ADVANCED METAL FOAMS

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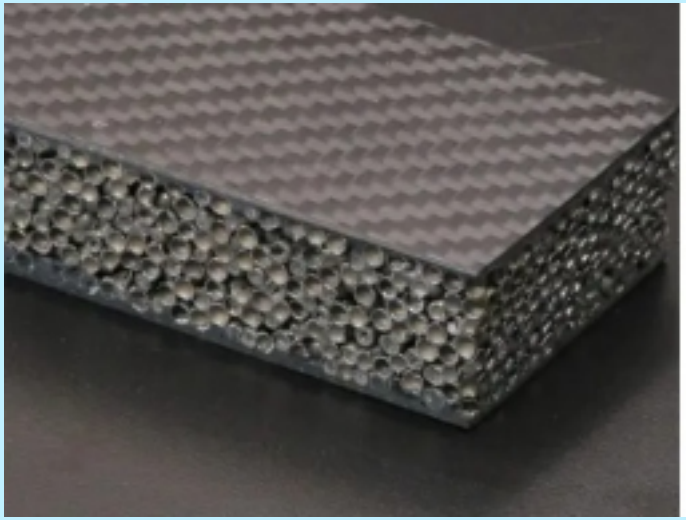
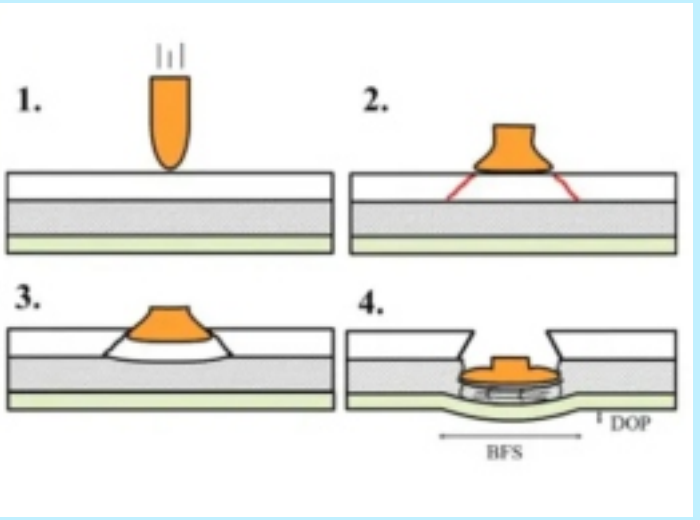
If the front doors of Police Vehicles were treated with Advanced Metal Foams, they could act as a bulletproof shield.
Examining the weight and cost per vehicle, requires a more complete feasibility study.

It is expected that this vehicle armor may also be deployed as a removable personal shield.

Law Enforcement Partners are being actively sought to engage in field tests and studies regarding the deployment of this amazing new material.





INDUSTRIES
SECURITY

ADVANCED METAL FOAMS

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RESEARCH
INNOVATION

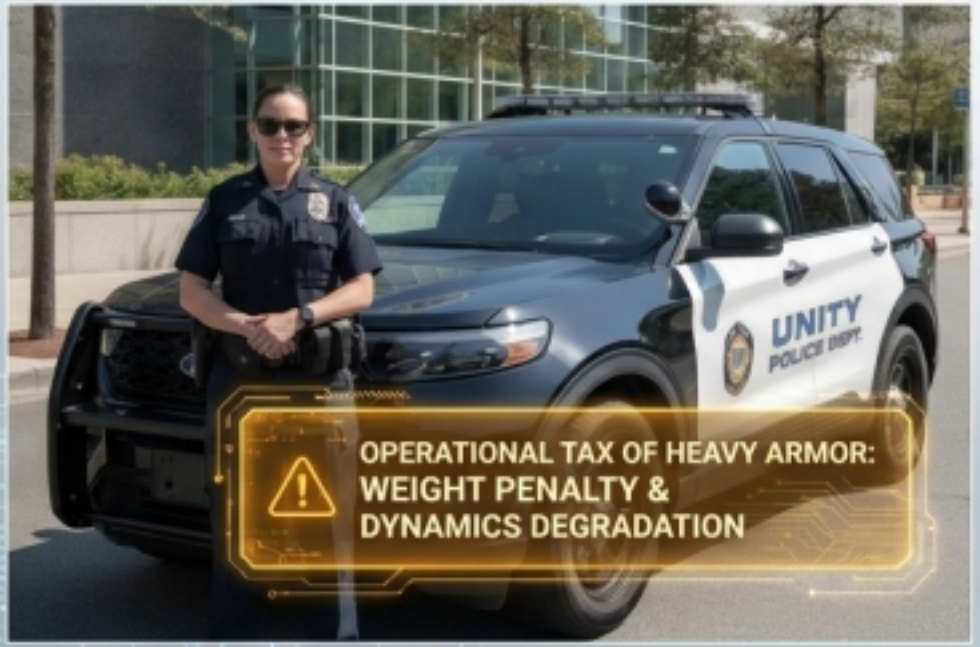
ZERO-COMPROMISE FLEET SURVIVABILITY

Advanced CMF Armor Integration for Modern Patrol Operations

DOMISTAT - RESEARCH FOR LAW ENFORCEMENT

ADVANCED METAL FOAMS

The Historical Compromise of Fleet Protection



1

Side A: Officer Safety Mandate

Achieving NIJ Level III/IV protection traditionally requires heavy Rolled Homogeneous Armor (RHA) steel.

2

Side B: Fleet Agility Penalty

Adding heavy steel compromises vehicle gross weight ratings (GVWR), destroys suspension systems, increases braking distances, and degrades fuel economy.

Leadership has historically been forced to choose between optimal ballistic protection and viable vehicle dynamics. That paradigm is now obsolete.

