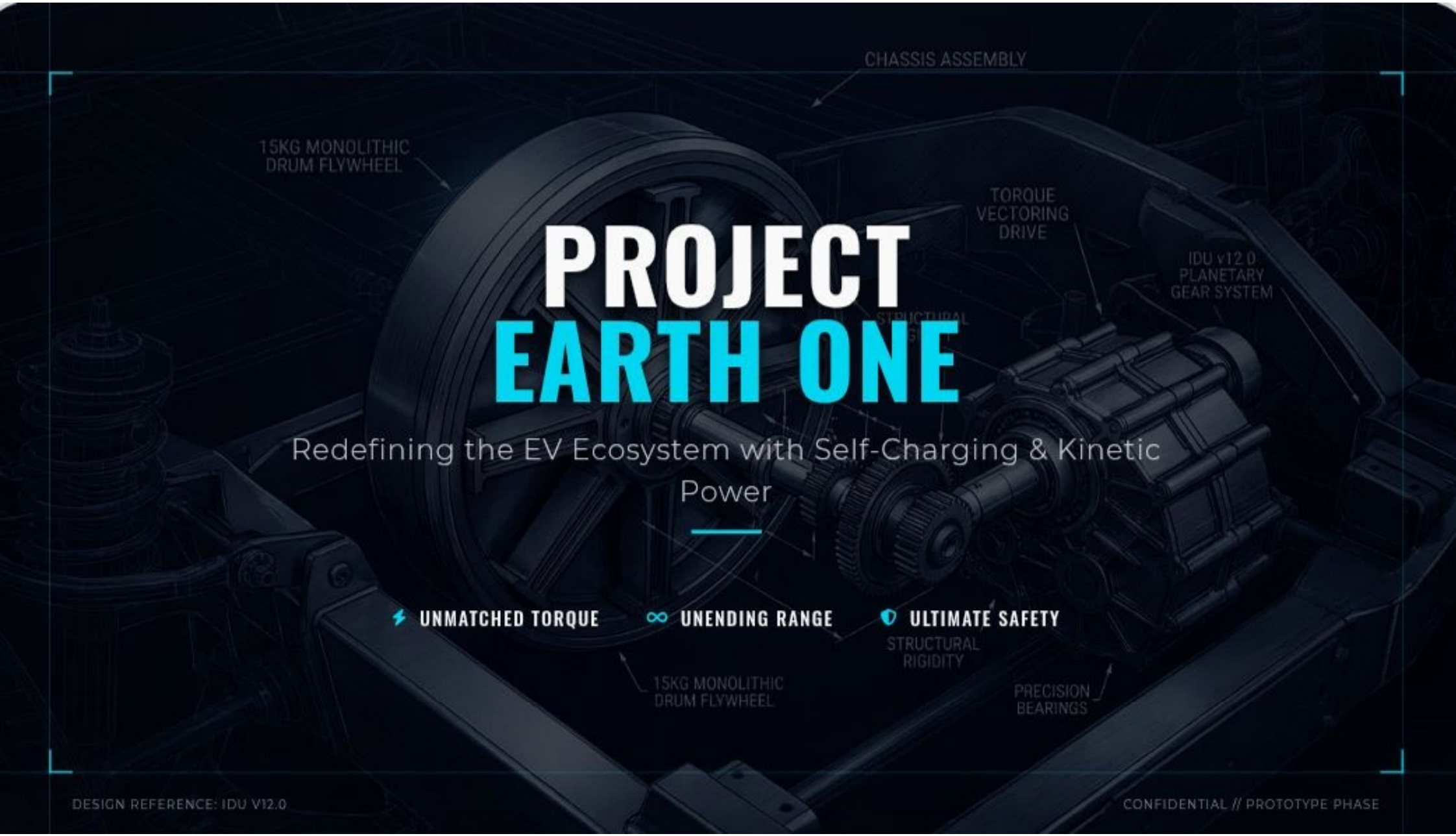

CHASSIS ASSEMBLY
15KG MONOLITHIC DRUM FLYWHEEL
TORQUE VECTORING DRIVE
IDU v12.0 PLANETARY GEAR SYSTEM
PROJECT
EARTH ONE
Redefining the EV Ecosystem with Self-Charging & Kinetic Power
UNMATCHED TORQUE
UNENDING RANGE
ULTIMATE SAFETY
STRUCTURAL RIGIDITY
15KG MONOLITHIC DRUM FLYWHEEL
PRECISION BEARINGS
DESIGN REFERENCE: IDU V12.0
CONFIDENTIAL // PROTOTYPE PHASE

THE PROBLEM STATEMENT

Range Anxiety

The constant fear of battery depletion during long-distance travel, creating psychological stress and limiting vehicle utility for cross-country journeys.

Charging Bottlenecks

Excessive downtime at charging stations (45+ minutes) and severely limited infrastructure in rural or remote regions creates reliability gaps.

Weight Penalty

Standard EV powertrains suffer under heavy loads. Hauling 2,200kg places immense thermal and mechanical stress on batteries and motors.



FIGURE 1.2: CONVENTIONAL EV LIMITATIONS

OUR SOLUTION

SELF-CHARGING LOOP

An innovative in-built alternator system that **harvests energy from motion**, constantly feeding power back into the system to extend operational range.

MECHANICAL ADVANTAGE

The strategic synergy between a **15kg High-Inertia Flywheel** and a classic 5-Speed Manual Gearbox to optimize torque delivery and reduce motor strain.

ZERO DOWN-TIME

Eliminating charging queues with **"Snack-Break" Battery Switching**. Swap packs in minutes instead of waiting hours for a recharge.

01 / PURPOSE

OUR MISSION

To build a **"Perpetual Motion" EV** that matches the uncompromising reliability of traditional Diesel engines while maintaining a strict zero-emission footprint. We bridge the gap between heavy-duty capability and sustainable technology.

02 / FUTURE

OUR VISION

To create a **zero-dependency EV ecosystem** defined by autonomous range, ultimate safety, and robust performance. A future where infrastructure limitations no longer dictate where your vehicle can take you.

02 / MECHANICAL ARCHITECTURE

IDU-ULTIMATE V12.0

The Heart of the System

The Intelligent Drive Unit (IDU) v12.0 represents a breakthrough in mechanical engineering. By integrating a double-stage compound planetary design, we achieve efficient torque multiplication while maintaining compact spatial requirements.

14 Planet Gears

High-density gear mesh for extreme load distribution.

Kinetic Energy Storage

Integral design acts as a mechanical battery.

Torque Multiplication

Compound stages amplify motor output seamlessly.

