DESIGNING CANADA'S AUTOMOTIVE ECOSYSTEM

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PLEASE SEE **THE ATTACHED EXTENDED ECOSYSTEM DIAGRAM** FOR A MORE IN-DEPTH BREAKDOWN SHOWING ALL INTERACTIONS, LOOPS, AND SYSTEM-LEVEL RELATIONSHIPS.

MY POSITIONING FOR THIS PART OF THE THESIS

INDUSTRIAL DESIGNER’S ROLE

As an industrial designer, my role is not to engineer each individual component, but to:

- Understand the entire system architecture
- Identify how these systems interact and depend on one another
- Map user, performance, and engineering requirements
- Design the integration, not the parts
- Create forms, interfaces, and systems that respond to functional and user needs
- Translate engineering constraints into design opportunities
- Build a platform that coordinates suppliers, technology modules, and user experience
- Develop the service ecosystem that makes the performance car usable, maintainable, and meaningful

This critique focuses on how I am designing the structure, interactions, and ecosystem around these systems the foundation for Takaya’s identity as a Canadian performance platform.

WHAT THIS SEMESTER FOCUSED ON

High-level overview of your design intention and research process

This semester was dedicated to understanding how a Canadian performance vehicle could realistically exist, not to designing the final car. My goal was to build the system-level foundation: researching Canada’s automotive history, analyzing trade policies, mapping supplier capabilities, and identifying the gaps that prevent Canada from having its own performance OEM. Through this process, I developed the crate ecosystem, a modular system architecture that allows government, suppliers, HQ, investors, and drivers to work together.

This establishes the strategic and technical groundwork for next semester’s artifact development.

BRIEF OVERVIEW

WHO THE ECOSYSTEM SERVES

Shows user understanding and interaction logic
The ecosystem is designed for multiple end-users, not just drivers.
It serves Canadian suppliers who gain a unified innovation platform; government agencies that support R&D and national IP growth; investors seeking high-margin technology opportunities; engineers and students who engage with crate modules; and drivers and enthusiasts whose real-time telemetry feeds back into performance refinement.
By mapping how each user interacts with HQ, suppliers, and the crate system, this semester clarified how the ecosystem functions as a living system, not a static design.

BRIEF OVERVIEW

Why This Matters & What Comes Next

Shows strategic impact + trajectory into next semester

This ecosystem positions Canada to enter the hypercar bracket the only segment where low-volume, high-margin production is viable for a new OEM. The crate model reduces risk, aligns with supplier strengths, and generates scalable IP similar to Rimac, Koenigsegg, Pagani, and McLaren Applied. Next semester, the project transitions from ecosystem artifact, developing the exterior form, interior UX, aerodynamic strategy, CAD surfaces, and prototype models.

This creates a complete performance platform that integrates both design and national innovation strategy.

BRIEF OVERVIEW

HOW CANADA BECAME A SUPPLIER NATION

Why we build world-class components, but not our own performance cars.

Early 1900s–1950: Canada Becomes the Factory for America

- By the 1920s, American automakers took over the Canadian market.
- Ford, GM, and Chrysler built factories in Ontario.
- Canada became a production base, not a design base.
- Vehicles were built in Canada under American brands and shipped to the Commonwealth.

Impact:

- Canada rapidly developed:
- Skilled manufacturing
- Supply chains
- Tooling + machining expertise

But we did not develop:

- Domestic brands
- Design studios
- Performance/R&D divisions
- Canada’s role became: build the cars, don’t decide what the cars are.

1965 AUTO PACT

THE TURNING POINT

This is the MOST important historical factor.
The Automotive Products Trade Agreement (Auto Pact) between Canada & the U.S. stated that:

- Cars built in Canada could be sold in the U.S. without tariffs
- Cars built in the U.S. could be sold in Canada without tariffs
- Automakers had to maintain a production ratio in Canada
- Canada received guaranteed automotive manufacturing jobs

What this meant:

- Canada became deeply integrated into the U.S. automotive machine
- The Big Three used Canada as a production and assembly hub
- Canada focused on volume manufacturing, not innovation
- There was zero incentive to create a Canadian-owned brand
- U.S. companies controlled product design + strategy

This locked Canada into a supplier/assembler identity.

AP Photo

WINDBLOWN Canadian Prime Minister Lester Pearson arrived in Stonewall, Tex., to visit President and sign auto "free trade" agreement.

U.S., Canada Agree to End Most Tariffs on Cars, Parts

1994 NAFTA

(CANADA–U.S.–MEXICO AGREEMENT)

NAFTA expanded the automotive region:

- Canada, U.S., and Mexico became a single production block
- Automakers used each country for what they were best at:
  - U.S : design, engineering, corporate strategy
  - Mexico: cost-efficient labor + high-volume assembly
  - Canada: advanced manufacturing + parts + skilled workforce

Impact:

- Reinforced Canada’s specialization in parts and advanced components
- Still no need or incentives to develop a Canadian-owned OEM
- Canadian suppliers became global giants (Magna, Linamar, Multimatic)
- The automotive industry became deeply continental, not national

Canada got stronger , but not more autonomous.

2020 USMCA

(NEW NAFTA)

The United States–Mexico–Canada Agreement introduced MAJOR changes:

New rules:

- 75% North American content required (up from 62.5%)
- Higher wage requirements (favoring Canada/U.S. over Mexico)
- Battery materials + components must be regional
- EV subsidies require North American supply chains

Impact:

- Canada became strategically valuable for EV, hybrid, and advanced components
- Pressure increased to keep automotive IP and production in North America
- Canada’s mining and battery resources became essential
- Hybrid/EV performance platforms became economically viable here
- For the first time in history, policy encourages Canadian-designed vehicles.

WHY THIS IS THE BEST TIME FOR A CANADIAN AUTOMOTIVE BRAND

GLOBAL & NORTH AMERICAN SHIFT

The U.S.–China tariff war disrupted global supply chains, pushing North America to reduce dependence on foreign parts and rebuild regional manufacturing.
USMCA's higher content requirements and battery sourcing rules now favor Canadian suppliers, while reshoring trends make Canada the U.S.'s most secure and strategic technology partner. For the first time, trade policy supports Canadian-designed vehicles rather than just Canadian manufacturing.

NATIONAL IDENTITY & INDUSTRY MOMENTUM

Tariffs, geopolitical instability, and growing concerns over automotive sovereignty have reignited the question: Why doesn't Canada build its own cars?
Public opinion increasingly supports domestic innovation, and APMA president Flavio Volpe has emphasized, "Canada has the talent to build complete vehicles,we've simply never claimed our place."
Government initiatives like OVIN, NRC-IRAP, and federal EV funding now actively support Canadian automotive IP and platform development.

ONCE-IN-A-CENTURY OPPORTUNITY

Globally, nations are defending their automotive sectors, Europe protects EVs, China expands aggressively, and Korea/Japan strengthen domestic systems.
This shift creates a historic opening for Canada: we have world-class suppliers, rising public sentiment, government backing, and economic conditions aligned for national automotive identity building.
Takaya responds to this moment by unifying Canadian capabilities into a performance ecosystem,transforming Canada from a supplier nation into a creator nation.

CANADA’S PAIN POINT:

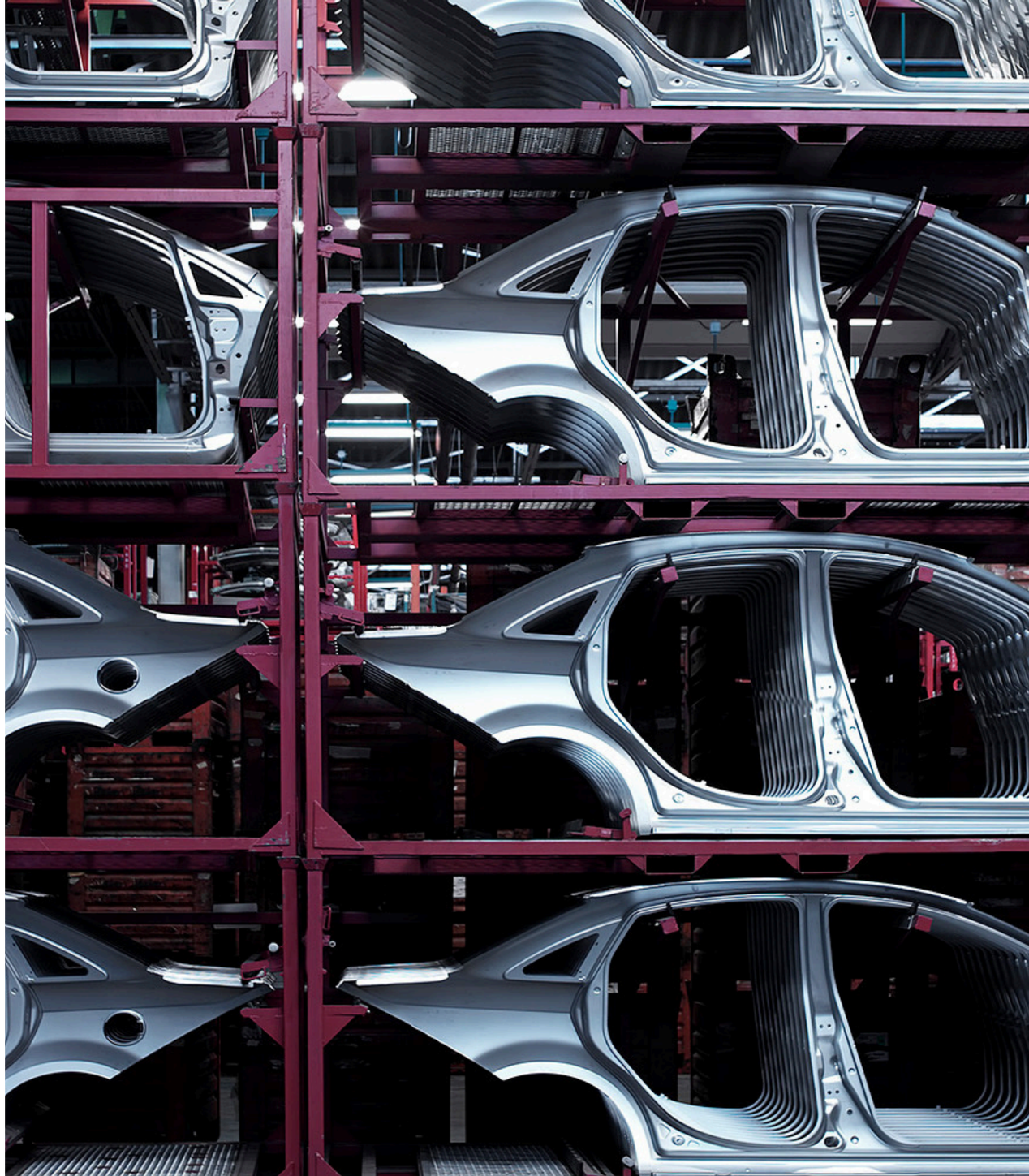
SCATTERED SUPPLIERS, NO SYSTEM

1. CANADA HAS WORLD-CLASS SUPPLIERS , BUT NO OEM STRUCTURE
Canada produces some of the most advanced automotive components in the world—carbon monocoques (Multimatic), hybrid drive systems (Magna), e-motors and inverters (TM4), powertrain components (Linamar), and structural engineering (Martinrea). Each company excels at its niche.
But none of these companies assemble complete vehicles or function as full automotive OEMs. They supply the world’s best brands instead of building Canadian ones.

2. EXTREME SPECIALIZATION = FRAGMENTED ECOSYSTEM
Canadian suppliers evolved to become global specialists:

- Multimatic focuses on chassis & composites.
- Magna builds transmissions, electric drives, and ADAS components.
- TM4 creates motors/inverters.
- Linamar and Martinrea produce engine/structural systems.

Each is a master in one domain,but they do not collaborate under a unified platform or shared vehicle architecture.



3. NO INTEGRATED MANUFACTURING HUB = NO CANADIAN AUTOMOTIVE IDENTITY

Countries that create iconic automotive brands (Germany, Japan, Italy, South Korea) all have integrated OEM hubs where design, engineering, supply chains, testing, and final assembly occur under one national industrial ecosystem.
Canada, in contrast, has:

- Supplier excellence
- Manufacturing capacity
- Engineering talent

but no central OEM hub to bring these strengths together.
As a result, Canadian technologies disappear into foreign brands, never contributing to a Canadian design identity.

4. THE STRUCTURAL GAP: MISSING SYSTEM ARCHITECTURE

CANADA HAS:
✓ the parts
✓ the talent
✓ the factories
✓ the innovation programs
What Canada does NOT have is:
A unifying architecture
A shared platform
A central performance ecosystem
A design-led OEM that integrates all Canadian technology
A national IP strategy for vehicle development
Without system-level cohesion, Canada remains a tier-1 supplier nation, not a creator of complete automobiles.

WHY THIS MATTERS

This fragmentation is not just an economic problem, **it is a design problem.**
Without a system that connects suppliers, engineers, universities, and government, Canada cannot develop vehicles that express national identity, innovation, or IP ownership.

Takaya exists to solve this structural gap by designing the missing ecosystem that unifies Canadian components into a single, coherent performance platform.

WHAT IS A CRATE?

A crate is a complete, self-contained module that performs a specific function and can be:

- Manufactured independently
- Transported easily
- Installed or replaced as a unit
- Integrated into a larger system

A crate is not one part — it is a whole subsystem packaged together.

In automotive terms, a crate engine is:

- Fully built engine
- Ready to drop into any compatible chassis
- Designed to work as a standalone performance module
- But this idea exists in many industries, not just cars.

1. Computer Industry — GPU, CPU, and Motherboard Modules

A graphics card (GPU) is a crate:

- Built by Nvidia
- Plugged into different PCs
- Used by multiple companies
- Upgradable, replaceable, modular

The whole PC industry is based on crate architecture.

2.Aerospace — Avionics Modules

Airplane flight systems come in:

- Navigation crates
- Communication crates
- Power crates
- Flight control crates

Airbus and Boeing assemble aircraft from modular avionics units.

3.Architecture — Prefabricated Buildi[illegible]s

Hotels and buildings use:

- Prefab bathroom crates
- Prefab kitchen crates
- Prefab electrical/hvac crates

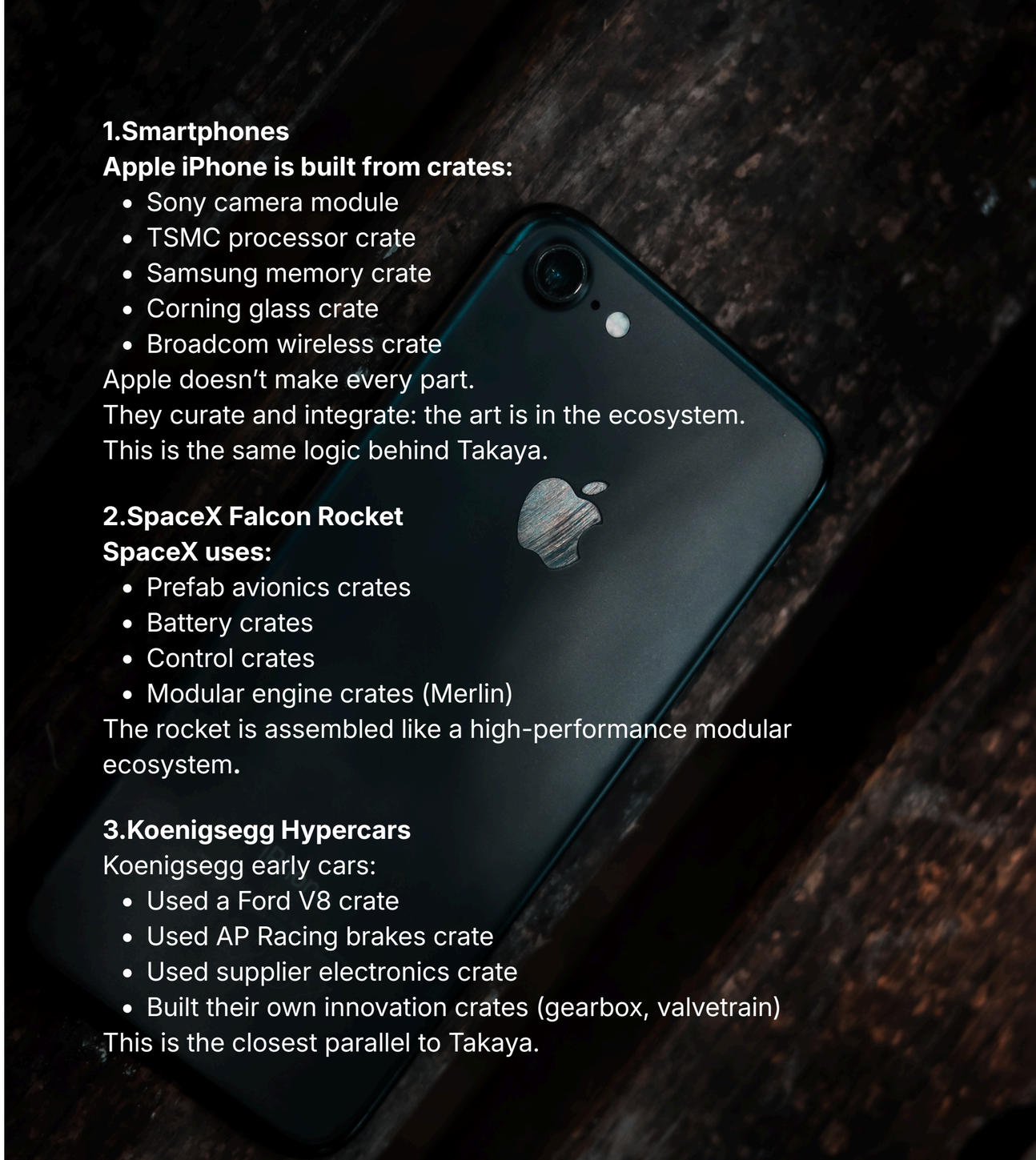
They plug into a structural core → just like vehicle systems.

WHAT IS A CRATE ECOSYSTEM?

A crate ecosystem is when multiple crates, from different experts are:

- Interconnected
- Compatible
- Standardized
- Designed to work together
- Combined into a unified system

It turns scattered subsystems into a coherent platform.
It allows multiple companies to collaborate without losing specialization.
It accelerates innovation because each crate evolves independently.



1.Smartphones
Apple iPhone is built from crates:

- Sony camera module
- TSMC processor crate
- Samsung memory crate
- Corning glass crate
- Broadcom wireless crate

Apple doesn't make every part.
They curate and integrate: the art is in the ecosystem.
This is the same logic behind Takaya.

2.SpaceX Falcon Rocket
SpaceX uses:

- Prefab avionics crates
- Battery crates
- Control crates
- Modular engine crates (Merlin)

The rocket is assembled like a high-performance modular ecosystem**.**

3.Koenigsegg Hypercars
Koenigsegg early cars:

- Used a Ford V8 crate
- Used AP Racing brakes crate
- Used supplier electronics crate
- Built their own innovation crates (gearbox, valvetrain)

This is the closest parallel to Takaya.

