



DUNA

A desert race machine, re-engineered as software · A Baja / Dakar-class rally-raid race motorcycle · series-hybrid powertrain · full by-wire control ·
Confidential 2026

01

The most advanced desert race machine on earth
— and a new powertrain proven doing it

THE THESIS

Rally-raid has never had a software-defined powertrain

A small engine runs at one fixed, most-efficient point as a generator only — no mechanical link to the wheel. It feeds a buffer battery and an electric motor that drives the rear wheel. The rider commands wheel torque; software commands everything else.

- Instant, exact torque — slip control that clamps in a millisecond, not by fighting an engine
- Range is a fuel-tank question, not a charging problem — refuels in the time it takes to pour fuel
- Silent low-speed running on the buffer — a tactical stealth capability
- Every component exists and is proven elsewhere. The innovation is integration, not invention.



THE PERFORMANCE BAR WE RESPECT

Measured against the best 450 rally bikes on earth

139 kg

KTM 450 RALLY DRY WEIGHT — THE BAR
(VERIFIED, KTM.COM)

~47 kW

KTM PEAK POWER — OUR ELECTRIC
DRIVE EXCEEDS IT (86 KW PEAK MOTOR)

35 L

REFERENCE FUEL CAPACITY — RANGE =
TANK SIZE

KTM 450 Rally Replica and Honda CRF450 Rally are the raceability reference — ~140 kg class, ~35 L fuel, hours at load in the heat, serviceable in a bivouac. Our answer is heavier by a known, quantified margin and defensible on handling, efficiency, and control.

02

A category never re-invented, and a proving ground you can enter with one prototype

WHY NOW

The software-defined powertrain moment has arrived

The parts are finally real

- Axial-flux traction motors at 10 kg, 86 kW peak (EMRAX 208, VERIFIED)
- Motorsport inverters at 6.75 kg, IP6K9K wash-rated (Cascadia CM200, VERIFIED)
- High-rate 21700 cells at 231 Wh/kg (Molicel P45B, VERIFIED)
- Compact rotary range-extenders that love one fixed RPM (Aixro XR50, VERIFIED)

The door is open

- US desert racing (Baja 1000 / SCORE) — fewer rules constraints, a prototype can enter sooner: the near-term proving ground
- Dakar Future / Mission 1000 — ASO's official hybrid & alternative-propulsion on-ramp (VERIFIED)
- FIM already runs Equivalence-of-Technologies rules for electric vs ICE
- Dakar is the aspirational ceiling. SCORE/Baja is where we prove it first.

“Series hybrid turns every hard mechanical problem — traction, torque delivery, engine efficiency, thermal — into a software problem. It is a software-defined powertrain in a category that has never had one.”

THE INVESTABLE THESIS, IN ONE LINE

03

Ducati-grade design language over
genuine desert race engineering



Exposed Core, stealth graphite

The canonical form — battery low and central, no gearbox bulge, no top-end engine · Baja terrain

No gearbox, no mechanical link to the wheel

What the engine does

The APU runs at one fixed, efficient point and delivers a smooth ~12–15 kW. It never chases transients — it just holds its best-efficiency point. This is why a series hybrid is efficient in a spiky, stop-start duty cycle like rally.

What the battery does

A ~2.0 kWh buffer absorbs generator surplus and supplies bursts up to ~31 kW for dune climbs and launches. It is a shock absorber between a steady genset and a spiky wheel demand — a buffer, not an EV pack.

THE CORE

The whole trick lives on one DC bus

Buffer pack in the frame, axial-flux motor, twin radiators. A single fixed reduction replaces the KTM's six-speed gearbox — an electric motor's flat torque curve removes the need for gears.

- EMRAX 208 traction motor — 86 kW peak / 56 kW continuous, 10 kg
- Cascadia CM200 inverter — 225 kW rated, 6.75 kg, wash-proof
- 96s2p Molicel P45B buffer — ~2.0 kWh usable, low and central
- Aixro XR50 rotary as the generator — buyable today



04

Once torque is a software variable, control is nearly free — and it compounds

Mechanical problems become software problems

Traction-by-wire

The VCU knows commanded torque, both wheel speeds, and lean angle in real time. Slip control clamps motor torque the instant the rear outruns a target slip ratio — roughly 100× faster than fighting an engine with ignition or a butterfly. Lean-sensitive torque and per-surface launch maps are trivial once torque is a software variable.

