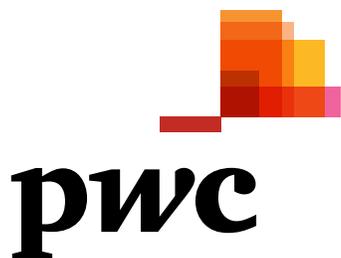


April, 2018

Lockheed Martin Study of Economic Impact in Canada



www.pwc.com/ca

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1. Executive summary

Lockheed Martin Canada has a corporate vision that aligns with the Government of Canada's focus on achieving sustainable growth for the Canadian economy through innovation and exports, and is committed to deploying its resources in a manner that will increase new skills development. A basic step in achieving these goals is to establish a baseline against which current initiatives and future activities will be benchmarked. To this end, Lockheed Martin Canada retained PwC to estimate its economic footprint in Canada over the last 10 years (2008-2017) and to explore the extent to which this economic footprint supports the Canadian government's economic priorities ("Assessment").



Lockheed Martin Corporation began operating in Canada in 1937. This led to the establishment of Lockheed Martin Canada, with its head office based in Ottawa. Lockheed Martin Canada represents all of Lockheed Martin Corporation's lines of business, which are: Rotary and Mission Systems, Aeronautics, Missiles and Fire Control, and Space. Currently, its primary focus is on naval Combat Systems Integration and training. A major program for Lockheed Martin Canada is the CMS 330 Combat Management System. This system was developed in Canada and was used in the modernization of Canada's 12 Halifax-Class Frigates. Lockheed Martin Canada subsequently won Combat System Integrator roles in Chile and New Zealand, through open competitions, against the world's best known Combat System Integrators. CMS 330 is now being exported to those countries. Several Lockheed Martin aircraft are used by the Canadian Forces including the CC-130 Hercules, CC-130J Super Hercules, and the CH-148 Cyclone helicopter made by Sikorsky, a Lockheed Martin company. In-service support for these programs also generates substantial economic activity in Canada. Lockheed Martin Canada also provides aircraft sustainment, training simulators, targetry systems, and electronic warfare systems.

In addition to Lockheed Martin Canada's activities, Lockheed Martin Corporation purchases intermediate goods from Canadian suppliers for aircraft, satellites and other systems assembled in the United States (also referred to in this report as "US").

Lockheed Martin Canada and Lockheed Martin Corporation have relationships with over 1,400 Canadian suppliers who provide inputs for systems assembled in Canada and the US. Canadian suppliers have provided maintenance and parts for Canada's CC-130 Hercules aircraft, Canada's CC-130J Super Hercules, other nations' Hercules, and F-35 Lightning II fighter jets flown by air forces around the world.



Over the last 10 years, Lockheed Martin Canada's operating activities, as well as purchases made by Lockheed Martin Corporation, have generated and facilitated substantial economic activity in Canada, as demonstrated through the following metrics:

Total economic impact generated between 2008 and 2017

\$3.8 billion in GDP

36,521 jobs in full time equivalent (FTE) person years

\$2.5 billion in labour income

\$1.9 billion in exports to the US

\$1.5 billion in total tax revenues

\$1 million in philanthropic contribution

Lockheed Martin has 1,000 employees at five main facilities in the National Capital Region, Montreal, Halifax, Victoria, and Calgary, and 10 Canadian Forces bases across the country.

Lockheed Martin Canada and its suppliers operate in every province in Canada, thus distributing the economic benefits it generates across the country:

Lockheed Martin Canada Locations and Lockheed Martin Suppliers



- Lockheed Martin Canada Locations
- Lockheed Martin Suppliers

In addition to the contributions made throughout its supply chain, Lockheed Martin Canada provides benefits to the Canadian economy through the following:



a. **Downstream impacts** – Once aircraft and systems are in use in Canada, they continue to generate economic activity through sustainment activities carried out in Canada, such as maintenance, training, and upgrades. Because Lockheed Martin Canada’s systems are used worldwide, several Canadian sustainment providers have taken advantage of export opportunities, providing similar services to armed forces around the world.



e. **Skill development** – Lockheed Martin Canada developed an elaborate training and education program that aids its employees in acquiring skills critical to the development of a knowledge-based economy in Canada.



b. **Research and Development (“R&D”)** – Between 2008 and 2017, Lockheed Martin Canada spent \$175.4 million on R&D activities, which equates to approximately 11% of the direct GDP it generated during the same period. By comparison, the total R&D spent in Canada is less than 2% of GDP.



f. **Corporate social responsibility activities** – Lockheed Martin Canada is involved in a number of social responsibility activities. Chief among them are its efforts to assist veterans of the Canadian Armed Forces, and to support Science, Technology, Engineering and Math (STEM) education for young people.



c. **Participation in industry clusters** – Lockheed Martin Canada’s presence in regional defence and aerospace clusters in Quebec, Ontario, Atlantic Canada and the Western provinces encourages competition and provides avenues for partnerships and collaboration that spurs innovation and increased productivity.



g. **Becoming the first customer for emerging Canadian tech companies** – Lockheed Martin Canada has benefitted some of Canada’s most promising emerging technology companies by providing them with their first major contracts, including some that are now global leaders in Artificial Intelligence and Quantum Computing. Such contracts with Lockheed Martin Canada have provided those companies with a platform for future business expansion globally.



d. **Acquisitions of Canadian companies** – Lockheed Martin Canada’s acquisitions of Canadian companies provides an opportunity for those companies to expand their operations.



Photo: Actua

Through these additional elements, our review concludes that Lockheed Martin Canada provides significant economic benefits to the Canadian economy.