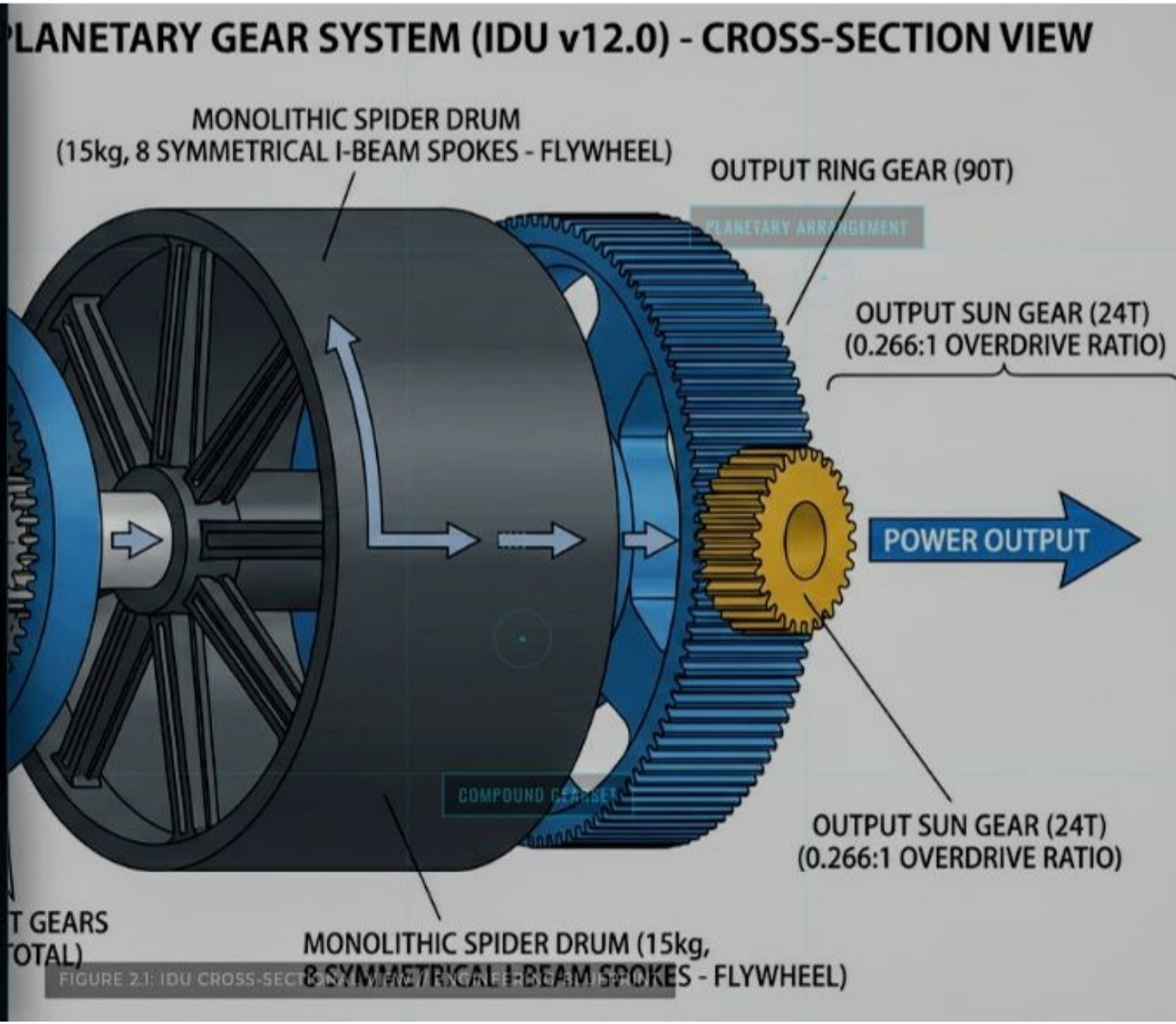


FIGURE 2.1: IDU CROSS-SECTION

INPUT STAGE (MOTOR SIDE)



SUN GEAR INPUT — 20 Teeth

High-speed input shaft directly coupled to the electric motor. Compact diameter minimizes inertia for rapid acceleration response.

RING GEAR REACTION — 80 Teeth

Stationary internal ring gear provides the reaction force necessary for torque multiplication. Machined for zero-backlash engagement.

REDUCTION RATIO — 5:1

This massive reduction builds the mechanical foundation, converting high motor RPM into raw driving force.

→ Target Output: 611 Nm Wheel Torque

15KG MONOLITHIC SPIDER DRUM

The cornerstone of our kinetic energy recovery system. This precision-engineered flywheel bridges the gap between electrical input and mechanical output, ensuring smooth power delivery.

PRECISION DESIGN

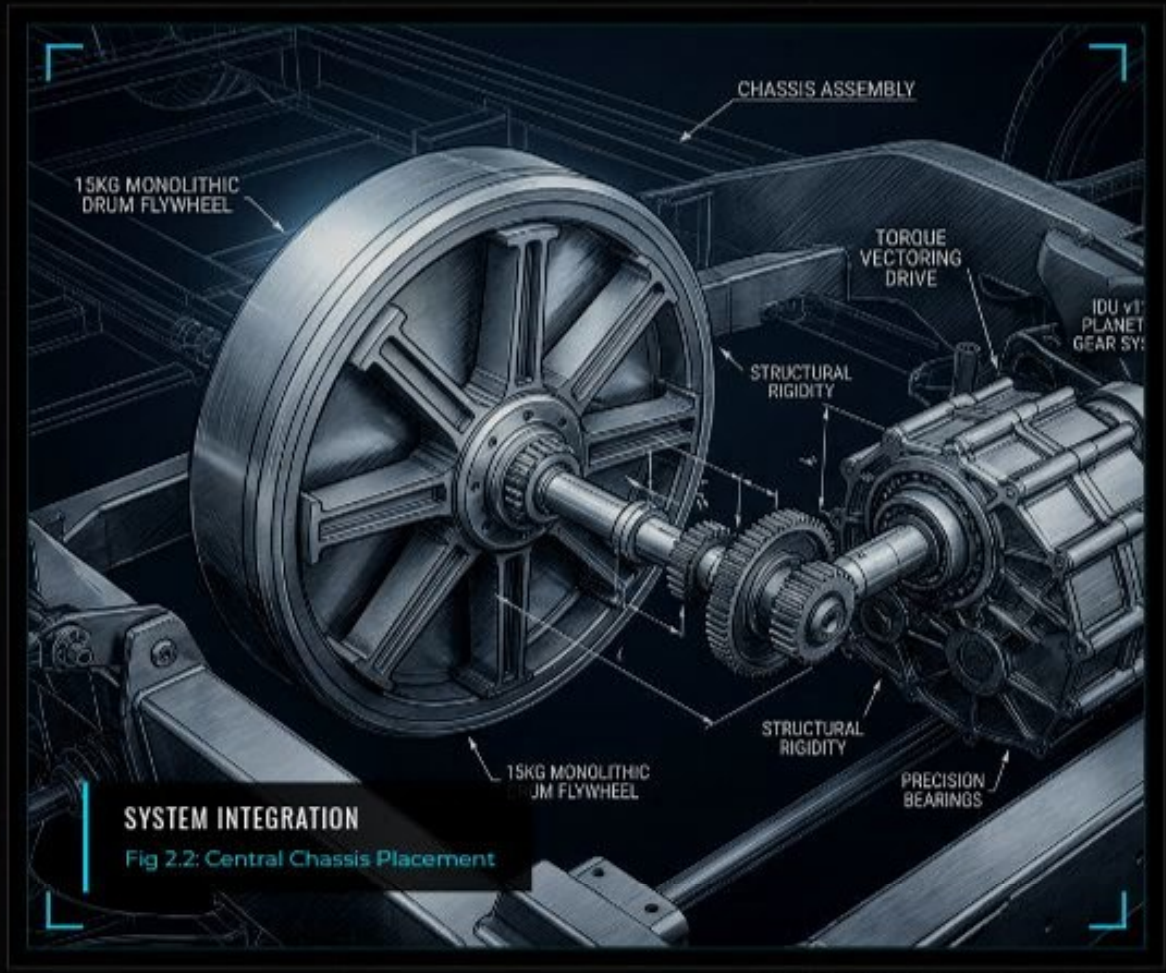
8-Symmetrical I-Beam Spokes engineered for maximum structural rigidity and minimal air resistance.