The compounding advantage

- The engine's thermal load is decoupled from vehicle speed — the VCU can crawl on battery to shed heat, then restart
- Torque maps per surface: sand, gravel, hardpack, rider-selectable
- Two-motor torque vectoring (true AWD in sand) is a clean roadmap option
- Every kilometre ridden makes the maps better — the software is the asset

What is mature, and what is the real work

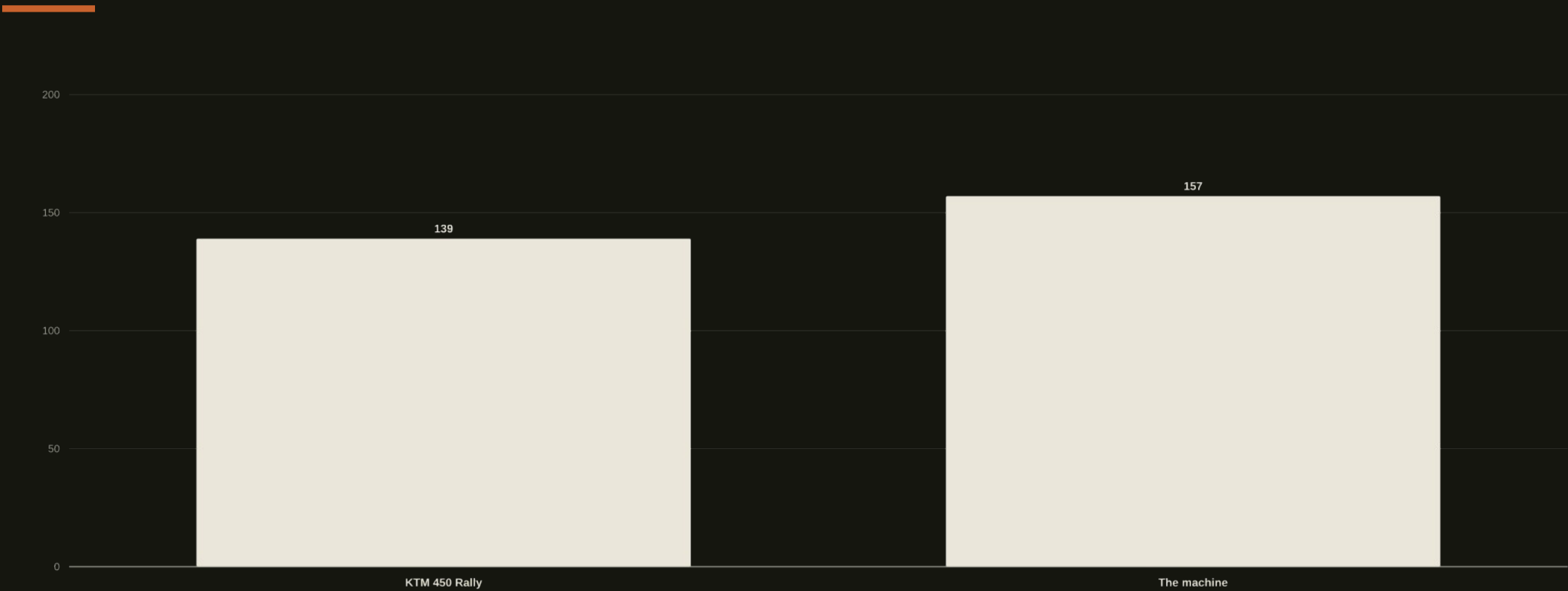
- Throttle-by-wire: dual-redundant grip sensors. Shipped on every premium bike today. Low risk.
- Brake: prototype runs a conventional hydraulic front (fail-safe) blended with by-wire regen on the rear — the responsible choice for a solo high-speed machine. Full dry brake-by-wire is the named production path, not the prototype spec.
- VCU: the brain — torque map, slip control, generator set-point, thermal management, regen blending. This is the single biggest build-cost line, and we treat it as such.
- Safety-conscious architecture designed toward functional safety — HV interlock, pyro-fuse crash disconnect, redundant channels, watchdog. We do not claim certification on a prototype.

05

The honest numbers — because the answers survive a mechanical engineer in the room

