

Driving Dual-Use Technologies: Advancing Ontario's Mobility and Defence Advantage

Leveraging Ontario's Mobility Ecosystem, Industrial
Capacity, and Strategic Supply Chains

Final Report

Ontario Vehicle Innovation Network

October 2026



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1. Executive Summary

The relationship between economic competitiveness, industrial capacity, and national security is undergoing significant change. Technologies once developed primarily for commercial markets are increasingly being adapted for defence, security, public safety, and critical infrastructure applications. At the same time, governments are placing greater emphasis on domestic industrial capability, trusted supply chains, resilient infrastructure, and access to strategic technologies as geopolitical uncertainty, technological competition, and supply chain disruptions reshape global markets.

This convergence has elevated the importance of dual-use technologies, which can serve both civilian and defence applications. Artificial intelligence, advanced sensing, autonomous systems, digital twins, secure communications, software-defined platforms, space-enabled services, advanced materials, and high-performance computing are being developed, tested, and commercialized in civilian markets before being adapted for defence and security applications. Global venture capital investment in defence technologies reached approximately USD \$29 billion in 2025, nearly three times the level recorded in 2020, demonstrating increasing interest in technologies that combine commercial scalability with strategic applications.

Ontario's dual-use opportunity at a glance:

- More than 300 defence organizations, employing over 13,000 workers and generating more than \$5 billion in annual revenue. Ontario accounts for roughly 35 percent of Canada's defence industry employment.
- Nearly 700 automotive parts suppliers, supported by major vehicle assemblers, globally active Tier 1 suppliers, software

developers, research institutions, and specialized testing facilities.

- More than 400 companies working in connected and autonomous vehicle development and smart mobility.
- Nine Regional Technology Development Sites, supported by approximately CAD \$70 million in investment, providing access to technical expertise, specialized equipment, commercialization support, and testing environments.
- More than 100,000 workers in vehicle assembly and parts manufacturing, supporting operations for major global automotive manufacturers.
- More than CAD \$12.4 billion in announced investments and 11,300 associated jobs supported through Invest Ontario during its first five years, across sectors including advanced manufacturing, electric vehicles, defence, critical minerals, artificial intelligence, and advanced technology.

Ontario is well positioned to participate in this emerging opportunity. The province combines one of North America's largest automotive and mobility ecosystems with strengths in advanced manufacturing, artificial intelligence, software development, connected and autonomous vehicles, critical minerals, battery production, research, and commercialization. These assets provide a foundation for participation in emerging dual-use pipelines that extend beyond traditional defence procurement pathways.

Ontario's mobility ecosystem is particularly relevant because many of the technologies underpinning next-generation transportation systems are increasingly applicable to defence and security. Autonomous navigation, advanced sensing, intelligent decision-making, software-defined vehicles, secure communications, fleet coordination, and resilient infrastructure are becoming important across both commercial mobility and defence applications. The province's concentration of

automotive manufacturers, technology firms, research institutions, and testing environments provides a strong platform for the development and commercialization of these capabilities.

An analysis of the Ontario ecosystem indicates that Ontario has two complementary opportunities. First, the province can continue to expand its established capabilities in specialized defence technologies, platforms, systems integration, and manufacturing. Second, it can create stronger pathways for commercially developed mobility, software, sensing, communications, manufacturing, and infrastructure technologies to enter defence and dual-use markets.

Ontario companies are already demonstrating both pathways. Established companies provide capabilities in advanced imaging, space-based surveillance and communications, military vehicles, software, sensors, and systems integration. At the same time, commercially oriented companies are developing artificial intelligence, autonomous systems, advanced sensing platforms, connected infrastructure, battery technologies, and software-defined mobility systems with potential applications across defence, public safety, emergency response, critical infrastructure, and security. Ontario's opportunity is therefore not limited to any one technology or market. Rather, it lies in connecting specialized defence capabilities with the scale, investment, talent, and rapid innovation associated with the province's broader commercial ecosystem.

Ontario's industrial capabilities further strengthen this opportunity. The province's advanced manufacturing ecosystem provides expertise in systems integration, precision manufacturing, supplier coordination, quality assurance, and production at scale. These capabilities are becoming increasingly important as governments seek to strengthen domestic industrial capacity, expand participation in trusted supply chains, and reduce dependence on concentrated sources of production for strategically important technologies. Ontario's integration within

North American manufacturing networks, combined with its growing battery sector, critical mineral resources, and advanced technology ecosystem, creates opportunities to participate in increasingly resilient and security-conscious supply chains.

Critical minerals, advanced materials, and processing capacity represent another strategic opportunity. Ontario's combination of Northern critical mineral resources and Southern Ontario's manufacturing and innovation ecosystem provides an opportunity to strengthen domestic value chains while supporting trusted North American supply networks. As governments and industry place increasing emphasis on secure sourcing and industrial resilience, these capabilities are expected to become increasingly important sources of competitive advantage.

Ontario's testing, validation, and commercialization infrastructure represents another important strength. OVIN's Regional Technology Development Sites (RTDS) including facilities such as Area X.O, Ontario Tech University's Automotive Centre of Excellence (ACE), CORE5, the Catalyst Connected Infrastructure Network (CCIN), and various demonstration and pilot environments provide companies with opportunities to test, validate, and refine technologies under closed-circuit and real-world operating conditions. Building on this infrastructure, OVIN has launched a new R&D Partnership Fund stream focused on defence and dual-use technologies to help Ontario companies de-risk technology development, validation and demonstration and accelerate pathways toward commercialization and deployment. Together, the RTDS network and new dedicated funding for Defence and Dual-use R&D will support commercialization across connected mobility, autonomous systems, communications technologies, advanced sensing, electrification, intelligent infrastructure and emerging technologies with applications in the defence sector. These initiatives also create opportunities to evaluate technologies with potential applications across civilian, industrial, and strategic domains.

Interviews and ecosystem analysis identified several opportunities to strengthen Ontario's pathway from technology development to defence adoption. Firms at different stages of readiness may require different forms of support, including assistance identifying operational use cases, understanding defence requirements, engaging end users and prime contractors, navigating accreditation and procurement, validating technologies under relevant conditions, and scaling production. A national survey of 642 small and medium-sized businesses similarly identified different barriers among established defence suppliers, firms with limited defence exposure, and prospective market entrants. Addressing these needs represents an opportunity to expand Ontario's defence-ready supplier base while preserving the civilian markets that provide commercial scale and continued innovation.

The report identifies a series of opportunities that build on Ontario's existing strengths. These include:

- Strengthening commercial-to-defence technology pathways
- Building a globally competitive autonomous systems cluster
- Advancing secure and software-defined mobility platforms
- Leveraging Ontario's testing and validation infrastructure as a strategic asset
- Building trusted supply chains for strategic technologies
- Strengthening Ontario's critical minerals and advanced materials advantage
- Supporting northern, remote, and resilience-focused innovation
- Developing a more integrated dual-use mobility ecosystem.

Collectively, these opportunities reflect a broader shift in how competitiveness and strategic capability are created. The technologies, infrastructure, supply chains, and industrial systems that support economic growth are increasingly the same assets that contribute to resilience, security, and long-term strategic advantage. Ontario enters this transition with significant strengths across mobility, manufacturing,

technology, research, and commercialization. By building stronger connections between these assets and emerging dual-use opportunities, the province is well positioned to support innovation, attract investment, strengthen industrial competitiveness, and contribute to the development of strategically important capabilities for Canada and its allies.

2. Dual-Use and the New Industrial Context

The relationship between technological innovation, industrial competitiveness, and national security is evolving rapidly. Advanced technologies that were once developed primarily for commercial markets are increasingly being recognized as strategic assets that contribute to defence capability, infrastructure resilience, emergency preparedness, and economic security. At the same time, governments are placing greater emphasis on domestic industrial capacity, trusted supply chains, and sovereign capabilities in response to geopolitical uncertainty, technological competition, and disruption to global production networks.

This section examines the broader context driving renewed interest in dual-use technologies. It explores how innovation ecosystems, industrial capacity, resilient infrastructure, and economic security are becoming increasingly interconnected, and why these trends are creating new opportunities for jurisdictions with strengths in mobility, manufacturing, advanced technology, and commercialization pathways. The section also examines how these developments are reshaping industrial strategy and influencing investments in strategic capabilities across Canada and allied economies.

2.1 Defence, Economic Security and Sovereign Industrial Capacity

Industrial Capacity and Dual-Use Defence Readiness

National defence has traditionally been understood through the lens of military platforms, weapons systems, bases, and physical infrastructure. These capabilities remain essential, but the nature of defence readiness has evolved to include the digital, cyber, industrial, and infrastructure systems that enable governments, businesses and communities to operate securely and respond effectively to disruption. As a result, defence capability is increasingly shaped by dual-use technologies that are developed and deployed across both civilian and military contexts, including artificial intelligence, advanced sensing, autonomous systems, secure communications, cybersecurity, space-enabled services, high-performance computing, and connected infrastructure.¹

In this context, defence preparedness depends on a broad range of industrial capabilities. Readiness requires the ability to produce advanced equipment, as well as advanced manufacturing capacity, resilient supplier networks, access to strategic inputs, digital infrastructure, energy systems, and systems integration capabilities.¹

Industrial ecosystems that can produce advanced components, integrate technologies across multiple domains, adapt to changing operational requirements, and sustain critical capabilities over extended periods are increasingly recognized as strategic assets that directly influence national security, economic security, and long-term competitiveness.¹

In this context, defence is no longer confined to a narrow set of military industries and is increasingly dependent on a wide range of industrial capabilities that extend beyond traditional defence contractors. Many technologies that support defence and security applications are now developed, tested, and deployed first in commercial markets. Investments in advanced manufacturing, industrial automation, digital

systems, energy infrastructure, and other enabling capabilities can therefore strengthen both economic performance and strategic readiness simultaneously. As a result, industrial development and defence preparedness are increasingly viewed as mutually reinforcing objectives rather than separate policy priorities.^{1, 2} This shift is reflected in government strategies that place greater emphasis on domestic industrial capability as a foundation for long-term security and resilience. Canada's Defence Industrial Strategy, for example, highlights the importance of maintaining a strong domestic industrial base capable of supporting national security objectives and sustaining critical capabilities over time. The strategy reflects a broader shift in thinking that recognizes defence capability, industrial competitiveness, innovation capacity, and economic resilience as interconnected priorities. As geopolitical competition intensifies and technological change accelerates, the ability to mobilize and sustain industrial capacity is becoming an increasingly important component of defence readiness.¹

These trends are particularly relevant for jurisdictions with strong manufacturing and innovation ecosystems. Ontario's automotive and mobility sector provides an example of how industrial capability, technology development, and integrated supply chains can contribute to emerging dual-use opportunities.¹

The implications for Ontario are explored throughout the remainder of this report.

Innovation, Investment, and Commercial-Scale Deployment

Commercial technology markets rather than traditional defence research and procurement pipelines are increasingly playing a role in developing defence solutions. Technologies such as artificial intelligence (AI), advanced sensing, autonomous systems, secure communications, and software-defined platforms are often developed first for commercial applications, where larger customer bases, competitive market pressures, and access to private capital accelerate innovation and adoption.³ Commercial markets also play a critical role in scaling innovation. Compared with traditional defence procurement systems, they typically enable faster product iteration, larger production volumes, broader talent pools, and more diverse sources of capital. These conditions enable organizations to refine technologies, reduce costs, and achieve commercial viability more rapidly. Once validated at scale, many of these capabilities can be adapted for defence and security applications, lowering development risk and accelerating deployment.³

This dynamic is particularly important for countries with relatively small domestic defence markets, such as Canada. In many cases, defence demand alone may be insufficient to support the investment, production scale, and continuous innovation required to maintain competitiveness in rapidly evolving technology fields. Dual-use innovation models help address this challenge by enabling organizations to commercialize technologies in larger civilian markets while simultaneously creating pathways for defence and security applications. This approach allows governments to leverage commercial scale, private-sector investment, and market-driven innovation to accelerate capability development, reduce costs, and strengthen access to critical technologies. However, technologies that have achieved commercial success may still require additional adaptation, testing, validation, security assurance, systems integration, and qualification before they are suitable for defence

applications. Even so, dual-use innovation can support both long-term economic resilience and strategic readiness by reinforcing the industrial and technological capabilities that underpin national security.³

Global investment patterns increasingly reflect the convergence between commercial innovation and strategic capability. Venture capital investment in defence technologies reached approximately USD \$29 billion globally in 2025, nearly triple 2020 levels, reflecting growing investor confidence in dual-use technologies spanning artificial intelligence, autonomous systems, advanced sensing, cybersecurity, and space-enabled capabilities.^{4, 5} These technologies are increasingly viewed as both commercial growth opportunities and strategic assets that support defence, security, and resilience objectives.

Allied governments and defence organizations have responded by establishing new mechanisms to accelerate the development and adoption of these technologies. NATO's Defence Innovation Accelerator for the North Atlantic (DIANA) and the NATO Innovation Fund were created to strengthen connections between commercial innovators, investors, industry partners, researchers, and defence stakeholders across the Alliance. These initiatives recognize that many emerging technologies, including artificial intelligence, autonomy, advanced communications, quantum technologies, and advanced manufacturing solutions, are often developed first in commercial markets before being adapted for security and defence applications. Together, they reflect a broader shift toward innovation ecosystems that leverage private investment, entrepreneurial activity, and rapid technological iteration as increasingly important sources of future defence capability.⁶

These developments reflect a broader transformation in how strategic capabilities are created and maintained. Jurisdictions that can align innovation ecosystems with dual-use commercialization pathways for defence applications will be better positioned to attract investment,

strengthen industrial competitiveness, and build long-term strategic capability than those that rely solely on military procurement.

Trusted Infrastructure, Supply Chains, and Economic Resilience

The convergence of industrial capacity, innovation, and defence capability is reshaping the nature of economic competitiveness. For several decades, organizations optimized supply chains around cost, scale, specialization, and just-in-time production, while global trade networks enabled organizations to access inputs, components, and manufacturing capacity from a wide range of locations. As geopolitical tensions, trade disruptions, supply shortages, and other external shocks have become more frequent, governments and businesses have begun reassessing the vulnerabilities associated with complex supply chains that often rely on a limited number of global suppliers, regions, or processing hubs for critical inputs.⁷

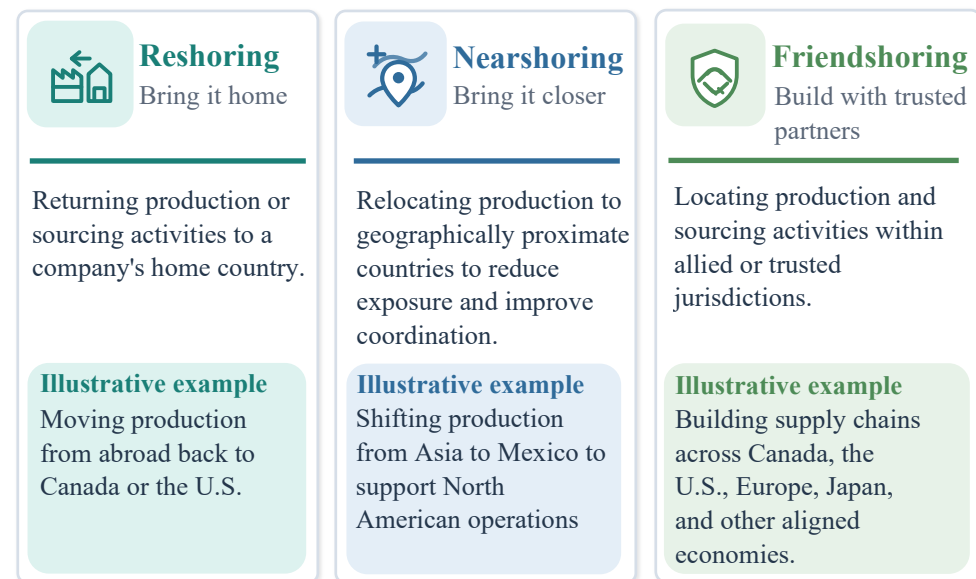
As a result, competitiveness is increasingly influenced by the ability to maintain access to critical inputs, sustain operations during disruption, and participate in reliable industrial networks. Governments, investors, and industry partners are placing greater emphasis on supply reliability, interoperability, and risk management when making sourcing, investment, and partnership decisions.⁸

These developments reflect a broader shift in how resilience is understood. Historically viewed primarily as a risk-management consideration, resilience is increasingly recognized as a source of competitive advantage that supports long-term growth, investment attraction, and strategic flexibility. Firms and jurisdictions that can adapt to evolving security requirements, withstand disruption, and maintain trusted relationships across complex industrial networks are likely to be better positioned than those competing primarily on cost or production scale.⁹

Reshoring, Friendshoring, and Trusted Industrial Networks

In response to growing geopolitical uncertainty and supply chain disruption, governments and businesses are placing greater emphasis on where production occurs and how industrial networks are structured. Figure 1 illustrates localization strategies such as reshoring, nearshoring, and friendshoring that reduce exposure to geopolitical risk, strengthen supply chain resilience, and improve the reliability of critical industrial systems.¹⁰ These approaches are reshaping sourcing, investment, and partnership decisions across industries. Although cost and efficiency remain important, firms and governments are placing greater emphasis on access to critical inputs, the stability of supplier relationships, and the long-term reliability of production networks.⁷

Figure 1: Supply Chain Localization Strategies



This shift does not represent a retreat from globalization. Rather, it reflects a reconfiguration of global production systems around trusted partnerships and strategic alignment. These principles are increasingly reflected in defence and security policy. Canada's Defence Industrial Strategy emphasizes a "Build-Partner-Buy" approach that prioritizes domestic capability development where Canada has strategic advantages, collaboration with trusted allies and partners where appropriate, and targeted procurement when required.¹¹ This approach reflects a broader shift toward resilient supply chains and industrial networks built across trusted jurisdictions.¹⁰

For Ontario, these dynamics present both opportunities and risks. The province's integration within North American automotive production networks provides access to a large and interconnected market. At the same time, changes in trade policy, tariffs, and regulatory requirements can affect production, investment, and competitiveness across the broader system.¹²

Implications for Competitiveness and Industrial Strategy

These developments mean competitiveness is increasingly influenced by the ability to support secure, resilient, and trusted industrial systems capable of operating effectively under changing economic, technological, and geopolitical conditions.¹³ For governments and industry, this changes the approach to industrial strategy from being built around cost structures and market access to a strategy focused on aligning industrial capacity, innovation ecosystems, infrastructure, workforce capabilities, and trusted partnerships within a coherent and resilient economic system. Jurisdictions that can provide reliable access to energy, advanced digital infrastructure, skilled talent, and secure production environments are likely to be increasingly attractive destinations for investment and industrial growth.¹⁴

Ontario's advanced manufacturing base, relatively low-carbon electricity system, research and innovation assets, digital infrastructure,

and integration within North American supply chains continue to support investment across strategic sectors. Over its first five years since 2020, Invest Ontario helped companies announce more than CAD \$12.4 billion in investments and over 11,300 jobs in the province, spanning sectors where Ontario has unique strength, such as advanced manufacturing, electric vehicles, defence, critical minerals, AI and advanced technology.¹⁵ This activity provides a broader indication of Ontario's ability to attract capital-intensive projects that expand industrial capacity, strengthen supply chains, and support technology development.

