

MarsSurfHab

Mars surface habitats · spacecraft and mission visualisation · Marsborn

Portfolio · November 2026 · Founder John Kerley · marssurfhab.com

A space design studio for Mars habitats.

MarsSurfHab creates realistic, engineered designs and renders of Mars habitats and missions, built on real physics, and turns that work into film, visualisation and Marsborn, a science-grounded Mars-colony game for families and schools.

Habitat concepts

Inflate-then-bury habitats shielded by sintered regolith, from the CAIRN-7 base to five advanced regolith buildings.

Engineering estimates

Volumes, regolith tonnage, firing energy, power and build time, worked from the 3D design models and published ISRU studies.

Film and visualisation

Photoreal Blender renders and an entry-to-landing film; physics-checked plasma, Mach-cone timing and plume behaviour.

Marsborn

A Mars-colony game where proven science, engineering concepts and future theory are each clearly labelled.

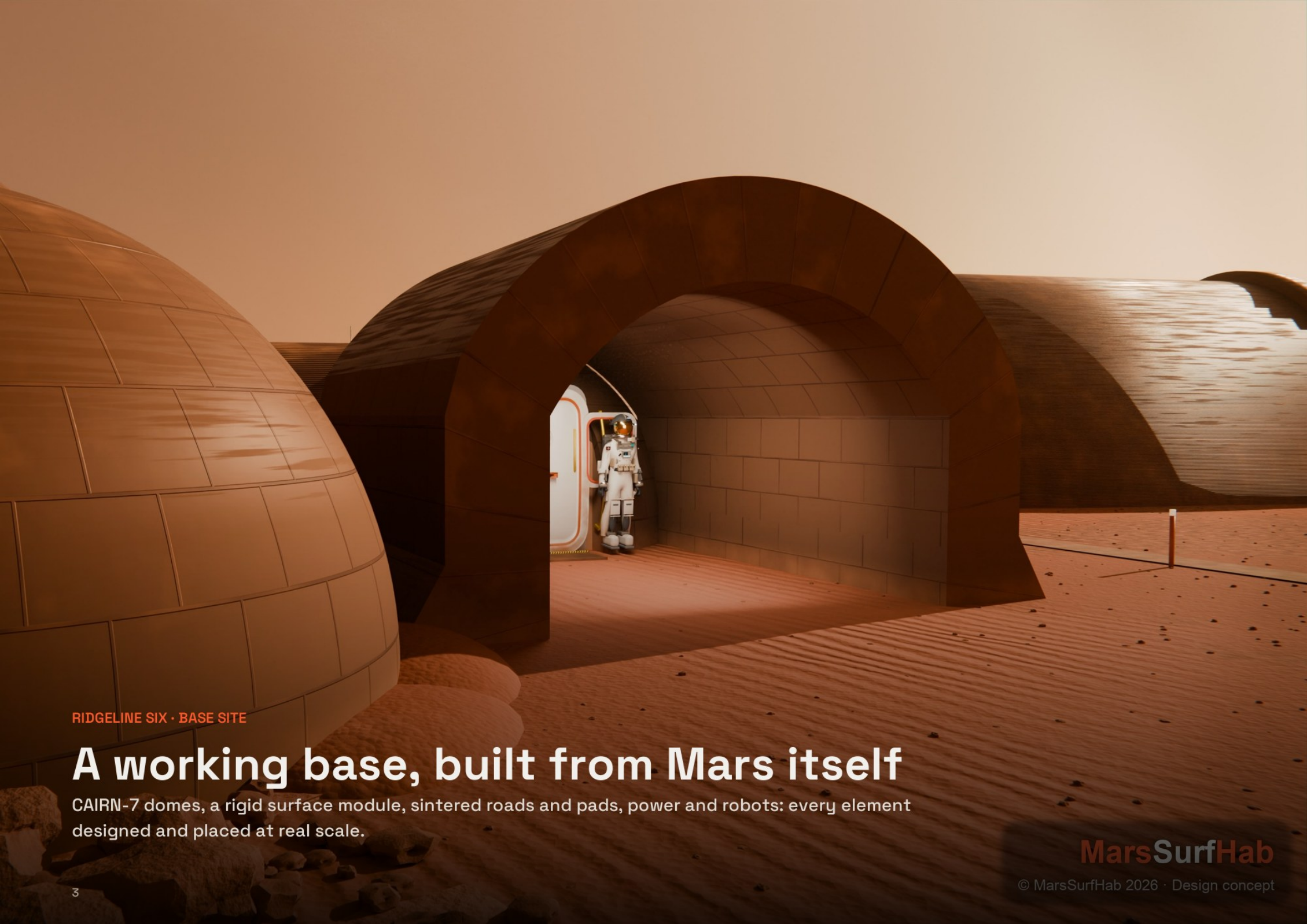


CAIRN-7 at Ridgeline Six: inflatable habitats under sintered-regolith shells.

Founder · John Kerley

Passionate about space exploration, space manufacturing and space law.

marssurfhab.com · X @marssurfhab · @MarsbornGame



RIDGELINE SIX · BASE SITE

A working base, built from Mars itself

CAIRN-7 domes, a rigid surface module, sintered roads and pads, power and robots: every element designed and placed at real scale.