Closed-Cell Metal Foam (CMF) Architecture

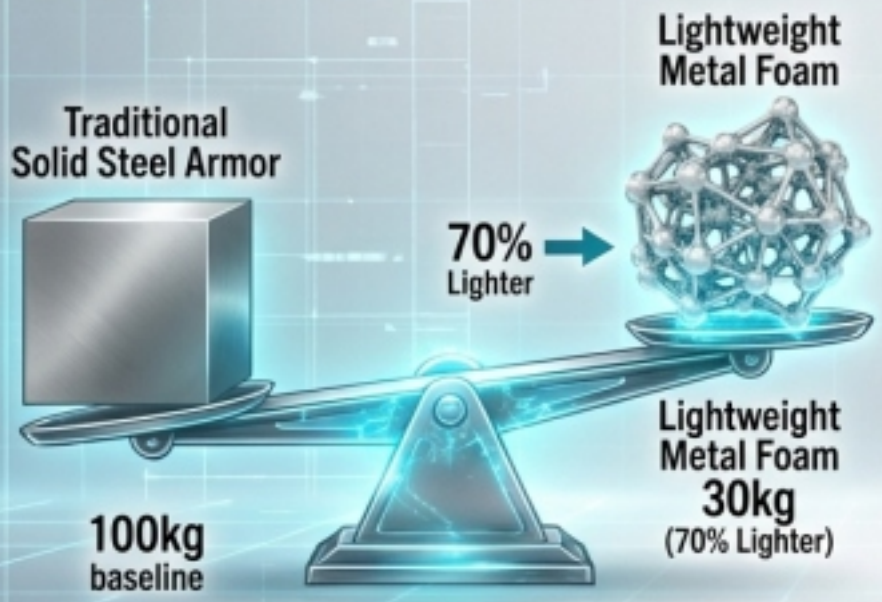
Ultra-Lightweight Core: Achieves equal or superior ballistic protection at a fraction of the mass of conventional slabs.

Multi-Threat Capability: Inherent thermal resistance and acoustic attenuation properties.

Energy Diffusion: Hollow-sphere matrix designed to absorb and diffuse shock waves rather than simply resisting blunt impact.

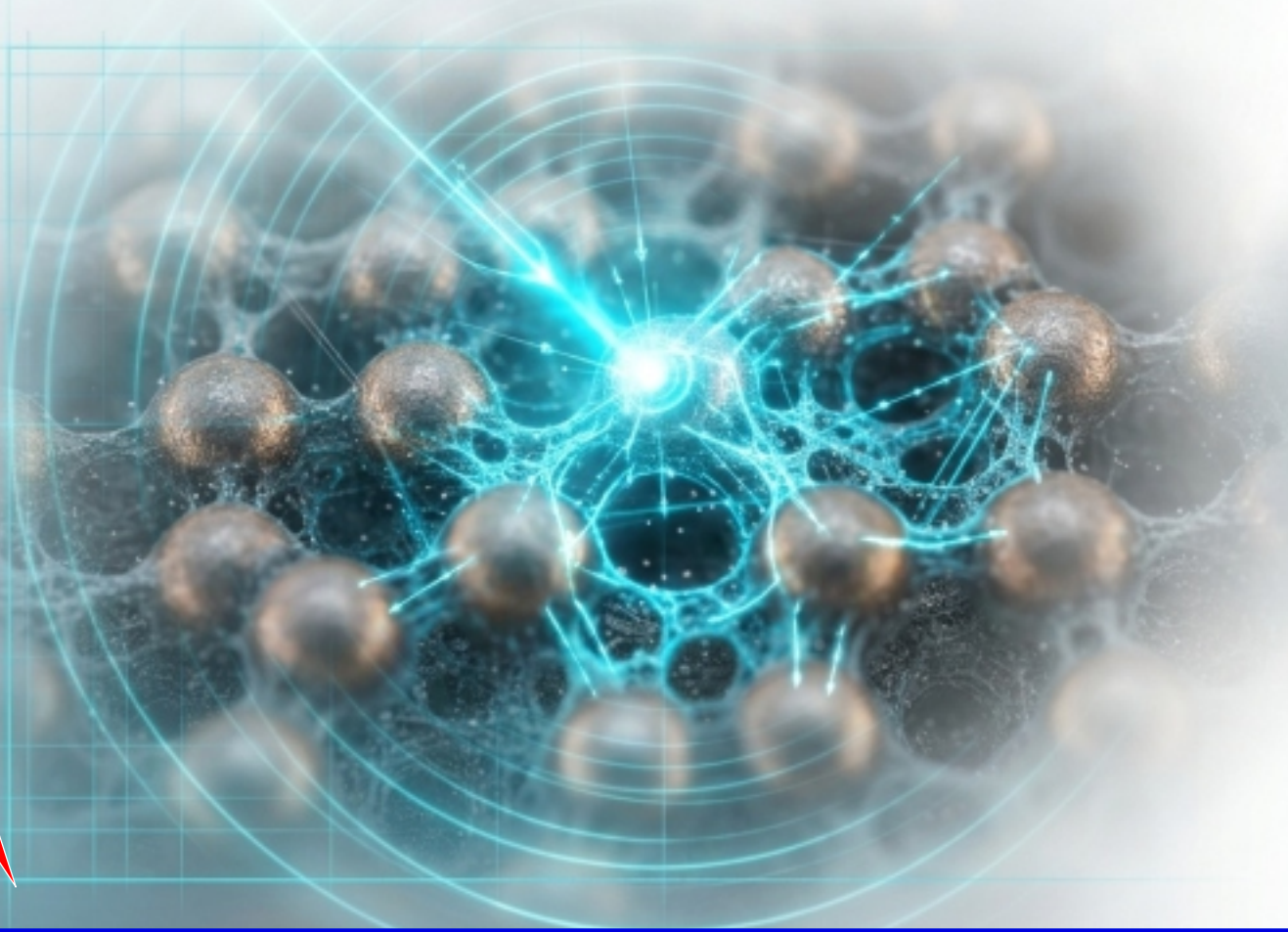
A de-risked, cost-effective upgrade moving advanced aerospace materials into pragmatic law enforcement applications

Armor Evolution Matrix: RHA Steel vs. CMF



Traditional Solid Steel Armor	Lightweight Metal Foam
Mass / Weight	
100kg baseline	30kg (70% Lighter)
Ballistic Threshold	
NIJ III/IV rated	Equal/Better (Stops military-grade .30 and .50 cal)
Spall Management	
Low (High fragmentation risk)	High (Internal open-cell/graded foams catch fragments)
Vehicle Dynamics Impact	
Severe penalty to GVWR	Negligible impact on pursuit performance
Integration Profile	
Requires factory redesign & heavy hinges	Modular door cavity retrofit

The Science of Survivability: Micro-Architecture



1. **Kinetic Impact**
   A high-velocity projectile strikes the outer ceramic face.