Recent digital infrastructure investment complements this growth. As part of a broader CAD \$19 billion commitment to expand cloud and AI infrastructure across Canada between 2023 and 2027, Microsoft announced a major expansion of its cloud and artificial intelligence infrastructure in Ontario. The investment is expected to support approximately 1,000 construction jobs and create 250 permanent positions while significantly expanding the province's computing capacity and domestic data infrastructure. Together, these investments strengthen the foundations needed to support advanced manufacturing, artificial intelligence, data-intensive industries, and emerging dual-use applications.¹⁶

More broadly, Ontario continues to attract investment across automotive manufacturing, battery production, artificial intelligence, advanced manufacturing, and digital infrastructure, reflecting the province's growing role within North America's innovation and industrial ecosystem. Together, these assets provide a foundation for participation in increasingly security-conscious and technology-intensive industries. While maintaining this position will require continued investment and adaptation, Ontario's combination of industrial scale, innovation capacity, digital infrastructure, and skilled talent positions the province

to benefit from the growing convergence of economic competitiveness, technological leadership, resilience, and security.¹⁷

Sovereign Capability, Infrastructure Resilience, and the Arctic

Infrastructure as Sovereign Capability

Sovereign capability is increasingly shaped by the resilience and integration of core infrastructure systems. Energy, transportation, communications, digital networks, and compute infrastructure are no longer simply enablers of economic activity. They are increasingly recognized as strategic assets that support industrial production, emergency preparedness, public safety, and defence readiness. As industrial systems become more connected and technology-intensive, the ability to maintain secure, reliable, and interoperable infrastructure is becoming central to both economic competitiveness and national security.¹⁸

This reflects a broader redefinition of infrastructure's role within modern economies. Infrastructure now functions as a shared foundation across civilian, industrial, and defence domains:

- Energy systems support manufacturing, data processing, and operational continuity.
- Transportation networks enable the movement of goods, people, and strategic inputs.
- Communications and digital networks support coordination, monitoring, and decision-making.
- Compute infrastructure enables data processing, modelling, and automation capabilities that increasingly underpin modern industrial systems.

Table 1: Canada’s Key Sovereign Capabilities

Canada’s Sovereign Capability	
Sovereign capabilities are strategically important areas in which Canada seeks to strengthen domestic capacity, reduce supply chain vulnerabilities, and maintain the freedom to defend its sovereignty and meet allied commitments. These capabilities reflect areas that are critical to Canada’s defence, build on existing or potential domestic strengths, and respond to demand from allies.	
Key Capability Area	Why it Matters
Aerospace 	Supports military and dual-use aircraft platforms, avionics, communications systems, and aerospace manufacturing capabilities.
Ammunition 	Strengthens domestic production of ammunition, munitions, missiles, and other critical defence supplies.
Digital Systems 	Includes AI, secure communications, cyber technologies, cloud computing, command and control systems, and quantum technologies.
In-Service Support 	Ensures long-term maintenance, modernization, repair, and sustainment of defence assets across naval, land, and air domains.

Key Capability Area	Why it Matters
Personnel Protection 	Supports medical countermeasures, protective equipment, and health-related technologies that enhance operational readiness and resilience.
Sensors 	Enables surveillance, detection, intelligence gathering, electronic warfare, navigation, and situational awareness capabilities.
Space 	Supports satellite communications, Earth observation, space-based intelligence, surveillance, reconnaissance, and space-domain awareness.
Specialized Manufacturing 	Provides industrial capacity to design and produce defence platforms, vehicles, surface ships, marine systems, and advanced manufacturing components.
Training and Simulation 	Supports operational readiness through advanced training environments, digital simulation systems, and synthetic learning technologies spanning naval, land, and air.
Uncrewed and Autonomous Systems 	Advances autonomous land, air, surface, and underwater systems used across defence, security, mobility, and industrial applications.

Source: Adapted from Canada's Defence Industrial Strategy: Security, Sovereignty and Prosperity (Government of Canada, 2026).

Collectively, these interconnected assets form the operating environment that enables commercial activity, emergency response, public safety, and defence operations.¹⁹

As these systems become more interconnected, resilience increasingly depends on how effectively they operate together. Organizations and jurisdictions must be able to exchange information securely, coordinate across networks, and maintain critical functions during disruption. Secure data exchange, common governance frameworks, and interoperable systems help ensure that infrastructure supports continuity during emergencies, supply disruptions, cyber incidents, and other events that affect industrial activity or public safety.¹⁹

Northern Readiness, Emergency Preparedness, and Space-Enabled Situational Awareness

The importance of resilient infrastructure is especially pronounced in northern and Arctic regions, where geography, climate, distance, and limited redundancy heighten operational risk. Long distances, severe weather, seasonal access constraints, and dispersed populations mean that disruptions to transportation, energy, communications, or digital systems can have significant consequences for communities, industry, emergency response, and national presence. In these environments, infrastructure reliability is both an economic necessity and fundamental to accessibility, continuity, and sovereignty.²⁰

Northern and Arctic infrastructure is inherently dual-use because the same assets often support multiple civilian, economic, and security functions. Transportation infrastructure enables community mobility, emergency response, resource development, and logistical access. Energy systems sustain communities, industrial operations, and critical services, while communications and digital networks support public safety, coordination across vast distances, and operational awareness. As the strategic importance of northern regions continues to grow, the ability to maintain and coordinate these interconnected systems is

becoming increasingly important to both defence readiness and broader national resilience.¹

Emergency preparedness further highlights the importance of resilient and interoperable infrastructure. Effective response during natural disasters, supply interruptions, search and rescue operations, or security events depends on the ability of transportation, energy, communications, and digital systems to function together under stress. In regions where infrastructure redundancy is limited, the failure of one system can quickly affect others, creating cascading risks for communities, industry, and public safety. As a result, resilience, secure coordination, and system interoperability are becoming essential components of northern readiness.¹

Space-enabled capabilities play an increasingly important role in supporting these functions, particularly where terrestrial infrastructure is limited or vulnerable. Satellite communications, remote sensing, positioning, navigation, and domain awareness help maintain connectivity, monitoring, and situational awareness across large and remote regions. These capabilities support emergency response, infrastructure monitoring, environmental observation, transportation safety, and defence operations. Their strategic value lies in their ability to strengthen visibility, coordination, and operational continuity in regions where physical infrastructure is difficult to build, maintain, or replicate.¹

At the same time, growing integration of physical and digital systems is creating new forms of cyber-physical risks. Disruptions to communications networks, positioning systems, digital infrastructure, or control systems can affect the reliability of transportation, energy, and emergency response services. In northern and remote environments, where alternative infrastructure may be limited, these risks can have disproportionate consequences for operational continuity and public safety. This reinforces the importance of resilient infrastructure,

emergency preparedness, secure digital systems, and space-enabled awareness as mutually enabling components of sovereign capability.²¹

Together, these dynamics show why northern resilience, emergency preparedness, and space-enabled situational awareness are central to sovereignty. Jurisdictions that can maintain reliable infrastructure, coordinate across physical and digital systems, and sustain visibility across remote regions will be better positioned to support communities, enable industrial activity, respond to emergencies, and maintain strategic presence in an increasingly complex security environment.

3. Dual-Use Technologies and Ontario's Potential

Dual-use technologies are becoming increasingly important as governments, industry, and investors seek solutions that can support both commercial and strategic priorities. Advances in artificial intelligence, autonomy, computing infrastructure, advanced sensing, communications, and digital systems are transforming transportation, manufacturing, infrastructure, and public services while simultaneously creating applications relevant to defence, security, and emergency response.

Ontario possesses many of the capabilities supporting this transition through its automotive and mobility ecosystem, research institutions, commercialization networks, and advanced technology sector. This section examines the technologies most commonly associated with dual-use innovation, highlights how they are being applied across civilian and strategic domains, and explores the specific ways Ontario's mobility ecosystem is positioned to contribute to their development, deployment, and commercialization.

3.1 Dual-Use Technologies

Dual-use technologies are best understood as capabilities developed for commercial, industrial, or public-sector purposes that can be adapted for defence and security applications. They are enabling capabilities that can operate across multiple domains, including mobility, infrastructure, emergency response, logistics, and communications. Technologies such as artificial intelligence, advanced analytics, compute infrastructure, digital twins, sensing, secure communications, and space-enabled systems can create value in civilian markets while also strengthening operational awareness, resilience, and strategic capability.

Artificial Intelligence and Advanced Analytics

Artificial intelligence and advanced analytics are increasingly central to dual-use technology development, as defence, public safety, infrastructure, and mobility systems become more dependent on real-time data, autonomy, sensing, and decision support. AI systems can process large volumes of information, identify patterns, support predictive analysis, and help operators respond more effectively in complex or fast-changing environments. In commercial mobility, these capabilities are used to support connected vehicles, fleet management, logistics optimization, infrastructure monitoring, predictive maintenance, and advanced driver assistance. In defence and security contexts, the same technology foundations can support situational awareness, intelligence analysis, autonomous systems, mission planning, and operational decision-making.

Canadian and allied initiatives demonstrate how artificial intelligence is moving from general-purpose digital tools into operational applications. Canada's Department of National Defence and Canadian Armed Forces Artificial Intelligence Strategy identifies AI, machine learning, networking, predictive and prescriptive analytics, and robotics as critical capabilities for defence modernization. The strategy indicates that

modern sensors are producing volumes and complexity of data that can exceed the capacity of human analysts to process manually. It identifies AI as an important enabler of military operations and defence business functions, while emphasizing that its adoption needs to be responsible, transparent, safe, and trusted.²²

European examples further illustrate how artificial intelligence and autonomous systems are being developed for applications across commercial, public-sector, and defence markets. Europe's artificial intelligence and advanced analytics ecosystem is increasingly being shaped by strategic investments that bridge commercial innovation and defence applications. Through the European Defence Fund (EDF), more than 10 percent of program funding has been directed toward technologies such as artificial intelligence, quantum technologies, cybersecurity, autonomous systems, and advanced data analytics.²³ These investments reflect growing recognition that emerging digital technologies are becoming important enablers of defence capability, while also creating commercial opportunities across transportation, infrastructure, manufacturing, and public-sector applications. The EDF's approach emphasizes collaboration among industry, research institutions, start-ups, and defence stakeholders to accelerate the development and deployment of dual-use technologies.

Germany-based Quantum Systems provides a mobility-adjacent example of this trend. The company develops AI-enabled uncrewed aerial systems and has partnered with Skyports Drone Services to offer Overwatch, an intelligence, surveillance, and reconnaissance service for government and commercial customers. Use cases include maritime surveillance, border control, linear asset inspection, pollution monitoring, environmental monitoring, asset inspection, security, and air quality monitoring.²⁴ This example illustrates how a combination of autonomous aerial platforms, sensors, communications systems, and

analytics capabilities can support both civilian infrastructure and security-related applications.

Helsing provides a second example of Europe's growing dual-use AI ecosystem. The company develops artificial intelligence software and autonomous systems designed for defence applications, including decision-support systems, autonomous platforms, and software-defined capabilities. Its recent development of AI-enabled autonomous aerial systems demonstrates how advances in machine learning, autonomy, sensing, and data analytics are increasingly being integrated into next-generation defence capabilities. Together, companies such as Quantum Systems and Helsing illustrate how European innovation ecosystems are linking commercial technology development, venture capital investment, and defence modernization through shared digital technology foundations.²⁵

South Korea is also advancing dual-use AI-enabled autonomy and robotics through a combination of company-led innovation and ecosystem investment. Bone AI is developing autonomous air, ground, and marine vehicles for government and defence customers, with applications spanning logistics support, wildfire detection, and anti-drone defence.²⁶ South Korea is also investing KRW \$50 billion (USD \$36 million) in a 45,000 square-meter AI defence robotics innovation cluster intended to accelerate the development, testing, and commercialization of next-generation military robots.²⁷ Together, these examples demonstrate how shared AI, robotics, and autonomy capabilities can serve public safety, emergency response, logistics, and defence applications. They also show that dual-use innovation is emerging not only through established defence firms, but also through startups and regional innovation ecosystems.

High-Performance Computing and Compute Infrastructure

As artificial intelligence, advanced analytics, simulation, and digital platforms become more central to economic and security systems, access

to computing capacity is emerging as a strategic asset. High-performance computing (HPC), cloud infrastructure, advanced semiconductors, data centres, and specialized AI chips provide the computational foundation required to process large datasets, train AI models, run complex simulations, and support real-time decision-making. These capabilities are increasingly important not only for commercial innovation, but also for national security, defence readiness, and industrial competitiveness. As a result, access to computing power is emerging as strategic infrastructure, essential to drive innovation, productivity, competitiveness, and technological leadership.^{28, 29, 30}

HPC and semiconductors are also core dual-use technologies. The same computing architectures and advanced chips that support scientific discovery, engineering, commercial AI development, autonomous systems, and digital twins can also be applied in security, emergency management, and defence environments where large volumes of data must be processed and analyzed in real time. By combining thousands of processors, servers, storage systems, and software into networked computing environments, HPC systems can execute calculations at a scale far beyond the capabilities of conventional computers and identify patterns faster than human analysts.^{28, 29}

In mobility and infrastructure contexts, HPC enables organizations to process large volumes of sensor data, evaluate millions of potential scenarios, and test system performance in virtual environments before real-world deployment. These capabilities are becoming increasingly important as transportation, infrastructure, and industrial systems generate larger volumes of real-time operational data.³¹

The strategic value of HPC is particularly evident in applications where physical testing is costly, time-consuming, or difficult to scale. In the automotive sector, it supports vehicle design, battery optimization, crash simulation, aerodynamics modelling, and autonomous driving development. Across transportation systems, advanced computing

enables digital twins and large-scale simulations that can evaluate traffic flows, infrastructure changes, emergency-response scenarios, and transportation network performance before deployment. These capabilities help shorten development timelines, reduce testing costs, improve safety and operational outcomes.²⁸

Beyond simulation and design, HPC plays a growing role in analyzing the large volumes of data generated by connected vehicles, transportation networks, infrastructure systems, satellites, and industrial assets. Advanced computing platforms help identify patterns, enable predictive analytics, optimize operations, and support real-time decision-making. These capabilities have applications across public-sector, security, and defence contexts, including infrastructure monitoring, disaster response, environmental management, resilience planning, satellite tracking, orbital-debris monitoring, and space-domain awareness.

Japan's Fugaku supercomputer illustrates the broader mobility and public-sector value of advanced computing. Researchers are using Fugaku to develop large-scale computing platforms that integrate vehicle movement data with information on infrastructure, environmental conditions, and urban systems. These platforms support traffic management, infrastructure planning, disaster mitigation, and smart-city operations. The initiative demonstrates how advanced computing infrastructure can strengthen mobility system performance, public safety and resilience while supporting broader economic and societal objectives.³²

Ontario's combination of relatively low-cost, low-carbon electricity generation, growing data centre investment, advanced research institutions, and integration into North American technology markets provides a strong foundation for attracting compute-intensive industries and dual-use technology investments. Access to affordable, clean energy is particularly important as AI companies face increasing scrutiny due to

the strain that large data centres can place on local electricity grids and energy costs.³³

Ontario's recent trends in electricity exports suggest the province is relatively well positioned to support growth in compute-intensive industries. Between 2021 and 2025, Ontario's electricity exports increased from 17.2 TWh to 21.1 TWh, while imports declined from 8.7 TWh to 3.1 TWh, increasing the province's net electricity exports from 8.5 TWh to 18.0 TWh over the period.³⁴ In 2025, Ontario generated 169.3 TWh of electricity on a system-wide basis, while total provincial electricity demand was 145.6 TWh, providing further evidence that the province has recently produced more electricity than it consumes domestically. Ontario also had 37,760 MW of grid-connected capacity in 2025, compared with a peak demand of 24,862 MW, while adding 555 MW of new capacity during the year, more than 80 percent of which came from storage.³⁵ These trends indicate that Ontario is well-positioned to meet near-term increases in demand. However, continued investment in generation, storage, transmission, and distribution infrastructure will remain important as demand increases from electrification, industrial growth, and emerging compute-intensive applications.