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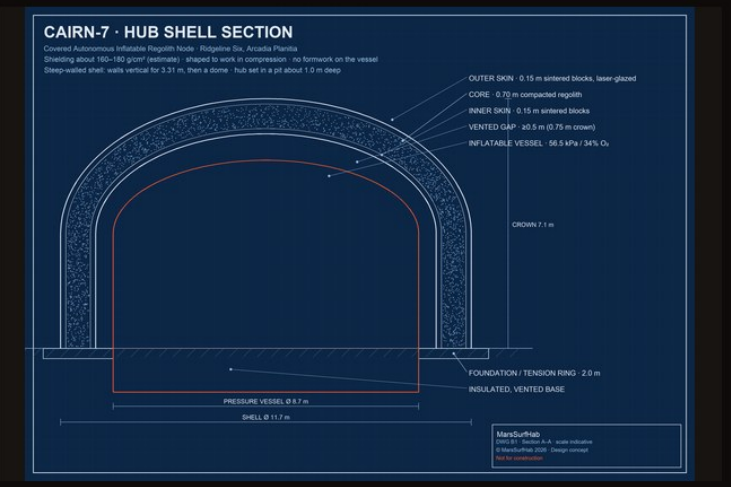
CAIRN-7

A seven-dome base: inflatable pressure vessels under a decoupled, steep-walled regolith shell of kiln-sintered blocks.



CAIRN-7 at Ridgeline Six. The render shows the earlier, rounder shell profile.



- Hub: inflatable Ø 8.7 × 6.6 m, about 347 m³, two decks, set in a pit about 1.0 m deep
- Shell: steep-walled, Ø about 11.7 m, 1.0 m thick; walls vertical for 3.31 m, then a dome
- Two 0.15 m kiln-sintered block skins around a compacted regolith core; outer skin laser-sintered into a glaze
- Shielding about 160–180 g/cm² (estimate); a 0.5 m vented gap keeps heat away from the inflatable
- About 390–440 t per hub shell; about 1,200 t of regolith across the base (estimate)
- Interlocking voussoir blocks: compression-only, quality-checked before laying, repairable
- Stage 1 demonstrator: inflate-then-bury and kiln-block trials (planned)



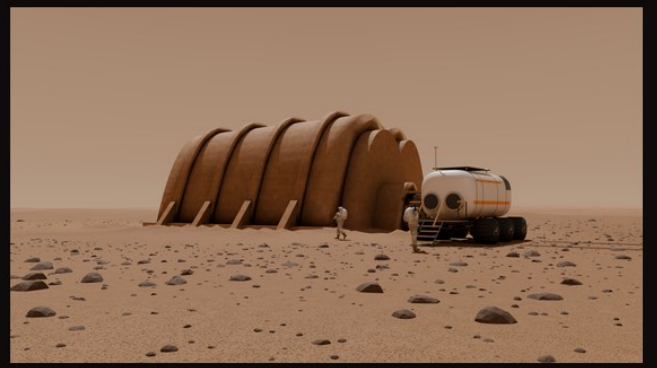
ADVANCED REGOLITH BUILDINGS

Ridgeline Terrace

806 m³ pressurised for 8 crew under about 3,250 t of sintered regolith, with a pressurised rover docked at its end airlock.

Five regolith buildings

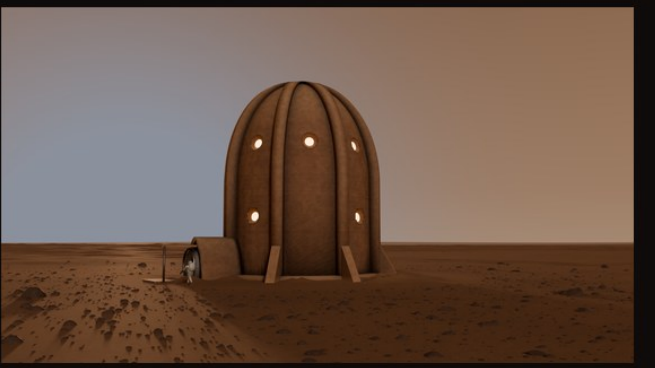
Each one is an inflatable vessel under a 1.5 m sintered-regolith catenary vault, designed to be built by robots before the crew arrive.



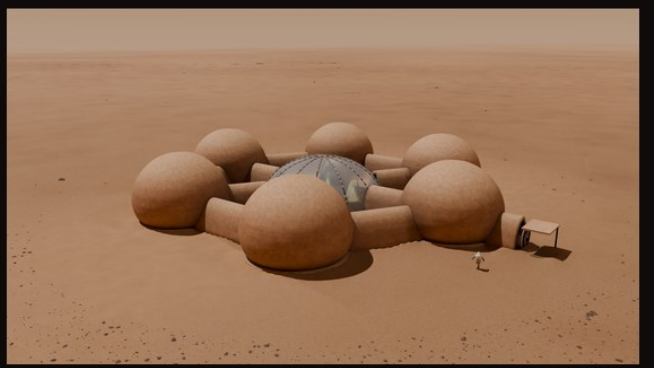
Ridgeline Terrace
806 m³ · 8 crew · about 3,250 t of regolith



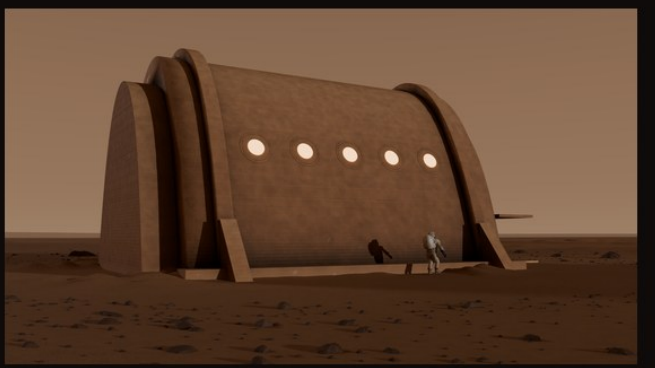
Crescent
1,274 m³ · 13 crew · about 2,900 t of regolith