2. **Energy Transfer**
   Instead of a localized structural failure, the force is transferred into the CMF core.

3. **Cellular Collapse**
   The hollow-sphere architecture progressively crushes, absorbing massive amounts of kinetic energy.

4. **Shockwave Diffusion**
   The blast/shock wave is diffused across the metallic matrix, drastically reducing the acceleration transmitted to the occupants.

Multi-Spectrum Energy Dispersion

Thermal Shielding

Demonstrates significantly higher resistance to heat transfer than solid stainless steel. Protects internal vehicle wiring and delays ammunition cook-off during prolonged engagements.

Acoustic & Vibration Damping

The internal void spaces within the foam attenuate harsh acoustics and dampen high-frequency vibrations, protecting sensitive onboard electronic sensor suites.

Blast Mitigation

Underbody application potential; the foam-cored structures absorb IED/mine blast energy without requiring massive steel V-hull retrofits.

Non-Invasive OEM Integration Architecture

Ceramic Strike Face:
The primary disruptor for incoming high-caliber rounds.

CMF Core:
The primary kinetic energy and thermal absorber.

Metallic Backer:
The structural support and final spall liner.

Integration Metrics

- **Fitment:** Engineered to fit completely within existing OEM door cavities.
- **Functionality:** Zero obstruction to existing window mechanisms, latches, or electronic wiring harnesses.
- **Aesthetics:** Maintains the standard civilian-facing appearance of the patrol unit.

Preserving Pursuit Dynamics and Fleet Agility

FLEET PERFORMANCE METRICS

GVWR Compliance — UNDER LIMIT

Targeting a weight-increase-to-protection ratio that keeps the cruiser well under Gross Vehicle Weight Ratings.

Braking Distance — FACTORY STANDARD

70% lighter armor mass ensures factory-standard braking performance is not compromised during high-speed pursuits.

Fuel Economy — EFFICIENT

Avoids the massive fuel consumption penalty associated with traditional multi-ton steel fleet up-armoring.

Hinge Torque — NORMAL LOAD

Eliminates the need for specialized, heavy-duty door hinges, preserving standard ergonomics for officers.

The Modular Fleet Advantage

1. Uncompromised Officer Safety

NIJ Level III/IV rated ballistic and blast resistance. Life-saving survivability in the field.