Lockheed Martin Canada has a workforce of 1,000 employees. In 2017, the average salary of these employees was \$90,527, which is 28% higher than the average Canadian aerospace product and parts manufacturing salary, and 45% higher than the average computer and electronic product manufacturing salary.

Lockheed Martin Canada is committed to gender and minority inclusion in its workforce. We found that Lockheed Martin Canada has fallen behind in recent years in its efforts for gender equality and is lagging industry average. To address this issue, Lockheed Martin Canada is committed to breaking down barriers to gender equality and has developed strategies to address the need for broader inclusion and diversity in its workforce. Their vision for 2020 would see the number of women in their workforce align with Canada's national goals.

Our Assessment suggests that Lockheed Martin Canada's actions are largely consistent with the Canadian government's major priorities. Moreover, Lockheed Martin Canada is actively identifying key areas that require further improvement in its quest to fully adhere with those priorities.



2. Introduction

2.1. Study objectives

Lockheed Martin Canada’s corporate vision is in accord with the economic priorities of the Canadian government, as described below. Consequently, Lockheed Martin Canada is committed to direct its future activities and deploying its resources in a manner that fully aligns with these priorities. A basic step in achieving this goal is to establish a baseline against which Lockheed Martin Canada’s current initiatives and future activities would be benchmarked. To this end, Lockheed Martin Canada has retained PwC to estimate Lockheed Martin’s economic footprint in Canada over the last 10 years (2008-2017) and to explore the extent to which this economic footprint actually supported the Canadian government’s economic priorities, as described below.

2.2. Introduction

Despite rapid advances in technology, many developed countries have experienced slowing productivity and economic growth over the last decade. Canada in particular has lower R&D investment than most of its peers, which is an important driver of productivity and thereby economic growth.

In response, the Canadian government has focussed its efforts on generating sustainable and inclusive growth that benefits all Canadians. As such, the government has identified innovation as a key lever of growth.

“To strengthen and grow the middle class, and remain competitive in the global economy, Canada must do more to encourage innovation. The future success of all Canadians relies on it.”

Government of Canada, Budget 2017

This government priority is based on the well-founded notion that innovative companies and industries increase productivity and growth, and generate well-paying jobs, thereby supporting the goal of inclusive growth.

Given the relatively small Canadian market, its relatively high labour costs, and the environmental challenges faced by its resource sector, sustainable and inclusive growth, inevitably, requires a significant increase in high value added exports, an effort that is linked with increasing innovation. Due to the well-documented linkages between innovation, exports, and a strong and growing middle class, Canada’s Innovation and Skills Plan focuses on innovation. Part of this plan is a target to increase Canada’s exports by 30 per cent by 2024, and naming advanced manufacturing as an area of focus.

Industry “clusters” are one driver of innovation that can encourage investment, spur innovation, and create jobs. Clustered industries in Canada have a history of creating sustainable growth, particularly in high-tech industries. Recognizing the importance of such clusters, the Canadian government recently announced five clusters that would collectively receive up to \$950 million in investment, to be matched by industry contributions.

“When small, medium-sized and large companies, academic institutions and not-for-profit organizations come together to generate bold ideas, Canadians benefit from more well-paying jobs, ground-breaking research and a world-leading innovation economy that creates global market leaders.”

Innovation, Science and Economic Development
Canada, 2018

An important aspect of clusters is their linkages with educational institutions, which ensure that the demand for skills is being met, and encourage research partnerships between academia and industry. Education is a key component of inclusive growth, and given the state of fast technological change, it is now well accepted that education must be an ongoing process beyond formal education.

¹ In this report, the term “Lockheed Martin” is used as a general term referring to all or part of its global operations.

The defence industry is an area in which the Government of Canada has encouraged growth. Due to its highly innovative and export-focused nature, the defence sector is well-positioned to advance the priorities discussed above. Moreover, as a major buyer of defence products and services, the Canadian government can influence the industry.

“Governments around the world recognize the importance of a strong defence sector, not only for national security, but to fuel economic growth. The defence sector is highly innovative and produces advanced technologies with defence and civilian applications.”

Current ITB Policy Guide

One way the government of Canada supports the Canadian defence industry is through Industrial and Technological Benefit (ITB) credits that defence contractors must fulfil. Generally, a contractor must generate business activity in Canada equal to the value of the defence contract awarded to them. Fulfilment of these obligations has the potential to support a strong and stable defence industry in Canada, as well as encouraging innovation and research in other areas of the economy.

As indicated previously, an important component of Canada’s priorities identified above, is the inclusiveness of growth. Many innovative and high-tech industries, including defence and advanced manufacturing, have traditionally lagged behind the overall economy in diversity of their workforce.

“For Canadian research to reach its true and full potential, it must be equitable, diverse and inclusive. A diversity of perspectives, voices and experiences is key in supporting innovation and excellence.”

—Danika Goosney, Executive Director, Tri-agency Institutional Programs Secretariat

The Government of Canada has made efforts to minimize this disparity, such as developing the Equity, Diversity, and Inclusion Action Plan for universities, and by launching a campaign that encourages young women to enter science, technology, engineering, and math (STEM) fields.

2.3. Scope of review

To prepare this Assessment, we have reviewed and, where appropriate, relied upon various documents and sources of information. By general classification, these sources include:

- › Interviews with Lockheed Martin employees
- › Data provided by Lockheed Martin
- › Statistics Canada
- › Ministry of Innovation, Science, and Economic Development
- › Department of National Defence
- › Organization for Economic Cooperation and Development (OECD)
- › Academic research articles

A full list of sources and articles used for the purpose of this Assessment is available in Appendix A.

