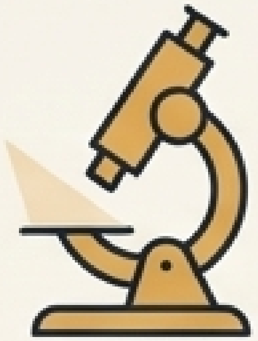
A new commercial ecosystem is forming. Companies like VAST are developing artificial gravity stations, driven by the need to support future Mars missions and the market for in-space manufacturing of pharmaceuticals and semiconductors.

Renewed Institutional Focus

NASA could focus on rapidly building large volumes at a scale beyond private funding.

Loosen Prohibitive Regulations

Revise rules like the International Traffic in Arms Regulations (ITAR) to foster collaboration.



New Research Models

Employ Focused Research Organizations (FROs) with a specific mandate to solve remaining challenges.

Where is the von Braun Wheel?

Still in 1962. But it could be back, and sooner than 2062, if we want it enough.

Based on the article ‘Inflatable space stations’
By Angadh Nanjangud
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