HIGH-SPEED BALANCE

Dynamically balanced for 4500 RPM operation, ensuring vibration-free rotational stability.

"KINETIC BATTERY"

Acts as a mechanical buffer, smoothing out motor load spikes and storing momentum for gliding phases.



SYSTEM INTEGRATION

Fig 2.2: Central Chassis Placement

OUTPUT STAGE (GEARBOX SIDE)



RING GEAR INPUT — 90 Teeth

The large outer ring gear acts as the input source for this stage, driven by the system's accumulated kinetic energy.

SUN GEAR OUTPUT — 24 Teeth

Connects directly to the transmission. The smaller tooth count relative to the ring gear facilitates rapid rotation.

OVERDRIVE RATIO — 0.266:1

This overdrive ratio tames extreme torque and multiplies speed, transforming raw power into efficient highway cruising capability.

Result: High-Speed Cruising Optimization

5-SPEED MANUAL TRANSMISSION

The critical interface between kinetic storage and road performance. Our manual gearbox empowers the driver to actively manage the energy loop, optimizing the system for specific driving conditions.

TORQUE MANAGEMENT

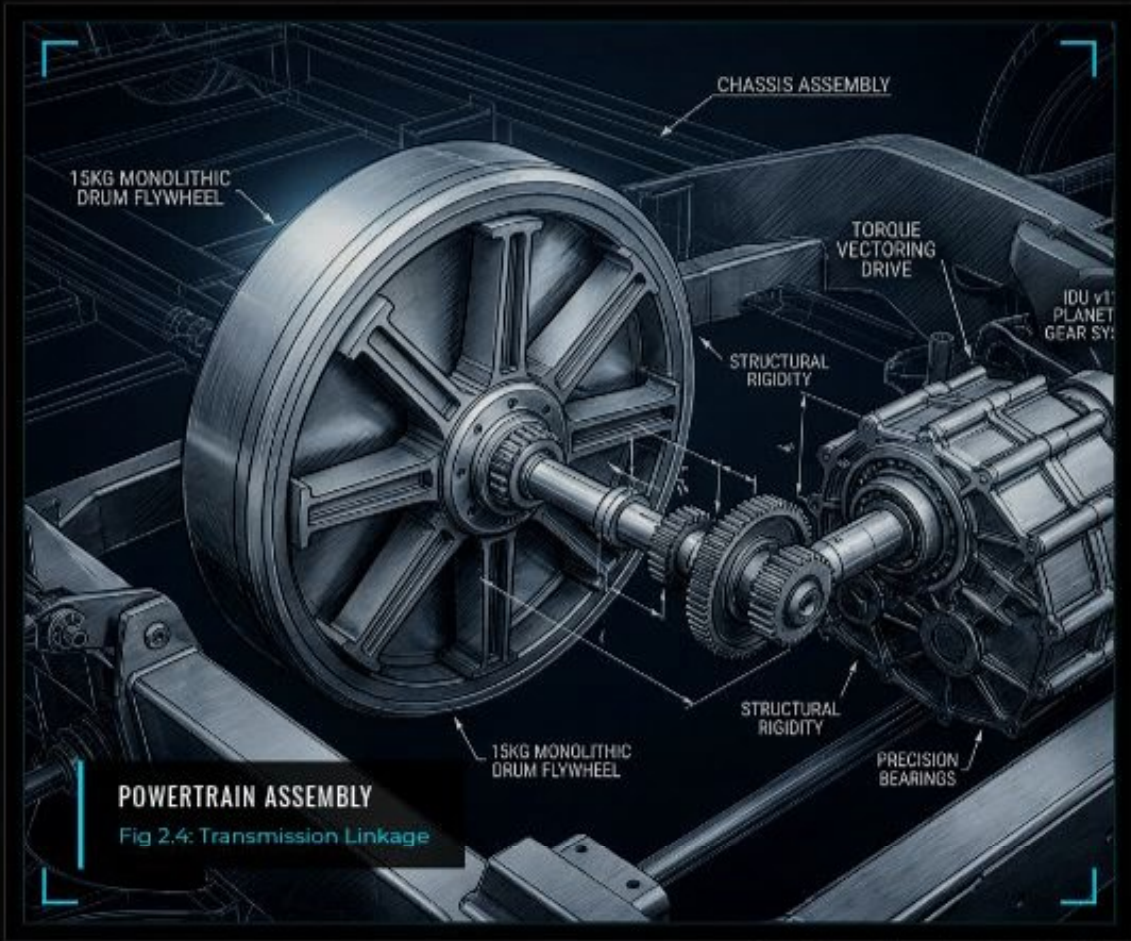
Low gears (1st-2nd) leverage the IDU's massive torque for towing 2.2 tons and steep climbs.

SPEED OPTIMIZATION

High gears (4th-5th) utilize overdrive ratios for efficient highway cruising, maximizing flywheel momentum.

DRIVER CONTROL

Total engagement authority allows for strategic shifting to harvest energy or deploy maximum power.



POWERTRAIN ASSEMBLY

Fig 2.4: Transmission Linkage

ELECTRO-MAGNETIC CLUTCH

Seamless Power Decoupling

A high-performance magnetic coupler positioned between the Motor and IDU. This critical component enables complete mechanical isolation, allowing the vehicle to enter "Gliding Mode" without motor drag or resistance.