Future competitiveness in attracting compute infrastructure will depend not only on current export levels and generation output, but also on the province's ability to expand generation, storage, and transmission infrastructure as demand grows. The Independent Electricity System Operator (IESO) forecasts that Ontario's electricity demand will increase by 65 percent by 2050, rising from 152 TWh in 2026 to 250 TWh in 2050 under its reference scenario. The IESO identifies economic development, electrification, population growth, and increasing demand from energy-intensive facilities, including data centres, as important contributors to this growth.³⁶

Together, Ontario's energy, computing, and research assets support the processing, simulation, and analysis of large-scale operational data. These capabilities have applications across commercial, public-sector, defence, and security environments, reinforcing their relevance to the province's dual-use technology ecosystem.

Digital Twins and Simulation Environments

Digital twins provide another important dual-use application of compute infrastructure. Digital twins are increasingly being used to improve the management of complex industrial systems, infrastructure assets, and operational environments. By combining real-time operational data with virtual models, digital twins create dynamic representations of physical systems that can be monitored, analyzed, and tested before decisions are implemented in the real world.³⁷

In industrial settings, digital twins are helping manufacturers optimize production lines, improve equipment performance, and reduce downtime through predictive maintenance. Automotive manufacturers, for example, are using digital twins to test production changes, validate design modifications, and identify operational improvements before making physical investments.^{38, 39} The same approach is increasingly being applied to critical infrastructure and public-sector operations. Utilities can use digital twins to monitor infrastructure performance, transportation agencies can model network disruptions, and emergency planners can evaluate different response scenarios before real-world events occur.^{40, 41}

Digital twin technologies are increasingly being used to model and optimize complex systems before changes are implemented in real-world environments. In Canada, NAV CANADA has deployed an AI-enabled digital twin across its Area Control Centres to support airspace capacity planning. The system combines historical airspace and flight data with employee schedules to predict flight trajectories, estimate controller task loads, and recommend sector configurations up to 30 hours in advance.

This provides operational teams with a more complete view of anticipated demand, complexity, and staffing requirements.⁴²

Similar approaches are being adopted in the automotive sector. For example, BMW and Mercedes-Benz use digital twins to simulate factory operations, optimize production processes, and evaluate production changes before implementation,^{43, 44} while Renault has developed digital twins of its factories and supply chains to improve operational visibility and resilience.⁴⁵ In dual-use contexts, these capabilities can support logistics planning, infrastructure management, operational readiness, and the coordination of critical assets and networks.

When combined with HPC, digital twins can support more sophisticated simulations, faster scenario testing, and higher-fidelity modelling of complex systems. Recent research on HPC-enabled digital twins also shows how HPC can be integrated into digital twin workflows to balance real-time responsiveness with computationally intensive simulations, supporting more capable decision-making across complex systems.⁴⁶ As digital twins become more integrated with AI, sensor networks, and connected infrastructure, they are evolving from monitoring tools into operational platforms that support industrial competitiveness, infrastructure resilience, and strategic capability development.

What is a Digital Twin?

A **digital twin** is a virtual model of a physical asset, system, or process. It uses real-time data from sensors and other sources to reflect what is happening in the real world and provide up-to-date insights on performance and operations.

By combining live data with historical information and predictive analytics, digital twins can help organizations monitor conditions, test scenarios, anticipate issues, and make more informed decisions before problems occur.

Source: Federal News Network

While digital and intelligent systems provide the computational and analytical foundation for many dual-use technologies, their value is often realized through physical systems operating in real-world environments. The next section examines how capabilities such as autonomy, connected mobility, advanced sensing, and uncrewed systems are translating digital innovation into applications across transportation, critical infrastructure, public safety, and defence.

Advanced Sensing and Situational Awareness

Many emerging dual-use technologies rely on the ability to collect, process, and interpret information from the surrounding environment. Advanced sensing technologies, including cameras, LiDAR, radar, satellite imagery, and other sensor platforms, support monitoring, navigation, infrastructure management, and operational awareness.⁴⁷

In commercial applications, sensing technologies are used throughout transportation, advanced manufacturing, mining, logistics, and infrastructure management. For example, utilities increasingly use sensor-equipped drones to inspect transmission networks, monitor infrastructure conditions, and identify maintenance requirements more efficiently than traditional inspection methods.⁴⁸

The same capabilities support operational awareness, monitoring, and decision-making in public safety and defence applications. Increasingly, competitive advantage is shaped not only by the ability to collect data, but also by the ability to transform data into actionable insights.

Secure Communications and Cyber-Physical Security

Modern industrial, transportation, and infrastructure systems depend on secure communications networks and reliable information exchange. As physical assets become increasingly connected to digital systems, cybersecurity and operational resilience are emerging as foundational technology capabilities rather than standalone technical requirements.

Cyber-physical security focuses on protecting systems where digital and physical operations are closely integrated. Disruptions affecting software platforms, communications infrastructure, or connected assets can have real-world consequences for transportation networks, industrial operations, public safety systems, and critical infrastructure.^{49, 50}

For example, in 2021, the cybercriminal group DarkSide conducted a ransomware attack against the Colonial Pipeline, which transports approximately 100 million gallons of fuel per day between Texas and New Jersey. This attack was conducted through a phishing campaign that targeted unsecured communications to gain access to internal systems. The attack caused significant disruptions to the energy supply chain, as Colonial Pipeline was forced to shut down portions of its operations for five days to contain the spread of the malware. The resulting fuel shortages affected communities across the eastern U.S. and prompted the country to declare a national emergency.⁵¹ Beyond its economic impacts, the attack also highlighted potential risks to defence logistics, particularly in New Jersey, where several major military installations are located, including Joint Base McGuire-Dix-Lakehurst and Naval Weapons Station Earle.^{52, 53} The military operations conducted at these bases rely on a continuous supply of fuel to support aircraft, naval vessels, ground vehicles, training activities, and logistics operations. As a result, disruptions to fuel distribution networks hinder military mobility, reduce operational readiness, delay deployments, and constrain the ability of defence organizations to respond to emerging threats or emergencies.^{52, 53} As a result of these trends, secure communications, trusted data exchange, and cyber resilience are becoming increasingly important enablers of economic competitiveness, public safety, and strategic capability.

Space-Enabled Communications and Geospatial Intelligence

Space-based capabilities underpin communications, positioning, navigation, timing, Earth observation, and situational awareness across

both civilian and strategic applications. Satellite communications connect remote regions, support transportation networks, enable emergency response, and increasingly serve as critical infrastructure for military command, control, and coordination.^{54, 55} The conflict in Ukraine demonstrated the operational significance of commercial satellite communications, which supported battlefield communications, uncrewed systems, and real-time coordination between dispersed forces, highlighting how commercial space services can simultaneously advance civilian and security objectives.^{56,57}

Similarly, Earth observation and remote sensing technologies support infrastructure monitoring, environmental management, resource development, disaster response, and climate monitoring while also providing intelligence, surveillance, and reconnaissance capabilities. Commercial providers now deliver near-real-time imagery and analytics that are increasingly integrated into military planning and operational awareness, further blurring the distinction between civilian and defence applications.^{56, 58}

Global Navigation Satellite Systems (GNSS) illustrate a similar dual-use trajectory. Originally developed for military purposes, positioning, navigation, and timing services have become essential to transportation, logistics, financial markets, emergency response, and industrial operations worldwide, while remaining critical enablers of modern military activities.⁵⁹

Together, these technologies provide the connectivity, visibility, and information infrastructure that underpin modern economies and security systems. Recent conflicts have also highlighted their vulnerability to cyberattacks, jamming, spoofing, and kinetic threats, prompting governments and defence alliances to invest in more resilient satellite architectures, distributed constellations, redundancy, and enhanced space domain awareness to ensure continuity of operations in contested environments.^{55, 56}

3.2 Automotive and Mobility Dual-Use Applications

Autonomous and connected systems represent one of the clearest examples of dual-use technology convergence. Advances in software, artificial intelligence, sensing, communications, and computing are enabling vehicles, equipment, and infrastructure to operate with increasing levels of automation, connectivity, and situational awareness. These capabilities are transforming commercial transportation, industrial operations, public safety, and infrastructure management, while also creating applications relevant to defence and security.

Ontario's mobility ecosystem is particularly relevant in this context. The province's concentration of automotive manufacturing, software development, connected vehicle innovation, testing environments, and advanced transportation infrastructure provide a strong foundation for the development and commercialization of autonomous and connected technologies. Many of the capabilities being developed for commercial mobility applications have direct relevance to broader public-sector, infrastructure, and defence applications.

AI-Enabled Mobility Systems and Software-Defined Vehicles

Vehicles are increasingly becoming software-defined platforms that integrate connectivity, computing, sensing, and AI-driven decision-making. Capabilities such as advanced driver assistance systems, predictive maintenance, fleet optimization, and autonomous navigation are transforming the automotive sector while creating applications relevant to logistics, public safety, and defence-related mobility operations.⁶⁰

Commercial autonomous mobility platforms provide a useful illustration of the dual-use potential of connected and autonomous technologies. In Canada, companies such as Waabi are developing AI-powered autonomous trucking systems that combine perception, simulation, route planning, and real-time decision-making to improve freight

transportation and logistics operations.⁶¹ Similar capabilities are being deployed in autonomous freight and fleet-management applications, where connected vehicles rely on sensor fusion, communications networks, mapping systems, and software-defined control platforms to operate safely and efficiently. These technologies demonstrate how advances in autonomy, connectivity, and vehicle intelligence can support commercial transportation, logistics optimization, public safety, and infrastructure management. Since they are built on common technology foundations, they also have relevance for adjacent applications requiring autonomous navigation, environmental awareness, and decision support.⁶²

Ontario is well positioned to contribute to this convergence. Ford's Connectivity and Innovation Centres in Ottawa, Waterloo, and Oakville advance capabilities in in-vehicle software, connectivity, autonomy, and systems integration. These investments strengthen the province's position in software-defined mobility and provide a foundation for adjacent dual-use applications, including autonomous logistics, secure fleet operations, and intelligent vehicle platforms.

Connected Mobility and Vehicle-to-Everything Systems

Connected mobility systems enable vehicles, transportation infrastructure, cloud platforms, and other road users to exchange information in real time. Commonly referred to as Vehicle-to-Everything (V2X) communications, these systems integrate connectivity, sensing, edge computing, and data-sharing capabilities. In civilian transportation, V2X can support collision avoidance, traffic management, infrastructure monitoring, and emergency response. The same capabilities can enable secure logistics, coordinated vehicle movement, infrastructure protection, and situational awareness in defence environments.

Global adoption of V2X technologies is accelerating, with the market projected to grow from approximately USD 2.9 billion in 2025 to USD

18.7 billion by 2030.⁶³ The shift toward cellular V2X, supported by 5G and future wireless networks, is also increasing demand for reliable telecommunications infrastructure, edge computing, and connected roadside systems. These investments are establishing the digital foundation for autonomous mobility, next-generation transportation networks and coordinated operations across civilian, public-safety, and defence networks.⁶³

Civilian deployments demonstrate how these technologies can create a shared operational picture across complex transportation networks. The U.S. Department of Transportation's New York City Connected Vehicle Pilot equipped thousands of vehicles and hundreds of roadside units to exchange information with transportation infrastructure and traffic-management systems. Applications included forward-collision warnings, emergency-braking alerts, intersection assistance, lane-change warnings, and pedestrian-safety notifications. The pilot demonstrated how connected vehicles, roadside sensors, and data-sharing platforms can improve situational awareness and support coordinated decision-making at scale.⁶⁴

Similar capabilities are being explored in Canada through connected and automated vehicle (CAV) initiatives that seek to improve transportation safety, mobility, and system performance. Transport Canada's Safety Framework for Connected and Automated Vehicles highlights the growing importance of vehicle-to-vehicle, vehicle-to-infrastructure, and data-sharing technologies in supporting safer and more efficient transportation systems.⁶⁵ Ontario has also identified connected and automated mobility as a strategic priority. The province's CAV Readiness Plan emphasizes the development of digital infrastructure, communications networks, testing environments, and collaborative governance frameworks needed to support the deployment of connected transportation technologies.⁶⁶ Together, these initiatives demonstrate how connected mobility systems are increasingly being viewed as

foundational digital infrastructure that supports real-time information sharing, coordinated operations, and system-wide situational awareness across transportation networks.

Platforms such as Waze for Cities and HAAS Alert Safety Cloud apply similar capabilities to public-safety operations. Waze for Cities enables real-time exchange of traffic conditions, hazards, and road closures across more than 1,500 municipal and agency partners, leveraging a shared data layer that supports both consumer navigation and emergency response coordination.⁶⁷ HAAS Alert's Safety Cloud similarly integrates automotive-grade telematics and cloud infrastructure to provide drivers with real-time alerts about approaching emergency vehicles and roadway hazards. These applications illustrate how connected mobility data can strengthen coordination among vehicles, infrastructure operators, emergency services, and public authorities.⁶⁸

The underlying technologies are also being adapted for defence logistics. In Canada, the Department of National Defence's *Essential Deliveries: Getting Vital Supplies to Troops Using Autonomous Vehicles* challenge explores autonomous convoy operations, leader-follower vehicle formations, remote driving, obstacle avoidance, and autonomous navigation in complex environments.⁶⁹ These functions draw on capabilities already advancing in commercial freight and fleet operations, including sensor-based perception, automated vehicle control, route planning, and coordinated movement.

Germany's Interoperable Robotic Convoy research program similarly examines automated military logistics convoys. Earlier demonstrations used autonomy-equipped military trucks operating through a leader-follower arrangement, while the newer InterRoC VII phase focuses on highly automated convoy control and interoperable formations in which different vehicle platforms can operate safely and autonomously together. The program combines perception and decision-making

systems with robust route planning and automated convoy management for demanding military operating conditions.⁷⁰

Together, these initiatives demonstrate how commercially relevant autonomy and connectivity capabilities can be adapted to improve defence logistics, reduce personnel exposure, and strengthen operational coordination. Defence deployment nevertheless requires additional adaptation for off-road terrain, degraded communications, cybersecurity, survivability and other contested-environment requirements.

In defence applications, resilient connectivity is also essential when terrestrial communications are unavailable or disrupted. Commercial satellite networks can provide an alternative connectivity layer for vehicles, personnel, and command systems operating across remote or dispersed environments. Starlink's use in Ukraine highlighted how commercial communications networks can support mobility, logistics coordination, situational awareness, and command-and-control functions across both civilian and defence environments.⁷¹

Connected Infrastructure, Public Safety, and System Resilience

Many mobility technologies are increasingly being deployed beyond transportation into broader infrastructure and public safety applications. Vehicle-based sensing systems are being adapted to support infrastructure monitoring, pavement assessment, traffic management, and asset maintenance. Platforms such as Michelin's DDi and Iteris' ClearMobility illustrate how mobility technologies can provide transportation agencies with continuous operational insights. By aggregating and analyzing data from connected vehicles, telematics systems, roadway infrastructure, weather conditions, and other transportation network sources, these platforms provide agencies with near real-time visibility into traffic patterns, congestion, safety risks, infrastructure performance, and incident conditions. Michelin's mobility intelligence solutions use advanced analytics and machine learning to

identify high-risk roadway segments, monitor driver behaviour, and support evidence-based infrastructure safety interventions, while Iteris' ClearMobility platform integrates data from connected infrastructure, sensors, and vehicles to support traffic management, incident detection, and operational decision-making. These examples illustrate how the same capabilities that support transportation planning and traffic operations can also contribute to emergency response, critical infrastructure monitoring, and broader public-sector resilience by providing decision-makers with timely, network-wide operational intelligence.^{72, 73}

Defence installations are applying similar capabilities to strengthen infrastructure resilience and emergency preparedness. At Tyndall Air Force Base, the U.S. Air Force's Installation Resilience Operations Center connects operational-technology sensors and facility-control systems to create a common view of base conditions. The system supports emergency-response coordination, infrastructure maintenance, and cybersecure information sharing, while an associated digital twin enables operators to simulate extreme-weather and security incidents and assess potential vulnerabilities before they affect operations. This example demonstrates how connected sensors, control systems, data platforms, and simulation capabilities developed for civilian infrastructure can also strengthen the resilience and operational continuity of defence installations.⁷⁴

Table 2: Examples of Defence and Civilian Applications of Key Dual-Use Technologies

Technology	Defence/National Security Application	Mobility/Civilian Use
Artificial Intelligence and	Situational awareness, intelligence analysis, mission planning,	Connected vehicles, fleet management, logistics optimization, predictive

Technology	Defence/National Security Application	Mobility/Civilian Use
Advanced Analytics 	autonomous systems, and operational decision-making.	maintenance, and infrastructure monitoring.
High-Performance Computing and Compute Infrastructure 	Military modelling and simulation, intelligence analysis, cyber operations, missile defence, advanced weapons development, and space domain awareness.	Commercial AI development, automotive engineering, climate modelling, renewable energy research, and complex system simulation.
Digital Twins and Simulation Environments 	Mission rehearsal, operational planning, logistics modelling, asset readiness, and infrastructure resilience.	Production optimization, predictive maintenance, transportation modelling, infrastructure monitoring, and emergency planning.
Advanced Sensing and Computer Vision 	Intelligence collection, operational awareness, threat detection, reconnaissance, and infrastructure protection.	Infrastructure inspection, asset monitoring, transportation management, roadway condition assessment, and maintenance planning.

