

To: Office of Technology Evaluation
Bureau of Industry and Security
U.S. Department of Commerce

**RE: Government of Canada Response to BIS 2021-0036 Notice of Request for Public Comments on
Risks in the Semiconductor Supply Chain**

Introduction

The Government of Canada appreciates the opportunity to provide input in response to the Department of Commerce's *Notice of Public Request for Comments on Risks in the Semiconductor Supply Chain*.

This Notice of Request is timely from a bilateral perspective as the Government of Canada (GoC) continues to explore opportunities to further strengthen our joint industrial base and mitigate risks to the critical semiconductor supply chain. On February 23, 2021, Prime Minister Trudeau and President Biden met and released a [Roadmap for a Renewed U.S.-Canada Partnership](#). As part of their commitment for our governments to promote a sustainable and inclusive economic recovery, the leaders: **“launched a strategy to strengthen Canada-U.S. supply chain security”**, noted **“ways to more closely align our approaches to China, including to address ... national security challenges”** and agreed to **“reinforce our deeply interconnected and mutually beneficial economic relationship”**.

Trusted Partners

As the GoC has noted in parallel consultations on [Executive Order 14017 America's Supply Chains](#), the Canada-U.S. trading and security relationship is built in part on long-standing partnerships and binational supply chains. The Canadian market is the #1 customer for more than 30 states, with CA\$6.4B in Canadian exports of Information and Communications Technology (ICT) goods to the United States and US\$35.7B in Canadian imports from the United States in 2020. Canada and the U.S. are each other's most trusted suppliers and trade with Canada supports millions of jobs. As we look towards economic recovery, strengthened Canada-U.S. supply chain cooperation, security, and resiliency to ensure that our integrated industrial base can continue to thrive to benefit our workers on both sides of the border.

Canada-U.S. Defence and Security Relationship

Canada has long been a trusted defence and security partner of the U.S., as well as a secure and responsible source of strategic and critical materials, including 14 of the 35 minerals deemed 'critical' by the United States. Our countries are currently working together to advance our mutual objectives of establishing reliable and sustainably sourced supplies of critical minerals through the Joint Action Plan. The [Action Plan on Critical Minerals Cooperation](#) – a priority commitment by Leaders – recognizes that an integrated, bilateral approach that builds on our longstanding trade and defence relationship, can best advance our shared objective to secure the mineral supply chains needed to support technological advances, especially semiconductor technology, national defence, and the global transition to the low-carbon economy.

The global impact of COVID-19 has underscored the need for secure, sustainable and diversified supply chain for semiconductors. Whether it be through the Joint Action Plan, multilateral dialogue on critical minerals, or other collaborative arrangements such as the National Technology and Industrial Base, the Government of Canada remains committed to collaboration with the U.S. in securing the strategic semiconductor supply chains for our countries.

Canada-U.S. Semiconductor Supply Chain Integration

Global chip shortages are severely impacting industries across Canada and the U.S. and have revealed the fragility of the semiconductor supply chain. That said, the Canadian and U.S. semiconductor industries are highly integrated. The U.S. has historically been the major market for Canada's exports of semiconductors and other electronic components (e.g. printed circuit boards, microwave tubes, etc.), accounting for 81% of domestic production and 67% of re-exports in 2019.

Canadian-based companies are key suppliers of critical semiconductor materials and specialized components to the U.S. market. 5N Plus, for example, was awarded a multi-year contract by the U.S. Government as the sole North American source of specialty semiconductors required by U.S. satellite suppliers. The company specializes in high purity metals like cadmium, tellurium, tin, and zinc. Additionally, Teledyne DALSA is Canada's largest microelectromechanical systems (MEMS) foundry and partners with the Defense Advanced Research Projects Agency (DARPA), by providing imaging and MEMS components for consumer, automotive, defence, industrial and biotech applications.

Canada is also a producer of both upstream and downstream supply chain inputs that could be leveraged to support a secure and resilient North American supply chain, particularly related to semiconductors. This includes existing capacity for producing silica, and silicon carbide, where the U.S. is the main export market for Canadian product, as well as manufacturing circuit board substrate, photolithography, circuit board mapping, and many others. Given the high-level of integration and collaboration between the Canadian and U.S. industries, continued cooperation will be pivotal for meeting growing demand for components both within the ICT sector as well as to support development of technologies like Connected and Automated Vehicles (CAV), artificial intelligence, and quantum computing.

Opportunity also exists to collaboratively explore next generation materials and devices that could replace current semiconductor technologies, helping decrease reliance on overseas partners in the future. Canada is a producer of many materials that could be used in emerging technologies (including, but not limited to, silicon carbide, gallium nitride, gallium arsenide, lithium fluoride, pyrite, and diamonds). Moreover, Canada's strengths in nanotechnologies and quantum make it well positioned to explore semiconductor alternatives such as metal-insulate chips, nanomagnets, and quantum semiconductor devices.