HOW THE CRATE ECOSYSTEM CONNECTS TO VEHICLE SYSTEM ARCHITECTURE

MACRO (CANADA)
MESO (ECOSYSTEM)
MICRO (VEHICLE SYSTEMS)

Crates = The Building Blocks of Vehicle Systems
Each crate corresponds directly to one of the core systems inside a performance car:

- Powertrain crate → Engine + hybrid system
- E-Drive crate → Motors + torque vectoring
- Battery crate → Energy storage & thermal systems
- Chassis crate → Monocoque + suspension inputs
- Aero crate → Active aero modules
- Software crate → VCU, hybrid maps, traction logic

Crates become the subsystems that define the car's performance architecture.

1. **POWER DELIVERY**
2. **HYBRID ARCHITECTURE**
3. **AERODYNAMICS**
4. **COOLING**
5. **BRAKING**
6. **STEERING**
7. **SUSPENSION**
8. **CONTROL SOFTWARE**
9. **STRUCTURAL SYSTEM**
10. **SAFETY SYSTEM**
11. **ELECTRONICS**
12. **INTERIOR/ERGONOMICS**

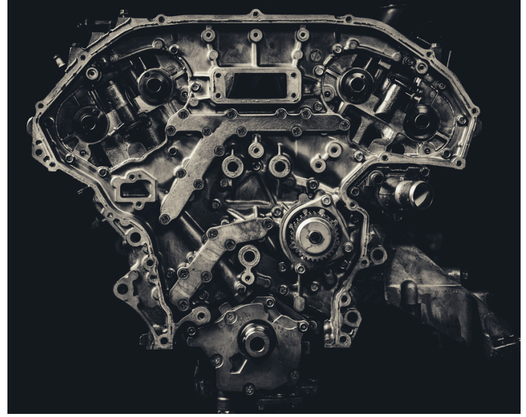
WHAT A PERFORMANCE CAR IS MADE OF?

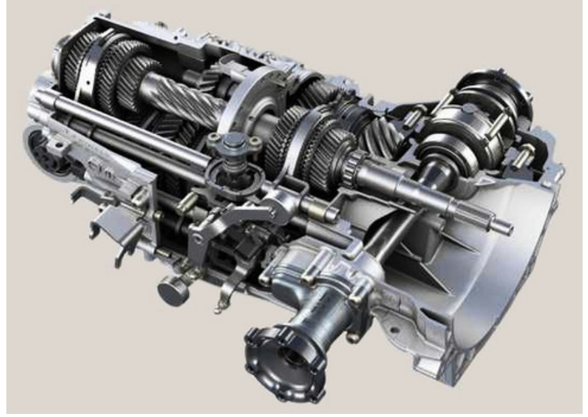
THE 12 CORE SYSTEMS

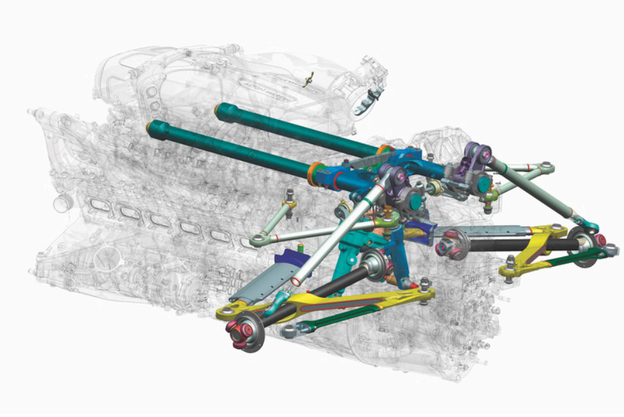
it is made up of a complex ecosystem of systems and subsystems.
A modern performance car is built from:

- **12 Core Systems**
- **70+ Subsystems**
- **Hundreds of interconnected components**
- **Multiple overlapping software layers**
- **Tightly controlled mechanical, electrical, and aerodynamic interactions**

These systems include the powertrain, drivetrain, chassis, aerodynamics, hybrid architecture, software, cooling, control systems, structural design, and the serviceability layer.







POWERTRAIN SYSTEM (HEART OF THE CAR)

Includes:

- Engine (ICE)
- Forced induction (turbo/supercharger)
- Hybrid electric motors (MGU-K, front e-axle)
- Inverters
- Battery system
- Energy management system
- Exhaust system
- Power electronics

Performance functions:

- Peak horsepower & torque
- Response (throttle, boost, electric fill)
- Efficiency of power delivery
- Thermal stability

TRANSMISSION & DRIVELINE SYSTEM

Includes:

- Gearbox (DCT, automated manual, Koenigsegg LST, etc.)
- Differential(s)
- Driveshafts
- Clutch or multi-plate systems
- Torque vectoring units (front/rear)

Performance functions:

- Speed of shifting
- Driver engagement
- Efficient transfer of power
- Launch capability
- Corner exit performance

CHASSIS & STRUCTURAL SYSTEM

Includes:

- Carbon monocoque tub
- Front & rear subframes
- Crash structures
- Mounting points for powertrain, suspension, aero
- NVH tuning
- Rigidity optimization

Performance functions:

- Safety
- High stiffness for aero + cornering
- Light weight
- Modular mounting (for Takaya: serviceability)

SUSPENSION & HANDLING SYSTEM

Includes:

- Suspension type (pushrod/pullrod/double wishbone)
- Dampers (Multimatic DSSV!! Canadian)
- Springs
- Bushings
- Active ride control
- Rear-wheel steering
- Alignment geometry

Performance functions:

- Mechanical grip
- Stability
- Feedback & driver confidence
- Ability to handle high G-forces

BRAKING SYSTEM

Includes:

- Carbon ceramic brake discs
- 6-piston or more calipers
- Brake-by-wire system
- Hybrid regen braking system
- Cooling ducts
- Master cylinder
- ABS module

Performance functions:

- Stopping power
- Fade resistance
- Brake feel
- Heat management

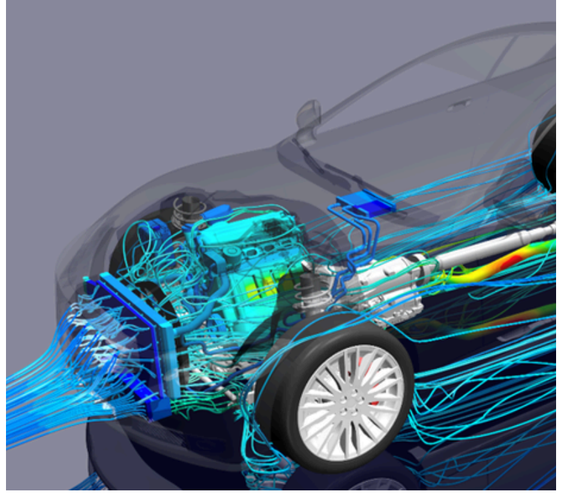
AERODYNAMICS SYSTEM

Includes:

- Wings (active or fixed)
- Splitters
- Diffuser
- Venturi tunnels
- Underbody geometry
- Fan system (GMA T.50, Red Bull RB17 style)
- Drag reduction systems
- Cooling intakes

Performance functions:

- Downforce
- Drag management
- Stability
- High-speed cornering
- Tire loading consistency



COOLING & THERMAL SYSTEM

Includes:

- Radiators
- Intercoolers
- Battery cooling
- Oil coolers
- Brake cooling
- Fans
- Thermal valves/shutters

Performance functions:

- Engine preservation
- Battery efficiency
- Reliability during track use
- Safety

ELECTRICAL & CONTROL SYSTEM

Includes:

- VCU (Vehicle Control Unit)
- ECUs (engine, hybrid, gearbox)
- Wiring harness
- Telemetry system
- Sensors (temp, pressure, wheel speed, etc.)
- ADAS (if any)

Performance functions:

- Power coordination
- Mode control (Road/Track/Quali)
- Safety limits
- Precision of hybrid deployment

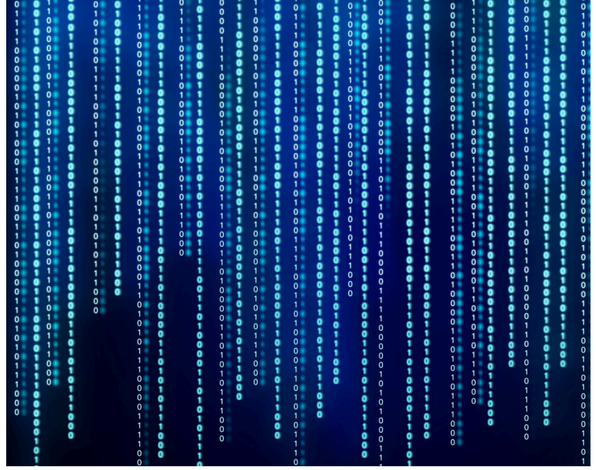
INTERIOR & DRIVER INTERFACE SYSTEM

Includes:

- Steering wheel (F1-inspired, mode switches)
- Digital cluster
- HUD
- Seats & harnesses
- Ergonomics
- Pedal box
- Driver visibility

Performance functions:

- Driver confidence
- Clarity of information
- Comfort during high-G driving
- Control precision



SOFTWARE & INTELLIGENCE LAYER

Includes:

- Hybrid strategies
- Torque vectoring
- Traction control
- Stability algorithms
- Energy mapping
- Cooling strategy management
- Track mode logic
- Over-the-air updates

Performance functions:

- Efficient power usage
- Lap time optimization
- Engine longevity
- Battery protection

ECOSYSTEM & SERVICEABILITY LAYER

Includes:

- Modular crate system
- Quick service modules
- Engine cradle
- Battery swap module
- Aero module
- Front e-axle module
- Predictive maintenance system

Performance functions:

- Reduced cost of ownership
- Track readiness
- Future upgrades
- Rapid prototyping
- Supplier integration

EXTERIOR BODY SYSTEM

Includes:

- Surface design
- Body panels
- Doors, windows
- LED lighting
- Aesthetic identity
- Aero integration

Performance functions:

- Airflow
- Heat extraction
- Structural contribution
- Brand identity

THE CRATE ECOSYSTEM

This ecosystem represents the only realistic way a Canadian performance car can exist. The structure follows a proven pattern seen in Ford vs. Ferrari, Rimac, Koenigsegg, Pagani, and other innovation-driven hypercar companies: government enables the project, suppliers provide specialized modules, HQ integrates and designs the system, investors scale it, and users validate it.