3. Company overview

This chapter provides an overview of Lockheed Martin's presence in Canada going back to the 1930s and describes the scope of its operations over the last ten years. Lockheed Martin has a longstanding relationship with Canada's armed forces, industry, and history that lay the groundwork for the economic impact it currently generates.

Lockheed Martin Canada has 1,000 employees, and its primary activities are naval systems work including system integration, command and control units, combat management systems, and commercial engine maintenance, repair, and overhaul (MRO).

The map below shows Lockheed Martin Canada's locations.



History

Lockheed Martin has a long history in Canada and has consistently been a valuable partner to Canadian industry and military. Lockheed's¹ operations in Canada began in 1937 with the development of the Hudson Bomber for the British Air Commission. The planes were manufactured in Burbank, California, but could not be transported directly to the United Kingdom (also referred to in this report as "UK") because the United States (also referred to in this report as "US") was not at war with Germany at the time. This led to Lockheed setting up its first operations in Canada, where the final assembly and engine integration was done for the Hudson Bombers before transportation to the UK. In 1939, the Hudson Bomber was the first Lockheed system used by the Canadian military and supported the RCAF in a variety of roles. Also, in 1937 Trans Air Canada purchased two Lockheed Electra L-10 A airliners.

"Our relationship with Canada began with shared values – belief in democracy, human rights and the need to prepare for an emerging global threat."

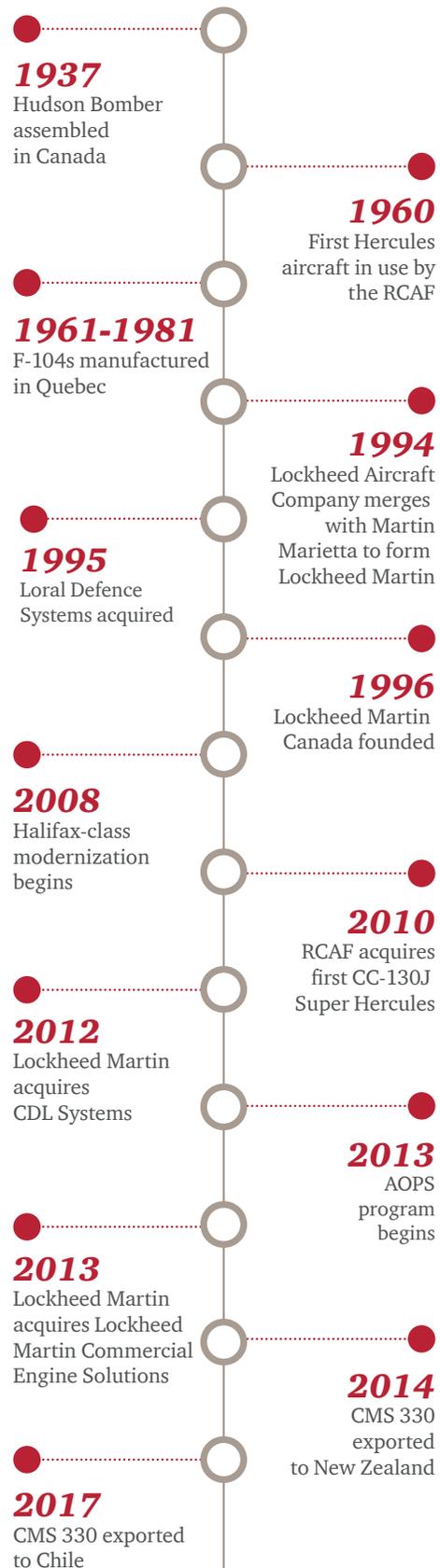
-Marillyn A. Hewson, Chairman, President and CEO, Lockheed Martin

¹ Lockheed is the predecessor of Lockheed Martin.

In 1955, the Lockheed F-104 Starfighter, designed by Clarence “Kelly” Johnson, entered use in West Germany as a NATO warplane.² Lockheed sold the licensing rights to several other countries and from 1961 to 1981, the Canadian firm Canadair manufactured the F-104 in Quebec.³ Canadair also produced the Lockheed Martin T-33A Silver Star jet trainer, which was used by the RCAF from 1952 to 1974 to train pilots and for solo aerobatic displays. Canadair produced a total of 656 T-33As between 1952 and 1958.⁴ Canadair also produced components for Lockheed’s CP-140 Aurora and the P-3C Orion, which were used for maritime patrol and anti-submarine warfare.

The versatile CC-130⁵ cargo aircraft has been used by the RCAF since 1960 for troop transport, tactical airlift, search and rescue, air-to-air refuelling, and aircrew training.⁶ It is considered a “workhorse” by the RCAF’s air transportation fleet. SPAR Aviation maintained the CC-130 for several decades for the RCAF and other air forces and was the only Canadian company licensed to do so other than Lockheed Martin.⁷ In 2010, the RCAF began flying the CC-130J “Super Hercules.”⁸

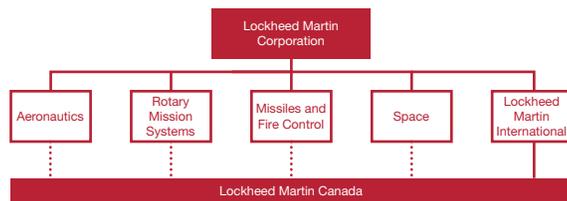
In the 1980s and 1990s, Lockheed Martin underwent several mergers and acquisitions. Where companies like Martin Marietta and Sanders had Canadian branches, these merged with Lockheed Canada. During this time, Lockheed Martin also acquired Loral Defence Systems, on which the Lockheed Martin Canada naval systems integration business is based. Over the past ten years, more Canadian businesses have been acquired by Lockheed Martin Canada, as it has grown and diversified.



