



# 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

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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

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

## WHY NOW

# The software-defined powertrain moment has arrived

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### 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.

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*“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

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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

## THE ENERGY PATH

# No gearbox, no mechanical link to the wheel

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### 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

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

# Mechanical problems become software problems

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## 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

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- 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.

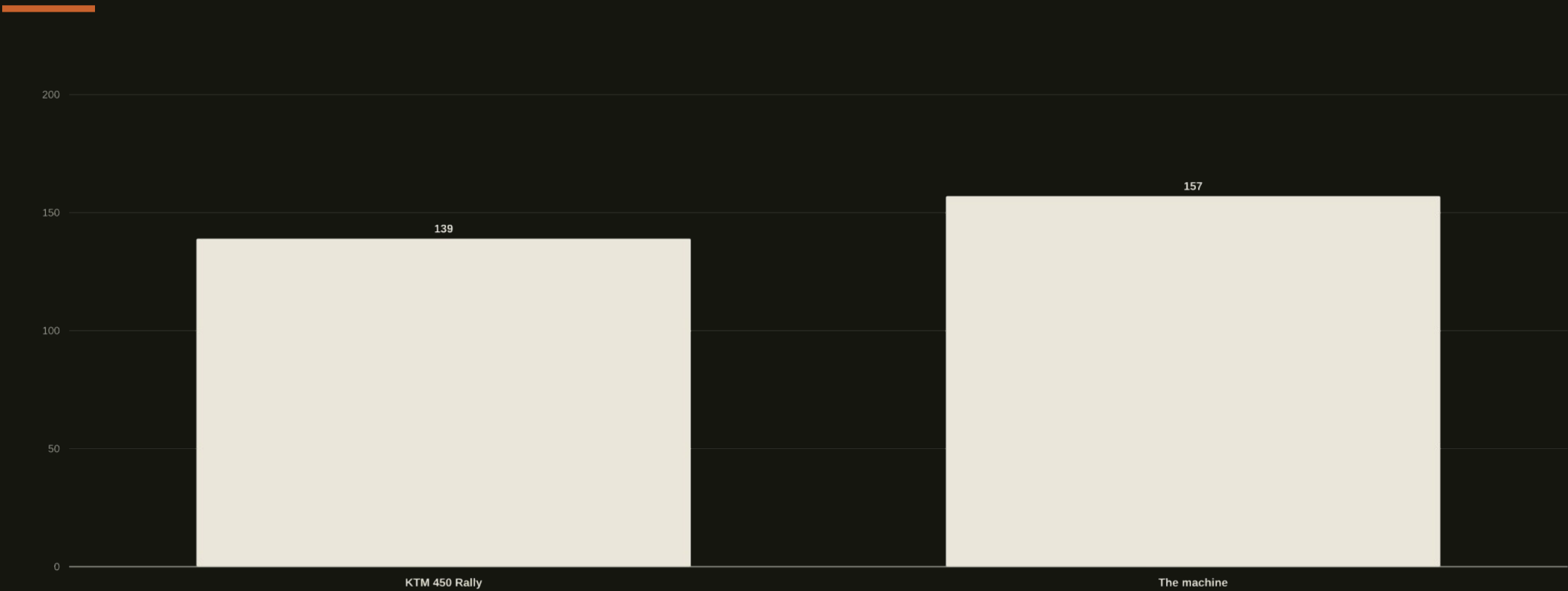
# 05

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

THE HONEST WEIGHT VERDICT

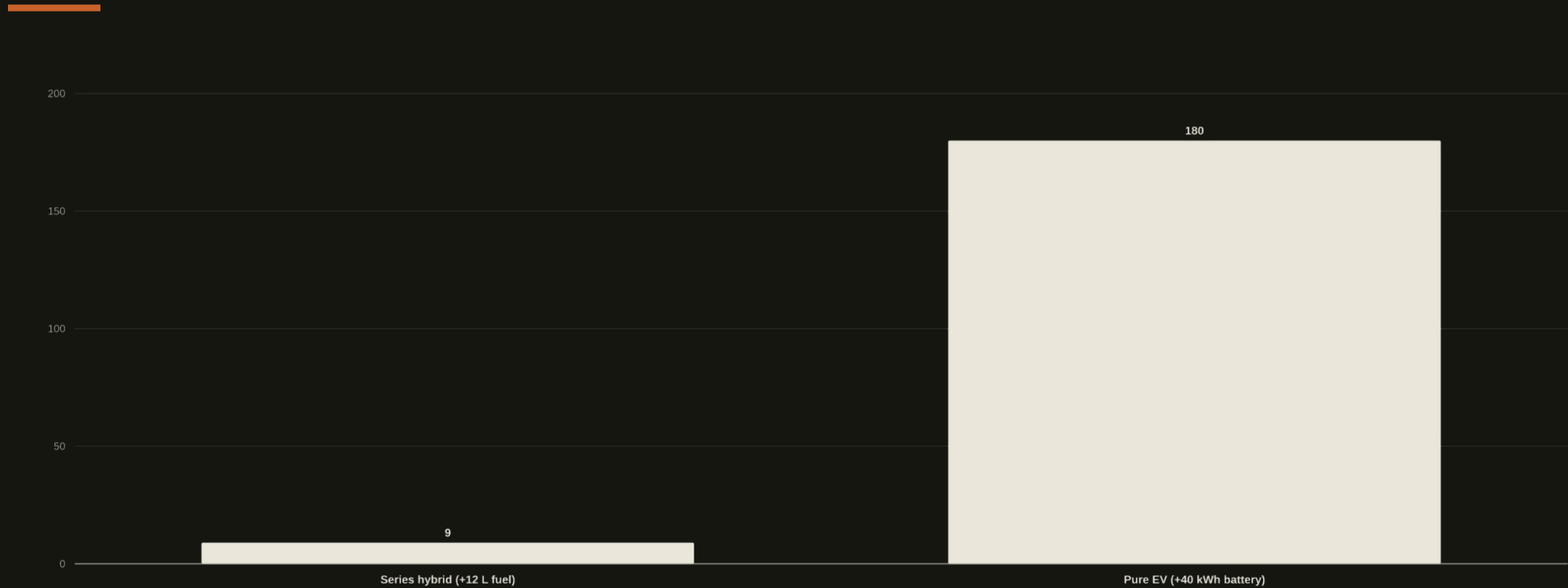
~+18 kg dry (~+13% vs KTM) — quantified, not hidden



*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

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**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

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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

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## 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

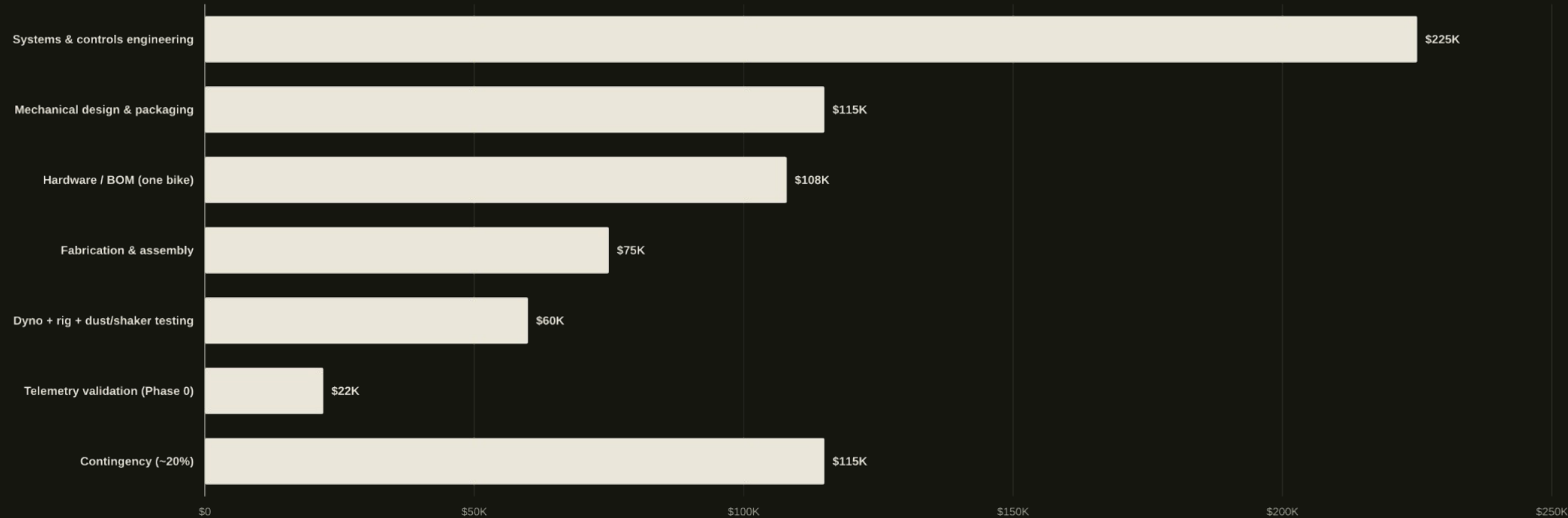
# 08

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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

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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.