Canada already operates as a highly specialized supplier nation, not an OEM nation, which is why a traditional top-down car company model is impossible. Instead, this ecosystem functions as a network, where government agencies (OVIN, NRC, IRAP, SDTC) provide legitimacy and R&D access; Canadian suppliers contribute world-class hardware like motors, gearboxes, monocoques, and battery systems; HQ (me) acts as the central integrator defining design, architecture, and software; investors fund scaling; and the ecosystem loops back into national innovation, motorsport culture, and future IP creation.

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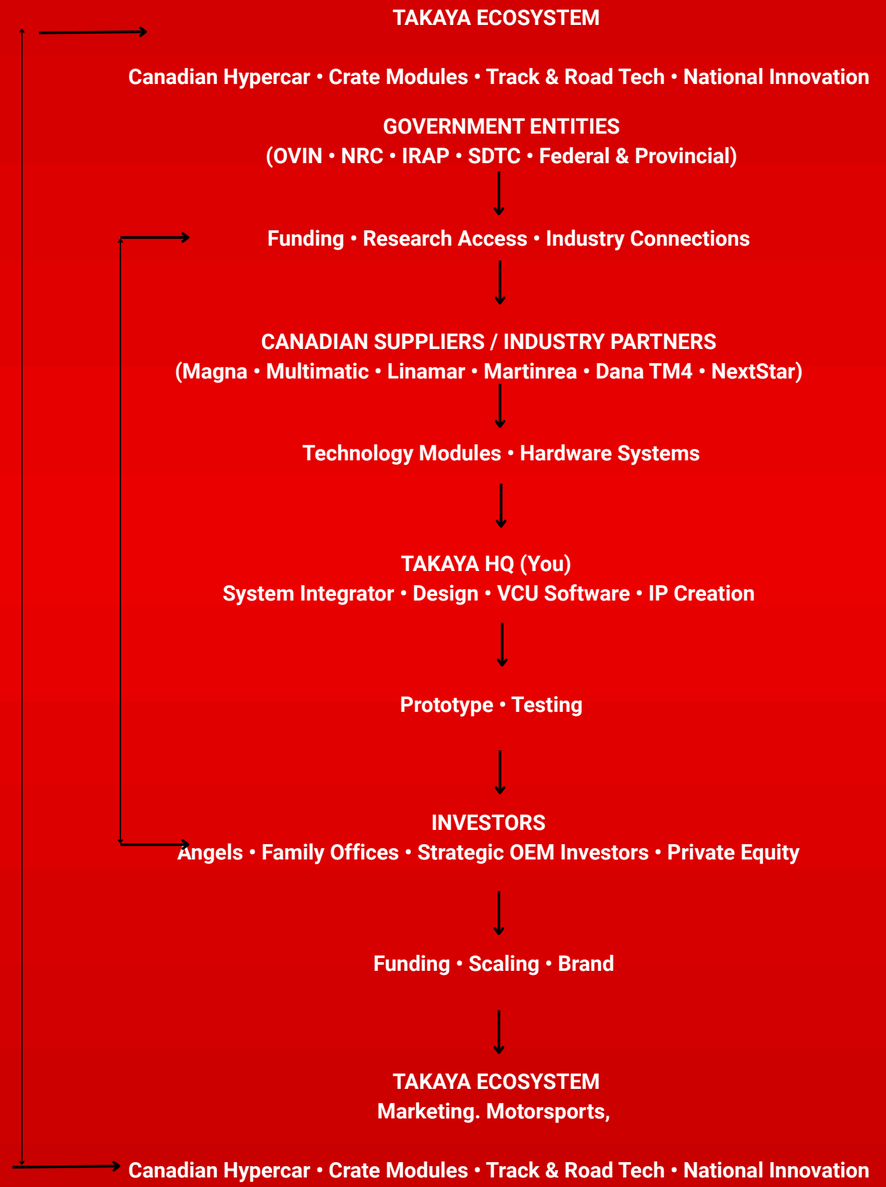


Category	Canada Already Produces (Canadian DNA)	Canada Does NOT Produce	Opportunity (IP + R&D Potential)
Chassis / Structure	Carbon monocoques (Multimatic)		
Aluminum frames			
Composite structures (Martinrea)	Full vehicle platform architecture	Develop Canadian structural integration standards + modular chassis IP	
Suspension	F1-level DSSV dampers (Multimatic)		
Track suspension systems	Proprietary adaptive suspension systems	Create Canadian active-damper logic + performance tuning IP	
Powertrain (ICE)	Small components, machining (Linamar)	Full engines (V6, V8, V10)	
Turbo systems	Hybrid integration R&D; performance mapping; engine-partner licensing		
Hybrid / EV Drive	E-axles, motors, inverters (Dana TM4)		
Hybrid gearboxes (Magna)	Unified hybrid control units		
Performance-focused hybrid mapping	Develop Canadian hybrid control software + torque-vectoring IP		
Battery Systems	Cell manufacturing (NextStar)		
Pack components			
Thermal management suppliers	Complete battery packs		
High-discharge performance modules	Create Canadian performance battery pack architecture + cooldown IP		
Aerodynamics	CFD research (universities)		
Composites manufacturing (Multimatic)	Active aero systems		
Fan systems			
Dynamic aero logic	Build Canadian aero-control algorithms + modular aero crate systems		
Braking	Structural integration, cooling components	Carbon ceramic braking systems	Develop thermal optimization + brake-by-wire integration IP
Electronics / Software	QNX OS		
Infotainment electronics			
ADAS components	Vehicle control units (performance VCU)		
Integrated software stack	Create Canadian VCU, control logic, and safety/diagnostic IP		
Interior / UX	Design talent (OCAD, IDC)		
Prototyping + industrial design	Automotive-specific UX systems		
Driver-mode interfaces	Build Canadian performance UI/UX language + driver interaction IP		
Tires	None	Performance tire manufacturing	R&D partnerships with tire companies; Canadian track-optimised compounds
Assembly	High-end manufacturing (Ontario plants)		
Prototype builds (Multimatic)	Full OEM-scale assembly culture	Develop small-series, low-volume performance assembly models	

DO WE HAVE EVERYTHING?

HOW MUCH OF A HIGH-PERFORMANCE VEHICLE CANADA ALREADY HAS?

CANADA ALREADY HAS (≈ 70% OF THE CORE SYSTEMS):

✓ **CARBON MONOCOQUE & STRUCTURE (100% CANADIAN)**
Multimatic builds monocoques for Valkyrie, Ford GT, GT3 race cars
Canadian composites & crash structures = world class

✓ **SUSPENSION SYSTEMS (100% CANADIAN)**
DSSV dampers, race suspension, control arms
Used in F1, WEC, GT racing

✓ **HYBRID GEARBOXES & E-DRIVE SYSTEMS (85% CANADIAN)**
Magna produces hybrid gearboxes, e-axles, driveline systems
Ready for high-performance integration

✓ **MOTORS & INVERTERS (80% CANADIAN)**
Dana TM4 produces world-class electric motors & power electronics

✓ **BATTERY CELLS & PACK COMPONENTS (60% CANADIAN)**
NextStar + POSCO supply lithium-ion cell manufacturing
Thermal systems and enclosures exist in Canada

✓ **STRUCTURAL & POWERTRAIN MACHINING (90% CANADIAN)**
Linamar, Martinrea → engine parts, housings, aluminum structures

✓ **ELECTRONICS & OS (70% CANADIAN)**
Blackberry QNX (used in automotive OS globally)
Magna/Vector electronics

CANADA DOES NOT HAVE (≈ 30% MISSING):

✗ **FULL ICE ENGINES (0% CANADIAN)**
Canada does not design or produce complete performance engines

✗ **CARBON-CERAMIC BRAKE SYSTEMS (0% CANADIAN)**
No domestic Brembo/AP Racing equivalent

✗ **PERFORMANCE TIRES (0% CANADIAN)**
No Canadian Michelin/Pirelli-level manufacturer

✗ **UNIFIED VEHICLE CONTROL SOFTWARE (0–10% CANADIAN)**
We have QNX OS but no Canadian-built performance VCU, torque vectoring logic, hybrid control maps

✗ **COMPLETE BATTERY PACK DESIGN FOR HYPERCARS (20% CANADIAN)**
We make cells but not high-discharge performance packs

✗ **ACTIVE AERODYNAMIC SYSTEMS (0–10% CANADIAN)**
Composites exist, but no dynamic aero-control IP

OPPORTUNITY SPACES FOR CANADIAN IP DEVELOPMENT

1. UNIFIED VEHICLE CONTROL SOFTWARE (VCU)
No Canadian OEM currently builds a full performance VCU.
Opportunity to develop software for:
✓ hybrid power distribution
✓ torque vectoring
✓ traction logic
✓ active aero control
✓ predictive cooling + diagnostics
High-value IP that can be licensed globally, like Rimac's technology.

2. ACTIVE AERODYNAMICS + AERO-CONTROL LOGIC
Canada has composites + monocoque capabilities but not active aero systems.
Developing adaptive aero (tunnels, fan systems, wings) creates:
✓ proprietary performance gains
✓ exportable modules
✓ a Canadian performance identity
Similar to how Koenigsegg built prestige around their aero and gearbox IP.

3. HIGH-DISCHARGE PERFORMANCE BATTERY PACK ARCHITECTURE
We manufacture cells, but not track-focused packs.
Opportunity to create:
✓ thermal management innovation
✓ quick-swap modules
✓ fast-charge solutions
This can become a Canadian battery platform used by motorsport, aviation, robotics.