Spire
1,110 m³ · 11 crew · about 3,200 t of regolith

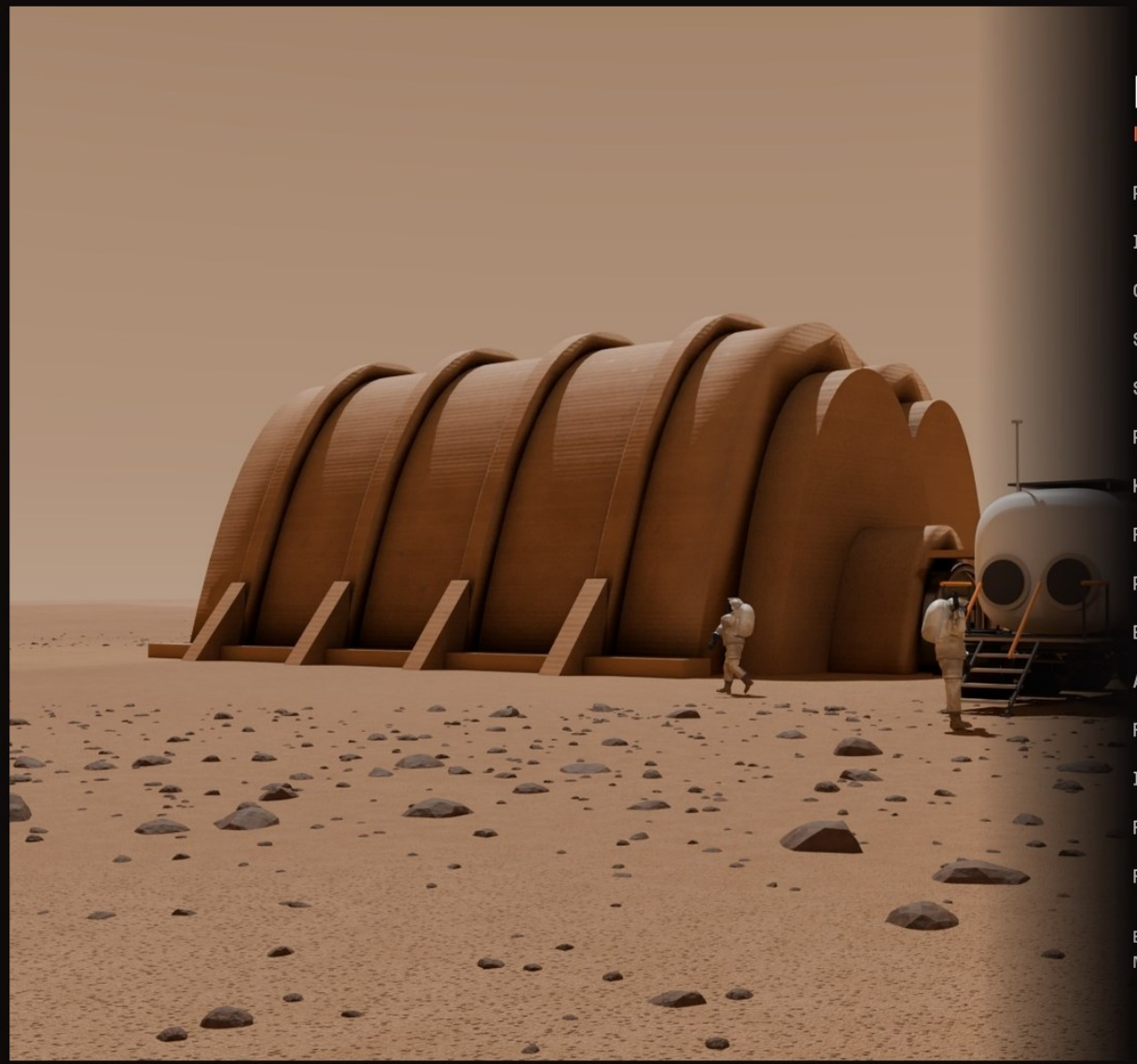


Courtyard
3,432 m³ · 34 crew · about 7,500 t of regolith



Overlook
570 m³ · 6 crew · about 1,700 t of regolith

Concept designs and visualisations. Figures are engineering estimates from the design models unless cited.



RIDGELINE TERRACE

Inflate-then-bury regolith habitat · concept design

Pressurised volume	806 m³ (603 + 203)
Decks / floor area	3 decks · about 280 m²
Crew	8 (about 100 m³ each)
Shield	1.5 m sintered regolith vault
Shielding mass	about 240–300 g/cm²
Regolith placed	about 3,250 t (about 4,000 t dug)
Kiln-fired blocks	about 9,000 × 120 kg (about 1,100 t)
Firing energy	about 550 MWh
Power	80 kWe fission (2 × 40 kWe)
Excavation	4 RASSOR-class robots, about 1 yr
Airlocks	2 suitport airlocks and a rover dock
From Earth	2 inflatables (about 30–45 t), kiln, robots
Build time	about 14–18 months, robotic, pre-crew
Fits in	one 26-month launch window
Footprint	about 21 × 12 m, upper 14 × 9 m, about 10 m high

Estimates from the 3D design geometry and published ISRU studies.
Not a flight design. TRL: inflatables 6–7 (BEAM), sintered blocks 3–4.