High-Torque Coupling

Securely locks motor to IDU for instant power transfer.

Zero-Drag Gliding

Disengages to eliminate back-EMF drag during coasting.

Instant Actuation

Microsecond response time managed by Arduino logic.

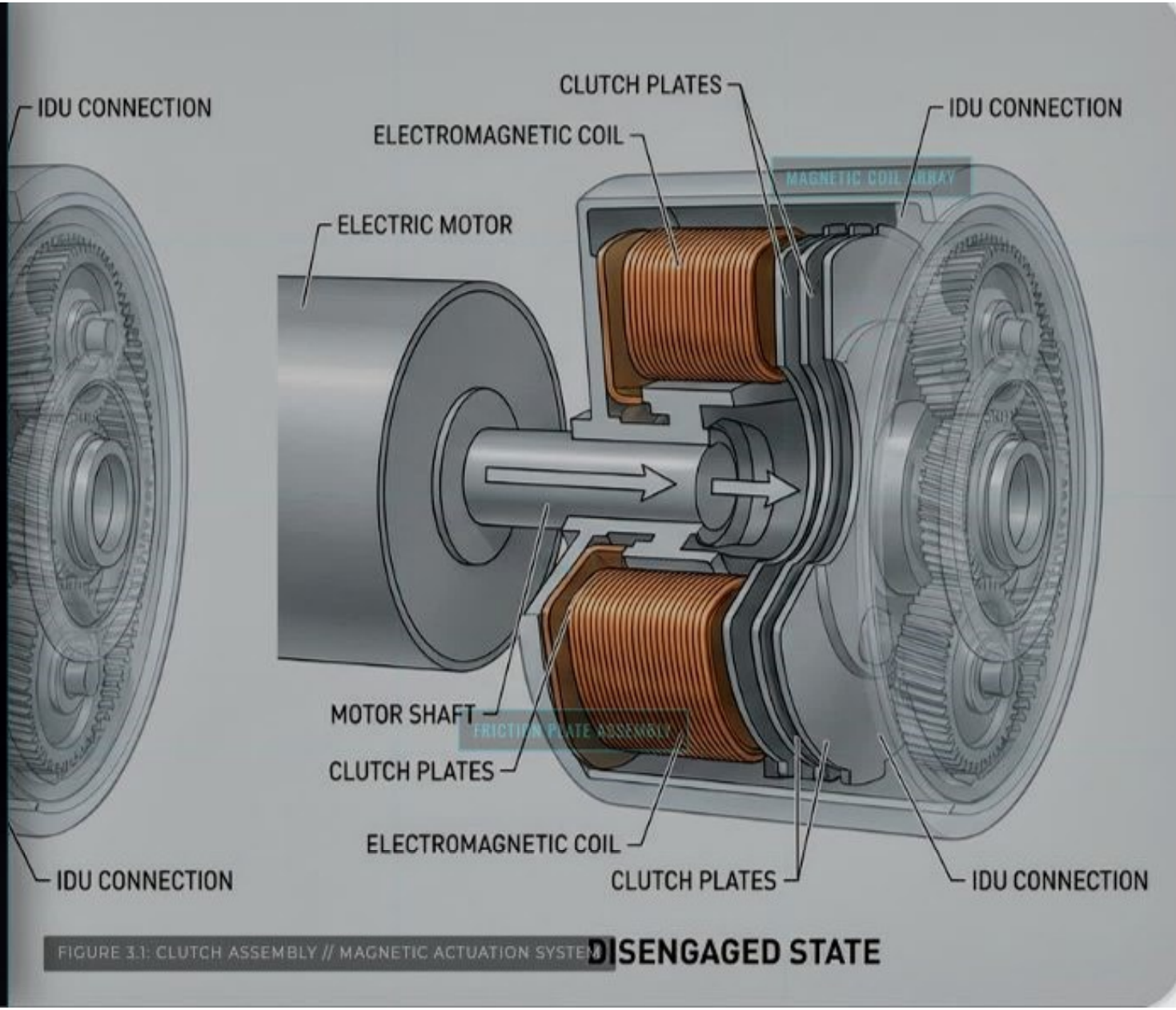


FIGURE 3.1: CLUTCH ASSEMBLY // MAGNETIC ACTUATION SYSTEM

DISENGAGED STATE

03 / INTELLIGENT CONTROL

ARDUINO RPM SYNC LOGIC



RPM SENSING

Dual Hall-Effect sensors monitor Motor and Drum speed in real-time.

REV-MATCHING

Arduino calculates the delta (Δ) between input and output shaft speeds.

PID CONTROL

Proportional-Integral-Derivative loop adjusts motor speed to close the gap.