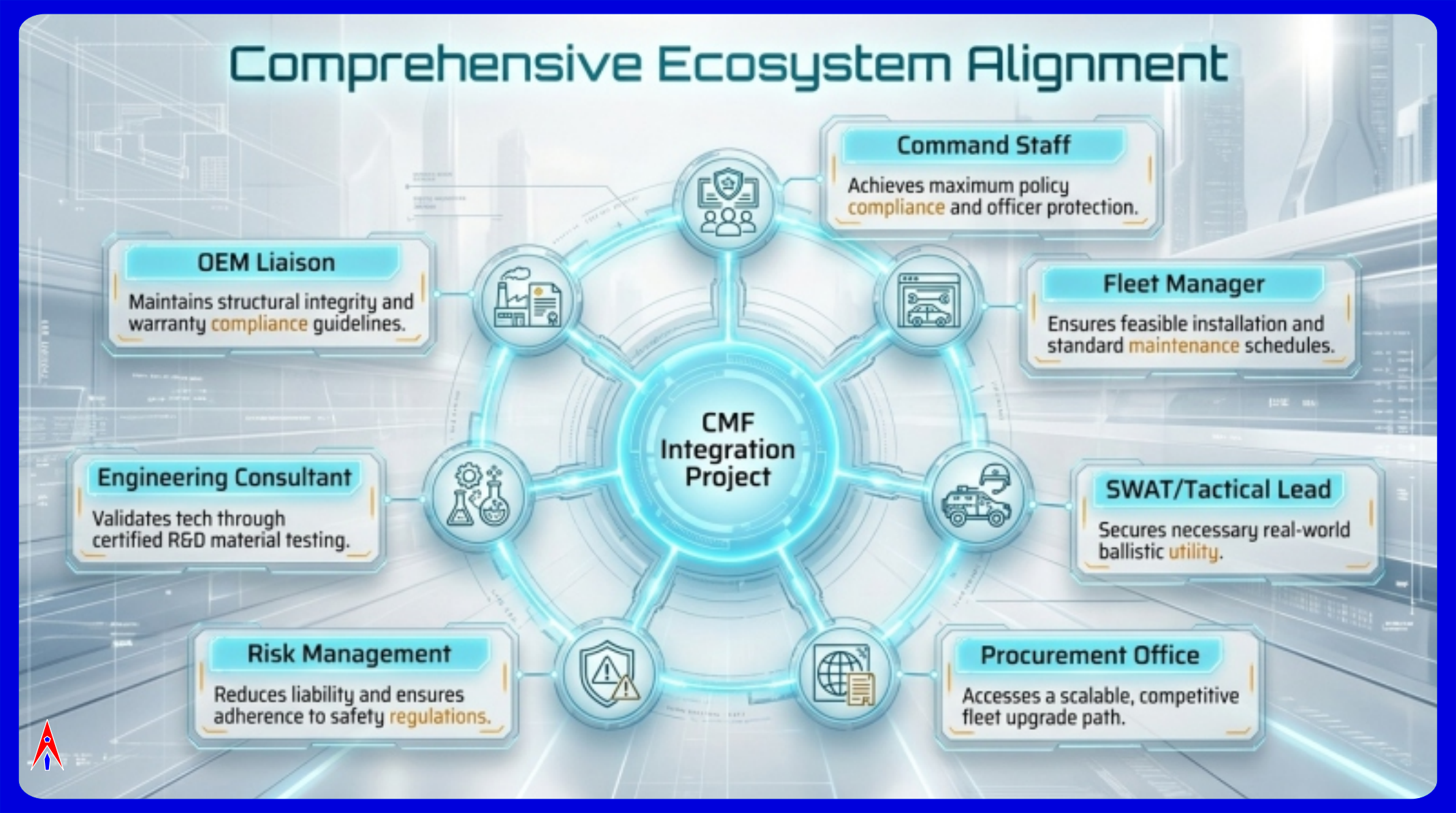
2. Maintained Vehicle Performance

Unaffected braking, acceleration, and handling due to severe mass reduction.

3. Unprecedented Cost-Efficiency

Kit-scale retrofitting at existing maintenance facilities. No need to purchase entirely new armored platforms.

Comprehensive Ecosystem Alignment



Manufacturing Readiness & Scalability

Step 1 : Specialized Core Production

Production of hollow-sphere and syntactic foam feedstocks.

Step 2: Automated Fabrication

Utilizing high-precision CNC trimming and controlled adhesive curing cycles to bond face sheets.

Step 3: Modular Standardized Kits

Moving away from complex, full-hull redesigns. Producing repeatable, standardized module sizes for doors and underbody zones.

Step 4: Localized Fleet Integration

Shipping flat-pack kits directly to municipal maintenance bays for rapid bolt-on/drop-in installation.

STRATEGIC INTEGRATION PARTNERSHIPS

METALLIC FOAM PRODUCERS
Supplying stabilized aluminum foam (SAF) and advanced core materials (e.g., AlCarbon, Cymat).

AEROSPACE DEFENSE FABRICATORS
Executing complex armor geometry via precision CNC and water-jet cutting.

BALLISTIC TESTING LABS
Independent validation and NIJ Level III/IV performance verification (e.g., H.P. White).

VEHICLE UPFITTERS
Experienced police cruiser modification experts ensuring structural OEM integration.

UNIVERSITY MATERIALS ENGINEERING
Ongoing proprietary alloy development and stress testing.

PHASED FEASIBILITY & DEVELOPMENT PATH (PHASES 1-2)

PHASE 1:
MATERIAL R&D & BALLISTICS
(MONTHS 1-4)

PHASE 2:
INTEGRATION & DESIGN
(MONTHS 5-8)

PHASE 3

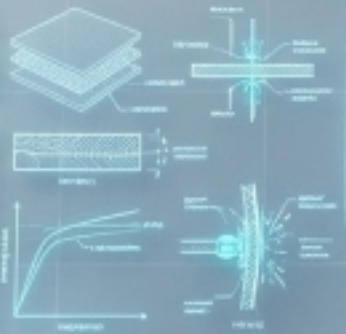
PHASE 4

Flight Path

PHASE 1: MATERIAL R&D & BALLISTICS (MONTHS 1-4)

OBJECTIVE:
Validate ballistic performance.

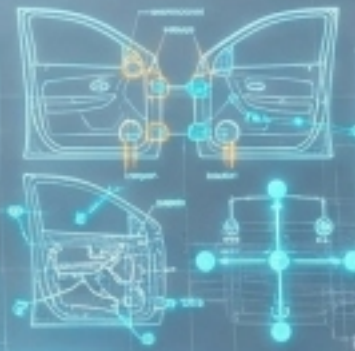
ACTIONS:
- Establish baseline density/porosity for CMF grades.
- V50 testing with .44 Mag and 7.62mm rounds.
- Compile stress-strain curves.



PHASE 2: INTEGRATION & DESIGN (MONTHS 5-8)

OBJECTIVE:
Viable door-panel prototype.

ACTIONS:
- FEM analysis on hinge loads.
- Ensure cavity compatibility (wiring/windows).
- Target strict GVWR ratios.



PHASED FEASIBILITY & DEVELOPMENT PATH (PHASES 3-4)

PHASE 1:
MATERIAL R&D & BALLISTICS
(MONTHS 1-4)

PHASE 2:
INTEGRATION & DESIGN
(MONTHS 5-8)

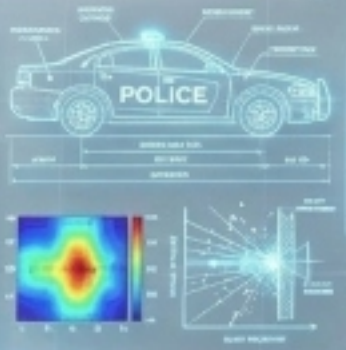
PHASE 3
(MONTHS 9-12)

PHASE 4
(MONTHS 13+)

PHASE 3: VEHICLE TESTING & PILOT (MONTHS 9-12)

OBJECTIVE:
Field-test on active patrol platform.

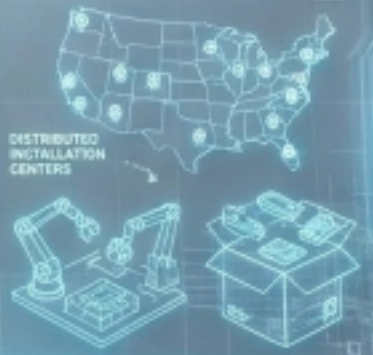
ACTIONS:
- MIL-STD-810G vibration, shock, and thermal cycling.
- Road test for fuel efficiency and handle torque.
- Full-scale blast/spall verification.