2 (Lockheed Martin, 2018)
 3 (The Canadian Encyclopedia, 2018)
 4 (Canadian Warplane Heritage Museum, 2018)
 5 The “C” before the aircraft number signifies that it is flown by the RCAF.
 6 (Royal Canadian Air Force, 2018)
 7 (SPAR, 2002)
 8 (Royal Canadian Air Force, 2018)

Organization Structure in Canada

Lockheed Martin has four business areas: Aeronautics, Missiles and Fire Control (MFC), Rotary and Mission Systems (RMS), and Space. Lockheed Martin Global is a subsidiary of Lockheed Martin Corporation (US) and owns overseas operations including Lockheed Martin Canada. This report focuses on all Lockheed Martin operations that have economic impact in Canada, which include the activities of Lockheed Martin Canada and purchases from Canadian suppliers by Lockheed Martin Corporation.



The primary focuses of Lockheed Martin Canada are Aeronautics and RMS. Within RMS, the main activities are naval systems, system integration, command and control units, and combat management systems. Within aeronautics activities include commercial engine maintenance, repair, and overhaul (MRO) and in-service support. For more than thirty years, Lockheed Martin Canada has been the combat systems integrator for the Royal Canadian Navy (RCN)'s Halifax-class frigates.

Current activities

The following section outlines the technology offered by Lockheed Martin over the past ten years, focusing on systems produced primarily in Canada and systems that have a substantial economic footprint in Canada.

Halifax class modernization and CMS 330 Combat Management System

Lockheed Martin Canada has been the Combat System Integrator for the RCN for over 30 years and was the original provider of the Navy's Halifax-class frigates. Lockheed Martin Canada also developed the CMS 330, a world-class combat management system used on Canada's Halifax-class ships. Combat management systems process information from sensors and make recommendations on the best way to counter threats. Starting in 2008, Lockheed Martin Canada led a modernization program for the Halifax-class frigates that included replacing sensors and command and control systems, modernizing the operations room, and providing associated simulations and training systems. The Halifax-class upgrade also enables communication with the new CH-148 Cyclone maritime helicopters. To date, the project is on budget, and on time, with all ships to be fully operational in 2018.

Following the success of the Halifax-class modernization for Canada's Navy, Lockheed Martin Canada has embarked on similar modernizations for other navies. In 2014, Lockheed Martin Canada was selected by the New Zealand Ministry of Defence as the Prime Systems Integrator and implemented the Canadian-developed Combat Management System.⁹ Furthermore, the arrival of the first New Zealand frigate in March 2018 at Seaspan's Victoria Shipyards marked the first time in Canadian history that a foreign navy sent its ships to Canada for full modernization. In 2017, Lockheed Martin Canada was selected by the Chilean Navy to replace its Combat Management System and select subsystems for three frigates.¹⁰ In addition to being developed and made in Canada, these systems use inputs from Canadian suppliers, and together will generate \$540 million in export revenue. We note that export activity is one of the pillars of the ITB program.

⁹ (Lockheed Martin, 2018)

¹⁰ (Lockheed Martin, 2017)

Figure 2: A HALIFAX- class frigate



Halifax-class Frigates: Quick Facts

- › The RCN currently operates 12 Halifax-class frigates, all of which were modernized by Lockheed Martin Canada
- › Originally procured by DND in the 1990s
- › Lockheed Martin Canada was the original Combat System Integrator through its heritage company Paramax Electronics
- › \$2.0 billion in associated ITB commitments fulfilled
- › 105% of ITB commitments met
- › On budget and on time
- › \$540 million in export value through contracts with Chilean and New Zealand navies
- › Modernized ships delivered from 2014-2018

Arctic Offshore Patrol Ships

Lockheed Martin Canada is providing internal systems for Arctic Offshore Patrol Ships currently being built by Irving Shipbuilding Incorporated for the RCN. Lockheed Martin Canada is providing key integration of data and information sources through its Combat Management System. Irving Shipbuilding Incorporated, Lockheed Martin Canada, and their suppliers are supporting a strong ocean technology industry in Atlantic Canada through the National Shipbuilding Program. To deliver this program, Lockheed Martin is working with suppliers across Canada, including Toolcomm, an Indigenous-owned business in British Columbia.

AOPS: Quick Facts

- › Five ships ordered by DND
- › The first delivery is scheduled, in 2018
- › Capabilities include sea-borne surveillance and situational awareness suitable for the Arctic region

Sustainment

In-service support (ISS) for Lockheed Martin technology used in Canada is also performed in-country by Lockheed Martin Canada and other domestic suppliers. ISS includes training maintenance technicians, maintenance and repair, determining maintenance requirements, and monitoring of aircraft to confirm their airworthiness.

For example, Lockheed Martin has performed ISS for the Halifax-class ships as a combat systems integrator for a decade. Additionally, ISS on the CC-130 Hercules and CC-130J Super Hercules aircraft involves extensive activity in Canada. Lockheed Martin Canada performs a substantial portion of ISS in Canada, and the personnel complement has grown along with the size of the CC-130J fleet used by the RCAF. ISS for the CH-148 Cyclone maritime helicopter used by the Canadian Armed Forces is also done in Canada.

Training

Lockheed Martin Canada operates a training centre in Dartmouth, NS for RCN teams, operators, and maintenance staff. This facility delivers training on the CMS 330 combat management system, and provides options to train in the classroom or at sea in a live environment.

The VISTA Simulation Training Application is a virtual environment developed by Lockheed Martin Canada that is used to train workers who maintain and operate complex equipment. Since this advanced training is provided virtually, it saves the RCN substantial time and money. As the CMS 330 system is increasingly used around the world, VISTA products have now been exported to over 10 countries worldwide.