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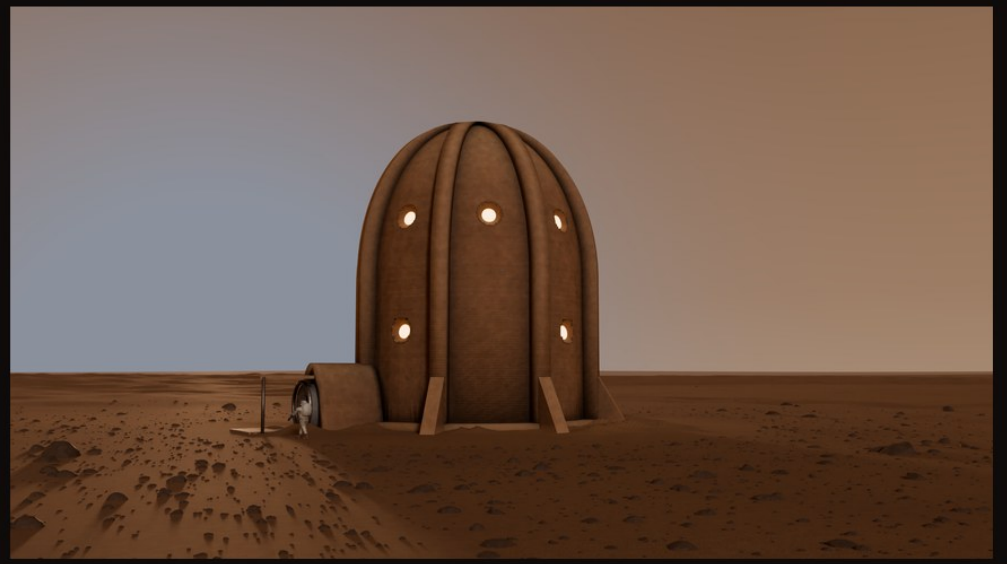
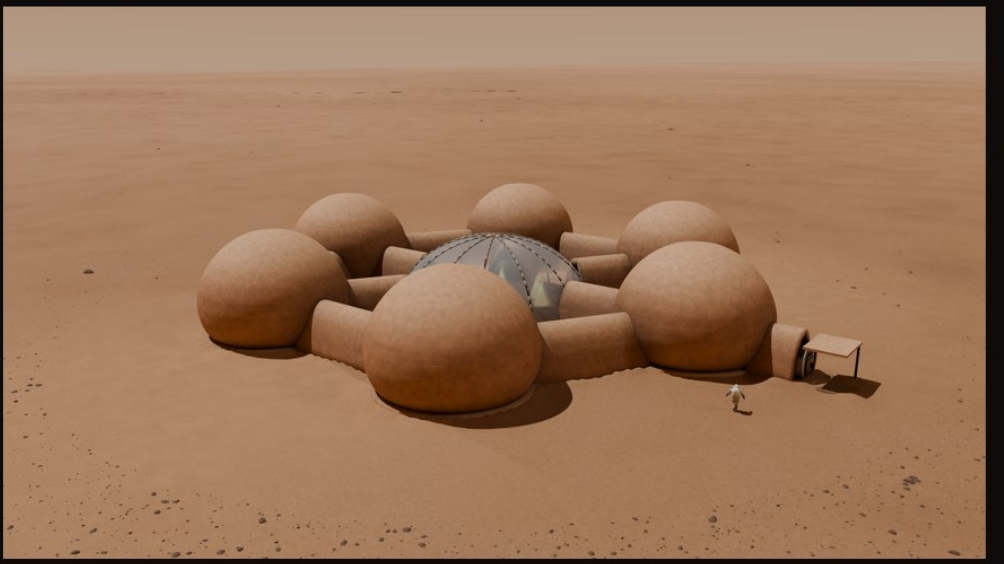
Volumes measured from the 3D model; masses, energy and timings estimated from published ISRU studies. Build: about 14–18 months, robotic, within one launch window.



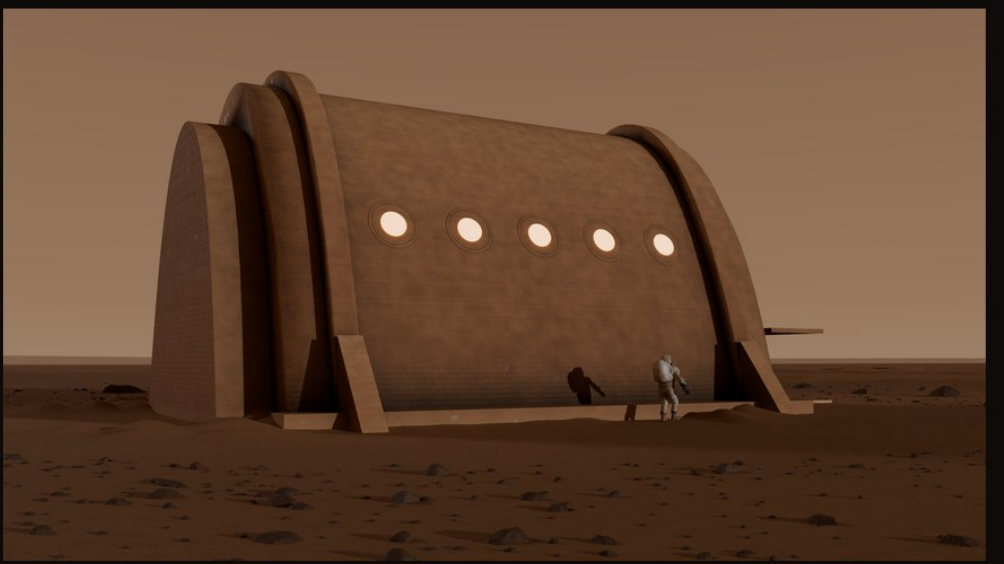
Spire: a vertical egg on the smallest footprint



Courtyard: six units around an aerogel greenhouse court



Crescent: three airlocks on a storm-sheltered street



Overlook: deep shielded window wells



SPACECRAFT · ENTRY

Arriving at 5.5 km/s

Tracked from orbit at peak heating: the 32 m ship inside its plasma sheath, the wake streaming from the trailing side.