PHASE 4: SCALING & ROLLOUT (MONTHS 13+)

OBJECTIVE:
Broad commercialization and fleet adoption.

ACTIONS:
- Secure final NIJ Level III/IV certification docs.
- Finalize scalable casting/bonding workflows.
- Distribute standardized installation kits to local facilities.



PROACTIVE RISK MITIGATION DASHBOARD

TECHNICAL RISK

Mitigated via iterative prototype testing & varying alloy compositions.

INTEGRATION HURDLES

Mitigated via high-fidelity CAD/FEM modeling & lightweight mounting brackets.

OPERATIONAL/SUPPLY CHAIN

Mitigated by sourcing multiple suppliers & initiating long-lead procurement in Phase 1.

REGULATORY APPROVAL

Mitigated by engaging NIJ bodies early & partnering directly with OEM engineering.

FINANCIAL OVERRUNS

Mitigated by strict phase-gate reviews and locked 15% contingency funds.

ADVANCING FLEET SURVIVABILITY

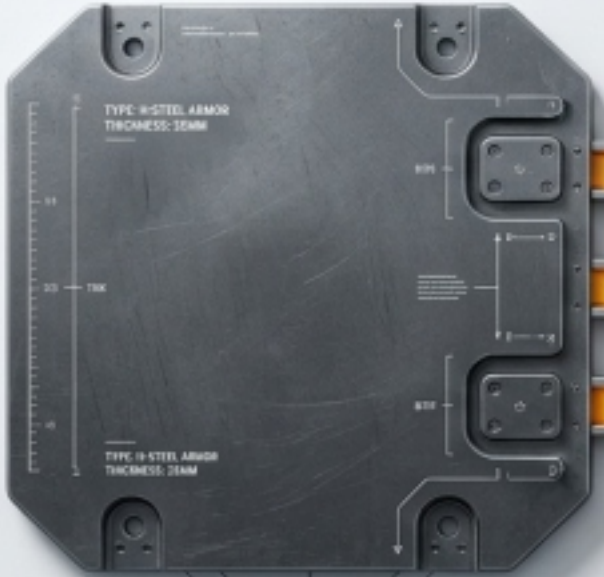
CMF offers a unique, life-saving energy-absorption profile that traditional steel cannot match. It provides a safer, more effective shield that preserves your vehicle mechanics and optimizes your municipal budget.

Let us transition this technology from the engineering lab to your patrol routes. We propose scheduling a Phase 1 Pilot Evaluation to empirically demonstrate these capabilities on your existing fleet.

Next-Generation Fleet Armor: The Agility Imperative

Restoring operational dynamics through Composite Metal Foam engineering.

THE HIDDEN COST OF STEEL BALLISTIC PROTECTION



DIMINISHED ACCELERATION

Heavy steel paneling severely limits pursuit speed and initial response times.

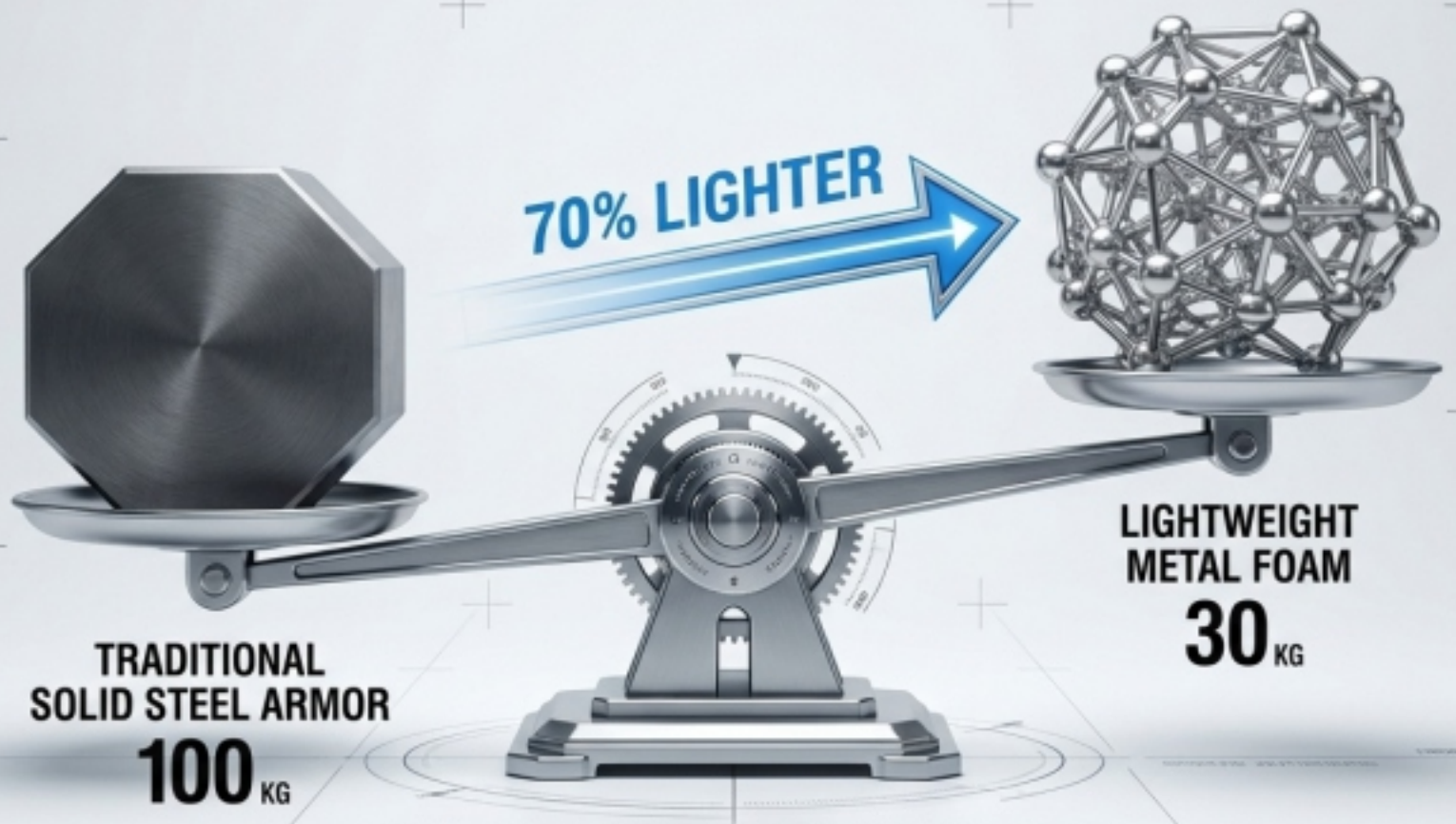
SLUGGISH HANDLING

High center of gravity and excess door weight drastically reduce cornering stability and emergency maneuverability.