Technology	Defence/National Security Application	Mobility/Civilian Use
Secure and Space-Enabled Communications 	Command and control, intelligence sharing, logistics coordination, resilient communications, and military positioning and navigation.	Satellite connectivity, transportation coordination, emergency response, remote connectivity, Earth observation, and geospatial services.
Autonomous and Connected Mobility Systems 	Autonomous logistics, uncrewed ground systems, convoy operations, secure vehicle coordination, and tactical mobility.	Autonomous driving, advanced driver assistance, vehicle-to-everything communications, traffic management, and fleet optimization.
Connected Infrastructure and System Resilience 	Defence installation resilience, emergency preparedness, operational continuity, and cybersecure infrastructure management.	Traffic management, public safety, infrastructure monitoring, incident detection, and infrastructure maintenance.
Autonomous Aerial Systems 	Intelligence, surveillance, reconnaissance, resupply, communications relay, and force protection.	Wildfire response, emergency operations, remote logistics, and situational awareness.

3.3 Ontario's Dual-Use Technology Potential

Ontario's mobility ecosystem provides a strong foundation for the development of dual-use technologies. While many companies in the province currently develop solutions for commercial and public-sector applications, the underlying technologies often have relevance to defence priorities, including situational awareness, autonomous operations, resilient communications, and the movement of personnel and critical supplies. Ontario's opportunity therefore extends beyond producing specialized military platforms. It includes adapting commercially developed technologies for more demanding defence and security applications.

The province's potential is illustrated by companies at different stages of this transition. Some Ontario-based firms already serve commercial and defence customers, while others have developed civilian technologies with credible defence relevance that have not yet been fully commercialized.

Telesat is one of the clearest examples of an Ontario-based company operating across commercial and strategic markets. Through its low Earth orbit (LEO) and geostationary (GEO) satellite networks, the company provides communications services that enable the movement and coordination of people, vehicles, aircraft, vessels, and critical operations across vast geographic areas. Its networks support connectivity, data transmission, and operational coordination across sectors including aviation, telecommunications, maritime transportation, energy, and natural resources.⁷⁵

Telesat's technology illustrates how capabilities developed for commercial mobility and connectivity applications can also support defence and security objectives. For example, the company's satellite networks provide in-flight connectivity for commercial airlines and support communications in remote and underserved regions. These same

capabilities are increasingly important to defence operations, where reliable communications enable command and control, intelligence sharing, logistics coordination, and situational awareness across geographically dispersed forces. Their value is particularly significant where terrestrial communications are unavailable, disrupted, or vulnerable. As governments and defence organizations place greater emphasis on resilient and globally connected communications networks, satellite-enabled mobility and communications systems are expected to remain an important area of dual-use innovation.⁷⁵

There are also potential opportunities for dual-use innovation by firms that are developing technologies for civilian markets but are not yet working with military or security customers. One such example is CityRover, an Ontario-based technology company that uses artificial intelligence, geospatial data, and computer vision to help governments monitor and manage public infrastructure. Its platform supports the inspection of assets such as roads, bridges, rail lines, and transit infrastructure by identifying damage, maintenance needs, and other operational issues. According to the company, its technology is currently deployed in more than 500 cities, including Victoria, British Columbia, and Winnipeg, Manitoba.⁷⁶

A key component of CityRover's offering is the CityRover Edge smart camera, a vehicle-mounted system that automatically captures and analyzes infrastructure and street-level conditions in near real time. The platform can identify public assets such as transit stops, as well as incidents requiring attention, including potholes, damaged infrastructure, and waste accumulation. While developed primarily to support municipal governments and public service delivery, the technologies may also have applications in defence and security environments.

One potential defence application is the detection of improvised explosive devices (IEDs). In recent conflicts, including Afghanistan,

IEDs represented one of the most significant threats to coalition forces. These devices are relatively inexpensive to produce and can be concealed along roadways or in confined urban environments, making them a preferred weapon for insurgent and terrorist groups. As a result, IEDs were responsible for approximately 66 percent of coalition casualties during the conflict.⁷⁷

Research conducted by Eindhoven University of Technology in collaboration with the Netherlands Ministry of Defence suggests that AI-enabled smart camera systems could support the identification of potential IED threats as part of an early warning capability. Rather than relying solely on personnel conducting visual inspections and foot patrols, computer vision systems could be used to monitor roadways and identify anomalies or suspicious objects that warrant further investigation. Such an approach could reduce risks to personnel while improving the speed and consistency of threat detection.⁷⁷

This potential reflects a broader opportunity for Ontario's artificial intelligence, computer-vision, and smart-infrastructure companies. The underlying capabilities align with emerging requirements for persistent sensing, infrastructure protection, and automated threat detection. With some adaptation such as additional data and security features, and operational validation testing they have the potential to serve defence markets. Ontario's research institutions, technology clusters, and testing environments could help firms assess these adjacent applications and validate their technologies under relevant conditions.

FireSwarm provides another example of civilian technology with potential defence relevance. The Canadian company, which has offices in Toronto, Ottawa, and Squamish, is developing autonomous aerial systems for wildfire response, emergency operations, and critical logistics. Its platform combines autonomous drones, swarm coordination capabilities, real-time sensing, and AI-enabled decision support to support operations in environments characterized by risk, complexity,

and urgency.⁷⁸ Through a single operator interface, FireSwarm enables the coordinated deployment of multiple aerial units, providing responders with enhanced situational awareness, scalable operational capacity, and more consistent mission execution in complex conditions.

A core focus of FireSwarm's technology is supporting wildfire suppression and logistics in remote or high-risk environments. Its autonomous aerial systems are designed to deliver water, equipment, and other critical supplies directly into active fire zones, while supporting sustained and coordinated response operations. These capabilities can extend access to locations that are difficult or unsafe for personnel to reach, improving operational capacity while reducing responder exposure.⁷⁸

Beyond wildfire response, FireSwarm's autonomous aerial systems and swarm coordination capabilities have clear dual-use applications in defence and security operations. The same technologies that enable multiple drones to coordinate logistics and situational awareness in complex emergency environments could also support military missions such as resupply, intelligence gathering, reconnaissance, communications relay, and force protection in contested or remote operating environments. Adapting these systems for defence would require additional capabilities related to secure communications, resilience to interference, interoperability, and operation in contested environments. Nevertheless, commercially oriented emergency-response technologies can provide a foundation for autonomous and networked defence applications.⁷⁹

Collectively, these examples show that Ontario's dual-use mobility potential extends across the systems that enable assets to communicate, perceive their surroundings, coordinate activity, and operate safely in complex environments. They demonstrate that the opportunity lies in supplying the communications, software, sensing, autonomy, and

systems-integration capabilities that make modern mobility platforms effective.

Realizing this potential will require deliberate pathways from civilian commercialization to defence adoption. Ontario firms may need support to identify relevant use cases, engage defence customers, validate technologies under operational conditions, and meet defence-specific requirements.

4. Strategic Inputs and Trusted Supply Chains

The competitiveness of advanced technology industries increasingly depends not only on innovation and manufacturing capacity, but also on secure access to critical inputs and trusted supply chains. Technologies such as artificial intelligence, autonomous systems, advanced communications, semiconductors, batteries, and electrified mobility platforms all rely on complex global networks of minerals, materials, components, software, and production capabilities. As governments and industry place greater emphasis on resilience, traceability, and supply chain security, these networks are becoming important strategic assets.

Ontario occupies a unique position within this evolving landscape through its combination of critical mineral resources, advanced manufacturing capabilities, processing potential, and integration within North American production networks. This section examines the growing importance of critical minerals, processing capacity, and trusted supply chains, and explores how Ontario can contribute to more resilient and strategically significant value chains supporting both commercial innovation and national security objectives.



4.1 Critical Minerals as Strategic Inputs

The growth of digital technologies and electrified systems in civilian and national security applications is increasing demand for the materials that these technologies are built with. Electrified vehicles, software-defined mobility systems, artificial intelligence infrastructure, advanced communications networks, semiconductors, aerospace systems, and defence technologies all rely on minerals such as gallium, germanium, lithium, nickel, cobalt, graphite, copper, platinum group elements, rare earth elements, tungsten, titanium, manganese, beryllium, and other critical minerals. This elevates critical minerals from conventional industrial inputs to strategic assets that shape economic competitiveness, technological leadership, and national security. As jurisdictions compete to develop, manufacture, and deploy next-generation technologies, secure access to critical minerals and the capacity to process them through trusted supply chains are becoming key determinants of competitive advantage, sovereign capability, and resilience in an increasingly contested global environment.

Critical minerals underpin many dual-use mobility and defence systems, including batteries, electric drivetrains, onboard computing, sensors, radar, secure communications, and advanced electronics. Technologies developed for autonomous and connected vehicles draw on many of the same materials and components used in defence surveillance, navigation, situational awareness, uncrewed systems, and resilient communications. This overlap makes secure access to critical minerals an important consideration for both commercial mobility innovation and defence readiness.⁸⁰ However, competitive advantage is shaped not only by access to mineral resources, but also by the capacity to process materials, attract investment, develop supporting infrastructure and workforce capabilities, and advance projects in partnership with Indigenous communities.

NATO describes critical raw minerals as essential to advanced defence systems and equipment. Modern armoured vehicles illustrate their importance across mobility, protection, sensing, and communications. Infrared and night-vision systems use materials such as germanium, copper, and tantalum, while laser rangefinders rely on rare earth elements, including neodymium and yttrium. Ontario is well positioned to contribute to these value chains through both current production and emerging processing capabilities. The province actively produces several minerals identified by NATO as strategically important, including cobalt, copper, nickel, magnesium, and platinum group elements, while also supporting processing and refining activities involving materials such as aluminum, uranium, vanadium, and gallium. In addition, several projects advancing at various stages of development are expected to strengthen Ontario's position in critical minerals and downstream processing, including initiatives related to rare earth elements, battery materials, and mineral refining. This

Ontario's Gallium Capacity a Strategic Dual-Use Input

Gallium demonstrates how Ontario's mineral-processing capacity could support both advanced technology and defence supply chains. Gallium is used in semiconductors that power computers, telecommunications equipment and optoelectronic devices, while defence applications include radar-jamming systems, missile-defence radar and satellites. Toronto-based Neo Performance Materials is currently the only producer of high-purity gallium in North America and is developing a facility in Peterborough that could initially produce 5.3 tonnes annually, with the potential to expand to 40 tonnes. This capacity could help reduce North America's reliance on Chinese supply while strengthening Ontario's role in producing materials needed for both commercial electronics and defence systems.

combination of resource availability, processing capabilities, and advancing projects reinforces Ontario's potential role in supporting both commercial technology supply chains and allied defence-industrial requirements.

Radios and battlefield-management systems require copper, gallium, beryllium, silicon, silver, and indium. At the same time, tungsten alloys, titanium, boron carbide, and advanced composites strengthen vehicle armour without relying exclusively on heavier conventional steel.⁸¹ As illustrated in Table 3, critical minerals are essential inputs across a wide range of defence applications, including military mobility, aerospace and space systems, secure communications, sensing, surveillance, energy storage, and advanced propulsion.⁸¹ Reliable access to these materials supports defence production, operational readiness, and technological capability.

While electrified transportation remains a major source of demand, advancements in artificial intelligence, cloud computing, advanced telecommunications, autonomous systems, and digital infrastructure are expanding the strategic importance of critical minerals. These technologies depend on mineral-intensive components such as semiconductors, sensors, communications equipment, advanced electronics, and energy-storage systems.^{7, 82}

The importance of these inputs has been reinforced by vulnerabilities within global supply chains. Although critical minerals may be extracted in a variety of jurisdictions, refining, processing, and advanced materials production remain concentrated within a small number of countries. China currently accounts for a large proportion of global rare earth processing capacity and more than half of global lithium refining capacity. This concentration creates dependencies across battery, semiconductor, advanced manufacturing, and defence-related supply chains. These dependencies have highlighted the strategic importance of

trusted sources of both raw materials and downstream processing capacity.^{82,83}

These risks are particularly acute for minerals that are essential to defence technologies and sourced through highly concentrated supply chains. The Silverado Policy Accelerator identifies 12 “strategic defence critical minerals”: antimony, arsenic, bismuth, gallium, germanium, indium, natural graphite, rare earth elements, scandium, tantalum, tungsten, and yttrium. These materials are used in applications such as missile systems, military aircraft, and ammunition. However, the U.S., for example, is fully or almost fully reliant on imports for 9 of the 12. This dependence creates constraints for North American defence production if supplies are constrained by export controls, geopolitical conflict, or other disruptions. For Ontario, this exposure reinforces the strategic value of developing trusted mineral supplies and processing capacity that can serve both commercial technology markets and allied defence needs.⁸⁴

Gallium, niobium, rare earth elements, cobalt, and tungsten are identified as five minerals through which Canada could help reduce vulnerabilities in the U.S. defence industrial base. These minerals are found or produced in Canada, and are directly linked to supply chain risks associated with limited sources of production or processing. This positions Canada, and Ontario in particular, having the potential to contribute to a more resilient North American defence and technology supply chain.⁸⁰

The examples presented in Table 3 illustrate Ontario's critical mineral assets and projects with potential relevance to defence-related supply chains. However, these assets are at varying stages of development, production, or redevelopment and may require additional permitting, infrastructure investment, financing, commercial validation, or other project advancement before contributing to long-term supply chain resilience objectives.

Table 3: Examples of Ontario's Critical Mineral Assets Supporting Defence Applications

Defence Application	Required Minerals Available in Ontario
Fighter aircraft and military aerospace systems 	Cobalt (Cobalt-Gowganda Camp, Sudbury Camp, Crawford Project, Lac Des Iles, Montcalm, Redstone and McWatters, Shebandowan, Temiskaming Shores) Gallium (Peterborough) Niobium (James Bay Project, Prairie Lake Project, Prairie Lake, Martison Lake) Platinum group elements (Sudbury Camp, Lac des Iles, Shebandowan, Montcalm, Redstone, McWatters) Rare earth elements (Martison Lake, Prairie Lake) Titanium (Ring of Fire)
Tanks and armoured vehicles 	Beryllium (Thunder Bay Mining District) Copper (Sudbury Camp, Temagami Copper Mine, Shebandowan, Lac des Iles, Montcalm, Redstone, Keeley-Frontier) Gallium (Peterborough) Rare earth elements (Martison Lake, Prairie Lake) Tantalum (Thunder Bay Mining District) Titanium (Ring of Fire) Tungsten (Fostung Project, Monument Bay Gold and Tungsten Project)

Defence Application	Required Minerals Available in Ontario
Missiles and precision-guided munitions 	Cobalt (Cobalt-Gowganda Camp, Sudbury Camp, Crawford Project, Lac Des Iles, Montcalm, Redstone and McWatters, Shebandowan, Temiskaming Shores) Gallium (Peterborough) Rare earth elements (Martison Lake, Prairie Lake) Titanium (Ring of Fire) Tungsten (Fostung Project, Monument Bay Gold and Tungsten Project)
Military satellites and space systems 	Gallium (Peterborough) Platinum group elements (Sudbury Camp, Lac des Iles, Shebandowan, Montcalm, Redstone, McWatters) Rare earth elements (Martison Lake, Prairie Lake) Titanium (Ring of Fire)
Submarines and naval vessels 	Cobalt (Cobalt-Gowganda Camp, Sudbury Camp, Crawford Project, Lac Des Iles, Montcalm, Redstone and McWatters, Shebandowan, Temiskaming Shores) Graphite (Albany Graphite, Kearney, Bissett Creek, Black Donald, Meadow Lake, Kirkham, Portland) Rare earth elements (Martison Lake, Prairie Lake) Titanium (Ring of Fire)

Defence Application	Required Minerals Available in Ontario
Military communications and battlefield command systems 	Copper (Sudbury Camp, Temagami Copper Mine, Shebandowan, Lac des Iles, Montcalm, Redstone, Keeley-Frontier) Gallium (Peterborough) Indium (Timmins) Rare earth elements (Martison Lake, Prairie Lake) Silver (Cobalt, Silver Islet, Gowganda)
Radar, air-defence, and electronic warfare systems 	Beryllium (Thunder Bay Mining District) Gallium (Peterborough) Rare earth elements (Martison Lake, Prairie Lake) Silver (Cobalt, Silver Islet, Gowganda)
Military drones and uncrewed systems 	Cobalt (Cobalt-Gowganda Camp, Sudbury Camp, Crawford Project, Lac Des Iles, Montcalm, Redstone and McWatters, Shebandowan, Temiskaming Shores) Lithium (Separation Rapids, PAK and Spark, Mavis Lake, Raleigh Lake, Root Bay and McCombe, Seymour, Georgia Lake area) Nickel (Sudbury Camp, Shebandowan, Lac des Iles, Montcalm, Redstone, Texmont, Alexo, McWatters) Rare earth elements (Martison Lake, Prairie Lake)

Defence Application	Required Minerals Available in Ontario
Military batteries and electrified defence platforms 	Cobalt (Cobalt-Gowganda Camp, Sudbury Camp, Crawford Project, Lac Des Iles, Montcalm, Redstone and McWatters, Shebandowan, Temiskaming Shores) Graphite (Albany Graphite, Kearney, Bissett Creek, Black Donald, Meadow Lake, Kirkham, Portland) Lithium (Separation Rapids, PAK and Spark, Mavis Lake, Raleigh Lake, Root Bay and McCombe, Seymour, Georgia Lake area) Nickel (Sudbury Camp, Shebandowan, Lac des Iles, Montcalm, Redstone, Texmont, Alexo, McWatters)
Hypersonic systems and advanced propulsion systems 	Cobalt (Cobalt-Gowganda Camp, Sudbury Camp, Crawford Project, Lac Des Iles, Montcalm, Redstone and McWatters, Shebandowan, Temiskaming Shores) Niobium (James Bay Project, Prairie Lake Project, Prairie Lake, Martison Lake) Rare earth elements (Martison Lake, Prairie Lake) Titanium (Ring of Fire)

Sources: NATO,⁸¹ Government of Canada,⁸² Silverado Policy Accelerator,⁸⁴ International Institute for Strategic Studies,⁸⁵ Ontario Ministry of Mines,⁸⁶ Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry,⁸⁷ Facets⁸⁸

Importance of Processing, Refining, and Advanced Materials

The strategic value of critical minerals depends not only on where they are mined, but also on whether they can be refined, processed, and converted into usable materials within trusted supply chains. Before entering batteries, semiconductors, advanced electronics, or defence systems, raw minerals must undergo several stages of transformation.^{7,89} Nickel, for example, needs to be refined and converted into battery-grade chemicals such as nickel sulfate before it can be used in electric vehicles and defence energy systems. Rare earth elements require separation and

refining before they can be used in electric motors, radar, and communications equipment. As a result, refining, processing, and advanced materials production are increasingly viewed as strategic capabilities alongside mineral extraction.^{82, 90, 91}

Chinese export controls affecting rare earth elements, battery materials, processing technologies, and advanced manufacturing inputs have reinforced concerns regarding supply chain resilience. As governments seek to reduce exposure to concentrated supply sources, increasing attention is being directed toward strategies that strengthen resilience through a combination of domestic capacity, supplier diversification, recycling and circular economy initiatives, and partnerships with trusted international jurisdictions. Within this context, integrated value chains that connect mineral extraction with refining, processing, advanced materials production, component manufacturing, and technology development are increasingly viewed as important contributors to secure and resilient supply chains.