4. BRAKE-BY-WIRE + THERMAL OPTIMIZATION SYSTEMS
Canada doesn't make carbon-ceramic discs, but we can innovate around:
✓ cooling management
✓ brake control software
✓ lightweight caliper structures
Much like how Brembo built a global empire around braking R&D.

5 TIRE R&D
Canada cannot easily build a tire factory initially
But we can build:
- compounds optimized for Canadian tracks
- winter-performance R&D
- track-day tire data systems
- collaborations with Pirelli/Michelin

6.CENTRAL INTEGRATION PLATFORM (KEY VALUE)
This is the core of the design:
A Canadian integration hub that orchestrates all systems — the brain, not the factory.
This platform becomes the product, similar to:
- Rimac Technology supplying Porsche, Aston Martin, Bugatti
- Cosworth Electronics supplying hybrid controls to F1
- Magna supplying gearboxes globally

HOW THE MISSING 30% CAN BE FILLED

(LICENSING + R&D PATHWAY)

SHORT TERM: LICENSE- MID TERM: CO-DEVELOP -LONG TERM: OWN THE IP.

1. ICE ENGINES — LICENSING FIRST, R&D LATER
Short-term: license performance crates (GM LT6, Ford GT engine, Cosworth).
Mid-term: co-develop modifications (intake, cooling, hybrid integration).
Long-term: Canadian-designed combustion architecture (like Koenigsegg did after 15 years).

2. BRAKING SYSTEMS — PARTNER FIRST, INNOVATE IN COOLING + CONTROL
Short-term: use Brembo/AP Racing crates.
Mid-term: develop Canadian brake-by-wire control algorithms.
Long-term: create proprietary lightweight calipers + thermal systems.

3. TIRES — NO MANUFACTURING, BUT HIGH-VALUE R&D
Short-term: use Michelin/Pirelli crates.
Mid-term: collaborate to build Canada-optimized compounds.
Long-term: launch a Canadian track-tire research division (similar to Bridgestone racing labs).

4.SOFTWARE, TORQUE VECTORING, HYBRID CONTROL — THE REAL GOLD MINE
Canada is uniquely positioned because:
✔ We have QNX (automotive OS)
✔ We have strong universities
✔ We have EV suppliers
Software IP can become:

- the biggest profit center
- a global export product
- licensable to OEMs worldwide

Canada's equivalent of Rimac’s technology division

5. BATTERY PACKS — BUILD AROUND EXISTING CELL SUPPLY
Short-term: buy cells from NextStar.
Mid-term: design a performance pack shell + thermal system.
Long-term: develop Canadian high-discharge pack IP for motorsport.

Canada’s missing 30% isn’t a weakness , it’s a roadmap for IP creation.
The systems we don’t have are exactly the systems that generate the highest profit in the global automotive industry.

WHO THIS PERFORMANCE ECOSYSTEM IS FOR

1. PERFORMANCE & MOTORSPORTS ENTHUSIASTS

People who love driving, not just owning cars.
They are drawn to F1, WEC, IMSA, NASCAR, GT racing — and want access to that world.
Their motivations:

- Emotion + sound + intensity
- Precision driving
- Real performance feedback (telemetry, data, progression)
- Experiences that go beyond public roads

Their frustration:

- Most hypercars overheat after 2–3 laps
- Track days require renting cars or paying massive fees
- They cannot access F1-level telemetry or coaching
- Many cars become garage art, not performance tools

This ecosystem exists to give them a real, usable, track-ready machine — not a museum piece.

2. CAR COLLECTORS & HIGH-NET-WORTH ENTHUSIASTS

A small but influential demographic that:

- Collects limited-production vehicles
- Values national identity and exclusivity
- Wants unique engineering stories
- Cares about provenance and brand heritage

Why they care:

- Canada has never had a performance brand — this fills a void
- Unique Canadian IP becomes historical value
- A functional performance platform is more compelling than static art

This demographic gives financial stability + prestige.

3. AMATEUR & SEMI-PRO TRACK DRIVERS

DRIVERS WHO:
Attend HPDE (High-Performance Driving Events)

- Want to improve their lap times
- Seek coaching, telemetry, real feedback
- Want a safe, predictable, track-optimized platform

Their pain points:

- Racing school costs are extremely high
- Dedicated track cars are unreliable or hard to maintain
- High-end simulators are expensive
- Data systems are confusing and fragmented

The platform gives them extended hot laps, real-time data, coaching tools like “F1-style feedback for normal people.”

4. CANADIAN PATRIOTS & NATIONAL IDENTITY SUPPORTERS

A demographic driven by pride and culture:

- Want Canada to have an iconic automotive brand
- Believe Canada underachieves in global tech visibility
- Want to support domestic innovation
- Align with government incentives and national strategy

They are cultural supporters and early adopters.

5. ENGINEERING STUDENTS, STEM LEARNERS & MOTORSPORT ASPIRANTS

People who want to learn by doing:

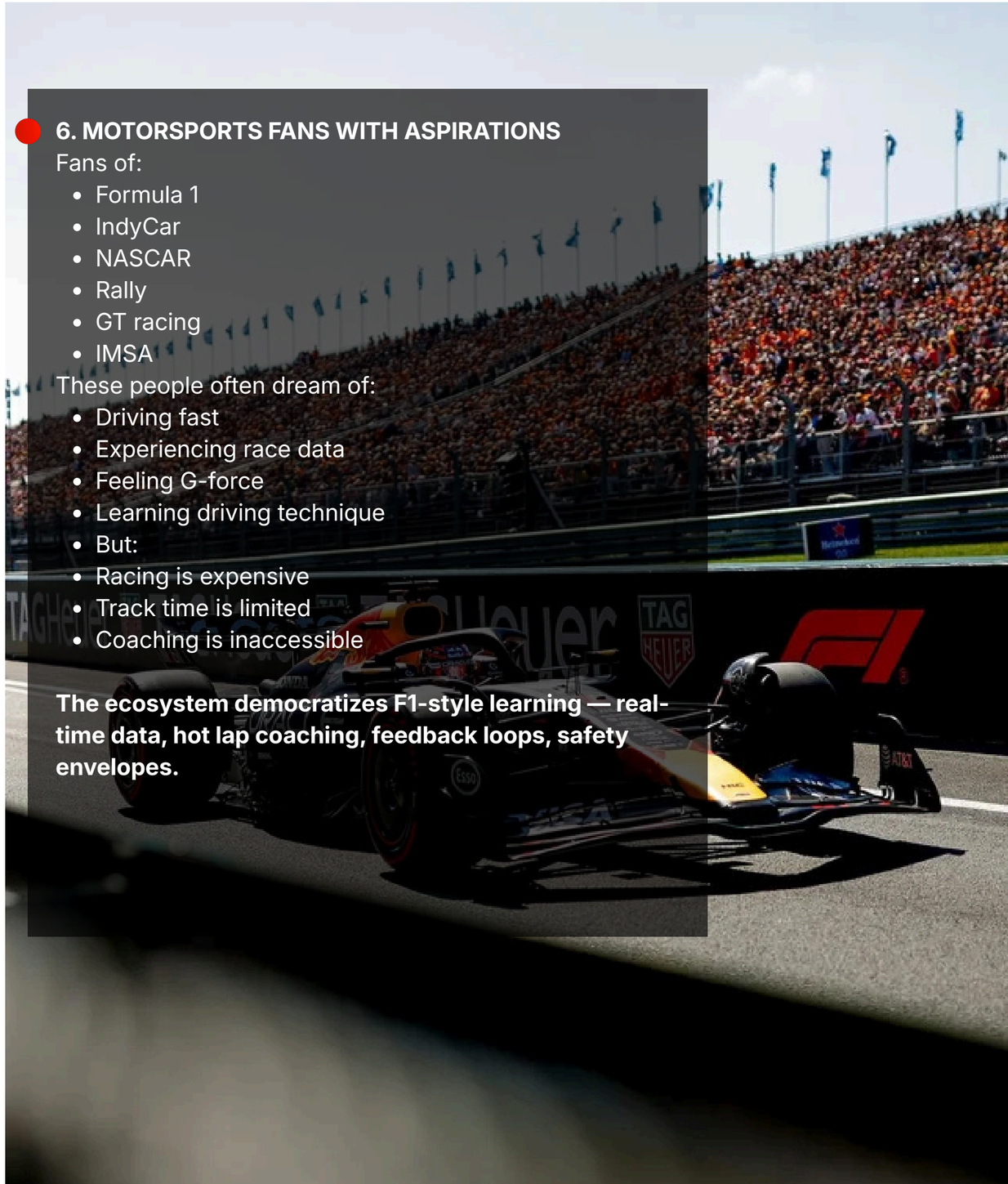
- Engineering students (UofT, Waterloo, McMaster)
- Design students (OCAD)
- Software & control systems students
- People who dream of entering motorsport engineering

Their frustration:

- Canada has no national learning platform
- Motorsport engineering is expensive and elite
- High-end hybrid/EV systems are inaccessible

The ecosystem gives them modules ("crates") they can study, test, and innovate with.

This ecosystem is designed for people who don't just want to own a car ,they want to use it, learn from it, grow with it, and access motorsport-level performance and telemetry traditionally reserved for the elite.
It transforms performance driving from a luxury into a learning platform.



6. MOTORSPORTS FANS WITH ASPIRATIONS

Fans of:

- Formula 1
- IndyCar
- NASCAR
- Rally
- GT racing
- IMSA

These people often dream of:

- Driving fast
- Experiencing race data
- Feeling G-force
- Learning driving technique
- But:
- Racing is expensive
- Track time is limited
- Coaching is inaccessible

The ecosystem democratizes F1-style learning — real-time data, hot lap coaching, feedback loops, safety envelopes.