Figure 3: Vista software



Lockheed Martin Canada has provided Direct Fire Targetry (DFT) services for the Canadian Armed Forces since 1997, and maintains four permanent DFT sites in Gagetown, NB, Edmonton, AB, Valcartier, QC and Petawawa, ON. DFT services provide weapons training so that soldiers can practice responding to threats with live ammunition in a controlled environment.

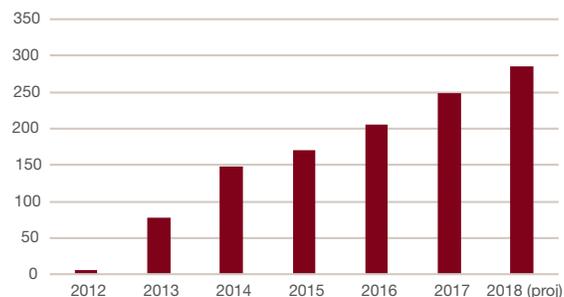
Electronic warfare systems

Lockheed Martin Canada has developed electronic warfare (EW) systems for the RCN and the United Kingdom's Royal Navy, and recently developed Coronis, a Windows-based EW software. Electronic warfare systems support situational awareness, and help ships identify and intercept threats. For example, EW systems can both disrupt signals and prevent their own receivers from being disrupted.

Lockheed Martin Commercial Engine Solutions

Lockheed Martin Commercial Engine Solutions (LMCES) provides Maintenance, Repair, and Overhaul (MRO) services out of its location in Montreal—one of the world's top aerospace clusters. This facility was acquired by Lockheed Martin in 2013 after Aveos Fleet Performance was liquidated. Lockheed Martin has rebuilt the shop, leveraging more than 40 years of experience in commercial and military aircraft engines. In addition to engine MRO, LMCES provides component repair, in-field services, logistics, testing services, lab services, specialty services and technology investment. Through service excellence, LMCES has maintained client relationships and serves many of the same clients as the Aveos facility including the RCAF, Air Canada, and Air Transat, as well as international commercial and military clients. To support the increased demand for its services, the LMCES workforce has grown substantially, from seven employees at the time of acquisition in 2013, to 250 employees today, as shown on the chart below.

LMCES Employment



For LMCES, there are a number of benefits to being a part of Lockheed Martin Canada. Lockheed Martin's strong brand and name recognition is helpful in winning business. Though following its acquisition by Lockheed Martin the facility was originally called Kelly Aviation, it changed its name to Lockheed Martin Commercial Engine Solutions to emphasize the connection with Lockheed Martin. For customers, the brand is associated with quality, reliability, and financial stability.



This acquisition has benefitted the Canadian and Quebec economies by providing the ability to maintain knowhow and building a sustainable operation that is expanding in domestic and export markets and creating higher value-added jobs.

CC-130 and CC-130J

The CC-130 Hercules tactical transport aircraft has been in service with the RCAF since 1960, and the H-model currently in use was purchased in 1996. Between 2010 and 2012, the RCAF acquired 17 J-model “Super Hercules” aircraft, which are more fuel-efficient and require a smaller crew compared to older models. Hercules aircraft have been instrumental to the operations of the RCAF, in use to deliver personnel, supplies, fuel, and equipment to remote parts of Canada’s North, delivering aid and assistance following disasters in remote areas around the globe, and transporting supplies and equipment in support of the Global Coalition against terrorism.¹¹

Technology such as the Hercules aircraft has economic impacts on Canada through Canadian suppliers and through ITB commitments that are associated with procurement for the Canadian military. Lockheed Martin recently completed \$1.4 billion in benefits to the Canadian economy through ITB commitments associated with CC-130J procurement. Read more about these commitments in Section 6: R&D Activities.

Figure 4: C-130J Hercules Transport Aircraft



CC-130: Quick Facts

- › The RCAF currently operates 12 CC-130H Hercules transport aircraft
- › In use by the Canadian Armed Forces since 1960 (H/E models)
- › Used for troop transport, tactical airlift, search and rescue, air-to-air refuelling, and aircrew training
- › Used to deliver supplies in Canada and in the Global Coalition against terrorism
- › Canadian sustainment providers work on C-130s around the world

CC-130J: Quick Facts

- › The RCAF currently operates 17 CC-130J Super Hercules transport aircraft
- › In use by the Canadian Armed forces since 2010
- › Upgraded by Lockheed Martin and Cascade Aerospace between 2013 and 2017 on budget
- › Used for troop transport, tactical airlift, search and rescue, air-to-air refuelling, and aircrew training, peace support operations, and for humanitarian assistance
- › Used to deliver supplies in Canada and in the Global Coalition against terrorism
- › Canadian sustainment providers work on C-130Js around the world
- › 100% IRB (ITB) commitments were fulfilled ahead of schedule

11 (Royal Canadian Air Force, 2018)

F-35 Lightning II

The F-35 Lightning II fighter jet is a fifth-generation stealth weapon system developed by Lockheed Martin. It is flown around the world, and sources a considerable share of its components from Canadian companies: there is \$2.3 million USD worth of Canadian components on every F-35 jet manufactured. The F-35 program has strengthened Lockheed Martin's relationships with Canadian aerospace suppliers who were chosen through a global competitive process.

In 2002, Canada became one of the original nine program partners. Since then, more than 110 Canadian suppliers have been involved, and the total value of contracts to these suppliers has exceeded \$1 billion, which has supported the creation of \$889 million in GDP and 9,500 jobs.¹² Read more about suppliers involved in the F-35 in Section 7.