Entry, physics-first

Belly-first direct entry. Plasma colour, wake turbulence, the Mach-cone shock timing and the blackout are all worked from the physics.



Probe camera: the stretched plasma wake trailing the ship



Closest pass at 0.8 km; the shock reaches the probe 3.3 s later



Onboard belly camera at peak heating



From orbit, 918 km away, the 32 m ship is a point inside its fireball

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SPACECRAFT · ENTRY

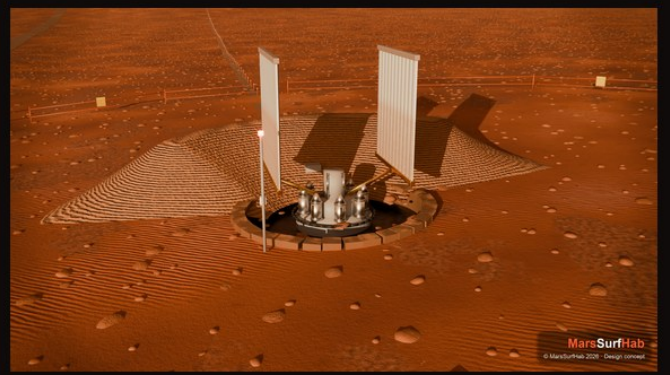
Peak heating, onboard

The belly camera at peak heating: flame-like plasma in Mars colours streaming past the heat shield.













Ridgeline Six on site, and the arrival from orbit.

Film, trailer and explainers

Arrive on Mars (website film)

About 48 s entry-to-landing film plus a studio showcase, looping on marssurfhab.com.

Marsborn trailer

45 s, cut from real gameplay of the game's Mars base.

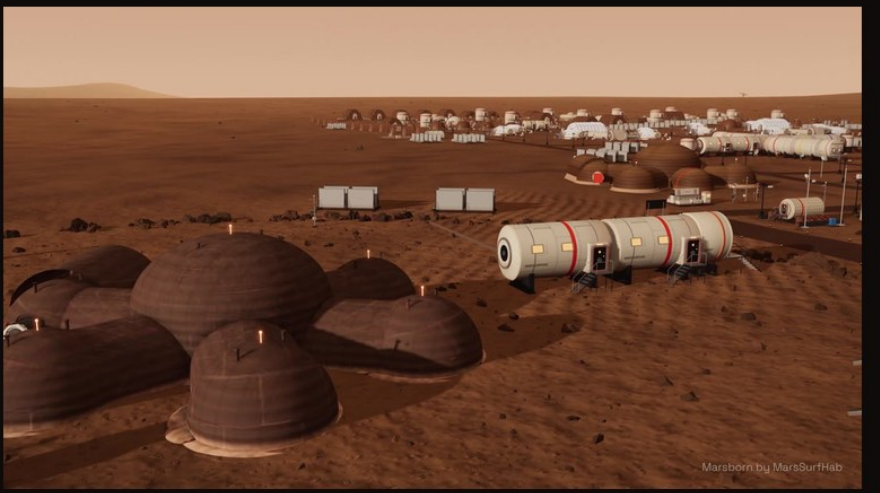
Thesis animations

The supply chain of a multi-planet civilisation; the helium-3 route; the inner/outer-system economy.

Regolith reel

Photoreal camera moves of all five buildings.

Video files available on request or at marssurfhab.com.



Marsborn trailer (45 s): poster frame.

Marsborn: the game

A Mars-colony game grounded in real science, with proven tech, engineering concepts and future theory each clearly labelled.

- Power through dust storms: solar, batteries, fission reactors, and radiators to dump their heat
- Oxygen from CO_2 (MOXIE's method scaled up); water from buried mid-latitude ice
- Sinter regolith into blocks; bury habitats to cut the radiation dose; robots inspect and repair
- Real launch windows; Earth is 3–22 light-minutes away
- Out to Titan, fusion and the Kardashev meter; 114 science-based designs
- For families and schools: no ads, no streaks, Children's Code throughout

Coming soon · iPhone, Android, PC and Mac



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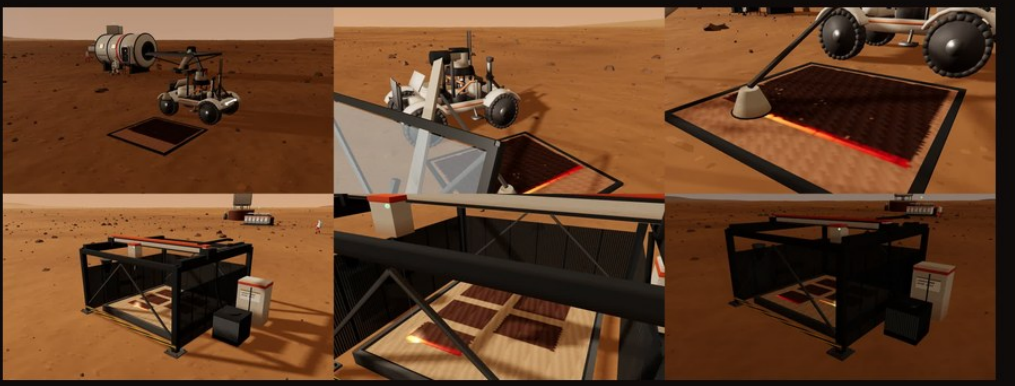