Ontario is already contributing to this transition. In addition to a USD \$20 million award from the U.S. Department of Defense,⁹² Electra Battery Materials Corporation's cobalt sulfate refinery in Temiskaming Shores has received CAD \$20 million from the Government of Canada⁹³ and CAD \$17.5 million from Invest Ontario.⁹⁴ Cobalt sulfate is a precursor for large-capacity batteries used in U.S. defence systems. The investment is also intended to strengthen North American battery and critical-minerals supply chains. The project demonstrates how Ontario-based processing capacity can serve commercial battery and electrified-mobility markets while supporting allied defence requirements.

This reinforces the importance of moving beyond resource extraction toward more integrated value chains that include refining, recycling, advanced materials production, component manufacturing, testing, and commercialization. Strengthening these capabilities would allow Ontario to capture more value from its mineral resources. It would also

reinforce trusted supply chains for dual-use technologies, including batteries, autonomous systems, secure communications, sensing, aerospace, and resilient energy platforms.⁹²

Northern Ontario Resources and Southern Ontario Manufacturing

Ontario's combination of Northern mineral resources and Southern manufacturing capacity creates a foundation for integrated dual-use. The province has deposits and advancing projects involving nickel, cobalt, lithium, graphite, copper, platinum group elements, rare earth elements, tungsten, niobium, and chromium. Several of these materials support both commercial technologies and defence systems. NATO identifies cobalt, lithium, platinum, tungsten, graphite, and rare earth elements among the raw materials that are critical to Allied defence production and operational readiness.⁸¹ Ontario's opportunity lies in connecting mineral development with in-province processing, advanced-materials production, component manufacturing, and recycling.

The Fostung project, located approximately 70 kilometres west of Sudbury, illustrates the potential role that Ontario's critical mineral endowment could play in supporting North American supply chains for strategically important materials. In 2025, United States Antimony acquired the property and indicated its intention to advance exploration and evaluation activities. A 2026 technical assessment reported an inferred tungsten resource containing approximately 53.6 million pounds of tungsten trioxide, although the project remains at an early stage of development. Tungsten's density, hardness, and heat resistance make it relevant to military applications such as kinetic-energy penetrators, tank shielding, counterweights, and aerospace components, as well as civilian applications in electronics, tooling, welding, and medical equipment. Development of Fostung could therefore support both advanced manufacturing and allied efforts to reduce dependence on highly concentrated foreign tungsten supply and processing.^{95, 96}

The Crawford Nickel Project, located north of Timmins, illustrates the

potential scale and diversity of Northern Ontario's mineral contribution. The project is planned around a major nickel resource and could also produce cobalt, chromium, iron, and platinum group metals. Ontario has accelerated the project under its One Project, One Process framework, while the federal government has referred it to the Major Projects Office. Although its initial markets are expected to include batteries, stainless steel, and green steel, Crawford's prospective nickel, cobalt, chromium, and platinum-group output could also strengthen trusted material supply for aerospace, military mobility, high-performance alloys, electronics, and other strategic manufacturing activities. The project's planned downstream nickel processing and alloy-production capacity is particularly important to improving defence supply resilience.^{97, 98}

Northwestern Ontario's advancing lithium projects provide another dual-use pathway. Federal infrastructure funding has supported road, electricity, engineering, and Indigenous-engagement work associated with the Frontier Lithium PAK project, Rock Tech Lithium's Georgia Lake project, and other proposed lithium developments near Armstrong and Nipigon.^{99, 100}

These projects are primarily positioned to serve commercial battery markets, but lithium is also required for rechargeable batteries used in portable communications, uncrewed systems, surveillance equipment, and other mobile defence technologies.⁸¹ Connecting Northern Ontario's advancing lithium projects with future in-province chemical conversion, battery-material production, and Southern Ontario's cell and advanced-manufacturing capacity could therefore serve commercial mobility at scale while expanding the trusted supply available for defence energy-storage applications.¹⁰⁰

Together, these examples show that Northern Ontario's defence relevance extends beyond the availability of mineral deposits. The larger opportunity lies in connecting resource development to refining, advanced-material production, alloy manufacturing, battery inputs,

traceability systems, and component production elsewhere in the province. Stronger linkages between Northern projects and Southern Ontario's automotive, aerospace, electronics, and advanced-manufacturing industries would allow Ontario to retain more value while contributing to secure North American supply chains for military mobility, aerospace systems, autonomous platforms, communications equipment, and other dual-use technologies. This integration would also align with Ontario's emerging defence strategy, which identifies critical minerals, domestic processing, and integrated supply chains as foundations for the province's defence-industrial growth.¹⁰¹

4.2 Trusted, Traceable and Resilient Supply Chains

Supply Chain Resilience

Supply chain resilience is becoming an increasingly important consideration for dual-use and defence technologies. As defence systems become more technologically complex and interconnected, their development and deployment depend on access to a broad network of suppliers, manufacturers, software providers, critical materials, and supporting infrastructure. Many of the technologies driving innovation in advanced manufacturing, connected mobility, artificial intelligence, communications systems, aerospace, and defence are produced through globally integrated supply chains. Disruptions affecting any part of these networks can have implications for both commercial production and national-security capabilities. As a result, governments are increasingly treating supply chain resilience as a component of economic security, industrial competitiveness, and defence preparedness.

Geopolitical tensions, trade disputes, semiconductor shortages, critical-mineral concentration risks, and logistics disruptions have exposed vulnerabilities within globally integrated production systems. Governments and industry are responding by diversifying suppliers, strengthening domestic capacity, and expanding sourcing relationships

with trusted allies. These measures are especially important for dual-use technologies because commercial and defence products often depend on the same materials, components, software platforms, and manufacturing capabilities.^{102,103,104}

Trusted and Traceable Supply Chains

A key outcome of this shift is the growing importance of supply chain transparency and traceability. What began largely as a regulatory and sustainability requirement is increasingly becoming a prerequisite for participation in advanced technology and strategic manufacturing ecosystems. Automotive manufacturers, technology firms, and government organizations are increasingly incorporating supplier transparency, provenance tracking, environmental performance, and operational risk management into procurement decisions. Programs such as Volkswagen Group's S-Rating and BMW's Catena-X ecosystem illustrate how access to major industrial supply chains is becoming increasingly dependent on verifiable supply chain performance and trusted data sharing.^{105, 106}

Regulatory developments are reinforcing these expectations. The European Union's Battery Regulation will require digital battery passports beginning in 2027, while similar sourcing and disclosure requirements are emerging across North American battery, critical-mineral, and advanced-manufacturing value chains. Together, these developments are increasing demand for supply chains capable of providing verified information across the full product lifecycle, from material extraction and processing through manufacturing, deployment, and end-of-life recovery.^{107, 108, 109}

For defence and dual-use systems, traceability has implications beyond sustainability and regulatory compliance. Governments need confidence that critical materials, components, software, and manufacturing processes do not introduce unacceptable supply, security, or operational risks. Verified provenance and supplier visibility can help reduce

exposure to adversarial jurisdictions, identify dependencies, and support continuity during disruptions. These capabilities are therefore becoming a strategic requirement for firms seeking to participate in defence procurement and allied industrial programs.

This requirement is reflected in U.S. defence procurement. The Defense Logistics Agency requires vendors to document the supply chain from the supplier to the approved manufacturer. Vendors that cannot demonstrate acceptable provenance may have offers or materials rejected, orders cancelled, or products subjected to verification testing. Traceability therefore functions as a practical procurement-control mechanism for confirming that components are authentic, technically compliant, and obtained from approved sources.¹¹⁰

Similar rules generally require defence contractors to source electronic parts from original manufacturers or approved suppliers. Parts obtained through other channels may require inspection, testing, and authentication to prevent counterfeit or misrepresented components from entering defence systems.¹¹¹ This demonstrates the importance of component-level traceability for Ontario firms seeking to supply electronics, sensors, processors, communications equipment, and other dual-use technologies to allied defence markets.

Defence organizations are also pursuing more continuous supply chain visibility. A 2025 Defense Business Board review recommended mapping critical supply chains through digital bills of materials and software bills of materials, supported by supplier traceability and near-real-time monitoring of selected high-risk components and networks.¹¹²

Trusted Continental Supply Networks

Ontario's integration within North American manufacturing and security networks provides a foundation for participation in trusted defence and dual-use supply chains. Established relationships among manufacturers, suppliers, technology developers, research institutions, and end users

support access to production capacity and specialized capabilities across Canada and the U.S. These longstanding cross-border production networks have helped create highly integrated industrial ecosystems spanning automotive manufacturing, advanced technology development, research, and supply chain operations. As governments and firms place increasing emphasis on resilience, security, and trusted industrial partnerships, maintaining strong relationships across these networks will remain an important source of competitive advantage.¹¹³

For dual-use systems, trusted sourcing must extend across both physical and digital inputs. Materials, electronics, embedded software, cloud services, and connected components may all require evidence of provenance, security, technical compliance, and continued availability. Meeting these requirements is becoming increasingly important as governments and defence organizations place greater emphasis on secure communications, advanced sensing, autonomous systems, cybersecurity, and resilient infrastructure, capabilities that are increasingly found within Ontario's commercial technology and manufacturing sectors.

Participation in these markets will depend not only on technological capability, but also on the ability to meet defence requirements for traceability, software assurance, interoperability, production reliability, and lifecycle support. Canada's Defence Industrial Strategy, including its Build-Partner-Buy approach, seeks to strengthen these capabilities by prioritizing domestic capability development, collaboration with trusted partners, and creating more opportunities for Canadian firms to participate in defence procurement and innovation ecosystems.

For Ontario firms, this policy direction may create new pathways to adapt commercially developed technologies for defence applications. Strengthening supplier readiness and trusted production networks would also position these firms to contribute to more resilient Canadian and North American defence supply chains.



5. Ontario's Strategic Position and Ecosystem Readiness

Ontario's ability to participate in emerging dual-use markets will depend not only on the technologies being developed within the province, but also on the strength and connectivity of the broader innovation ecosystem supporting them. Successful dual-use ecosystems require more than research excellence or individual technology firms. They depend on coordinated networks that connect innovators with commercialization support, testing infrastructure, investors, manufacturers, end users, supply chains, and procurement pathways.

Ontario enters this opportunity with significant advantages, including one of North America's largest automotive and mobility ecosystems, a strong research base, advanced manufacturing capabilities, specialized testing infrastructure, and growing policy support for innovation and industrial development. This section assesses Ontario's readiness to capitalize on the growing importance of dual-use technologies by examining the province's capacity, ecosystem strengths, current gaps, and opportunities to strengthen commercialization and adoption pathways.

5.1 Ontario's Capacity and Dual-Use Potential

Ontario's dual-use potential rests on its ability to combine technology development with industrial-scale production, systems integration, and real-world validation. The province's automotive and mobility ecosystem brings together major assemblers, nearly 700 parts suppliers, globally active Tier 1 firms, software developers, research institutions, and specialized testing facilities.¹¹⁴ At the same time, Original Equipment Manufacturer (OEM) research investments, including Ford's Connectivity and Innovation Centres in Ottawa, Waterloo, and Oakville, have reinforced Ontario's position in software-defined vehicles, connected mobility, and autonomous systems development.¹¹⁵ This breadth is strategically important because, as described previously, modern defence platforms increasingly depend on capabilities also found in advanced mobility systems, including embedded software, autonomy, sensing, secure communications, electrification, and advanced manufacturing.

Ontario's innovation ecosystem is further supported by structured testing and validation environments. Through its Regional Technology Development Sites (RTDS) Network, OVIN supports facilities such as Area X.O which provide integrated testing infrastructure for autonomous vehicles, smart city technologies, and V2X systems, including advanced telecommunications networks, cyber-resilience labs, and real-world simulation capabilities.¹⁶⁹ These assets support the testing, validation, and demonstration of emerging technologies in controlled and operationally relevant environments, helping organizations evaluate performance, safety, cybersecurity, interoperability, and deployment readiness.¹¹⁶ These facilities also provide a foundation for assessing the performance, safety, cybersecurity, and interoperability of mobility technologies with potential defence and security applications.

Ontario's testing infrastructure enables firms to evaluate connected and autonomous systems, communications technologies, sensors, and

vehicle components under controlled and real-world conditions. However, demonstrating commercial performance does not necessarily establish defence readiness. Technologies intended for defence and security applications may be required to operate in harsh terrain, extreme weather, degraded communications environments, and contested cyber conditions while meeting additional security, assurance, and interoperability requirements. Ontario's opportunity therefore lies not only in developing innovative technologies, but in converting existing commercial strengths into defence-ready capabilities. Achieving this transition will require stronger connections among mobility companies, defence customers, prime contractors, research institutions, testing organizations, and validation environments.

Canada's Defence Industrial Strategy identifies many of these enabling relationships as critical to strengthening domestic industrial capability and expanding participation in defence innovation and procurement ecosystems. Firms that are able to meet defence-specific requirements for security qualification, operational validation, supplier readiness, and production scale-up will be better positioned to participate in allied defence supply chains while continuing to leverage commercial markets that support investment, innovation, and manufacturing scale.^{1, 117}

Expanding Ontario's pool of defence-ready suppliers would also advance the federal strategy's objectives by strengthening domestic production, retaining strategically important intellectual property, and reducing reliance on external sources of critical technologies. Realizing that opportunity will depend on connecting Ontario firms with defence customers, prime contractors, accreditation pathways, operational test environments, and long-term procurement demand.

Policy Alignment, Strategic Investment, and Ecosystem Scaling

Federal and provincial policy is creating a more direct pathway for Ontario's commercial technology and manufacturing capabilities to

support defence priorities. Canada's Defence Industrial Strategy centres on five connected objectives:

- Strengthening government–industry relationships,
- Procuring strategically through the build–partner–buy framework,
- Investing in defence innovation,
- Securing critical supply chains, and
- Working with domestic partners.

It also emphasizes Canadian intellectual property, small and medium-sized business participation, workforce development, and export growth. Together, these priorities shift the focus from funding individual technologies to building the industrial capacity needed to develop, produce, sustain, and upgrade defence capabilities in Canada.¹

Canada's defence policy, *Our North, Strong and Free*, provides the strategic demand underpinning this industrial effort. The policy prioritizes Canadian sovereignty, continental defence, procurement reform, digital transformation, and a more innovative domestic defence industrial base.¹¹⁸ These priorities create demand for capabilities relevant to Ontario's mobility and technology sectors, including autonomous systems, advanced sensing, secure communications, software-defined platforms, and technologies suited to remote or infrastructure-constrained environments. Canada's Defence Industrial Strategy provides the corresponding framework for developing, producing, and sustaining these capabilities domestically.