GOVERNMENT AS A CORE ECOSYSTEM USER

WHY NATIONAL INSTITUTIONS BENEFIT FROM AND RELY ON THIS ECOSYSTEM

Government's Strategic Needs Align Perfectly With the Ecosystem

Canada wants:

- A domestic innovation platform
- A reason to fund homegrown automotive IP
- High-value engineering jobs
- National competitiveness in EV + hybrid tech
- A shift from low-margin assembly to high-margin IP development
- Global visibility beyond "supplier nation"

This ecosystem gives them all of this in one unified project.

Aligns With Existing Funding Streams

Programs such as:

- OVIN (Ontario Vehicle Innovation Network) — $100M+
- IRAP (Industrial Research Assistance Program)
- NRC (National Research Council) Automotive R&D
- SIF (Strategic Innovation Fund)
- SDTC (Sustainable Development Technology Canada)

All exist to fund exactly this type of work:

- hybrid/EV systems
- vehicle software
- battery technology
- predictive control systems
- IP development
- domestic manufacturing capacity

This ecosystem is a textbook fit for their priorities.

GOVERNMENT AS A USER: WHAT THEY GAIN

✓ Job Creation

High-value engineering jobs → $80k–$200k salaries

Not factory work → knowledge economy growth

✓ IP Ownership

Canada moves from "manufacturing for others" → creating our own tech

✓ Industry Diversification

Less dependence on foreign OEMs

More domestic autonomy

More resilience against tariff wars

✓ Technology Leadership

- Hybrid control systems
- Battery cooling
- Active aero
- VCU software
- Crate modularity

All exportable — high-margin IP, not low-margin assembly.

✓ National Identity Boost

A Canadian flagship performance ecosystem strengthens national pride.

The ecosystem gives Canada what it currently lacks a unifying technological platform that creates IP, jobs, capability, and national identity. Government becomes a user because the system solves their long-standing economic and innovation goals.

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SUPPLIERS AS CORE ECOSYSTEM USERS

WHY CANADA'S AUTOMOTIVE SUPPLIERS NEED THIS ECOSYSTEM TO GROW

1.CANADA HAS WORLD-CLASS SUPPLIERS — BUT NO PLATFORM TO SHOWCASE THEM

Major suppliers include:

- Multimatic → carbon monocoques, race programs
- Magna → hybrid gearboxes, EV systems, ADAS
- Linamar → structural/powertrain machining
- Dana TM4 → motors + inverters
- Martinrea → composites + lightweight structures

These companies build pieces of the world's best cars
but have no Canadian OEM to integrate them.
This ecosystem becomes the glue that brings them together.

2. SUPPLIERS GAIN A HIGH-VALUE MARKET: PERFORMANCE R&D

Suppliers normally work on:
mass-market contracts
low-margin OEM deals
outsourced international projects
This ecosystem gives them a new opportunity:
premium performance R&D
low-volume high-margin production
collaboration space
IP partnerships
technology visibility
This elevates their global reputation.

3. SUPPLIER PAIN POINTS THE ECOSYSTEM SOLVES

✓ Fragmentation
Suppliers rarely interact on deep system integration.
✓ No Halo Story
Canada lacks a narrative to promote their capabilities.
✓ Limited Innovation Freedom
OEM contracts restrict creativity.
✓ No Platform to Test IP Together
Testing hybrid systems, aero logic, and battery packs is difficult when working separately.
This ecosystem solves all four.

4. SUPPLIERS BECOME MORE THAN PART-MAKERS — THEY BECOME INNOVATION PARTNERS

Within the ecosystem, suppliers can:
co-develop new crates
test new hybrid systems
integrate motors + gearboxes with real data
validate aero solutions
collaborate on next-gen EV and performance systems
create licensable IP with you
This turns them into co-owners of innovation, not just contractors.

5. SUPPLIER OUTCOMES (WHY THEY CARE)

✓ New Markets

A performance ecosystem accesses global hypercar, motorsport, and EV markets.

✓ Technology Showcases

Multimatic built Valkyrie's monocoque → global recognition.

Your ecosystem gives them another Valkyrie-level showcase Canadian this time.

✓ IP Growth

Suppliers can develop:

- active aero systems
- EV integration modules
- torque vectoring crates
- battery cooling IP
- Talent Attraction
- Universities and suppliers form a shared pipeline.
- Increased Global Visibility

By being part of a national performance ecosystem, suppliers become more competitive globally.

Canadian suppliers are world-class individually, but lack a unifying platform.

This ecosystem transforms them from isolated parts manufacturers into an integrated, collaborative, IP-generating national performance network.

INVESTORS AS CORE ECOSYSTEM STAKEHOLDERS

WHY THE ECOSYSTEM IS ATTRACTIVE TO INVESTORS AND HOW IT CREATES LONG-TERM VALUE

1. INVESTORS WANT SCALABLE TECHNOLOGY, NOT JUST CARS

Car companies are high-capex, low-margin, risky investments.
But technology ecosystems software, control units, IP licensing are:

- scalable
- exportable
- high-margin
- defensible
- globally applicable
- much faster ROI

This ecosystem reframes the project from:
“investment in a car company”
to
“investment in a national automotive technology platform.”

2. CLEAR PARALLELS WITH GLOBAL SUCCESS STORIES

Rimac Technology: Started with a prototype car, became suppliers to:

- Porsche
- Hyundai
- Aston Martin
- Bugatti

Now valued in the billions.
Cosworth Electronics: Started in racing,now supplies most of:

- F1
- WEC
- IndyCar
- Supercars

Their revenue comes from IP + software, not cars.
Multimatic: Started as a supplier, now produces

- GT race cars
- Valkyrie chassis
- active dampers

Investors love businesses that scale into these models.

3. INVESTORS SEE 5 IMMEDIATE VALUE CENTERS

A. **IP Development (the most valuable asset)**
Software, torque vectoring logic, aero control systems
hese can be licensed globally.
Margins are extremely high.

B. **Crate Architecture Licensing**
The modular crate system can be sold to:

- universities
- motorsport teams
- engineering schools
- EV startups
- specialty OEMs

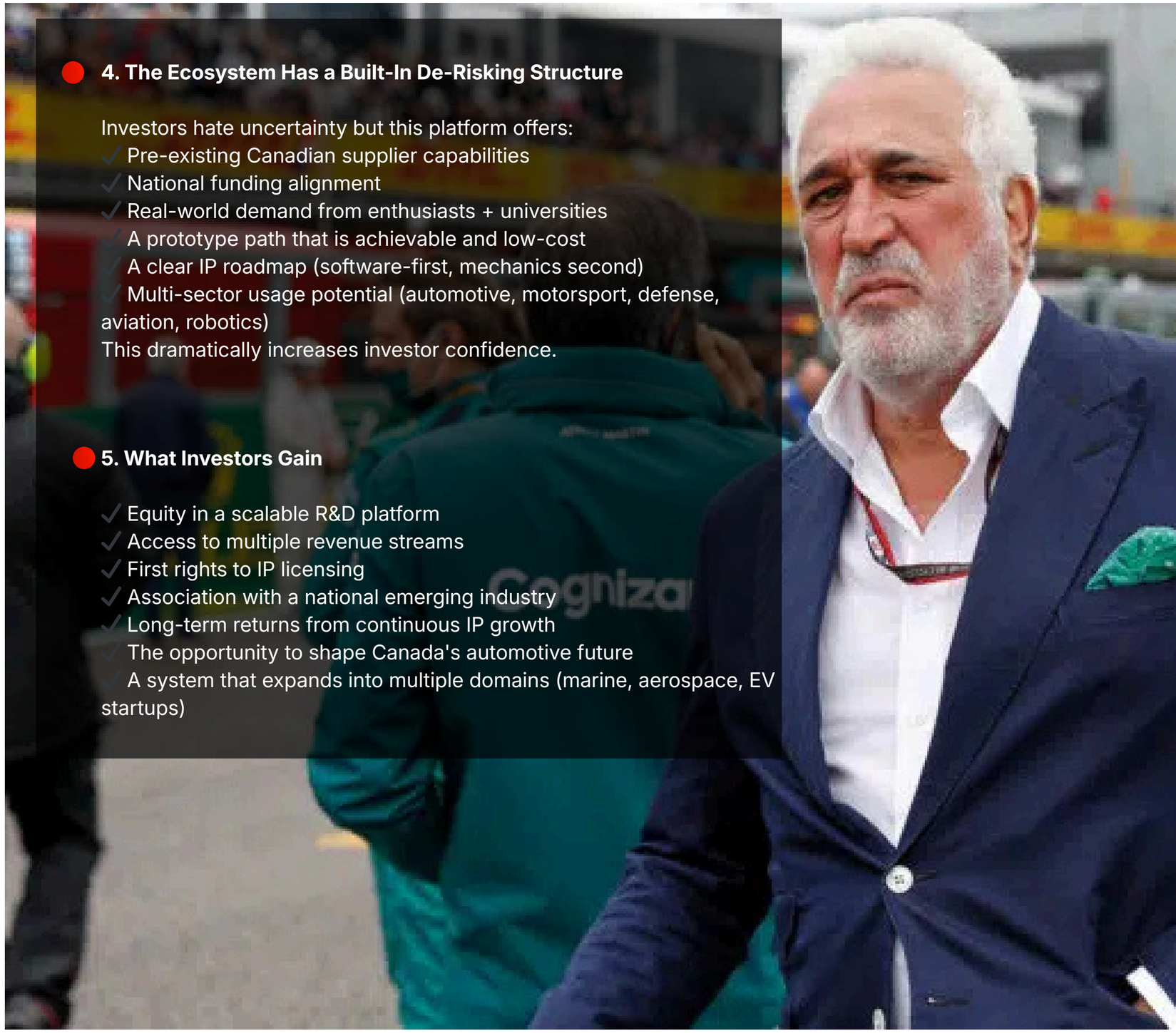
Much like how Rimac licenses drivetrains.