Lockheed Martin procures parts from Canadian companies for F-35s around the world, generating significant economic impacts in Canada. Canadian suppliers for the F-35 include Gastops which, due to a substantial investment received from Lockheed Martin, was able to develop an innovative technology which provides engine health monitoring sensors. Another key supplier for the F-35 is Magellan, an anchor of the Winnipeg aerospace cluster, which provides the horizontal tail, machined parts, and centre fuselage and wing composite parts. Magellan has entered into contracts with Pratt and Whitney and Rolls-Royce for initial engine work. The parts provided by Magellan are critical hardware that require advanced machining capabilities and strict quality standards.

Figure 5: F-35 Lightning II



F-35 Lightning II: Quick Facts

- > Over 280 delivered worldwide
- > 110 Canadian suppliers involved over the course of the program
- > \$2.3 million USD in Canadian components on every jet
- > \$889 million in Canadian GDP supported to date

Future Fighter Capability Project

“On December 12, 2017, the Government of Canada launched an open and transparent competition to permanently replace Canada’s fighter fleet with 88 advanced jets. This is the most significant investment in the Royal Canadian Air Force in more than 30 years and is essential for protecting the safety and security of Canadians and meeting international obligations.”

-Public Services and Procurement Canada



¹² (OMX Data Analytics, 2017)

CH-148 Cyclone

The CH-148 Cyclone helicopter is built by Sikorsky, which was acquired by Lockheed Martin in 2015. The CH-148 Cyclone is set to replace the CH-124 Sea King as Canada's main ship-borne maritime helicopter in 2018. The RCAF uses maritime helicopters for intelligence, surveillance, and reconnaissance, including anti-submarine and anti-surface warfare, search and rescue, utility missions, and tactical transport.¹³ Compared to the Sea King, the Cyclone is faster, has more cabin space, and higher endurance, as well as other innovative improvements.

“The Cyclone is an information rich aircraft and managing the flow of information to determine how best to meet the task is a key challenge and opportunity generated by the new technologies on-board Cyclone.”

- Colonel Sid Connor, the 12th Wing Commander¹⁴

The Government of Canada has ordered 28 CH-148 Cyclones. To support the introduction of these new helicopters, Sikorsky has built a Maritime Helicopter Training Centre at 12 Wing Shearwater in Nova Scotia. To date, the centre has trained more than 300 students on flying and maintaining the aircraft. Sikorsky is the prime in-service support (ISS) integrator for the CH-148 Cyclone and has partnered with Canadian companies including General Dynamics Mission Systems Canada and L3 MAS to deliver the ISS.¹⁵ Sikorsky commercial helicopters are also in use in Canada for oil and gas customers, search and rescue, and emergency medical services.

Figure 6: An RCAF CH-148 Cyclone Maritime Helicopter



CH 148 Cyclone: Quick Facts

- › The RCAF is in the process of replacing their CH 124 Sea King fleet with 28 CH-148 maritime helicopters
- › Initial operational capability in 2018 and full operational capability in 2025
- › Program value of \$6.1 B for acquisition and ISS
- › To date, 300 students trained at the dedicated Maritime Helicopter Training Centre

Sikorsky has completed its ITB obligations of over \$4.8 billion for the acquisition and maintenance of the helicopters, including the donation of a Sikorsky S-76 helicopter to the Saskatchewan Indian Institute of Technologies to help students learn about helicopter maintenance.

Figure 7: Students at the Saskatchewan Indian Institute of Technologies with a Sikorsky S-76 helicopter



¹³ (Royal Canadian Air Force, 2018)

¹⁴ (Second Line of Defense, 2017)

¹⁵ (Canadian Defence Review, 2017)

CP-140 Aurora Structural Life Extension

The CP-140 Aurora aircraft is a long-range patrol aircraft used by the RCAF for Intelligence, Surveillance, and Reconnaissance in domestic, continental, and international roles. Lockheed Martin Aeronautics was contracted in 2008, to carry out the Aurora Structural Life Extension Project (ASLEP) for 14 Auroras.¹⁶ This included replacing wings, horizontal stabilizers, and other parts on the aircraft to ensure ongoing safety. To complete this project, Lockheed Martin worked with a range of Canadian suppliers and fulfilled over \$250 million in ITB obligations, including an investment in a new 3-D metal printing centre of excellence at the University of New Brunswick.¹⁷ Read more about the economic impacts of the ASLEP in Section 6 (ITB credits) and Section 7 (supplier relationships).

Figure 8: A CP-140 Aurora surveillance aircraft



CP 140: Quick Facts

- › Manufactured by Lockheed Martin Aircraft Company, in use in Canada since the early 1980s
- › 18 in use by the RCAF
- › Used for surveillance, anti-submarine warfare, intelligence, surveillance, and reconnaissance, strike coordination, search and rescue, and disaster relief
- › Used to combat illegal immigration, illegal fishing, pollution, and drug trafficking
- › Used by the RCAF to support operations in Canada, the Caribbean Sea and the Pacific