This direction aligns closely with Ontario's emerging defence policy. The Framework for the Ontario Defence Industrial Strategy focuses on strengthening the province's industrial base, commercializing technologies in fields such as artificial intelligence and advanced materials, expanding access to defence markets, and building integrated supply chains.^{119, 120}

Ontario is home to more than 300 defence organizations employing over 13,000 workers and generating more than \$5 billion in annual revenue.^{119, 121} As such, Ontario accounts for 35 percent of Canada's defence industry employment, primarily in aircraft, mission and simulation systems, combat vehicle manufacturing, and aircraft and parts manufacturing.¹²² The strategic opportunity is to connect these established defence capabilities with the province's larger commercial and dual-use ecosystem. The Ontario Defence Industrial Strategy framework highlights the province's capacity to support allied defence requirements, attract investment, and create economic benefits, with projections of tens of thousands of jobs and billions in economic contribution by 2035.¹¹⁹

Targeted federal investment delivers one mechanism for making this connection. The Regional Defence Investment Initiative (RDII) provides a national funding envelope of \$379.2 million to support innovation and industrial capacity in defence and security sectors. Delivered through regional development agencies, the initiative prioritizes dual-use organizations in areas such as artificial intelligence, cybersecurity, sensors, autonomous systems, and advanced manufacturing.¹²³ In Southern Ontario, nearly \$200 million in combined funding is being deployed through FedDev Ontario, creating a significant pool of capital for organizations seeking to scale into defence-related markets. These programs create a defined pathway for Ontario-based companies to transition from commercial mobility applications into defence supply chains. Businesses already developing and validating technologies through OVIN programs, corridor pilots, and test environments are well positioned to leverage RDII funding to expand into adjacent sectors.¹²⁴

Provincial policy is reinforcing this direction. Ontario's 2025 budget includes additional venture capital funding through Venture Ontario, with a targeted allocation for technologies related to artificial intelligence, cybersecurity, and national defence.¹²⁵ The Province has

also recently expanded OVIN's R&D Partnership Fund to include a dedicated stream for defence and dual-use technologies. These funding programs function as a complementary mechanism to federal programs, supporting earlier-stage innovation and enabling businesses to scale toward commercial and strategic applications.

Ontario's existing defence firms illustrate the industrial pathways that this policy alignment could deepen. L3Harris WESCAM supplies advanced imaging systems,¹²⁶ MDA Space develops space-based surveillance and communications capabilities,¹²⁷ and General Dynamics Land Systems–Canada manufactures military vehicles.¹²⁸ These firms demonstrate Ontario's ability to combine specialized technologies with systems integration and production. They can also provide potential entry points for commercial suppliers developing relevant software, sensors, electronics, materials, manufacturing processes, and mobility technologies.

The policy environment also supports earlier-stage commercialization. Provincial capital directed toward artificial intelligence, cybersecurity, and national-defence technologies can complement federal scale-up programs by helping firms develop and retain strategic capabilities before pursuing defence customers. This is important for dual-use companies, which may need to preserve commercial revenue while investing in security clearances, product assurance, operational testing, intellectual-property protection, and defence-specific production requirements.

The principal challenge is therefore not whether Ontario has defence-relevant capabilities, but whether those capabilities can move efficiently from commercial development to defence adoption. Effective alignment will require clear demand signals, earlier engagement with defence customers and prime contractors, support for accreditation and testing, and procurement pathways that allow successful technologies to progress into production. It will also require measures that retain

intellectual property, manufacturing capacity, and lifecycle-support functions in Ontario. These connections would help translate policy investment into a larger base of qualified suppliers, stronger domestic supply chains, and scalable capabilities that serve both commercial and allied defence markets.

5.2 Ecosystem Strengths, Gaps and Opportunities

A dual-use ecosystem brings together the companies, research institutions, investors, governments, infrastructure owners, end users, and commercialization partners needed to develop technologies that can serve both civilian and defence or security applications. Ontario's dual-use mobility opportunity, therefore, depends not only on the presence of individual firms or technologies, but on how effectively the province connects automotive manufacturing, mobility innovation, defence customers, research institutions, testing environments, capital, and commercialization support. A well-functioning ecosystem must be able to move a technology from commercial development through defence-specific adaptation, operational validation, systems integration, production, procurement, and long-term support. Canada's Defence Industrial Strategy similarly emphasizes the importance of strengthening the relationships among government, industry, innovators, research institutions, and domestic suppliers required to build and sustain defence capability.¹

Ontario enters this transition with substantial industrial and technological depth. As discussed in Section 5.1, the province has an existing defence-industrial base alongside a much larger automotive, mobility, software, and advanced-manufacturing ecosystem. Southern Ontario alone is reported to have more than 900 defence-capable organizations, with recognized strengths in advanced manufacturing, aerospace, automotive technologies, cybersecurity, robotics, and artificial intelligence.¹²⁹ The significance of this broader base is not that

every organization is currently ready to supply defence programs. Rather, it indicates that Ontario has a large pool of firms with potentially transferable technologies, production capabilities, and technical expertise that could be developed into a deeper defence and dual-use supplier base.

The distinction between defence-capable and defence-ready is therefore important. A mobility company may possess commercially validated software, sensors, batteries, autonomous systems, vehicle components, or manufacturing processes with credible defence relevance. However, participation in defence programs can also require customer-specific qualification, secure contracting arrangements, cybersecurity and information-assurance controls, export compliance, production assurance, integration with other systems, and the ability to provide lifecycle support. Ontario's central ecosystem challenge is not an absence of applicable capabilities. It is the need for clearer and more efficient pathways that convert commercial mobility strengths into solutions that can meet defence operational and procurement requirements. Figure 2 illustrates Ontario's dual-use mobility system as well as the related strengths, gaps, and opportunities.

Ontario's Assets Across the Dual-Use Value Chain

Ontario's principal strength is the breadth of capabilities available across the mobility value chain. The province combines vehicle-platform manufacturing, automotive suppliers, embedded software, autonomy, sensing, electrification, batteries, advanced production technologies, and engineering services. These capabilities are relevant to defence mobility because modern military vehicles and logistics systems increasingly depend on the same technology layers found in advanced commercial vehicles: software-defined architectures, secure communications, sensor integration, power and energy management, automated navigation, fleet intelligence, and precision manufacturing.

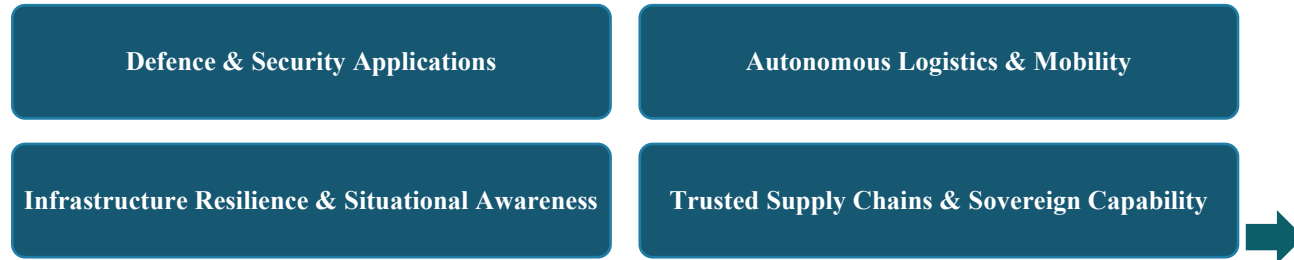
At the platform level, Ontario has firms that already integrate commercial automotive foundations with defence-specific design and manufacturing.¹³⁰ Brampton-based Roshel, one of Canada's leading defence manufacturers, designs and manufactures armoured vehicles for military, law-enforcement, and emergency-response customers.¹³¹ Its product model demonstrates one route through which Ontario's automotive ecosystem can support defence mobility: commercially available vehicle platforms and established automotive components can be combined with specialized armour, suspension, communications, surveillance, and protection systems to meet more demanding operational requirements. Roshel's use of a modular vehicle platform also illustrates that dual-use value can arise from the integration and adaptation of commercial technologies rather than from developing every component through a defence-only supply chain.¹³²

While Roshel has a vertically integrated supply chain, the company also leverages domestic suppliers for externally procured dual-use components such as a commercial Ford truck chassis and motors from a Canadian supplier. It also develops talent and local expertise critical for the dual-use ecosystem.¹³⁰

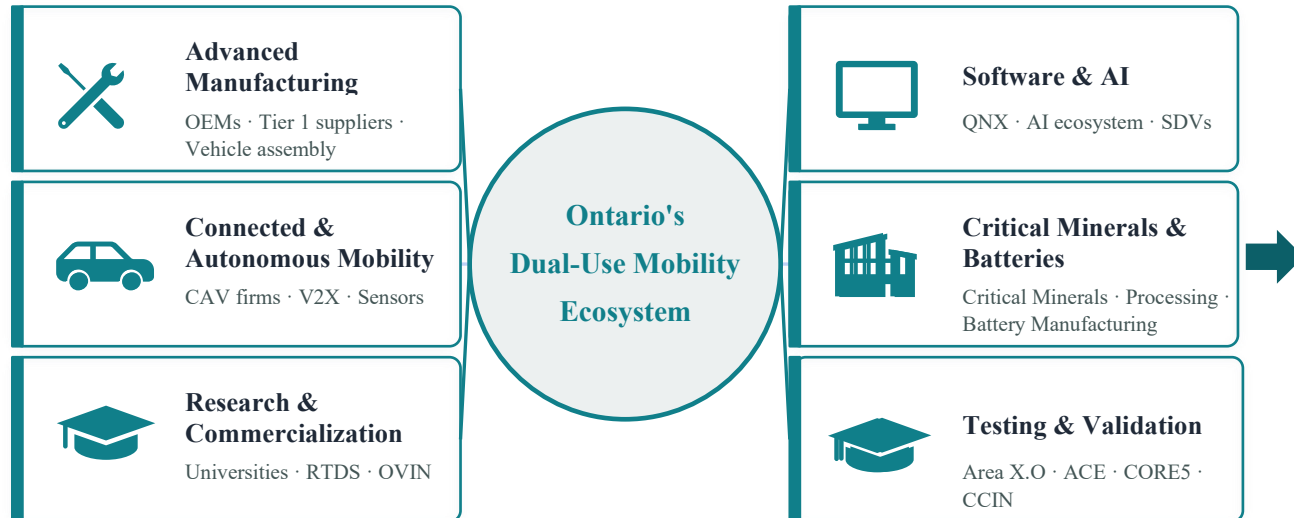
A broader group of Ontario suppliers provides the industrial capabilities needed to produce, modify, and sustain these platforms. Firms offering tooling, automation, precision manufacturing, repair, engineering, and parts can support both civilian vehicle production and defence fleets. Examples of this cross-sector capacity are Armo Tool's work automation and robotics for automotive, heavy truck, defence, and nuclear applications,¹³³ and JROBERTS Defence's support for military vehicle repair and parts.¹³⁴ The strategic value of these firms lies not only in supplying individual components, but also in their ability to apply established automotive production disciplines, such as repeatable manufacturing, quality control, supplier coordination, and product support, to lower-volume and specialized defence requirements.

Figure 2: Ontario's Dual-Use Mobility Ecosystem

CONTRIBUTIONS TO SOVEREIGN CAPABILITY



ONTARIO'S CORE STRENGTHS



ECOSYSTEM AREAS FOR IMPROVEMENT



OPPORTUNITY AREAS

Where strengths convert to advantage once gaps are closed



Ontario also has an important position in the software layer of next-generation mobility. As vehicles and defence platforms become increasingly software-defined, embedded operating systems, cybersecurity, deterministic performance, updateability, and long-term software support are becoming integral to platform reliability. Waterloo-based QNX's collaboration with TKMS demonstrates how expertise developed across automotive and other safety-critical markets can extend into defence. Under the collaboration, TKMS plans to use QNX foundational software in next-generation naval platforms, with an emphasis on resilient embedded systems, platform longevity, and interoperability. Although the application is maritime rather than road-based, it provides a concrete example of how Ontario's software-defined mobility capabilities can transfer into complex defence platforms.¹³⁵

Electrification provides another potential bridge between civilian mobility and defence applications. Ontario firms developing battery-management systems, high-energy-density batteries, thermal-management technologies, power electronics, and charging systems may be relevant to uncrewed systems, silent-watch capability, auxiliary power, portable communications, and electrified logistics platforms. Ottawa-based GBatteries, for example, is developing intelligent battery management and high-energy-density battery technologies for electric mobility applications, including drones, vehicles, and micromobility platforms.¹³⁶ The defence relevance of such technologies will depend on whether they can meet more demanding requirements related to safety, weight, endurance, temperature, reliability, secure control, and operation under constrained conditions. The ecosystem opportunity is therefore not simply to identify battery firms as "dual-use," but to help determine which technologies have credible operational applications and what additional engineering and validation would be required.

Ontario's connected and autonomous mobility cluster provides a particularly broad pipeline of potential dual-use capabilities. More than

400 companies in the province work in connected and autonomous vehicle development and smart mobility.¹³⁷ Their activities span areas such as perception, artificial intelligence, vehicle control, simulation, mapping, telematics, fleet management, connectivity, and infrastructure integration. These are commercially diverse capabilities, but many correspond to technology layers required for autonomous logistics, uncrewed ground systems, coordinated fleets, route planning, infrastructure monitoring, and mobility in remote or hazardous environments.

The size of this cluster should not be interpreted as an estimate of the number of defence-ready firms. It instead indicates the breadth of Ontario's potential technology pipeline. A more useful measure of ecosystem readiness would assess how many companies have a defined defence use case, protectable Canadian intellectual property, a technology that can be adapted without undermining its commercial market, access to relevant test environments, and a credible route to a prime contractor or public-sector customer. This distinction would shift the assessment from counting potentially relevant companies to evaluating their readiness to move from commercial mobility into dual-use adoption.

Taken together, Ontario's advantage is not based on a single defence technology or manufacturer. It lies in the potential to connect commercially scaled automotive platforms and suppliers with specialized defence firms, software developers, battery and autonomy companies, research institutions, and systems integrators. This breadth can support innovation across the complete mobility system, from materials and components to vehicle platforms, embedded software, communications, fleet operations, and sustainment.

The principal gap is fragmentation across that value chain. Commercial mobility firms may not understand defence demand, while defence customers and prime contractors may have limited visibility into

technologies emerging from civilian markets. Research may not be connected to operational requirements, commercially successful products may lack defence-specific assurance, and promising technologies may stall between demonstration and procurement. Ontario’s opportunity is therefore to build stronger conversion pathways between commercial capability and defence adoption while preserving the civilian markets that provide scale, investment, and continued product development.

The subsections that follow assess the main assets supporting that transition: research capacity, scalable industrial production, and testing infrastructure. They also examine whether these assets operate as an integrated pathway from research to deployment or remain a collection of strong but insufficiently connected capabilities.

Research and Commercialization Capacity

World-Class Research Institutions

Ontario’s research institutions provide scientific and engineering capabilities that are directly relevant to the next generation of mobility and defence systems. Areas of strength include artificial intelligence, autonomous systems, robotics, batteries, advanced materials, power electronics, cybersecurity, vehicle integration, and simulation. These capabilities support commercial automotive innovation while also contributing to the technology foundations required for autonomous logistics, resilient vehicle systems, uncrewed platforms, secure communications, and mobility in remote or demanding environments.

The ecosystem’s strategic value, however, depends on more than the volume or quality of research. Dual-use requires mechanisms that connect research with defined operational needs, industry-led development, intellectual-property strategy, systems integration, validation, and a customer capable of adopting the resulting technology. Ontario’s opportunity is therefore to use its research capacity as part of

a connected mobility commercialization pathway rather than treating universities and laboratories as stand-alone ecosystem assets. Table 4 highlights institutions with capabilities relevant to this pathway and identifies how their work can contribute to civilian and defence mobility applications.

Table 4: Examples of Research Institutions Supporting Dual-Use Innovation in Ontario

Institution	Centres, Laboratories, and Dual-Use Innovation Contribution
University of Waterloo	Waterloo's automotive research ecosystem supports several technologies with applications across both civilian and security sectors. The Ontario Battery and Electrochemistry Research Centre (OBEC) advances next-generation battery chemistries, cell materials, and manufacturing processes that are relevant to electric vehicles, energy storage systems, and electrified defence platforms. The Centre for Automotive Research (CAR) brings together more than 60 researchers focused on connected and autonomous systems, software, sensors, and vehicle electronics, capabilities that underpin both commercial mobility solutions and autonomous security applications. ¹³⁸ The University of Waterloo is also a member of the Waterloo Dual-Use Technology Consortium contributing with R&D on quantum, AI and advanced materials to the region’s dual-use ecosystem. ¹³⁹
McMaster University	McMaster's automotive and materials research contributes to foundational dual-use technologies in electrification, energy storage, and advanced manufacturing. The McMaster Automotive Resource Centre (MARC) hosts significant research on vehicle electrification, while the Magnetic Resonance and Materials for Energy Storage Lab

Institution	Centres, Laboratories, and Dual-Use Innovation Contribution
	provides specialized expertise in battery materials, degradation, and safety, capabilities that have relevance for transportation, energy resilience, and defence-related energy systems. ¹⁴⁰ McMaster's contribution to dual-use research also includes the Vaid Lab for Dual-Use Technologies researching defence to commercial technology transitions. ¹⁴¹
University of Toronto	Through the Department of Mechanical and Industrial Engineering, Electric Vehicle Innovation Ontario (EVIO), and the Robotics Institute, the University of Toronto conducts research across vehicle systems, power electronics, robotics, and autonomous systems. ^{142 , 143} These capabilities support commercial transportation and advanced manufacturing while also contributing to technologies commonly associated with dual-use applications, including autonomous platforms, sensing, and intelligent mobility systems. The university's commercialization ecosystem, including MaRS, helps translate these technologies into deployable products and companies. The University of Toronto is expanding its support for dual-use innovation and research through the Creative Destruction Lab (CDL) Defence program which provides support through funding and mentorship for science-based dual-use ventures. ¹⁴⁴
University of Windsor	Windsor's research strengths align closely with emerging dual-use priorities in electrification, power systems, and cybersecurity. The Centre for Automotive Research and Education (CARE) advances EV powertrains, motors, and power electronics, while the SHIELD Automotive Cybersecurity Centre develops expertise in software assurance, cyber resilience, and connected vehicle security.