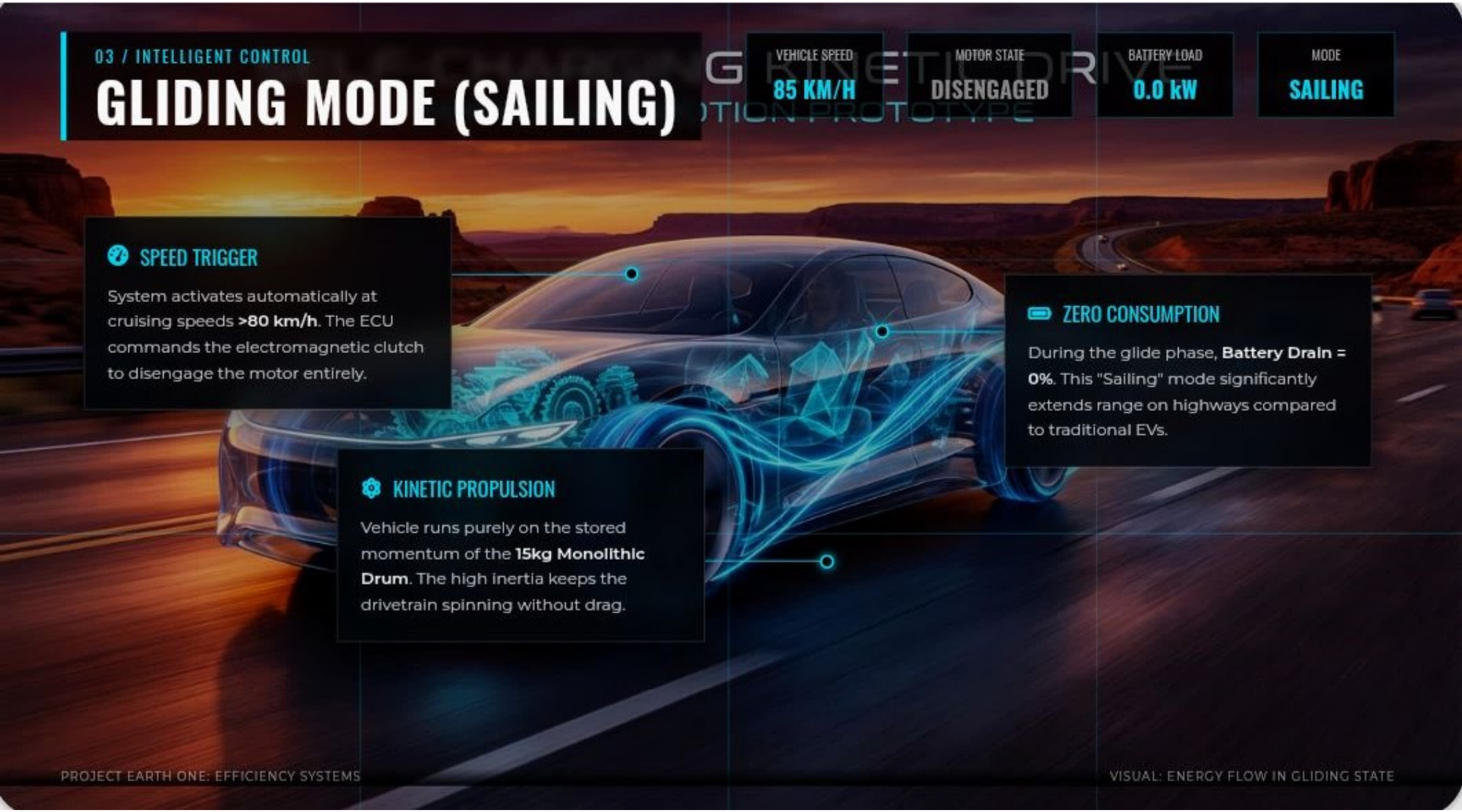
RPM MATCH

Speeds synchronize within ±50 RPM tolerance for shock-free coupling.

CLUTCH ENGAGE

Electromagnetic clutch locks, transferring power without mechanical jerk.

```
</> if (abs(Motor_RPM - Drum_RPM) < 50)  →  digitalWrite(CLUTCH_PIN, HIGH);  →  status = 'LOCKED';
```


03 / INTELLIGENT CONTROL
GLIDING MODE (SAILING)
VEHICLE SPEED
85 KM/H
MOTOR STATE
DISENGAGED
BATTERY LOAD
0.0 kW
MODE
SAILING
SPEED TRIGGER
System activates automatically at cruising speeds >80 km/h. The ECU commands the electromagnetic clutch to disengage the motor entirely.
ZERO CONSUMPTION
During the glide phase, Battery Drain = 0%. This "Sailing" mode significantly extends range on highways compared to traditional EVs.
KINETIC PROPULSION
Vehicle runs purely on the stored momentum of the 15kg Monolithic Drum. The high inertia keeps the drivetrain spinning without drag.
PROJECT EARTH ONE: EFFICIENCY SYSTEMS
VISUAL: ENERGY FLOW IN GLIDING STATE

03 / INTELLIGENT CONTROL

SEAMLESS RE-ENGAGEMENT



READ DRUM RPM

Hall sensors detect the exact rotational speed of the 15kg kinetic flywheel.

SPIN MOTOR TO TARGET

Controller accelerates the input motor to match the drum's RPM precisely.

SHOCK-FREE LOCK

Clutch closes at Zero ΔRPM, protecting the gearbox from mechanical stress.

```
Read(Drum_RPM) → Set_Motor(Target_RPM) → if(Δ = 0) Engage_Clutch();
```

PROJECT EARTH ONE: INTELLIGENT LOGIC
SYSTEM STATE: RE-ENGAGING

04 / PERFORMANCE METRICS

PEAK WHEEL TORQUE

611 Nm

DELIVERED IN 1ST GEAR @ 0 RPM

Instant Response

LAUNCH CAPABILITY

The unique compound planetary arrangement multiplies motor output to deliver massive low-end torque. This allows a fully loaded **2,200 kg vehicle** to accelerate with the agility of a sports car, overcoming inertia instantly without the lag typical of combustion engines.

2.2 Tons	0-60	100%
GROSS WEIGHT	UNDER 6.5S	TORQUE AVAILABILITY

04 / PERFORMANCE METRICS

GRADEABILITY (CLIMBING POWER)



32%

Incline Capability

Achieved with full 2.2-ton payload. The IDU torque multiplication prevents motor stall typically seen in direct-drive EVs.

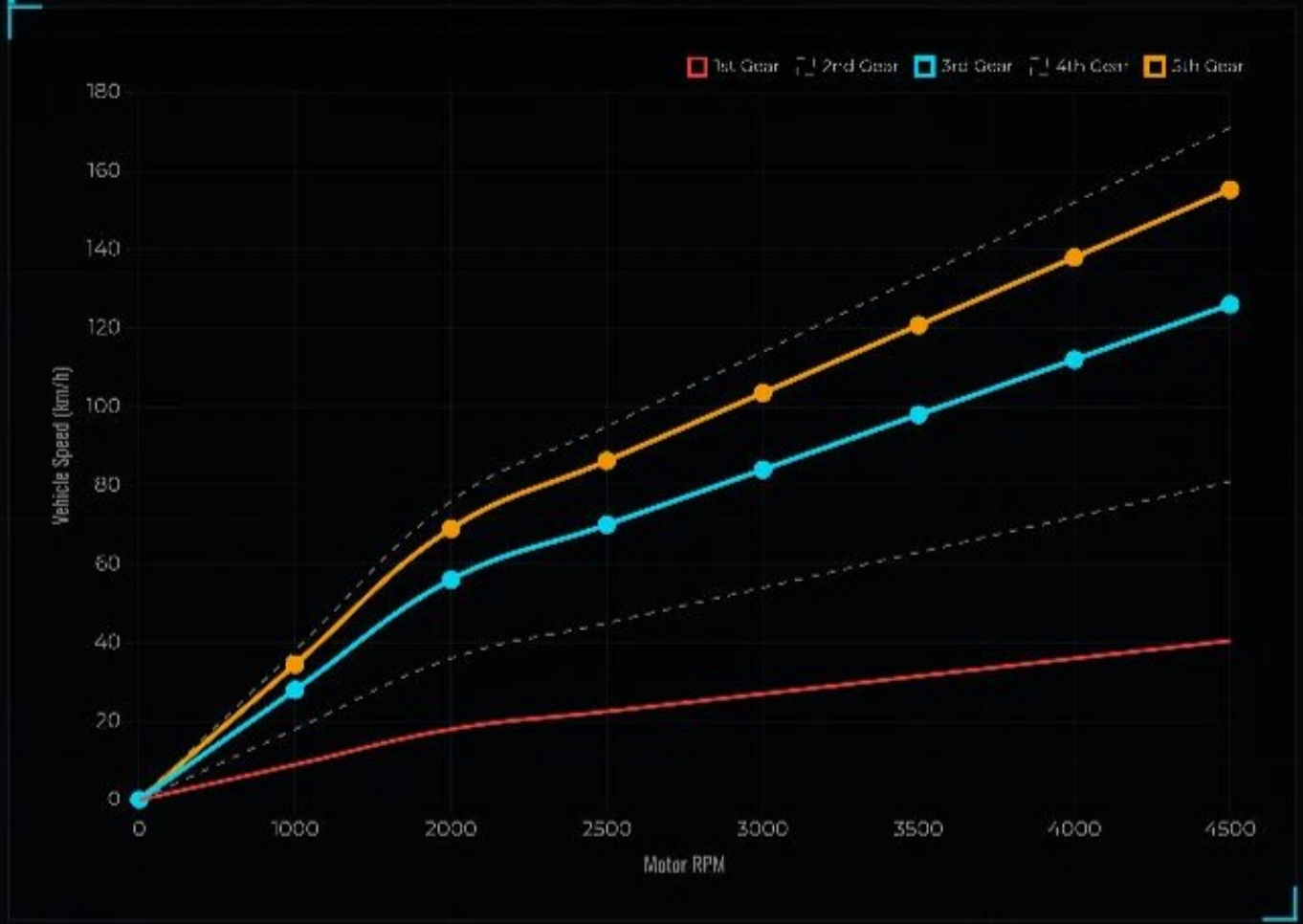
SYSTEM TYPE	MAX GRADIENT	PAYLOAD RATING	HILL START BEHAVIOR
Project Earth One	32% (18°)	2,200 kg	Zero Rollback (Locked)
Standard Diesel Utility	35% (19°)	2,000 kg	Clutch Slip / Stall Risk
Consumer Electric SUV	20% (11°)	1,500 kg	Thermal Cutoff Risk
Light Comm. Van (EV)	25% (14°)	1,800 kg	Power Limitation