C. **Brand + Halo Product Value**
High-net-worth collectors fuel early revenue.
Limited-run halo products validate:
engineering capability
performance credibility
market demand
This is how Ferrari, Pagani, Koenigsegg built dynasty-level value.

D. Government Matching Funds
Investors love when:

- OVIN
- IRAP
- SIF
- NRC

match their investments with non-dilutive capital.
This reduces investor risk significantly.



4. The Ecosystem Has a Built-In De-Risking Structure

Investors hate uncertainty but this platform offers:
✓ Pre-existing Canadian supplier capabilities
✓ National funding alignment
✓ Real-world demand from enthusiasts + universities
✓ A prototype path that is achievable and low-cost
✓ A clear IP roadmap (software-first, mechanics second)
✓ Multi-sector usage potential (automotive, motorsport, defense, aviation, robotics)
This dramatically increases investor confidence.

5. What Investors Gain

✓ Equity in a scalable R&D platform
✓ Access to multiple revenue streams
✓ First rights to IP licensing
✓ Association with a national emerging industry
✓ Long-term returns from continuous IP growth
✓ The opportunity to shape Canada's automotive future
✓ A system that expands into multiple domains (marine, aerospace, EV startups)

HOW PEOPLE INTERACT WITH THE ECOSYSTEM

- **Supplier Ecosystem Interaction**

  Interaction:
  Suppliers contribute crates (modules) into the ecosystem:
  - hybrid gearbox crates
  - motor/inverter crates
  - monocoque crates
  - battery crates
  - aero components

  What they receive:
  - integration feedback
  - shared testing standards
  - new R&D opportunities
  - IP collaboration

  Value:
  Transforms isolated suppliers into a unified Canadian performance framework.

- **Government & Agencies Ecosystem Interaction**

  Interaction:
  Government provides:
  - funding
  - incentives
  - regulatory support
  - research partnerships

  What they receive:
  - Canadian IP
  - manufacturing diversification
  - job creation
  - national prestige
  - export potential

  Value:
  Positions the ecosystem as a national technology driver.

- **Investors Ecosystem Interaction**

  Interaction:
  Investors fund early R&D stages and receive:
  - dashboards
  - progress milestones
  - licensing pathways
  - technology valuation

  Value:

  They invest in a platform, not a car reducing risk and increasing ROI.

- **Drivers & Enthusiasts Ecosystem Interaction**

  Interaction:
  Drivers use:
  - Mode switching (Road → Track → Quali)
  - Telemetry feedback loops
  - Driving analytics
  - Track data recording
  - Performance coaching

  What they gain:
  - better driving ability
  - longer track sessions
  - predictable performance
  - a national identity product

  Value:
  Transforms the car from a luxury object a learning machine.

Students & Engineering Labs Ecosystem Interaction

Interaction:
Students and researchers receive:

- crate modules
- simulation data
- open test platforms
- hybrid control frameworks
- aero testing modules

What they produce:

- new IP
- improved crate designs
- software improvements
- engineering talent

Value:
Creates a national innovation pipeline.

The Ecosystem Core Hub (HQ)

All stakeholders interact through:

- crate integration
- system architecture
- performance software
- IP development pipelines
- R&D collaboration
- data exchange
- prototyping cycles

This is the central design artifact:
A Canadian performance engineering ecosystem.

WHY WE BEGIN WITH A HYPERCAR

NOT A SUPERCAR, SPORTS CAR, OR EVERYDAY VEHICLE

Starting with a hypercar is not a stylistic decision , it is a strategic business necessity rooted in economics, capability, supply chain logic, and national opportunity.

OEM Dominance Makes Mass-Market Impossible for a New Player

Global automotive manufacturing is dominated by giants like:

- Toyota
- GM
- Ford
- Volkswagen Group
- Hyundai/Kia
- Stellantis
- BMW, Mercedes, Audi

These companies control:

- decades-long supplier relationships
- global distribution networks
- billion-dollar factories
- vertically integrated logistics
- patent walls + regulatory barriers

economies of scale no startup can match

If a Canadian startup tried to compete with them in:

- sedans
- SUVs
- daily-use EVs
- compact cars

it would be crushed immediately.

Why?

- Because mass-market vehicles require:
- extreme scale
- razor-thin margins
- massive capital at risk
- continuous global supply chains
- dealership infrastructure
- warranties, recalls, service networks

A new company cannot enter at the bottom and compete with giants.
It must enter where giants do not operate intensely : the hypercar bracket.

Mass-Market Manufacturing Would Injure Canadian Suppliers

Canadian suppliers (Magna, Multimatic, Linamar, Martinrea, etc.) thrive because:

- They sell to many OEMs
- They are flexible, independent, high-precision Tier1s
- They do NOT rely on one Canadian OEM
- They specialize in niche, high-tech modules
- If a Canadian startup suddenly demanded:
- high volume
- low-cost parts
- tight mass-production deadlines
- cost-cutting
- exclusivity contracts

it would hurt suppliers by:

- forcing them to re-tool billion-dollar lines
- making them dependent on a new, unstable OEM
- exposing them to huge financial risk
- distracting them from profitable Tier1 contracts
- damaging long-term relationships with global OEMs

Suppliers DO NOT WANT mass-manufacturing pressure from a new Canadian brand.
They do want partnerships in:

- ✓ high-tech R&D
- ✓ hybrid systems
- ✓ aero structures
- ✓ carbon monocoques
- ✓ motorsports-tier components
- ✓ advanced prototyping

Hypercars Align With Supplier Strengths (Low Volume, High Precision)

Canadian suppliers are WORLD-CLASS at:

- advanced composites
- performance chassis
- battery systems
- EV motors
- torque vectoring systems
- precision machining
- motorsport engineering

They are NOT optimized for:

- mass-production of cheap sedans
- economy vehicle interiors
- fleet manufacturing
- stamping floors for $25k cars

Canada’s suppliers thrive in:

- motorsport
- aerospace
- robotics
- high-end automotive engineering
- small-volume production

A hypercar ecosystem leverages exactly what Canada is already good at.

Hypercars Have the Highest Profit Margin Per Unit

Supercars → low margin
Sports cars → thin margin
Mass-market → extremely thin margin
Hypercars → very high margin, because:

- low volume
- high exclusivity
- high technology
- bespoke craftsmanship
- collectors' demand
- global prestige
- large engineering multiplier

Hypercar pricing: $500,000 - $3,000,000
Unit cost: $100,000 - $400,000
Gross margin: 40% - 60%

This supports:

- R&D
- salaries
- ecosystem development
- prototype programs
- the crate library
- future expansion

A hypercar business can sustain itself on dozens of units, not tens of thousands.

Hypercars Require No Billion-Dollar Factories

A mass-market vehicle plant costs:

- ❌ $2–5 billion
- ❌ 5,000–10,000 workers
- ❌ global logistics
- ❌ government mega-deals
- ❌ decades to scale

A hypercar operation requires:

- ✓ design studio
- ✓ carbon/composite workshop
- ✓ small integration facility
- ✓ supplier-delivered subassemblies
- ✓ tool-making and rapid prototyping
- ✓ testing contracts with NRC/Multimatic

This is:

- realistic
- fundable
- manageable
- sustainable

Hypercars are the ONLY entry point where a Canadian OEM can realistically exist.

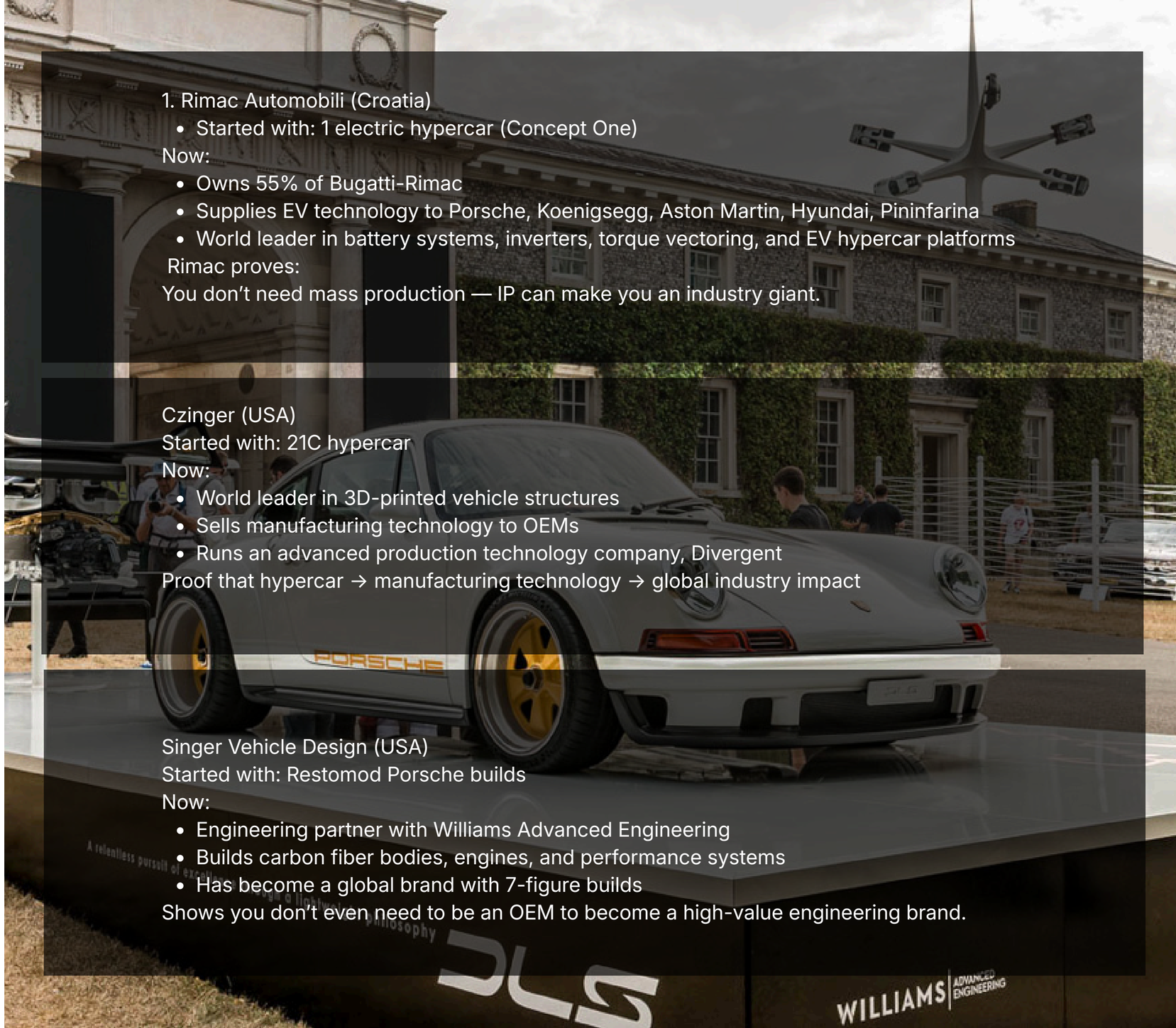
Hypercars For the Foundation Then Expansion Into Wider Markets