Institution	Centres, Laboratories, and Dual-Use Innovation Contribution
	These capabilities support both commercial mobility and the protection of increasingly networked transportation and defence systems. ^{145, 146}
Ontario Tech University	Ontario Tech's Automotive Centre of Excellence (ACE) provides specialized testing infrastructure that supports the validation of vehicles and components in extreme operating environments. This capability is relevant not only to commercial transportation but also to military and public-safety vehicles that must operate in demanding conditions. As such, the ACE Climatic Wind Tunnel and Core Research Facility is a designated NATO DIANA test centre. ¹⁴⁷ The university's Clean Energy Research Laboratory supports hydrogen technology demonstrations with applications across commercial fleets, heavy-duty transportation, and energy-resilient operational environments. ¹⁴⁸
Western University	Through the Emergent Mobility for Resilient Communities Lab, Western University contributes expertise in connected, electric, and autonomous transportation systems. These technologies have relevance for both civilian mobility and resilient transportation networks, including applications that support emergency response and remote operations. Overall, Western University engages in more than 300 industry partnerships for research on dual-use technologies across land, maritime, air, space and cyber domains. ¹⁴⁹
Carleton University	Carleton's engineering and industrial design capabilities contributed to the development of Project Arrow, which demonstrated Canada's expertise in advanced vehicle integration, electrification, and systems engineering. These

Institution	Centres, Laboratories, and Dual-Use Innovation Contribution
	capabilities are applicable across a range of dual-use sectors where advanced mobility platforms, electrical systems, and vehicle design are increasingly important. ¹⁵⁰ In addition, Carleton University is home to the National Centre for Critical Infrastructure, Protection, Security and Resilience (CIPSER) that connects government, researchers and industry on infrastructure and security topics. ¹⁵¹ CIPSER for example supports research on dual-use technologies such as small modular nuclear reactors used as mobile power sources for military bases securing Canada's arctic. ¹⁵²

Regional Technology Development Sites (RTDS)

Ontario's research strengths are reinforced by OVIN's nine Regional Technology Development Sites (RTDS), a province-wide commercialization network supported by approximately CAD \$70 million in investment. The network connects post-secondary institutions, SMEs, incubators, and end users, giving firms access to technical expertise, specialized equipment, business support, and industry partnerships. For dual-use mobility companies, these resources can help translate research in areas such as autonomy, sensing, cybersecurity, advanced materials, and energy storage into integrated prototypes and commercially viable products.¹⁵³

OVIN-supported pilot and demonstration environments provide a further step toward deployment. AI- and 5G-enabled traffic-management pilots in Toronto and the OVIN Demonstration Zone in Vaughan, which has supported more than 100 startups and SMEs, allow mobility technologies to be evaluated in real-world settings. Although commercial demonstrations do not establish defence readiness, they can generate evidence on performance, safety, interoperability,

communications reliability, and scalability. This provides a foundation for subsequent adaptation and testing against more demanding defence requirements.^{154, 155}

Together, Ontario's research institutions and commercialization network create a potential pathway from scientific expertise to deployable dual-use mobility technologies. Stronger linkages between these assets would help commercially oriented firms identify credible defence applications while preserving the civilian markets that support continued innovation and scale.

Scalable Industrial Production

Ontario's dual-use mobility potential depends on its ability to convert innovation into repeatable, reliable, and supportable production. The province combines advanced research with vehicle assembly, extensive supplier networks, engineering expertise, tooling, automation, and access to critical inputs. This integration gives Ontario a stronger foundation for scaling strategically important technologies than jurisdictions that concentrate primarily on research or early-stage development.

The automotive sector anchors this capability. More than 100,000 Ontarians work in vehicle assembly and parts manufacturing, supporting operations for Ford, General Motors, Honda, Stellantis, and Toyota.¹⁵⁶ Beyond production volume, this ecosystem has developed expertise in quality assurance, supplier coordination, systems integration, precision manufacturing, and lifecycle support. These capabilities can be applied to defence mobility, uncrewed systems, vehicle electronics, energy systems, and sustainment. However, suppliers may still need to adapt to lower-volume production, defence-specific qualification, secure contracting, traceability, and more demanding operating requirements.^{157,158}

The strategic value of this industrial base is increasing as governments place greater emphasis on domestic production and trusted supply chains. Trade restrictions, technology controls, and sourcing requirements are reshaping investment decisions across semiconductors, batteries, connected systems, and advanced manufacturing. Ontario's established supplier base, North American market access, relatively low-carbon electricity, and growing mineral-processing capacity position it as a potential location for production that serves both commercial and allied defence markets.^{159, 160, 10}

Recent battery investments illustrate Ontario's ability to add production capacity in an important segment of the mobility value chain. Volkswagen PowerCo's planned St. Thomas facility would establish large-scale battery-cell manufacturing, while NextStar Energy's Windsor plant represents Canada's first commercial-scale advanced battery manufacturing facility.¹⁶¹ Although directed primarily toward electric-vehicle markets, these investments expand capabilities in cell production, process control, battery integration, and supplier development that may also support defence energy-storage applications. Potential uses include uncrewed systems, auxiliary power, portable equipment, and electrified logistics platforms, subject to defence-specific requirements for safety, endurance, weight, temperature tolerance, and reliability.^{162, 163}

These investments do not by themselves create a defence-ready battery or mobility supply chain. Their strategic value lies in expanding the industrial capabilities, workforce, infrastructure, and supplier depth from which dual-use production can develop. Ontario's opportunity is to connect this commercial scale with defence customers, prime contractors, qualification pathways, and procurement demand. Doing so would allow the province to capture more value from its innovation ecosystem while advancing the domestic industrial capacity, trusted

supply chains, and supplier readiness prioritized in Canada's Defence Industrial Strategy.

Defence-Relevant Testing Infrastructure

Commercial mobility technologies often require additional validation before they can be considered for defence applications. Systems intended for military use may need to operate across rugged terrain, extreme temperatures, degraded communications, cyber-contested environments, and remote locations. They may also need to satisfy stricter requirements for reliability, interoperability, security, and lifecycle support. Ontario's testing advantage lies in its ability to assess many of these characteristics within a connected research, commercialization, and manufacturing ecosystem.^{164, 165}

OVIN's RTDS network provides the provincial foundation for this capability. Its distributed facilities support the development, testing, prototyping, validation, and commercialization of automotive and smart-mobility technologies. For dual-use firms, the network can help identify performance limitations, generate technical evidence, and determine what further adaptation may be required before a commercially developed technology can enter defence qualification or procurement pathways.¹⁶⁶

Several Ontario facilities offer capabilities with direct relevance to defence mobility. Ontario Tech University's Automotive Centre of Excellence (ACE), part of OVIN's Regional Technology Development Sites (RTDS) network, can evaluate vehicles and components under controlled climatic conditions and is designated as a NATO DIANA test centre.¹⁶⁵ In 2026, Ontario Tech also received a \$5 million investment from FedDev Ontario to expand ACE's capabilities as a Canadian defence technology hub, strengthening testing and validation capacity for advanced vehicles, aerospace systems, drones, and other emerging defence technologies. OVIN's Northern RTDS provides underground and industrial environments for validating electrification,

communications, sensing, and mobility technologies through the CORE5 network.¹⁶⁷ OVIN's Simcoe-Barrie-Orillia RTDS offers simulation, prototyping, rugged-terrain evaluation, and advanced manufacturing through the Oro Station Innovation Park and Georgian College.¹⁶⁸ Together, these facilities can help assess whether technologies developed for structured commercial settings can perform under conditions more representative of military logistics, remote operations, and uncrewed-system deployment.¹⁴⁷

Ontario also possesses nationally significant testing and validation infrastructure for connected, autonomous, and mission-critical technologies. OVIN's Ottawa RTDS provides one of Canada's leading testing environments for connected and autonomous vehicles, uncrewed aerial systems, robotics, V2X applications, and other advanced mobility technologies through Area X.O.¹⁶⁹ The facility's strategic importance has been further reinforced through its designation as a NATO DIANA test centre, providing defence innovators with opportunities to validate and demonstrate technologies with potential military and security applications. This role strengthens Ontario's position within the broader defence innovation ecosystem and creates pathways for dual-use technologies to transition from commercial development to defence deployment.¹⁷⁰

Complementing this capability, OVIN's Waterloo RTDS provides a large-scale real-world environment for evaluating vehicle connectivity, infrastructure integration, telematics, and fleet-level performance through the Catalyst Connected Infrastructure Network (CCIN). CCIN enables companies to assess how vehicles, sensors, communications networks, and infrastructure operate together under real-world conditions. This systems-level capability is relevant to dual-use applications that depend on reliable data exchange, situational awareness, autonomous coordination, and resilient communications across both civilian and defence environments.¹⁷¹

The province's climate, geography, and industrial environments provide an additional advantage. Extreme temperatures, winter roads, underground settings, and rugged terrain create demanding conditions for testing sensors, batteries, autonomous systems, communications equipment, and vehicle platforms. Ontario-based Labforge's Snow Flea technology provides a defence-specific example. Labforge describes Snow Flea as an AI-enabled, multisensor surveillance system designed to protect critical Arctic assets while operating off-grid in extreme cold. The company has also partnered with the Royal Canadian Air Force to test its AI-enabled sensing and security technology in demanding environments. These examples demonstrate how Ontario-developed sensing systems can support remote, environmentally demanding, and security-sensitive applications.^{172, 173}

These assets provide a strong base for dual-use validation, but they may not form a complete defence-qualification pathway. Commercial test results may not address classified requirements, electronic interference, denied navigation, adversarial cyber conditions, military standards, or integration with defence command and logistics systems. A coordinated pathway from commercial testing to defence-specific validation would reduce uncertainty for firms and customers and help promising mobility technologies progress from demonstration to qualified deployment.^{164, 165, 166}

Ecosystem Opportunities

Ontario's industrial ecosystem has an opportunity to accelerate the pathway for moving commercial mobility capabilities into defence adoption. Firms may have applicable software, sensors, autonomous systems, batteries, vehicle components, or manufacturing processes, but often lack a defined defence use case, access to end users, integration partners, qualification support, or a route from demonstration to procurement. Addressing this conversion opportunity could help Ontario develop a larger base of firms capable of serving commercial and

defence markets without sacrificing the civilian demand that supports innovation and scale.

Recent evidence shows that firms are impacted differently depending on their stage of defence participation. A national survey of 642 small and medium-sized businesses conducted by the Business Development Bank of Canada and The Icebreaker identified three broad groups:

- Established defence suppliers facing capacity, hiring, and financing constraints,
- Firms with some defence exposure that remain cautious about investing without clearer demand, and,
- Prospective entrants navigating defence-specific requirements, financing barriers, and uncertain pathways into the market.

These findings suggest that expanding the domestic defence base requires support tailored to firms' readiness, from initial market navigation and qualification to workforce development and production scale-up.¹⁷⁴

This distinction is particularly relevant to Ontario's mobility ecosystem. Established defence suppliers may need capital, talent, and production capacity to respond to growing demand. Automotive, software, sensing, battery, and autonomous-systems firms entering defence markets may instead require clearer operational use cases, earlier access to defence users and prime contractors, and support meeting security, regulatory, and technical requirements. A differentiated approach would help firms progress from commercial relevance to qualified defence participation while preserving the civilian markets that underpin their competitiveness.

This also reflects a broader opportunity to accelerate collaboration between research, commercialization, and manufacturing. Dual-use technologies generate greater strategic and economic value when firms can move from research and prototyping into domestic production

without losing intellectual property, process knowledge, or control over critical systems. Ontario has substantial assets at each stage, but their value will depend on whether they operate as a connected pathway rather than as separate research, testing, and production capabilities. Stronger linkages would help firms scale in Ontario, retain downstream value, and build the manufacturing capacity required to serve both commercial mobility and defence markets.¹⁷⁵

Retaining intellectual property and scale-up activity in Ontario is therefore a related priority. In dual-use markets, ownership of software, technical data, patents, platform architectures, and manufacturing know-how can influence commercial value and Canada's ability to produce, sustain, and upgrade strategically important systems. Canada's Defence Industrial Strategy identifies Canadian intellectual-property ownership, protection, and access as elements of a stronger domestic defence sector.¹

The partnership between the Ontario Centre of Innovation and Intellectual Property Ontario (IPON) provides a practical provincial foundation for addressing this gap. It combines commercialization pathways with intellectual-property expertise, gives OCI-supported firms access to IPON services, and provides training, mentorship, and resources to help SMEs develop effective IP strategies. Applying this support early in research commercialization, pilot deployment, and scale-up could help Ontario mobility firms protect strategic technologies while pursuing civilian and defence opportunities.¹⁷⁶

A further opportunity is to better equip commercially oriented firms in navigating defence accreditation, contracting, supplier qualification, and market access. The RDII supports businesses seeking to enter or grow within defence supply chains, including firms pursuing dual-use applications in artificial intelligence, cybersecurity, sensors, land vehicles, and autonomous systems. It also supports activities related to technology integration, commercialization, market development, and industrial capacity. Funding alone, however, does not provide a complete

route to adoption. Firms also need clearer demand signals, earlier engagement with defence users and prime contractors, and support progressing from commercial validation to qualified supply.¹⁷⁷

Ontario's opportunity is therefore to connect technology identification, research commercialization, intellectual-property strategy, defence-specific validation, manufacturing scale-up, supplier development, procurement navigation, and allied market access into a coherent conversion pathway. This would allow promising mobility technologies to progress beyond isolated pilots while retaining intellectual property, production activity, process knowledge, and lifecycle-support capabilities in the province. The following section considers how OVIN's networks and commercialization infrastructure could contribute to this pathway.

5.3 OVIN's Role in Advancing Ontario's Dual-Use Mobility Opportunity

OVIN is well positioned to support the development of Ontario's dual-use mobility ecosystem by building on its established role in automotive and mobility innovation. Through its programs, regional networks, industry relationships, and commercialization infrastructure, OVIN connects technology developers, manufacturers, post-secondary institutions, municipalities, infrastructure owners, and other ecosystem partners. To further strengthen this role, OVIN has launched a new R&D Partnership Fund stream focused on defence and dual-use technologies to support homegrown Ontario companies, strengthen collaboration with industry and end-users, and advance Ontario developed solutions that respond to defence priorities and operational needs. This expanded program complements the broader set of commercialization supports and funding that OVIN provides entrepreneurs in Ontario. OVIN's connections provide a foundation for helping Ontario firms assess whether commercially developed mobility technologies could address

emerging needs in defence, security, emergency response, critical infrastructure, and other strategic markets.^{178, 179}

This role aligns with the broader direction of federal and provincial defence policy. Canada's Defence Industrial Strategy emphasizes stronger engagement with industry, accelerated innovation and commercialization, increased participation by small and medium-sized businesses, Canadian intellectual-property retention, and expanded access to domestic and allied markets. The Framework for the Ontario Defence Industrial Strategy similarly identifies opportunities to strengthen the province's industrial base, commercialize frontier technologies, expand export reach, and develop more integrated supply chains. Within this policy environment, OVIN contributes to a focused mobility-sector perspective by helping firms connect existing commercial capabilities with emerging defence and dual-use opportunities.^{1, 119}

Connecting Ontario's Mobility Ecosystem

Ontario's dual-use mobility opportunity extends beyond established defence contractors. Firms developing autonomous systems, embedded software, sensing technologies, cybersecurity solutions, batteries, vehicle components, connected infrastructure, and advanced manufacturing processes may possess capabilities relevant to defence and security applications, even where defence is not currently their primary market. OVIN's relationships across the automotive and mobility ecosystem position it to help identify these capabilities and connect firms with relevant technical, commercial, and institutional partners.

The objective is not to broadly classify commercial technologies as dual-use. Defence relevance depends on whether a technology addresses a defined operational need and can meet more demanding defence-specific requirements. By convening firms with potential customers, research organizations, established defence suppliers, and systems integrators,

OVIN can help companies better understand adjacent applications and the additional development or validation required. This would strengthen visibility on both sides of the market: firms would gain a clearer understanding of defence requirements, while defence organizations and prime contractors would gain greater awareness of mobility technologies emerging from Ontario's commercial ecosystem.