ANTI-ROLLBACK TECHNOLOGY

The IDU's high-inertia drum coupled with the 1st gear ratio mechanically holds the vehicle stationary on steep inclines without brake application.

04 / PERFORMANCE METRICS

SPEED & CRUISING ANALYSIS



3RD GEAR ANALYSIS

82 KM/H

Optimal balance point for City/Highway transition. Engine operates at peak efficiency (approx. 2500 RPM).

5TH GEAR MAX

155 KM/H

Theoretical top speed at redline (4500 RPM). Overdrive ratio maximizes range during sustained highway travel.

GEAR RATIO VS RPM LOGIC

- 1st Gear: Torque Emphasis (Launch)
- 3rd Gear: Efficiency "Sweet Spot"
- 5th Gear: Overdrive (Speed)

POWER-TO-WEIGHT OPTIMIZATION

A paradigm shift in EV engineering: utilizing high-ratio IDU gearing and kinetic storage to decouple motor power from vehicle weight, enabling a 10kW motor to propel a 2.2-ton chassis.

MECHANICAL LEVERAGE

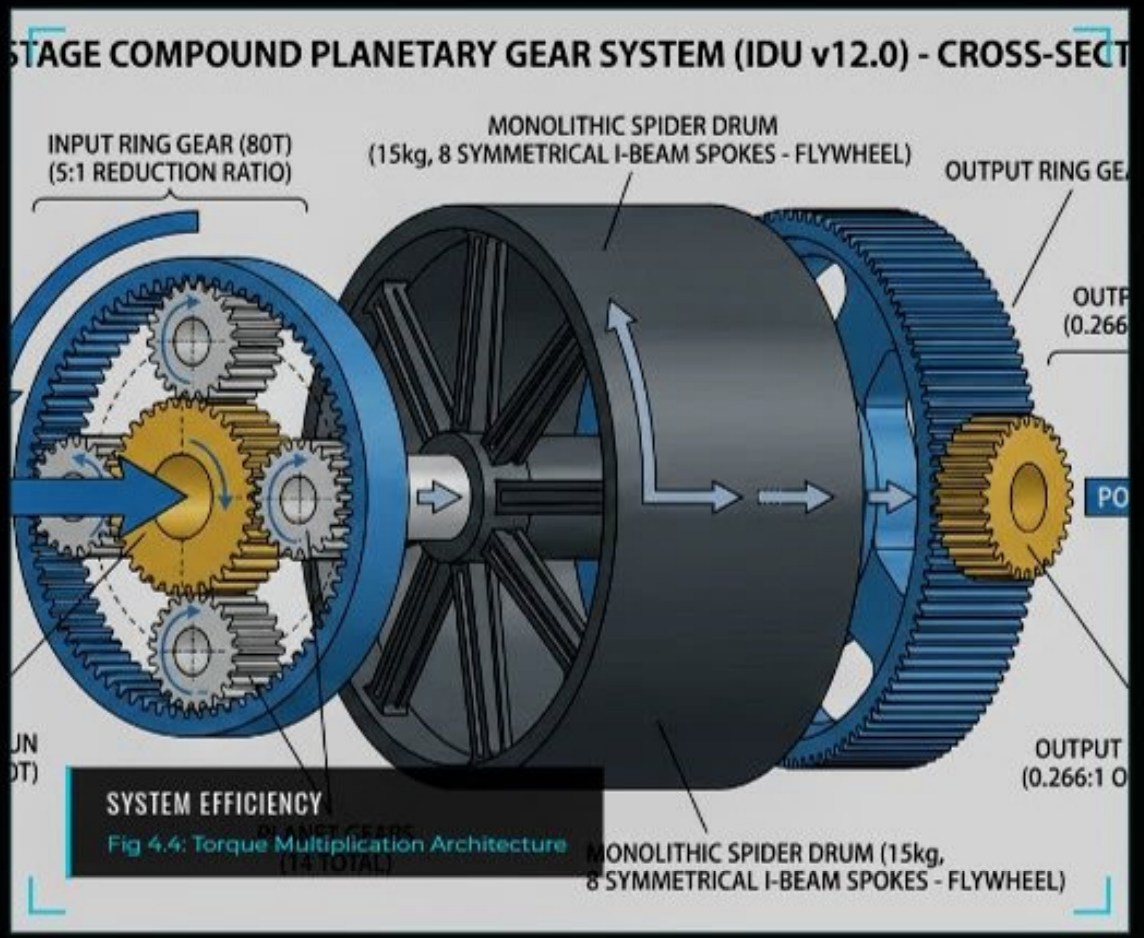
Integrated Drive Unit (IDU) multiplies torque, allowing a compact 10kW motor to launch a 2200kg vehicle without stall.