THE HONEST WEIGHT VERDICT

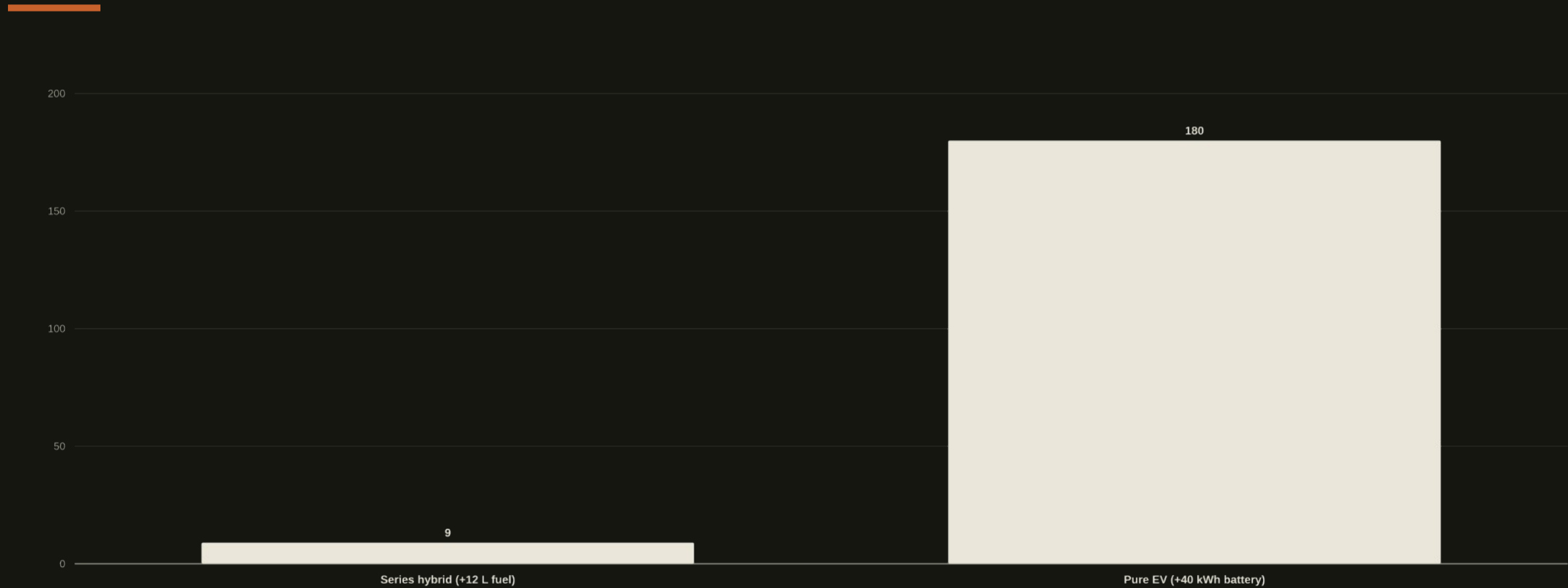
~+18 kg dry (~+13% vs KTM) — quantified, not hidden



Sum of verified component masses + estimated structure. The penalty is powertrain duplication (both an APU and a full e-drive); the offset is that the heaviest item sits low and central, lowering CG.

THE STRUCTURAL ADVANTAGE

Range scales with the tank, not the battery



Want 500 km instead of 400? Add ~12 L (~9 kg) of fuel — not ~40 kWh of battery (~180 kg). This is the series-hybrid advantage, and it is real. Figures are engineering estimates from the master numbers (20 kW stage average, ~27% fuel-to-wheel).

NO PHYSICS WALL

Every component is real, spec'd, and proven elsewhere

157 kg

DRY MASS — RE-ADDED FROM VERIFIED
COMPONENTS (EST)

~27%

FUEL-TO-WHEEL EFFICIENCY — THE
MATH SHOWN, NOT OVER-CLAIMED (EST)

~40 L

DESIGN TANK FOR A ~340 KM SPECIAL —
SCALES LINEARLY

The risk is integration, not invention. The three risks that actually decide this program are weight, controls software, and the stage-power assumption — each named, quantified, and with a concrete retirement plan on the timeline.

06

The honest risk section is the credibility —
nothing here is hand-waved

THE THREE RISKS THAT DECIDE THE PROGRAM

Named, quantified, each with a retirement plan

We own the 20 kW assumption first, as a Phase-0 validation plan — not as an ambush. All range/fuel/APU math scales off it, and it is the one number diligence will push on.

Risk	Severity × likelihood	How it retires
Weight (+~13% vs KTM)	High × certain	Package all major mass low & central; model in multibody sim, then prove on a rider. Beat the KTM on handling, not the scale.
Controls software maturity	High × high	Develop maps on a dyno + HIL rig before open-desert running. The biggest cost line, treated as such.
The 20 kW stage-average assumption	High × medium	Phase-0 telemetry: data-log a real 450 at Baja pace before freezing APU & tank. Closeable in ~2 weeks.