Additionally, as discussed in the previous section, firms enter defence markets from different starting points. Existing research identifies distinct challenges among established defence suppliers, firms with limited defence exposure, and prospective entrants. Established suppliers often face capacity, talent, and financing constraints, while firms entering the market require clearer pathways through technical requirements, procurement, compliance, and financing. OVIN can help address these differences through the Defence & Dual-Use R&D stream by providing Ontario mobility firms with support appropriate to their stage of development and creating a clearer pathway from automotive and mobility capabilities to defence-market readiness.¹⁸⁰

Supporting Development, Validation, and Commercialization

OVIN's development and demonstration infrastructure provides an important foundation for advancing dual-use mobility technologies.¹⁵⁵ Its programs support Ontario SMEs in developing, testing, validating, and demonstrating connected, autonomous, electric, and smart-mobility solutions in collaboration with industry and academic partners. OVIN's new Defence and Dual-use R&D stream further strengthens this support by advancing projects focused on the development, testing, validation and demonstration of technologies for defence and dual-use applications, including autonomous and uncrewed systems, electrification, propulsion, advanced sensors, space transportation, satellite-based positioning, and Earth observation technologies. The RTDS network provides access to specialized facilities, technical expertise, and commercialization support,¹⁶⁶ while the Technology Pilot Zones and

Demonstration Zone enable firms to test technologies in live operating environments.^{178, 179}

These environments do not replace formal defence testing or qualification. They can, however, help firms demonstrate baseline performance and identify gaps related to safety, reliability, communications, interoperability, scalability, and systems integration. For example, the Technology Pilot Zones provide access to urban, highway, cross-border, and multimodal operating environments in Toronto and the Windsor-Sarnia corridor. The Demonstration Zone enables SMEs to test mobility solutions using public infrastructure and engage potential customers and strategic partners. Evidence generated through these settings can help reduce technical and commercialization risk before a technology advances to military-standard testing, controlled-goods facilities, defence end-user evaluation, or procurement.^{155, 181}

The opportunity is to create stronger connections between these commercial validation environments and specialized defence pathways. OVIN is positioned to help firms identify an initial application, connect with appropriate technical and industry partners, and generate evidence through existing mobility programs. Technologies demonstrating credible defence relevance could then be referred to defence users, prime contractors, NATO-linked test facilities, or other organizations responsible for specialized evaluation and qualification. This would support a clearer progression from commercial development to defence-relevant validation while preserving the distinction between commercially viable, defence-capable, and defence-ready technologies.

Retaining and Scaling Ontario-Based Innovation

The strategic value of dual-use innovation depends partly on whether intellectual property, technical knowledge, production activity, and lifecycle-support capabilities remain anchored in Ontario. This is particularly important for software-defined and autonomous mobility

technologies, where a significant share of value may reside in algorithms, technical data, system architectures, cybersecurity capabilities, and manufacturing processes.

Through a dedicated partnership, firms participating in OVIN programs can access intellectual-property support from Intellectual Property Ontario. The partnership between the two organizations combines commercialization support with intellectual-property expertise, training, mentorship, and resources for Ontario SMEs. Connecting this support with dual-use mobility projects could help firms develop appropriate intellectual-property strategies before entering partnerships, undertaking pilots, or adapting technologies for defence applications.¹⁷⁶

OVIN also helps connect technology firms with Ontario-based manufacturers, automotive suppliers, and systems integrators capable of supporting product development and scale-up. Stronger linkages between research, commercialization, testing, and production would help promising technologies progress beyond isolated demonstrations. They could also enable Ontario to retain more of the process knowledge, supplier capacity, and long-term economic value generated by dual-use innovation. This approach aligns with the federal strategy's emphasis on Canadian intellectual property, domestic industrial capability, and secure supply chains.¹

Expanding Access to Domestic and Allied Markets

Access to broader markets will be important to the long-term growth of Ontario's dual-use mobility ecosystem. Canada's domestic defence market may not provide sufficient scale for every technology, while commercial and allied applications can support continued investment, product development, and production. Federal and provincial defence strategies therefore identify export development and participation in allied supply chains as important components of industrial growth.^{1,119}

OVIN contributes to this objective by helping firms build the commercial maturity and technical evidence needed to engage domestic and international partners. Existing activities related to technology demonstration, partnership development, industry engagement, and commercialization can provide a foundation for connecting eligible firms with provincial trade offices, federal programs, defence-sector events, and allied innovation networks. The objective would not be to duplicate established export services, but to help ensure that Ontario mobility firms approach these channels with validated technologies, credible partners, and a clear value proposition.

OVIN is uniquely positioned to provide a mobility-sector pathway into Canada's broader defence-industrial ecosystem. By maintaining visibility into Ontario's pipeline of commercially validated mobility technologies, aligning promising capabilities with defined defence needs, and directing qualified firms toward specialized testing, procurement, financing, and allied-market channels, OVIN could help reduce fragmentation between commercial innovation and defence adoption. This role would support the objectives of Canada's Defence Industrial Strategy by expanding the pool of Canadian suppliers positioned to develop, produce, sustain, and upgrade strategically important mobility capabilities.

An aerial night photograph of a city skyline, likely Toronto, with numerous skyscrapers illuminated and their lights reflecting on the water in the foreground. The image is used as a background for the document.

6. Opportunities for Ontario

The analysis presented throughout this report suggests that Ontario possesses many of the assets necessary to support the development of a globally competitive dual-use mobility ecosystem. The province combines strengths in advanced manufacturing, automotive production, software and artificial intelligence, critical minerals, batteries, testing infrastructure, and research commercialization. These capabilities provide a strong foundation for participation in emerging markets where commercial innovation and strategic applications increasingly overlap.

Realizing this opportunity will require deliberate action to strengthen commercialization pathways, improve ecosystem coordination, support supplier readiness, and connect mobility innovators with broader strategic markets. Drawing on the findings from secondary research, ecosystem analysis, and stakeholder interviews, this section identifies key opportunity areas that could help Ontario strengthen its industrial competitiveness while expanding its contribution to emerging dual-use technology ecosystems.

6.1 Strengthening Commercial-to-Defence Technology Pathways

Ontario's mobility ecosystem is already developing many of the technologies increasingly relevant to defence and security applications, including artificial intelligence, autonomous systems, advanced sensing, connected infrastructure, cybersecurity, batteries, and software-defined platforms. Through OVIN, the province has established commercialization programs, demonstration environments, Regional Technology Development Sites (RTDS), and testing infrastructure that help firms move technologies from research and development toward market deployment. These assets have helped create a large pipeline of companies developing commercially relevant mobility technologies across automotive, transportation, infrastructure, and industrial markets.

Interview findings suggest that many firms face challenges understanding defence requirements, identifying relevant use cases, navigating procurement pathways, and obtaining operational validation. At the same time, defence organizations are increasingly seeking commercially developed technologies that can be adapted more rapidly than traditional defence-only solutions. This creates an opportunity to strengthen pathways that connect mobility innovators with defence organizations, operational users, prime contractors, and testing environments. By leveraging existing OVIN networks and commercialization infrastructure, Ontario could help accelerate the transition of commercially successful technologies into defence and security applications while preserving access to the civilian markets that provide scale, investment, and ongoing innovation.

6.2 Building a Globally Competitive Autonomous Systems Cluster

Autonomous systems are emerging as one of the most significant dual-use technology categories. Capabilities such as autonomous navigation, intelligent sensing, robotics, software-defined mobility, and AI-enabled decision-making have applications across transportation, logistics, public safety, infrastructure management, emergency response, and defence operations.

Ontario possesses many of the assets required to support leadership in autonomous and intelligent systems. The province is home to one of North America's largest automotive and mobility ecosystems, a growing AI sector, globally recognized software expertise, and numerous companies active in connected and autonomous vehicle technologies. Research institutions, including the University of Waterloo, University of Toronto, Ontario Tech University, and others, contribute expertise in artificial intelligence, robotics, autonomous systems, software engineering, and advanced sensing. OVIN's RTDS network, demonstration zones, and testing environments further support technology development and commercialization.

Research and interview findings highlighted autonomous systems, drones, AI-enabled sensing, robotics, and intelligent mobility platforms as some of the most promising dual-use opportunity areas. Ontario's concentration of automotive manufacturers, software developers, AI expertise, testing environments, and connected and autonomous vehicle innovators creates an opportunity to further strengthen its position in autonomous and intelligent systems.

As allied governments increasingly seek commercially developed technologies that can be adapted for defence applications, Ontario's existing strengths could support growth across both civilian and strategic markets.

6.3 Advancing Secure and Software-Defined Mobility Platforms

The automotive sector is undergoing a transition toward software-defined vehicles, connected infrastructure, artificial intelligence, and digital mobility services. Increasingly, competitive advantage is determined not only by vehicle hardware, but by the software, connectivity, cybersecurity, and data-management capabilities that enable vehicles and infrastructure to operate as intelligent, networked systems. Ontario already possesses many of the assets required to compete in this transition through organizations such as QNX, the province's broader software ecosystem, AI research institutions, and

OEM investments such as Ford's Connectivity and Innovation Centres. These assets are contributing to the development of embedded software, cybersecurity capabilities, connected systems, and intelligent vehicle platforms that increasingly underpin modern transportation systems.

Research and interview findings suggest that these same capabilities are becoming increasingly important in defence and security applications, where resilience, secure communications, software assurance, interoperability, and real-time decision support are growing priorities. Many of these capabilities are already being developed and commercialized within Ontario's mobility sector. This creates an opportunity to accelerate the adaptation of commercially developed technologies for applications such as autonomous logistics, resilient communications, connected infrastructure, intelligent transportation systems, operational awareness, and remote operations. Ontario therefore has an opportunity to build on its existing software and mobility strengths to support the development of secure, software-defined systems capable of serving automotive, infrastructure, public-sector, and defence markets simultaneously.

6.4 Leveraging Ontario's Testing and Validation Infrastructure as a Strategic Asset

Ontario's testing infrastructure represents a distinctive competitive advantage. The province hosts a network of specialized facilities that support connected and autonomous vehicles, advanced communications, electrification, robotics, and smart infrastructure. Assets in OVIN's RTDS network such as Area X.O, ACE, CORE5, and CCIN as well as OVIN's demonstration zones and pilot environments provide companies with access to real-world testing, validation, and commercialization support. Ontario is also home to multiple NATO DIANA test centres, further strengthening its position within emerging defence innovation networks.

Research and interview findings consistently identified validation, testing, and access to operational feedback as critical factors influencing

commercialization and defence adoption. As dual-use technologies become more complex and interconnected, Ontario has an opportunity to position its testing and validation ecosystem as a strategic asset that supports technology deployment across commercial, public-sector, and defence applications. This could help attract investment, support innovation, and strengthen the province's role within broader North American and allied innovation ecosystems.

6.5 Building Trusted Supply Chains for Strategic Technologies

Ontario's automotive ecosystem has developed extensive expertise in advanced manufacturing, supplier coordination, systems integration, quality assurance, and production at scale. The technologies underpinning autonomous mobility, artificial intelligence, electrification, advanced communications, and defence systems often depend on the same critical minerals, advanced materials, batteries, semiconductors, and manufacturing capabilities. These capabilities are increasingly valuable as governments and industry place greater emphasis on supply chain resilience, trusted sourcing, traceability, and domestic industrial capacity.

Ontario's integration within North American manufacturing networks, combined with its advanced manufacturing capabilities and growing critical minerals ecosystem, creates an opportunity to strengthen participation in trusted supply chains supporting both economic competitiveness and national security objectives. Interview findings suggest that trusted suppliers, traceability, domestic production, and secure sourcing are becoming increasingly important considerations for participation in defence and strategic technology markets. As these requirements continue to evolve, Ontario has an opportunity to leverage its existing manufacturing base and supplier ecosystem to support trusted North American supply chains serving both commercial and strategic industries.

6.6 Strengthening Ontario's Critical Minerals and Advanced Materials Advantage

Ontario's combination of critical mineral resources, processing capacity, advancing critical-mineral projects, battery-sector investments, and advanced manufacturing ecosystem provide an important foundation for participation in emerging technology and defence value chains. The province's strengths span mineral development, battery manufacturing, advanced materials, vehicle assembly, and technology commercialization. Through its Critical Minerals Strategy and recent investments in processing capacity, Ontario is working to strengthen its role across a larger portion of the value chain.

Many of the minerals found or processed in Ontario support technologies that are increasingly important across both commercial mobility and defence applications. These materials underpin batteries, semiconductors, communications systems, sensors, aerospace technologies, autonomous systems, advanced computing infrastructure, and next-generation defence platforms. As governments and industry place greater emphasis on supply chain resilience, sovereign capability, and trusted sourcing, access to these materials and the capacity to process them within allied jurisdictions is becoming an increasingly important source of competitive advantage.

Ontario therefore has an opportunity to strengthen linkages between Northern Ontario's resource base and Southern Ontario's manufacturing, battery, automotive, aerospace, and technology ecosystems. Advancing refining, processing, advanced materials production, recycling, and component manufacturing would enable the province to participate in a larger share of the value chain while reducing reliance on concentrated global processing hubs. This approach would also reinforce Ontario's position within emerging North American supply chains for batteries, advanced electronics, autonomous systems, communications technologies, and defence-related manufacturing.

Research and interview findings suggest that the greatest opportunity lies not simply in supplying raw materials, but in building integrated and traceable value chains that connect mineral production with downstream manufacturing and technology development. By leveraging growing investments in battery manufacturing, critical minerals processing, advanced materials, and electrified mobility, Ontario can strengthen domestic industrial capacity, support trusted supply networks, and position itself as a strategic supplier of the materials and inputs underpinning next-generation commercial and dual-use technologies.

6.7 Supporting Northern, Remote, and Resilience-Focused Innovation

Ontario's geography, climate, infrastructure, and industrial landscape create unique conditions for developing technologies suited to remote, northern, and operationally challenging environments. Autonomous systems, satellite-enabled communications, advanced sensing, digital twins, emergency-response technologies, and resilient infrastructure solutions all have applications across northern mobility, resource development, public safety, infrastructure management, and defence operations. The province's northern mining sector, transportation networks, remote communities, and testing environments provide real-world conditions that are difficult to replicate elsewhere.

Several interviewees identified Canada's extreme weather, northern conditions, and remote operating environments as potential areas of competitive advantage. These strengths create opportunities to develop and validate technologies that address infrastructure resilience, emergency preparedness, Arctic operations, northern mobility, remote logistics, and service delivery in remote communities. In addition to supporting commercial and strategic applications, these technologies can contribute to broader provincial priorities, including economic development, community connectivity, infrastructure resilience, and collaboration with Indigenous communities and partners.

6.8 Developing an Integrated Dual-Use Mobility Ecosystem

Ontario's greatest strategic advantage may be the breadth of assets already present across its innovation ecosystem. Automotive manufacturing, software development, artificial intelligence, critical minerals, batteries, research institutions, testing facilities, commercialization programs, and advanced manufacturing capabilities collectively provide many of the ingredients required to support a successful dual-use ecosystem. OVIN itself plays an important role by connecting firms, post-secondary institutions, municipalities, investors, infrastructure owners, and other ecosystem participants through programs, partnerships, demonstration environments, and commercialization support.

Interview findings repeatedly emphasized the importance of stronger connections between commercial innovators, defence organizations, research institutions, prime contractors, and end users. They also highlighted the need for clearer pathways linking research, commercialization, validation, procurement, and deployment. Ontario therefore has an opportunity to further strengthen coordination across its existing assets and build a more integrated dual-use mobility ecosystem. Such an ecosystem could support dual-use technology commercialization in both mobility and defence markets, supplier development, intellectual property retention, industrial competitiveness, and long-term economic growth while enhancing the province's contribution to emerging strategic and defence priorities.

7. Glossary

5G	Fifth Generation Wireless Communications
ACE	Automotive Centre of Excellence
AI	Artificial Intelligence
CAR	Centre for Automotive Research (University of Waterloo)
CARE	Centre for Automotive Research and Education (University of Windsor)
CAV	Connected and Automated Vehicle
CCIN	Catalyst Connected Infrastructure Network
CDL	Creative Destruction Lab
CIPSER	Centre for Critical Infrastructure Protection, Security and Resilience
DIANA	Defence Innovation Accelerator for the North Atlantic
EV	Electric Vehicle
GNSS	Global Navigation Satellite System
HPC	High-Performance Computing
IED	Improvised Explosive Device
IESO	Independent Electricity System Operator
IP	Intellectual Property
IPON	Intellectual Property Ontario
LEO	Low Earth Orbit

LiDAR	Light Detection and Ranging
MARC	McMaster Automotive Resource Centre
NATO	North Atlantic Treaty Organization
OEM	Original Equipment Manufacturer
OCI	Ontario Centre of Innovation
OBEC	Ontario Battery and Electrochemistry Research Centre
OVIN	Ontario Vehicle Innovation Network
QNX	Embedded operating system and software platform developed by BlackBerry QNX
R&D	Research and Development
RDII	Regional Defence Investment Initiative
RTDS	Regional Technology Development Site
SDV	Software-Defined Vehicle
SME	Small and Medium-Sized Enterprise
TKMS	Thyssenkrupp Marine Systems
U.S.	United States
V2X	Vehicle-to-Everything

8. OVIN Team

Information on OVIN team members and relevant contacts for outreach is available on OVIN's website at: <https://www.ovinhub.ca/connect/team/>

9. Disclaimers

This report was commissioned by the Ontario Centre of Innovation (OCI) through a Request for Proposals titled “Ontario Vehicle Innovation Network (OVIN) – Annual Comprehensive Sector Report & Quarterly Specialized Reports,” dated September 26, 2025, and has been prepared by MNP LLP. It is one of five reports covering an analysis of Ontario’s automotive technology, electric vehicle and smart mobility landscape while incorporating implications for the sector’s skills and talent landscape.

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10. Expert Interviews

The project team conducted targeted consultations with industry, defence sector stakeholders, technology developers, aerospace and mobility organizations, and policy experts between July 2026 and August 2026. Consistent with the engagement protocol, interviews were non-attributable and findings are presented in aggregated form. The table below summarizes the organizations and areas of expertise represented in these consultations.

Organization	Interviewees
Department of National Defence	Uriel Marantz, Senior Policy Advisor, Defence Industrial Strategy
General Motors Defence Canada	Geoffrey Johnstone, Executive Director
Indro Robotics	Philip Reece, CEO and Founder
MHIRJ (Mitsubishi Heavy Industries RJ Aviation Group)	Ross Mitchell, Senior Vice President
Superwake	Kanwar Johal, Co-Founder

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