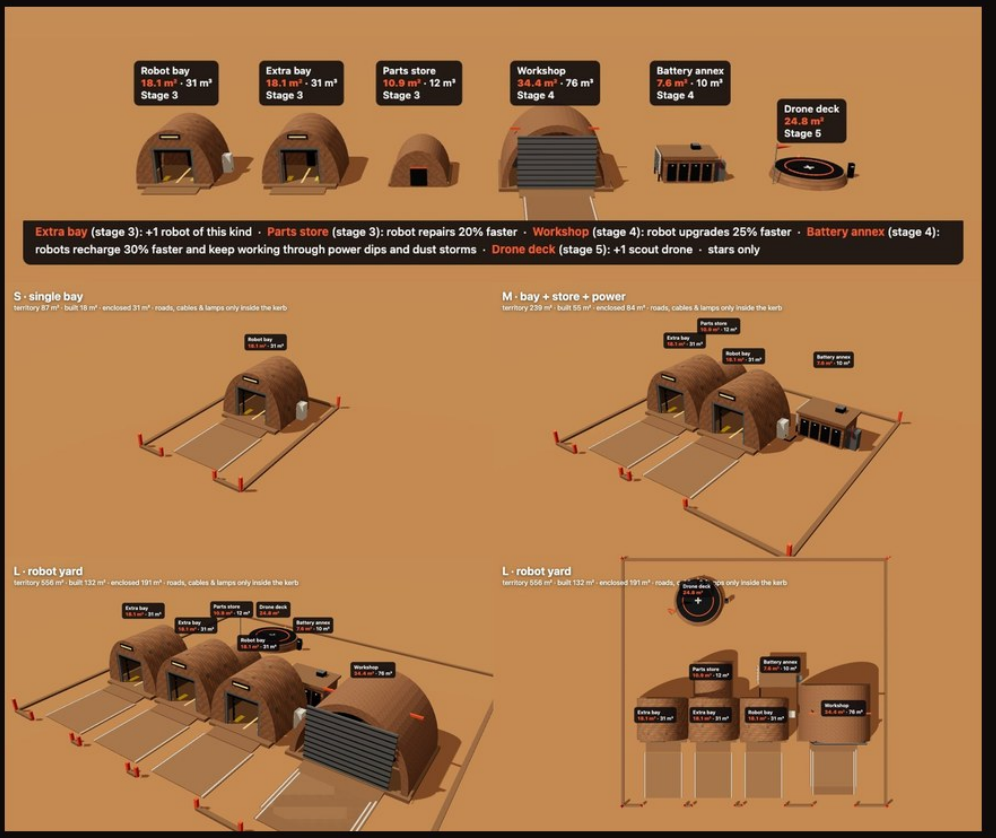

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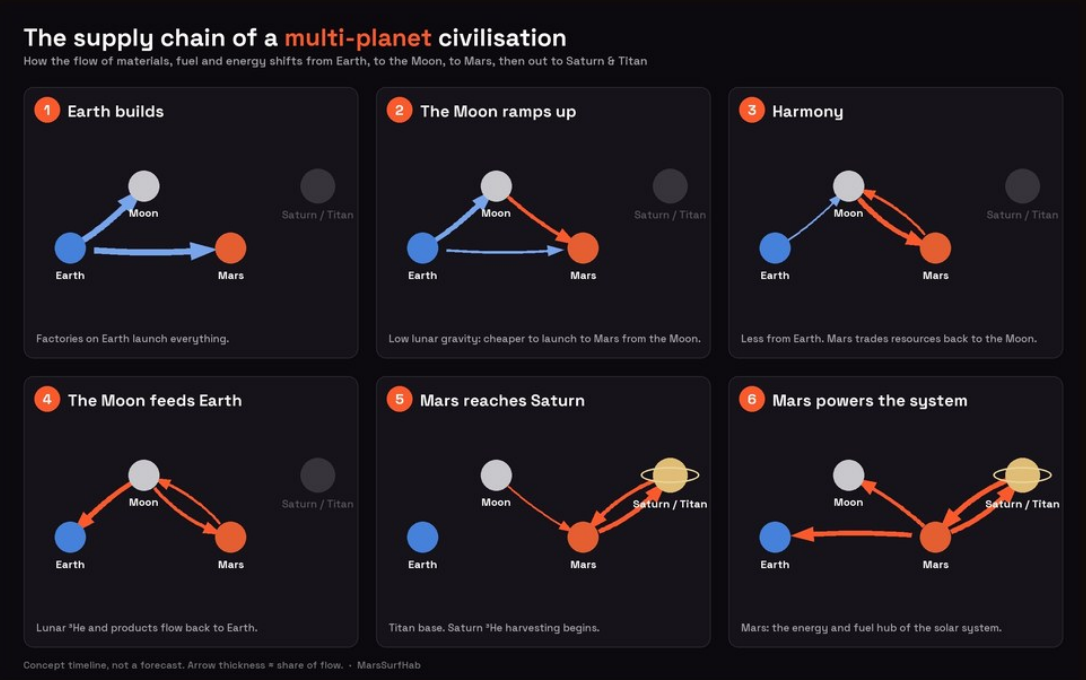
Solar to climb, fusion to reach

Sunlight powers the inner Solar System's climb up the Kardashev scale. Beyond Mars, sunlight falls to about 1% at Saturn, so industry and fast ships need fusion: helium-3 burned with deuterium.