DETERIORATED SUSPENSION

Constant structural strain leads to accelerated wear on hinges, struts, and braking systems, driving up maintenance costs.

THE BREAKTHROUGH: 70% WEIGHT REDUCTION



MAINTAINING UNCOMPROMISING BALLISTIC INTEGRITY.

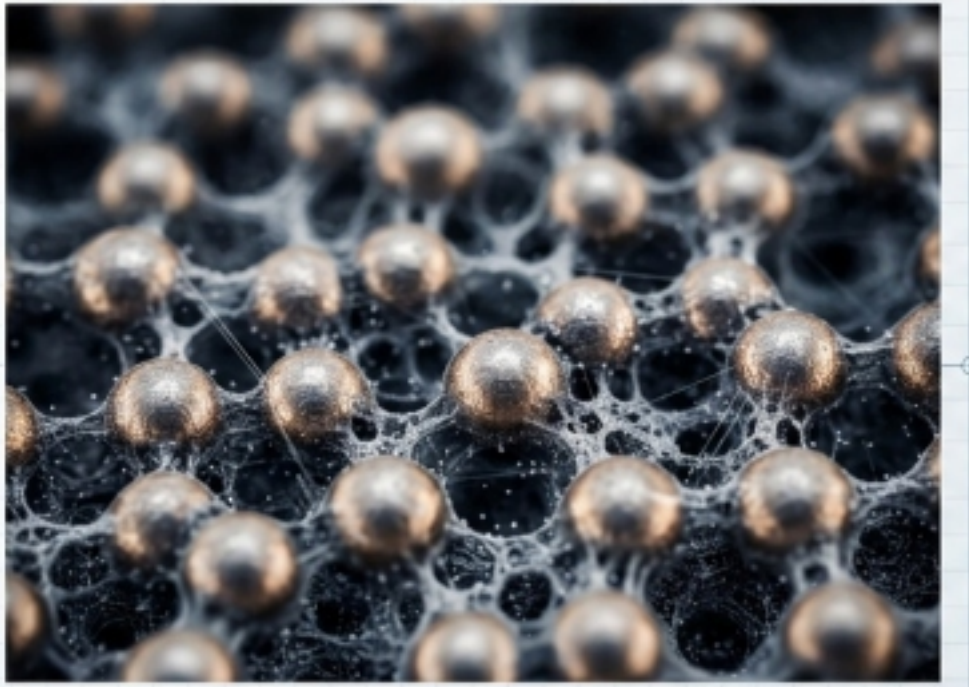
STRUCTURAL ANATOMY OF COMPOSITE METAL FOAM (CMF)

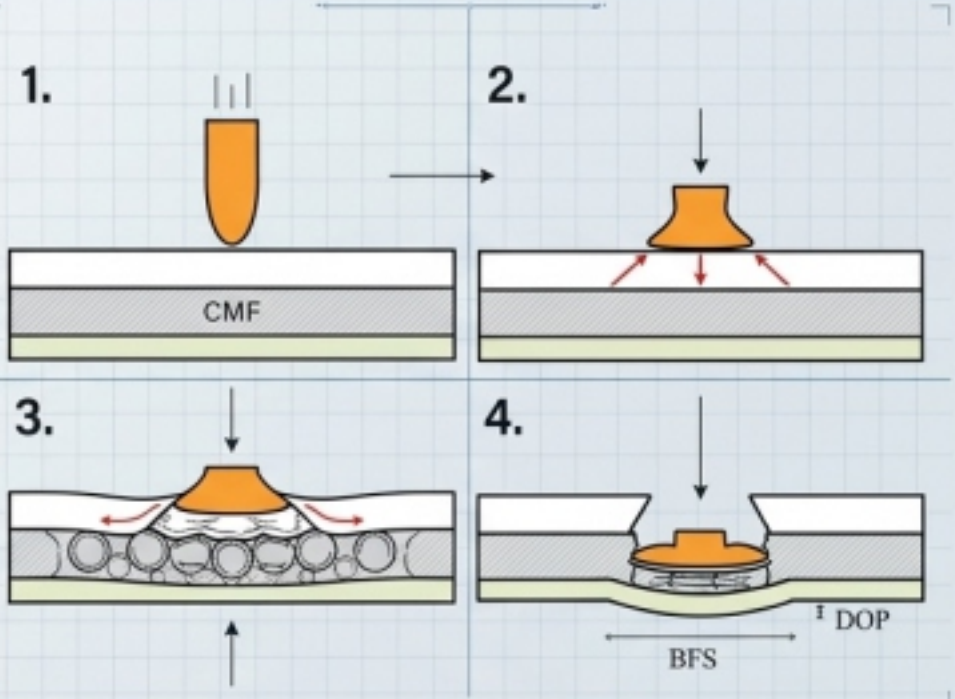
CERAMIC STRIKE FACE
The rigid outer layer designed to immediately blunt and fracture the incoming projectile.

CMF CORE
The engineered metallic foam matrix that performs the primary kinetic absorption.

METALLIC BACKER / TRAUMA FOAM
The inner foundation that provides structural rigidity and prevents backface deformation.