ENERGY SMOOTHING

The 15kg flywheel buffer absorbs transient load spikes, protecting the battery from high-current draw events.

CRUISING EFFICIENCY

Optimized for momentum maintenance rather than brute acceleration, drastically reducing energy consumption at steady speeds.



05 / ENERGY HARVESTING & BATTERY SAFETY

48V 200A HIGH-OUTPUT ALTERNATOR



PLACEMENT — Hub Coupled

Directly mechanically coupled to the output hub shaft. This ensures energy generation occurs continuously whenever the vehicle is in motion, independent of motor load.

OUTPUT CAPACITY — 48V / 200A

High-amperage generation capability designed to rapidly replenish the secondary battery pack, maximizing the self-charging loop efficiency.

ON-BOARD POWER STATION

Serves as an active mobile charging station. By converting excess kinetic momentum back into electricity, the system extends range significantly without requiring stationary downtime.

05 / ENERGY HARVESTING & BATTERY SAFETY

25% BATTERY THRESHOLD ALERT

25%

STATE OF CHARGE (SOC)

Proactive Notification

SMART DASHBOARD LOGIC

The intelligent energy management system continuously monitors voltage levels. When the State of Charge drops to the critical **25% threshold**, the dashboard triggers a "Snack-Break" alert. This signals the driver to prepare for a quick battery swap, preventing deep discharge and ensuring system longevity.

Priority	< 2 Min	Safety
HIGH ALERT	SWAP TIME	DEEP DISCHARGE PROT.

05 / ENERGY HARVESTING & BATTERY SAFETY

SECURE BATTERY SWITCHING



1 ZERO VELOCITY

Sensors verify vehicle speed is absolute zero before enabling switch.

2 SAFETY INTERLOCK

High-voltage contactors open to isolate the drivetrain load.

3 STATIC SWAP

Source switches from depleted Pack A to charged Pack B instantly.

4 ARC PREVENTION

Switching at zero current eliminates dangerous 96V DC electrical arcing.

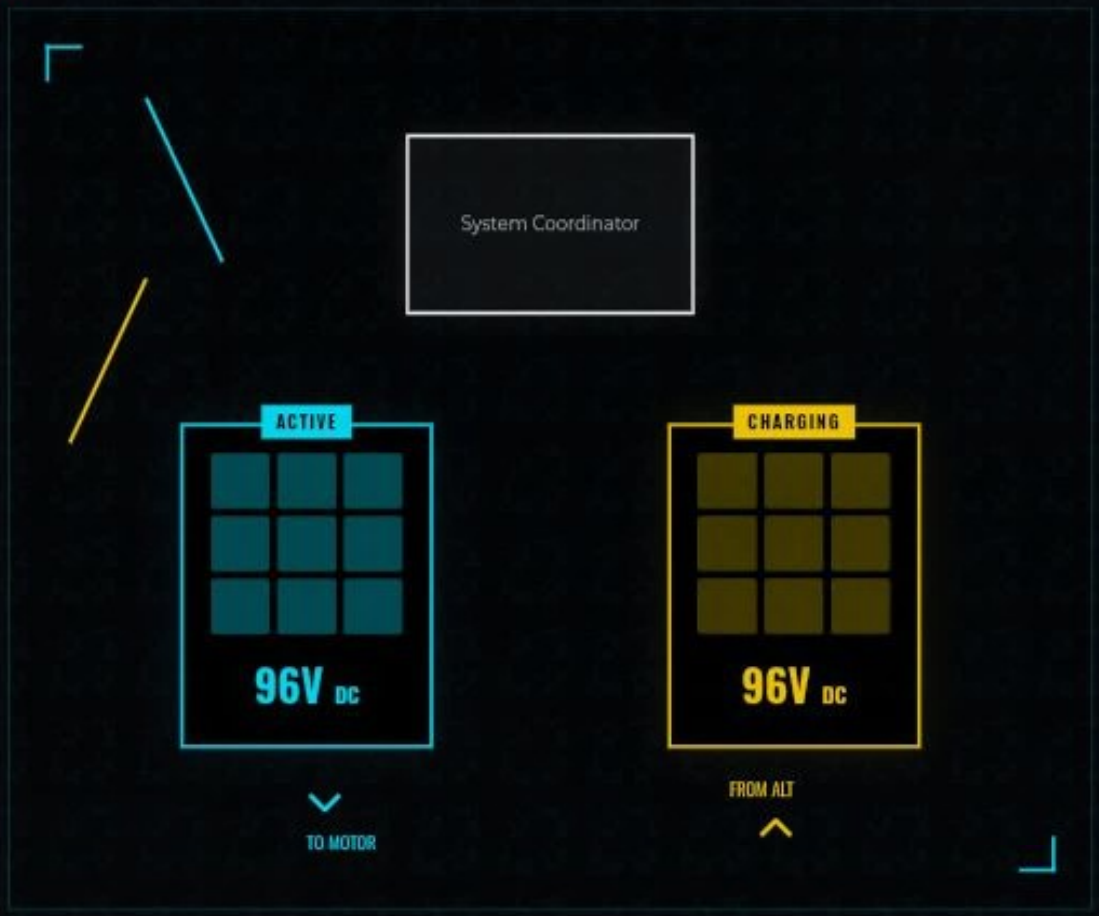
5 POWER RESUME

System re-engages, ready for the next leg of the journey.

```
</> if (Vehicle_Speed == 0)  ➜  Contactors(OPEN);  ➜  Switch_Source(PACK_B);  ➜  System_Status = "SECURE";
```

05 / ENERGY HARVESTING & BATTERY SAFETY

DUAL 96V BATTERY PACK



DUAL ISOLATION

A / B Split

Two independent 96V battery banks ensure that the driving circuit is electrically isolated from the charging loop, preventing interference and load spikes.

CYCLE MANAGEMENT

Continuous

While Pack A powers the IDU for traction, Pack B absorbs energy from the 200A alternator. The system eliminates downtime by rotating roles.

SYSTEM BRAIN

10kW Inverter

A high-capacity inverter acts as the BCM (Battery Control Module), seamlessly managing the hand-off between packs without interrupting power delivery to the wheels.

Status: Perpetual Energy Loop

06 / ENGINEERING PRECISION

DYNAMIC BALANCING

Precision at 4,500 RPM

To ensure structural integrity and ride comfort, the 15kg Monolithic Spider Drum and 8-planet gear set undergo rigorous dynamic balancing. This eliminates harmonic resonance at high rotational speeds.

Micro-Gram Precision

Balanced to eliminate even the slightest rotational asymmetry.

Vibration Elimination

Zero mechanical shock transfer to the chassis or gearbox.

4,500 RPM Stability

Tested for smooth operation at peak rotational velocity.