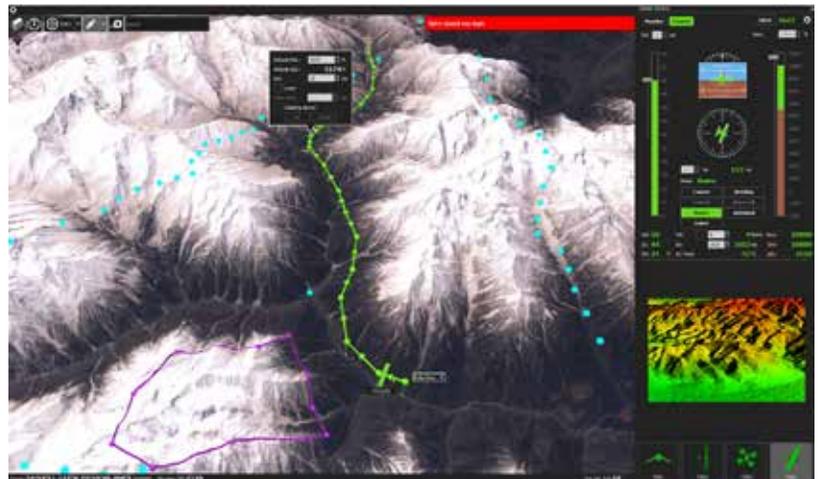
Software for unmanned Aerial Vehicles

CDL Systems, located in Calgary, produces software for Unmanned Aerial Vehicles (UAVs). It was acquired by Lockheed Martin in 2012 in order to expand its capabilities in this industry.

CDL Systems was founded in 1993 to commercialize ground control software for UAVs. The ground control software functions like a cockpit on the ground, providing visuals and control mechanisms. CDL licenses the software system to users and provides additional services such as customizing the software for different types of UAVs or specific uses. Currently, almost all sales are to defence contractors, the vast majority of which are exported. Military applications of UAVs include surveillance, strikes, and target tests.

CDL Systems has a staff of 50 employees hired mostly from the University of Calgary's engineering program and offers an internship for recent graduates. It is also piloting a partnership with the Southern Alberta Institute of Technology to test and evaluate their software.

One advantage to CDL of the acquisition by Lockheed Martin is its name recognition, which expands CDL Systems' range of potential clients. Additionally, CDL Systems now has access to Lockheed Martin's sales support in a number of countries, increasing their potential to grow international sales, which will benefit the economies of Calgary, Alberta, and Canada.



¹⁶ (Royal Canadian Air Force, 2014)

¹⁷ (Industry Canada, 2017)

Canadian Forces Health Information System

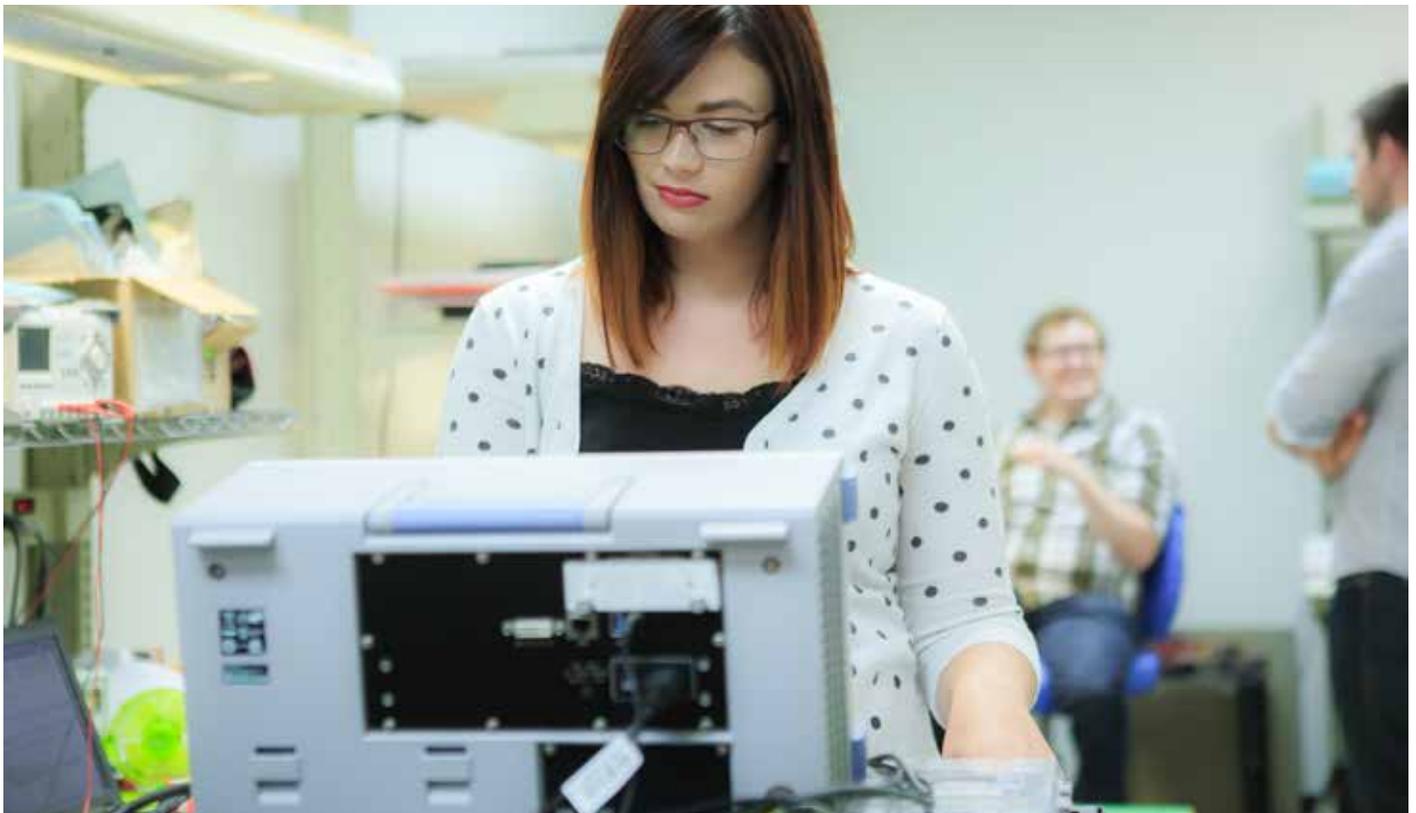
Between 2002 and 2016, Lockheed Martin Canada was the prime contractor for the development and ISS of the Canadian Forces Health Information System (CFHIS), a software system that provides health information in a secure electronic form to 2,500 health care providers. The CFHIS is an important tool to ensure that the 85,000 Canadian Forces personnel that use it receive consistent healthcare. Lockheed Martin Canada's role in developing the CHFIS was to integrate different off the shelf software to create an Electronic Health Record that can be securely and efficiently accessed around the world. The CHFIS continues to be used successfully by the Canadian Armed Forces.