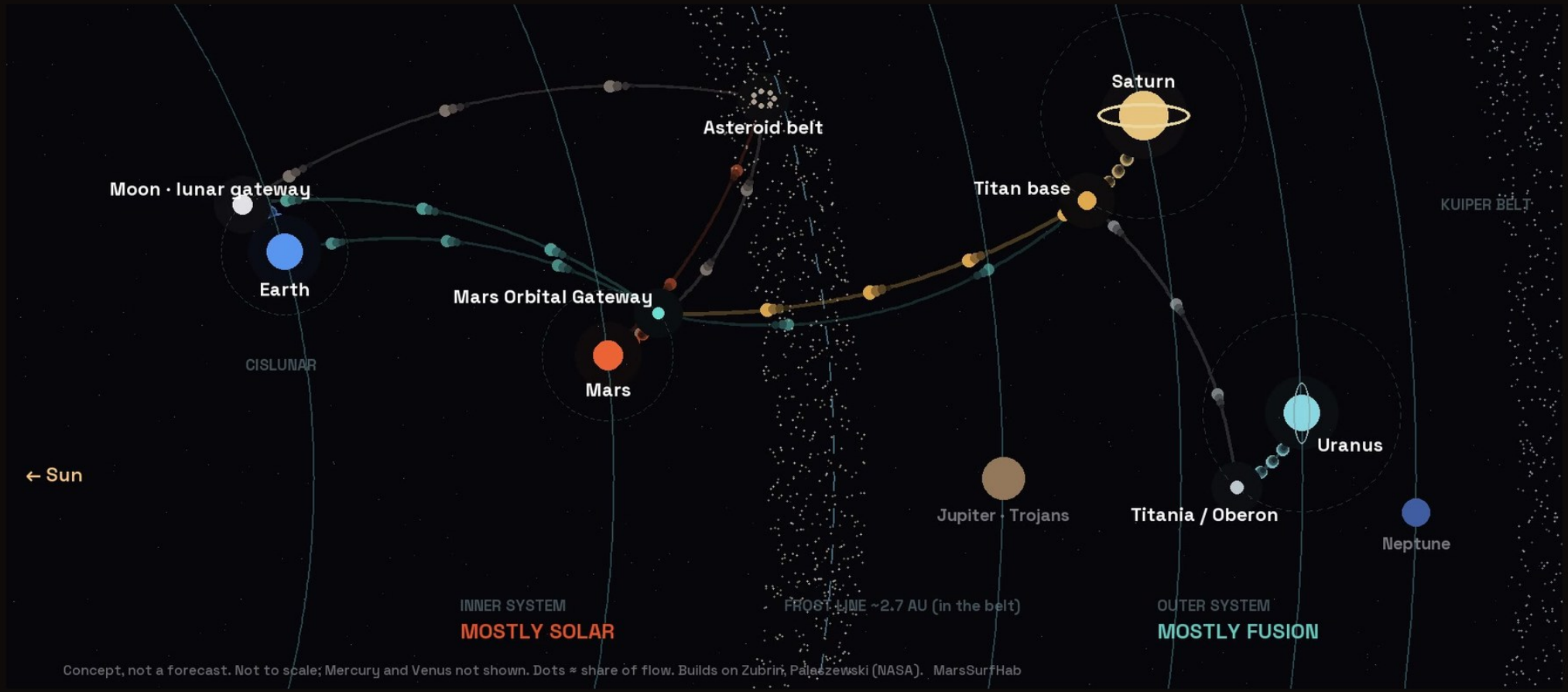
- Moon: the first D–^{3}He plants and the lunar gateway (escape 2.4 km/s)
- Moon's about 1 Mt of ^{3}He: about 1,000 yr at today's use, but about 2 yr at Type I (about 540,000 t/yr)
- Mars: the hub; its water holds 5–7× Earth's deuterium
- Titan base and nuclear tugs to a Mars Orbital Gateway; fusion drive opens Uranus
- Builds on Kulcinski and Schmitt, Zubrin, Palaszewski (NASA Glenn), Nixon et al.

Concept, not a forecast. D–^{3}He fusion power has not yet been demonstrated.



The working economy

Sunlight runs the inner system, fusion the outer, and Mars connects them: Moon gateway, Mars Orbital Gateway, Titan base, Uranus moons, with asteroid flows through the belt.