Canada's Semiconductor Strengths

Canada's semiconductor industry is long-established, innovative, and has coveted expertise in technology areas such as imaging, sensors, and photonics. While Canada is a relatively small semiconductor industry player compared to nations with major fabrication capabilities, our domestic sector has built a competitive advantage in semiconductor R&D and the low- to medium- volume production of specialized components like sensors and microelectromechanical systems (MEMS). Canada is home to several cutting-edge semiconductor firms, including Ranovus, Untether AI, and Tenstorrent, which are pushing the state-of the-art in chip development. Our country also plays host to branches of major American semiconductor firms, ranging from AMD to Intel to Qualcomm. IBM's facility in Bromont, Quebec, in particular, is that company's largest advanced semiconductor testing and packaging facility in the world.

While Canada's semiconductor industry is primarily concentrated in Ontario and Quebec, there are notable clusters of expertise and capabilities across the country:

- **Alberta:** The Edmonton Metropolitan Region is another major manufacturing center that specializes in computer and electronic manufacturing, and boasts the highest per capital

manufacturing sales in the country. The region is also home to AMII, an Alberta-based non-profit institute that supports world-leading research in AI and machine learning.

- **British Columbia:** Vancouver is a top manufacturing hub with a particular strength in electronics manufacturing. The University of British Columbia's Materials Engineering Department also focuses on semiconductor research, specializing in developing smaller, faster, lower-cost and more energy efficient Group IV semiconductors.
- **Nova Scotia:** Dalhousie University is home to Canada's Research Chair in Ultrafast Science. Kimberley Hall, whose research group uses femtosecond lasers to investigate charge and spin dynamics in semiconductor materials with the broad objective of developing new semiconductor technologies.
- **Ontario:** In Ontario, the Toronto-Waterloo innovation corridor is a major technology and manufacturing hub where leading semiconductor companies can leverage the largest engineering schools in the country. The Vector Institute in Toronto equally offers world class expertise in AI. Meanwhile, Ottawa is a hub for cutting-edge chip development, especially as it relates to telecommunications networks.
- **Quebec:** Montreal, Quebec is a major semiconductor manufacturing and research center. Polytechnique Montreal is home to the Nano and Quantum Semiconductors Laboratory which focuses on shaping the form and function of semiconductor materials down to the atomic level. The city's AI ecosystem has the largest concentration of academic researchers in deep learning in the world.

Compound semiconductors represent another area of strength for Canada. These specialized semiconductors provide cost, speed, and durability advantages over traditional silicon-based components, and are critical to optical, satellite, and wireless networks. With expertise tracing back to the advances made by Nortel Networks and Bell Northern Research in the 1990s, Canada is currently home to the design centers of the world's leading companies focused on 5th generation coherent optical communications (e.g. Cisco, Ciena, Nokia). Canadian universities also continue to focus research talent towards areas like photonics, photovoltaics, sensors and quantum technologies, creating a continued stream of top talent. Meanwhile, Canadian firms, such as GaN Systems, have developed high-performance compound semiconductor devices for applications like electric vehicles and critical infrastructure.

Recognizing the opportunity presented by compound semiconductors, Canada is currently engaging with industry to identify potential opportunities to further grow this niche sector. The National Research Council of Canada (NRC) demonstrates Canadian and international leadership in Compound Semiconductors for photonics and microelectronics centered around the Canadian Photonics Fabrication Centre (CPFC). Canada's compound semiconductors complement and strengthen the overall North American asset base. Manufacturing the chips of the core elements of telecom & datacom such as lasers, amplifiers and detectors enabling the entire ICT infrastructure is the core of our capabilities. Thus, NRC-CPFC is a good foundation for North American collaborative strategy, could further de-risk important national security issues related to IP, sovereignty of telecom networks and emerging technology bases, e.g. quantum.

Prospective Areas for Strengthened Collaboration

Further to our Leaders' commitments in the *Roadmap for a Renewed U.S.- Canada Partnership* regarding strengthening our countries' supply chains and Joint Action Plan on critical minerals, the GoC invites discussion on future coordinated approaches which could be explored by our governments. These include:

- Assessing mechanisms that could support joint strategic projects that will secure and further develop Canada-U.S. semiconductor supply chains and production capacity for mutual benefit. This may include initiatives undertaken through enhanced partnerships between governments as well as the private sector;
- Establishing new Research and Development partnerships and initiatives, especially in areas like compound semiconductors, to accelerate innovation and maximize environmental performance that will help our countries address near- and long-term challenges;
- Support vendor diversity through open technical standards, industry-led innovation, and exploring industrial policy levers to reassert domestic control over ICT supply chains such as Five Eyes-exclusive suppliers of critical and sensitive technologies; and
- Integrating Canadian companies into current and future USG consultation processes, in order to reflect a more complete view of the North American ICT market and industrial base.

Conclusion

The Government of Canada appreciates the Department of Commerce's review of our comments with respect to this *Notice of Request for Comments*. Building on our longstanding bilateral relationship in trade, security, and ICT innovation, as well as decades of cross-border trade in goods that rely on semiconductors such as light vehicles, Canada looks forward to working with the Department of Commerce to strengthen our supply chains for the development and production of semiconductor products. Together, our countries recognize that collaboration presents an opportunity for mutual benefit – by jointly addressing supply chain risks, facilitating greater trade and investment, and increasing competitiveness for the U.S. and Canada.