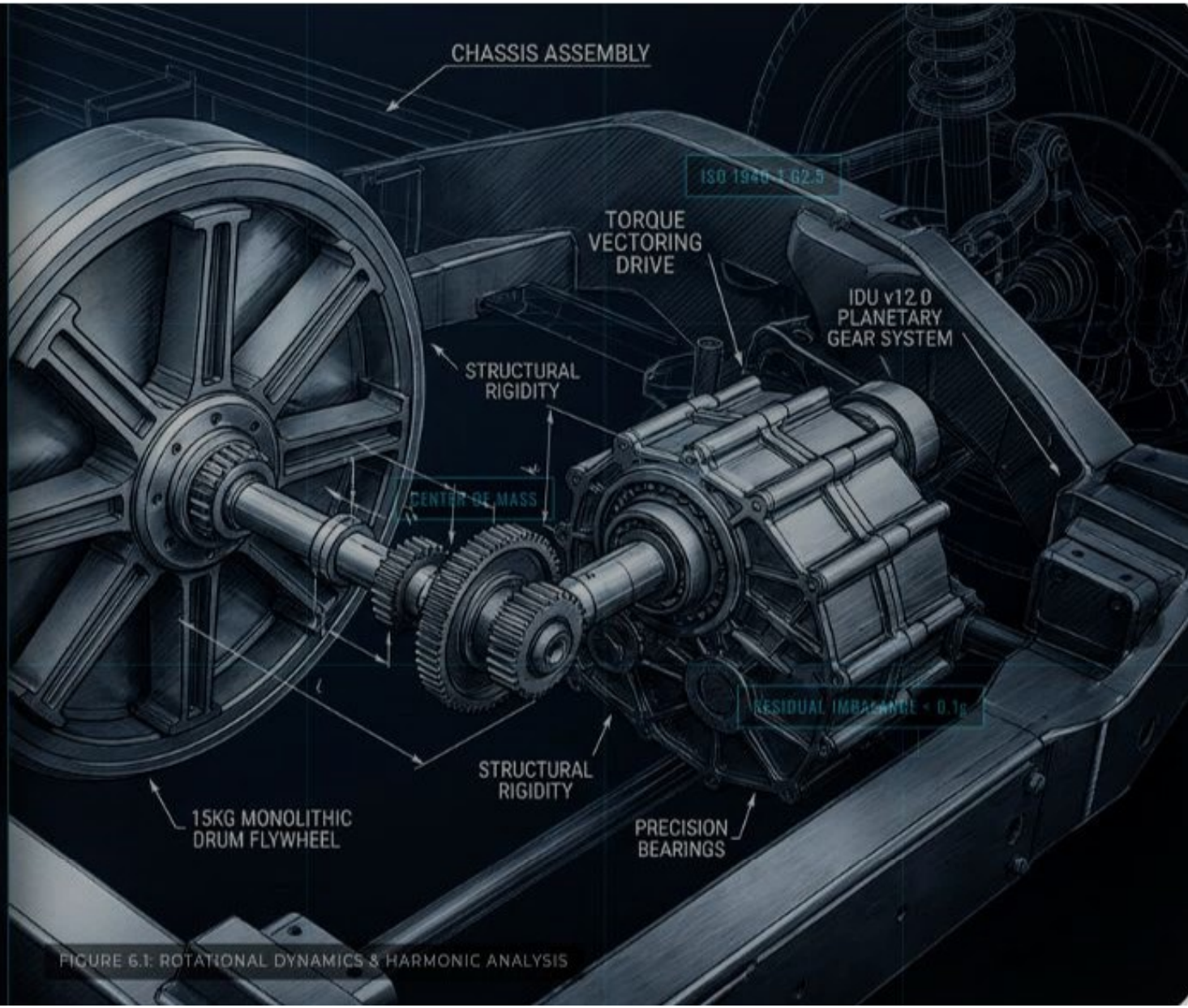
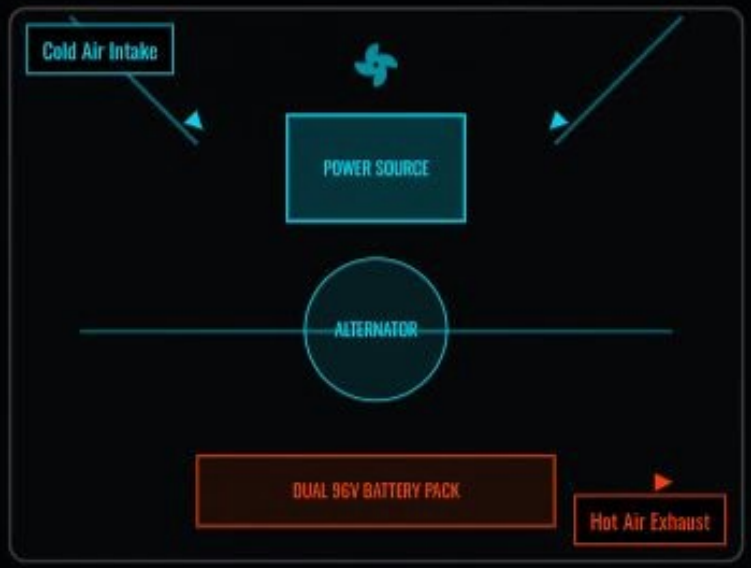


FIGURE 6.1: ROTATIONAL DYNAMICS & HARMONIC ANALYSIS

THERMAL MANAGEMENT (AIR COOLING)



ACTIVE DUCT SYSTEM

Custom Design

Strategically routed air channels direct high-velocity airflow over the 96V battery packs and power electronics, utilizing vehicle motion for cooling.

TARGET TEMPERATURE

< 45°C

Maintains optimal operating range for the 200A alternator and 10kW inverter, preventing thermal throttling even under sustained load.

SYSTEM EFFICIENCY

Passive + Active

Combines natural convection with forced induction cooling. Eliminates the need for heavy, power-hungry liquid cooling pumps.

Outcome: Consistent Performance

07 / CONCLUSION & ROADMAP

PROJECT ROADMAP

PHASE 01

PROTOTYPE TESTING

Validation of IDU v12.0 mechanics, 15kg flywheel balancing, and bench-testing of the 5:1 reduction gearset.

COMPLETED

PHASE 02

DYNAMIC TRIALS

On-road testing of the "Gliding Mode" algorithm, thermal management calibration, and 2.2-ton load hill-start verification.

IN PROGRESS

PHASE 03

COMMERCIAL LAUNCH

Mass production of the 2.2-ton model. Rollout of the dual-battery "Snack-Break" infrastructure and global market entry.

Q4 2026

PROJECT EARTH ONE

MISSION COMPLETE

"Where **Engineering** meets **Autonomy**."

The future of zero-dependency EV travel.

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