Printed at 1:200

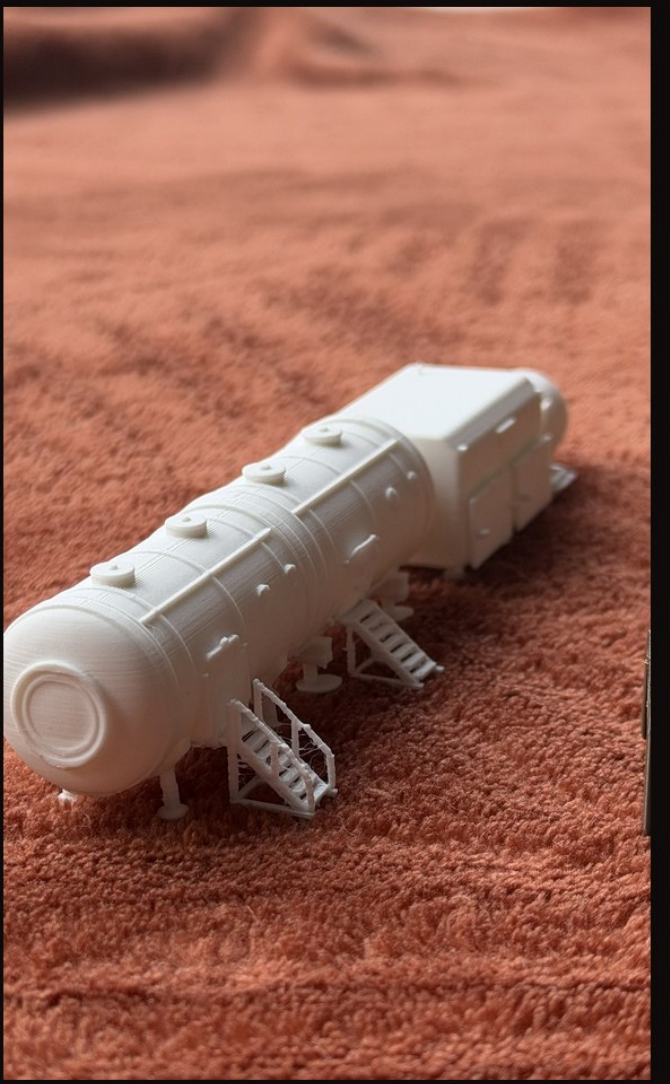
Our latest prints: the CAIRN-7 v11 inflatable vessels (white) and their regolith shell (terracotta) as separate parts, plus the rigid surface module.



CAIRN-7 v11 inflatable, 1:200



CAIRN-7 v11 regolith shell, 1:200



Rigid surface module, 1:200

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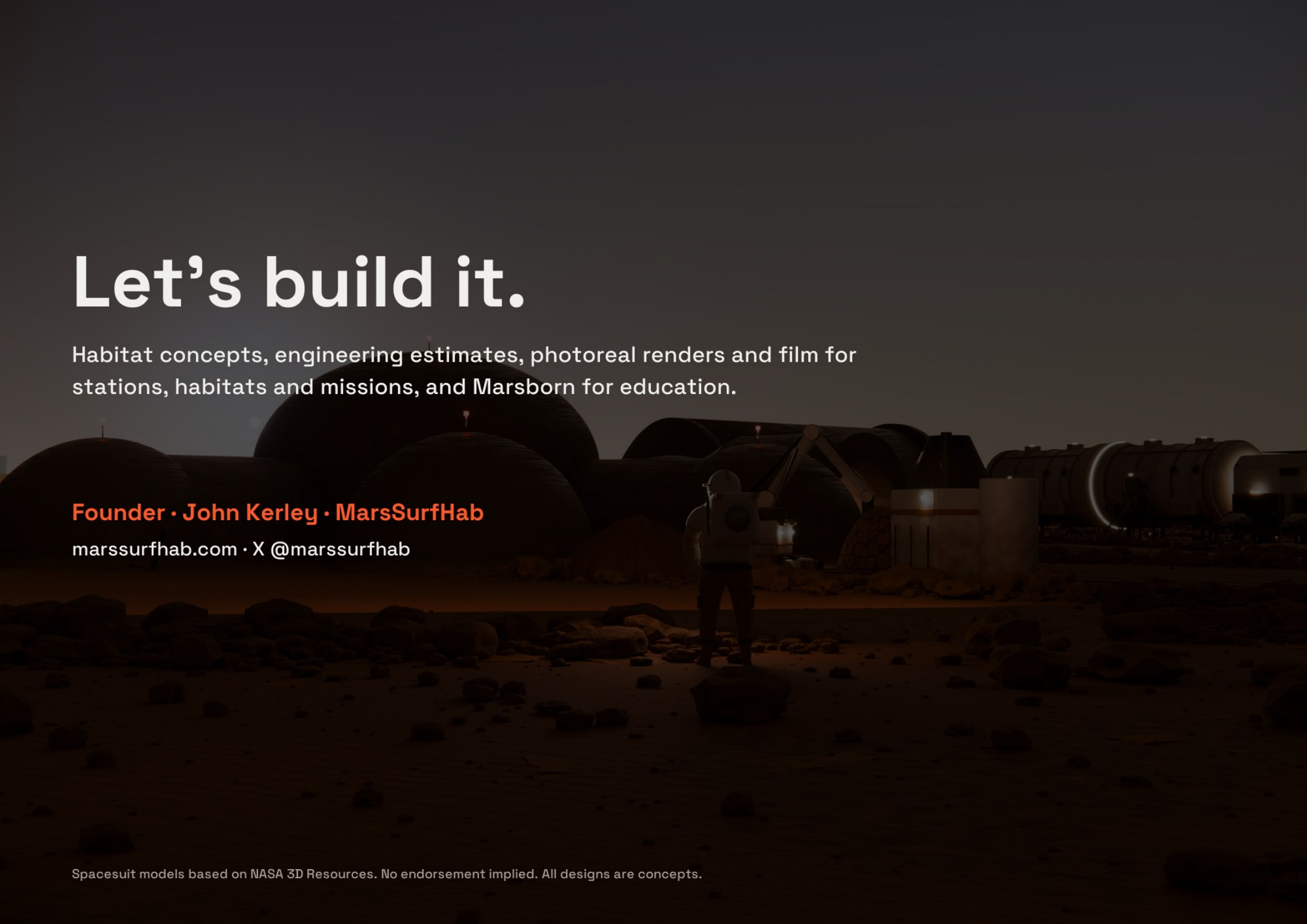

Let’s build it.

Habitat concepts, engineering estimates, photoreal renders and film for stations, habitats and missions, and Marsborn for education.

Founder · John Kerley · MarsSurfHab

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Spacesuit models based on NASA 3D Resources. No endorsement implied. All designs are concepts.