KINETIC ENERGY ABSORPTION MECHANICS





1. INITIAL STRIKE:
High-velocity impact on the ceramic outer layer.

2. PROJECTILE DEFORMATION:
The strike face forces the round to flatten ("mushroom"), distributing the force over a wider surface area.

3. CELLULAR CRUSHING:
The hollow spheres within the CMF core systematically collapse, acting as microscopic crumple zones to absorb the kinetic shockwave.

4. ENERGY DISSIPATION:
The kinetic energy is fully transformed and dissipated, neutralizing the threat without transferring lethal blunt force trauma.

PERFORMANCE MATRIX: STEEL VS. CMF TECHNOLOGY

	SOLID STEEL PLATES	CMF ARMOR
SYSTEM WEIGHT	100 kg/panel	30 kg/panel
VEHICLE DYNAMICS	Sluggish, high inertia	Agile, factory-spec handling
BALLISTIC RATING	NIJ Certified	NIJ Certified
TACTICAL FLEXIBILITY	Fixed to vehicle	Deployable as personal shield

FLEET AGILITY AND PERFORMANCE RESTORED

ACCELERATION PROFILES:
Shaving 70kg per door instantly restores factory-rated pursuit acceleration.

BRAKING DISTANCE:
Significantly reduced stopping distances due to lower overall mass, crucial for urban environments.

CORNERING STABILITY:
Lowered center of gravity ensures the vehicle remains planted during high-speed evasive maneuvers.

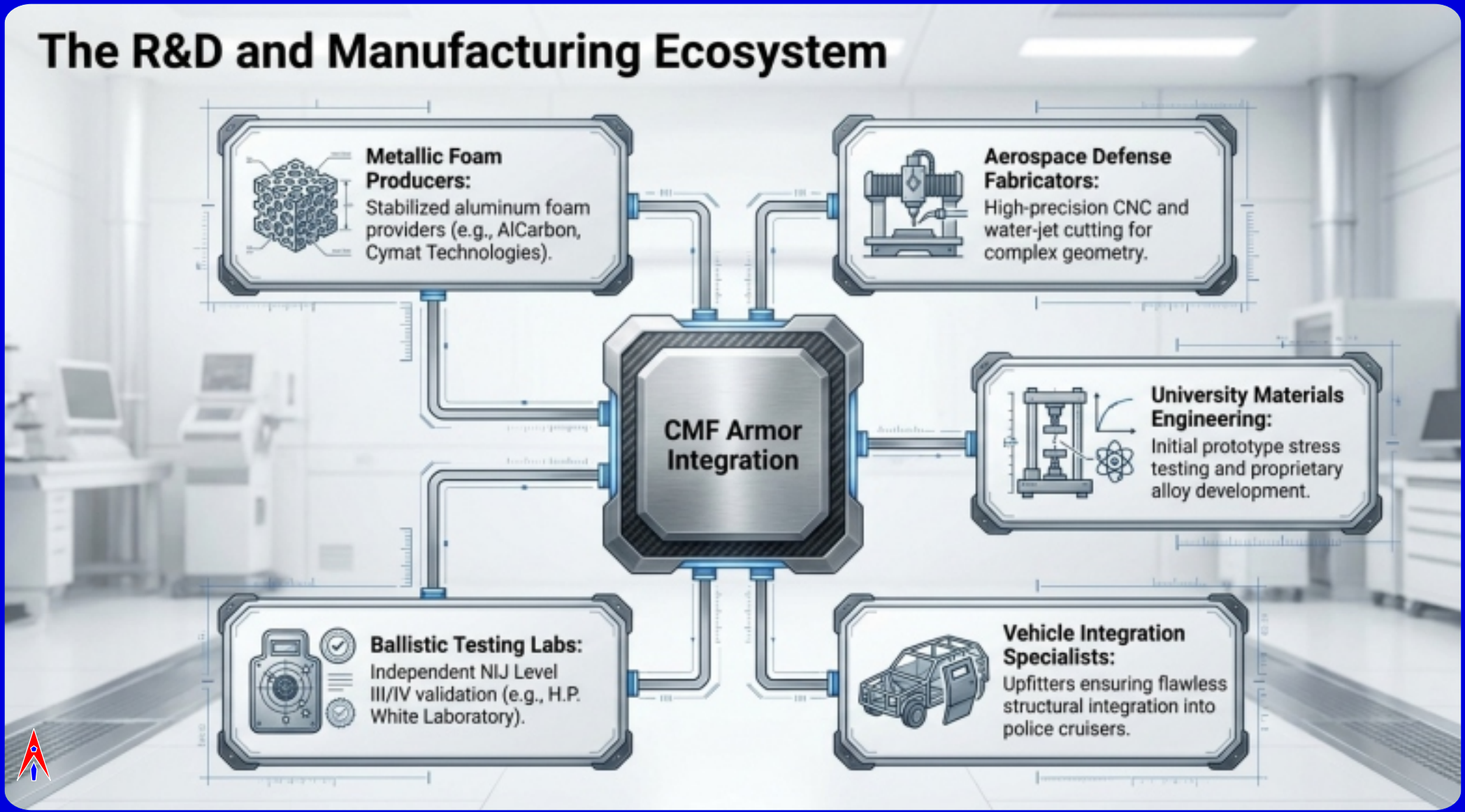
LIFECYCLE LONGEVITY:
Massively reduced sheer stress on custom heavy-duty door hinges and suspension struts.

The Tactical Dual-Advantage: Deployable Shielding

Key Insight: At just 30kg, the standard armored door transitions from a static vehicle barrier to a dynamic, mobile defense tool.

Operational Application: Equipped with quick-release mechanisms, tactical teams and SWAT units can unlatch the door panel during active shooter or barricade scenarios, utilizing it as a standalone, heavy-duty personal ballistic shield for advancing into hostile zones.