07



Prove the hardest subsystem in the
cheapest, safest place first

~18-24 MONTHS TO A RUNNING, SHAKEN-DOWN PROTOTYPE

Risk retires in the right order

Phase 0-1 — freeze & bench

- Phase 0 (Mo 0-3): close the power assumption with telemetry, freeze BOM & voltage architecture, order long-lead items
- Phase 1 (Mo 3-9): the powertrain runs on a bench — APU genset, buffer pack, motor + inverter on a dyno, VCU on HIL
- Retires the fuel math and the bulk of the controls risk before anything moves

Phase 2-3 — roll & shake down

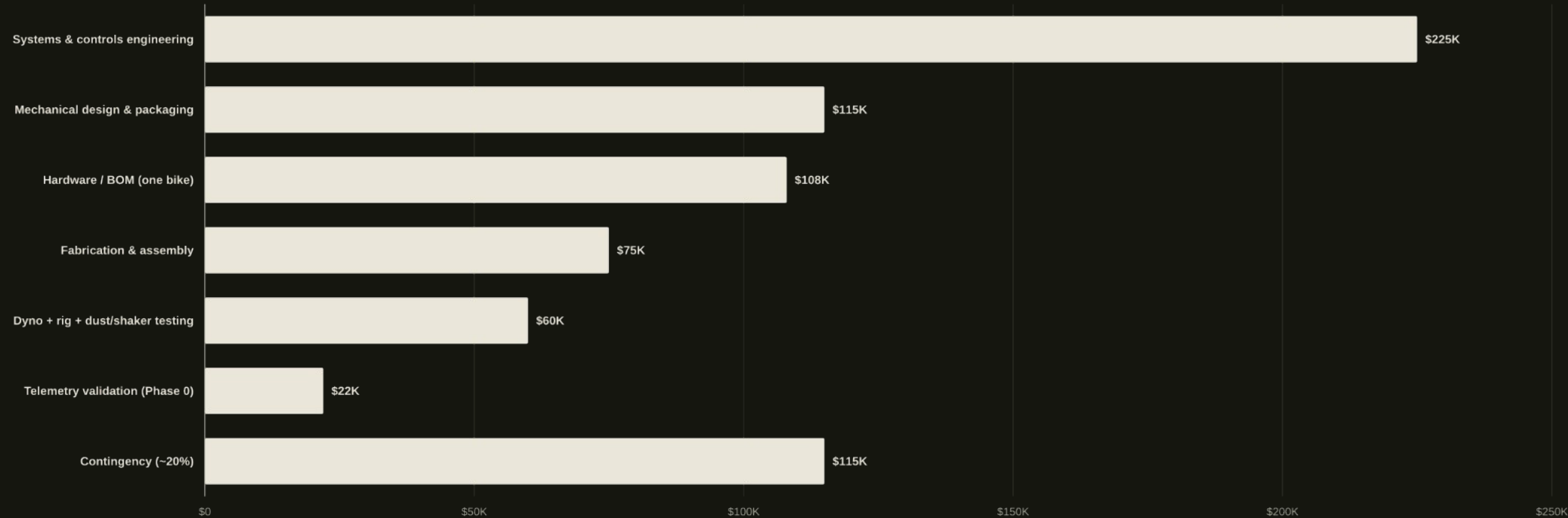
- Phase 2 (Mo 6-15): CAD, CG/handling sim, fabricate chassis, first rolling self-powered running
- Phase 3 (Mo 15-24): dust + shaker durability, progressive desert testing, HV crash-safety, map refinement
- Deliverable: a prototype that completes a representative stage — the data package for Mission 1000 and the next raise
- Critical path: the APU generator integration and the controls software

08

This raise buys a running proof-of-concept. The race program is the next raise.

USE OF FUNDS — ONE RUNNING PROTOTYPE

~\$0.75M buys one running proof-of-concept bike



Budgetary estimate for ONE proof-of-concept bike. Does NOT include a race season, a spare bike, a team, or homologation testing — those are the next raise. A prototype is dominated by engineering labor, not parts.

PHASED CAPITAL, STATED HONESTLY

A seed-stage number that proves the thesis

~\$0.75M

THIS RAISE — ONE RUNNING PROOF-OF-
CONCEPT PROTOTYPE

18–24 mo

TO A SHAKEN-DOWN BIKE THAT
COMPLETES A REPRESENTATIVE STAGE

Phase 2

THE RACE PROGRAM — THE NEXT,
LARGER, DE-RISKED RAISE

A factory Dakar bike program runs into the tens of millions per season. A single innovative prototype at ~\$0.75M is credible and modest against that — exactly what a venture investor funds to de-risk the next, larger raise.

DUNA

The proving ground is open. The parts are real. The moat is the software.

A Baja / Dakar-class rally-raid race machine with the first software-defined powertrain in its category.

This raise builds the running proof-of-concept. The race program follows, de-risked.

Every load-bearing number traces to the feasibility dossier and its verified sources.