Once the hypercar ecosystem generates:

- crate library
- hybrid control IP
- torque vectoring IP
- aero systems
- battery modules
- brand identity
- supplier alignment
- investor confidence
- capital reserve

THEN expand into:

- ✓ performance SUVs
- ✓ mid-level sports cars
- ✓ GT tourers
- ✓ crossover EVs
- ✓ motorsport programs
- ✓ aerospace/robotics applications
- ✓ licensing to other OEMs



1. Rimac Automobili (Croatia)
   - Started with: 1 electric hypercar (Concept One)

Now:

- Owns 55% of Bugatti-Rimac
- Supplies EV technology to Porsche, Koenigsegg, Aston Martin, Hyundai, Pininfarina
- World leader in battery systems, inverters, torque vectoring, and EV hypercar platforms

Rimac proves:
You don’t need mass production — IP can make you an industry giant.

Czinger (USA)
Started with: 21C hypercar
Now:

- World leader in 3D-printed vehicle structures
- Sells manufacturing technology to OEMs
- Runs an advanced production technology company, Divergent

Proof that hypercar → manufacturing technology → global industry impact

Singer Vehicle Design (USA)
Started with: Restomod Porsche builds
Now:

- Engineering partner with Williams Advanced Engineering
- Builds carbon fiber bodies, engines, and performance systems
- Has become a global brand with 7-figure builds

Shows you don’t even need to be an OEM to become a high-value engineering brand.

ECOSYSTEM COST BENCHMARKING & INVESTMENT LOGIC

- The cost structure of this ecosystem follows the same financial logic used by modern hypercar companies like Rimac, Koenigsegg, Aston Martin (Valkyrie), and Red Bull (RB17).
  These programs are not expensive because of the car itself, but because of the ecosystem required: system architecture, hybrid software, aero development, supplier integration, prototyping, and validation.
  When benchmarked against real hypercar programs, the projected $12.5M–$25M CAD ecosystem investment is not only realistic but conservative, given that RB17 and Valkyrie exceeded $40M–$50M in R&D.
  The model is positioned in the “smart startup zone,” where outsourcing to Canadian suppliers (Multimatic, Magna, TM4, Linamar) dramatically reduces overhead by not requiring a billion-dollar factory.
  This is how companies like Rimac and Pagani scaled: high-IP development, low-volume production, premium pricing, and long-term licensing opportunities.

Category	Takaya Ecosystem	Rimac Nevera	Koenigsegg Jesko/Gemera	Valkyrie	RB17
R&D Program	$4M–$9M	~$12M	~$10M–$15M	~$20M	~$25M
Prototype Build	$7M–$12M	~$10M	~$5M–$8M	~$15M	~$20M
Testing + Validation	$1.5M–$4M	~$5M	~$3M	~$5M	~$8M
Total Program Cost	**$12.5M–$25M**	**$27M–$30M**	**$18M–$26M**	**$40M+**	**$50M+**

Per-Car Manufacturing Cost Comparison

Component	Your Cost	Rimac	Koenigsegg	Valkyrie
Monocoque	$180K–$250K	~$200K	~$250K	~$300K
Hybrid Gearbox	$40K–$70K	N/A (EV 1-speed)	~$50K	~$80K
Motors (TM4 dual axle	$45K–$70K	~$50K	~$40K	~$60K
Battery Pack	$18K–$35K	~$30K	~$40K	~$50K
Carbon Body Panels	$35K–$70K	~$70K	~$100K	~$120K
Suspension	$10K–$25K	~$20K	~$25K	~$30K
Brakes (Carbon	$18K–$30K	~$25K	~$25K	~$30K
Interior	$10K–$30K	~$20K	~$40K	~$50K
Assembly	$30K–$60K	~$50K	~$70K	~$90K
Total Per Unit Cost	**$415K–$700K**	**$450K–$650K**	**$600K–$750K**	**$750K–$900K**

Sales Price Comparison (Market Reality)

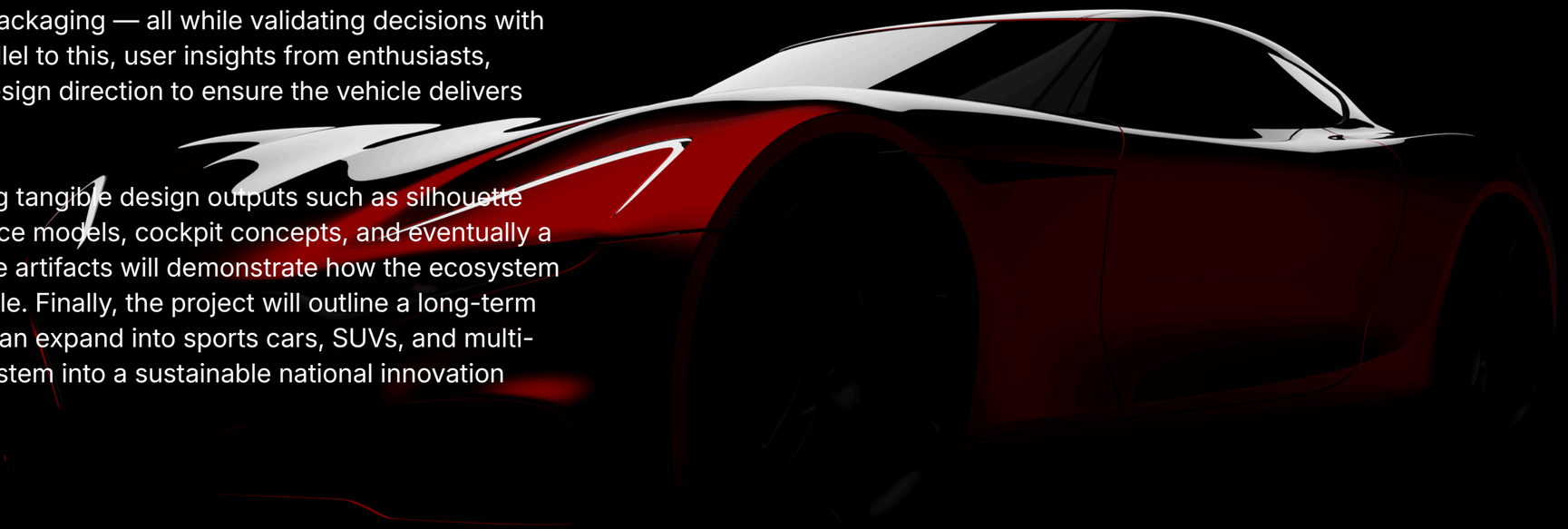
Brand / Car	Per-Car Cost	Sale Price	Margin
Your Hypercar	$415K–$700K	**$1.5M–$2.2M**	**3×**
Rimac Nevera	~$600K	~$3M	5×
Koenigsegg Jesko	~$650K	~$3M	4.5×
Valkyrie	~$800K	~$4M	5×
Pagani Utopia	~$500K	~$2.6M	5×

- These costs are market-based assumptions derived from comparable hypercar programs such as Rimac, Koenigsegg, Valkyrie, and RB17. The ranges reflect typical R&D, prototyping, and low-volume manufacturing economics in the high-performance automotive sector, adjusted for Canadian regional supplier capability (Multimatic, Magna, TM4, Linamar). While exact numbers may vary during real development, these benchmarks provide a realistic financial framework grounded in similar product models, competitive platforms, and the current supplier ecosystem. In summary, these values represent industry-aligned assumptions, not fixed or guaranteed costs.

TRAJECTORY

With the ecosystem framework established this semester, the next phase shifts from research and system architecture into actual vehicle design and prototype development. The goal is to translate the crate ecosystem, stakeholder interactions, and performance strategy into a coherent physical concept. This includes developing the exterior proportions, aerodynamic philosophy, interior experience, and hybrid packaging — all while validating decisions with real industry experts such as engineers Parallel to this, user insights from enthusiasts, collectors, and track drivers will refine the design direction to ensure the vehicle delivers emotional and performance value.

The second semester will focus on producing tangible design outputs such as silhouette sketches, aero tunnel integration, early surface models, cockpit concepts, and eventually a digital prototype or a scale clay model. These artifacts will demonstrate how the ecosystem becomes a real Canadian performance vehicle. Finally, the project will outline a long-term roadmap showing how a hypercar platform can expand into sports cars, SUVs, and multi-sector technologies, transforming this ecosystem into a sustainable national innovation pathway.



THANK YOU