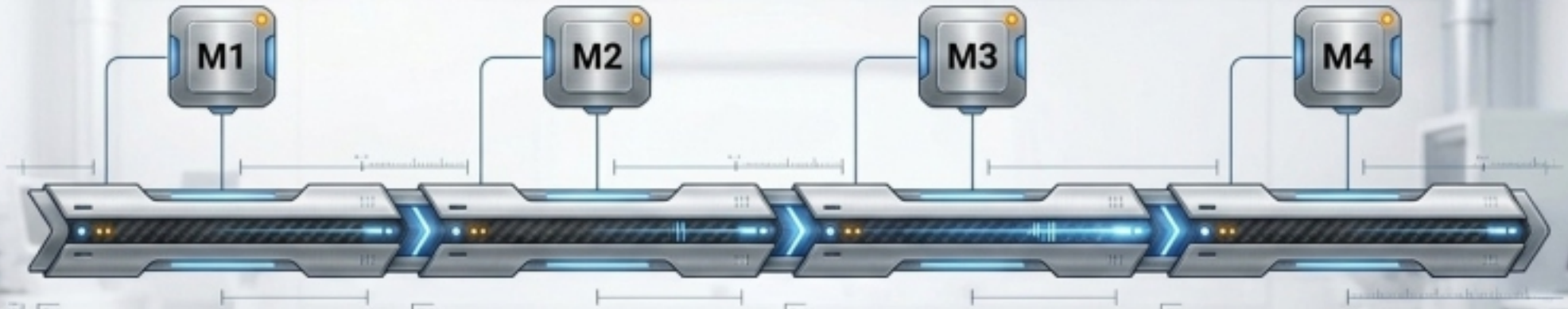
The R&D and Manufacturing Ecosystem



Cross-Functional Alignment & Oversight

Police Chief / Command Staff	Focuses on final budget, policy compliance, and procurement approval.
Fleet Manager / Logistics Director	Oversees installation feasibility, maintenance schedules, and long-term upkeep.
Tactical / SWAT Team Lead	Evaluates real-world scenario utility and ballistic performance needs.
City Procurement & Risk Management	Manages competitive bidding, safety regulations, and liability policies.
OEM Liaisons & Tech Consultants	Consults on warranty impacts, material certification, and structural integrity.

Phased Deployment Roadmap



Phase 1 (Months 1-4)

Material R&D & Ballistics. Focus on prototype testing and lab validation.

Phase 2 (Months 5-8)

Integration & Design. High-fidelity modeling and upfitter coordination.

Phase 3 (Months 9-12)

Vehicle Testing & Pilot. Real-world installation and tactical field evaluations.

Phase 4 (Months 13+)

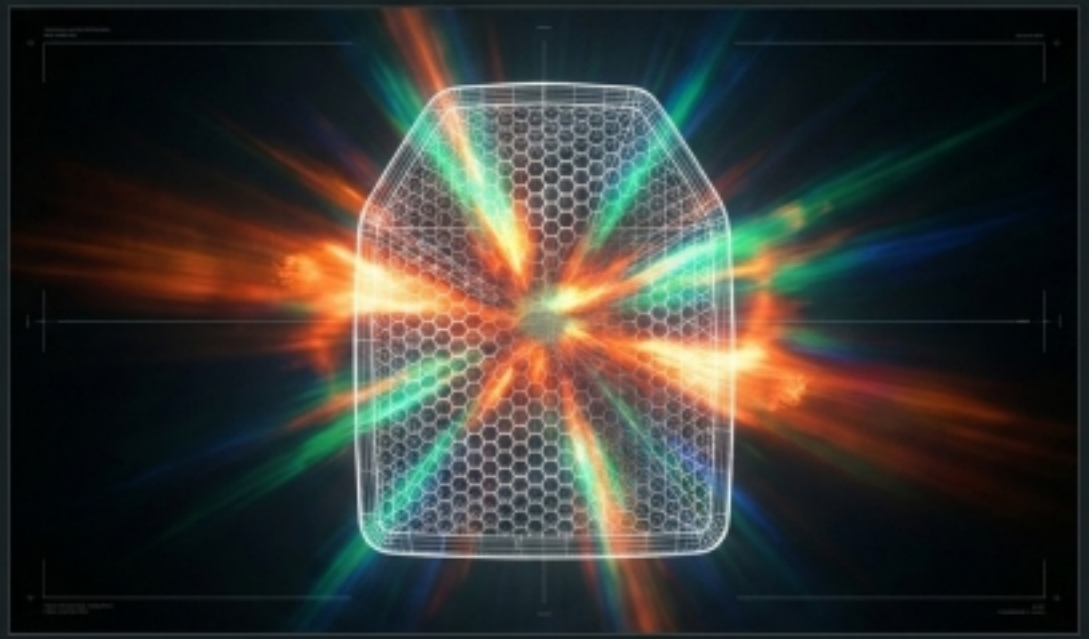
Scaling & Rollout. Department-wide implementation and long-term integration.

De-Risked Deployment Strategy

Project Assurance Framework

HURDLES	MITIGATIONS
Regulatory (High Impact): Certification hurdles for vehicle modifications	Engage NIJ certification bodies early; partner with OEM engineering teams.
Technical (High Impact): Failure to meet ballistic threshold in Phase 1	Iterative prototype testing with varying alloy compositions.
Operational (Medium Impact): Supply chain delays for specialized foam	Source multiple suppliers; initiate long-lead procurement in Phase 1.
Financial (Medium Impact): Budget overruns due to R&D complexity	Implement strict phase-gate reviews; establish a 15% contingency fund.
Integration (Medium Impact): Excessive vehicle door weight affecting hinges.	Utilize CAD/FEM modeling; investigate lightweight mounting brackets.

The Future of the Fleet



By transitioning to Composite Metal Foam, we achieve an unprecedented dual-advantage: protecting the lives of our officers with NIJ-certified defense, while completely restoring the **operational agility** of our fleet. It is a paradigm shift in urban protection.