Solar Tilt Roller Tracker

Lockheed Martin is expanding investment and operations in the area of sustainable energy. In 2011, Lockheed Martin Canada began development of the Tilt Roller Tracker (TRT), an off-grid energy solution which is substantially more efficient than traditional fixed solar panels. In 2013 Lockheed Martin Canada designed a full micro-grid solution bringing the solar tilt technology together with batteries and diesel generator to make a complete power system ideally suited for off-grid applications.

In the same year, Manitoba Hydro ran a competition for the supply of a renewable power solution to four remote communities in Northern Manitoba. Lockheed Martin Canada's TRT microgrid solution was selected by a stakeholder community consisting of Manitoba Hydro, Natural Resources Canada (NRCAN), and Indigenous and Northern Affairs Canada (INAC). A prototype TRT was installed in Swift Current, Saskatchewan prior to 2016 Energy Forum in Saskatoon.

Since then, TRT technology has continued to develop: a prototype TRT was installed in Swift Current, Saskatchewan prior to 2016 Energy Forum in Saskatoon, and Lockheed Martin has applied for technology patents in both the US and Canada.



4. Economic footprint, 2008–2017

Introduction

This section estimates the economic footprint of Lockheed Martin's operations in Canada for each year from 2008 to 2017. This includes capital expenditures such as investment in new property and equipment, operating expenses of Lockheed Martin Canada, and intermediate goods purchased from Canadian suppliers by Lockheed Martin Corporation for aircraft, satellites and other systems assembled in the United States.

We note that the economic footprint of Lockheed Martin, as estimated in this section does not fully reflect the economic contribution of Lockheed Martin to the Canadian economy. As discussed later in this report in addition to the contributions made throughout its supply chain, Lockheed Martin provides benefits to the Canadian economy through:

- › Downstream impacts (see Section 5)
- › Research and Development (see Section 6)
- › Participation in industry clusters (see Section 7)
- › Skill development (see Section 8)
- › Corporate social responsibility (Section 9)

Those additional elements have been identified and described by us in the above noted sections. Our review suggests that Lockheed Martin provides significant economic benefits to the Canadian economy, through those elements. However, the scope of this report does not include a quantification of those benefits into common economic footprint measures.

Lockheed Martin's Economic Footprint

The data used to conduct the economic impact Assessment was expenditure data collected from Lockheed Martin Canada and Lockheed Martin Corporation.

Based on these expenditure figures, we estimated the economic footprint of Lockheed Martin's operations in Canada. The economic footprint estimates for 2008-2017 are summarized in the table below.

Total economic impact generated between 2008 and 2017:

\$3.8 billion
in GDP

36,521 jobs
in full time equivalent (FTE) person years

\$2.5 billion
in labour income

\$1.9 billion
in exports to the US

\$1.5 billion
in total tax impact

In a typical year¹, the economic impact of Lockheed Martin on the Canadian economy is:

\$379 million
in GDP

1,000 direct FTE jobs²

2,652 additional FTE jobs supported

\$254 million
in labour income

\$147 million
in total tax impact

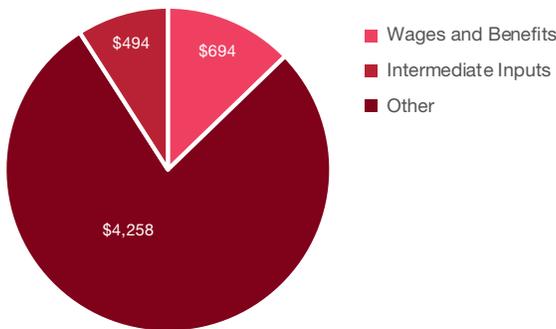
\$193 million
in exports to the US

1 Average of the years 2008 to 2017

2 Full time equivalent jobs. 2017 figure.

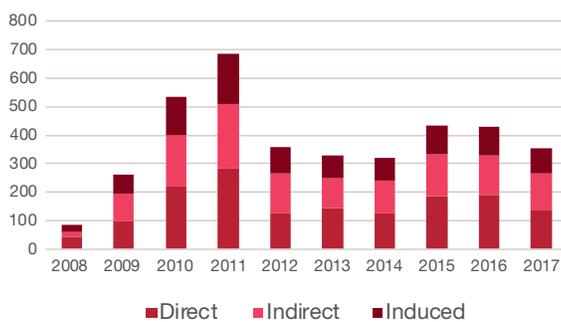
Economic impact estimates were based on spending data collected from Lockheed Martin. This includes capital expenditures and operating expenses by Lockheed Martin Canada, as well as purchases by Lockheed Martin Corporation from Canadian suppliers. This spending amounted to \$5.4 billion between 2008 and 2017, an average of \$545 million per year. The following chart shows the breakdown of this spending between 2008 and 2017. By far the largest category of spending was intermediate inputs (components) from Canadian suppliers, which accounted for 78% of expenditure. The second largest category was wages and benefits, accounting for 13%, and other, such as utilities and equipment, accounting for 9%.

Expenditure by Type, \$ Millions 2008-2017



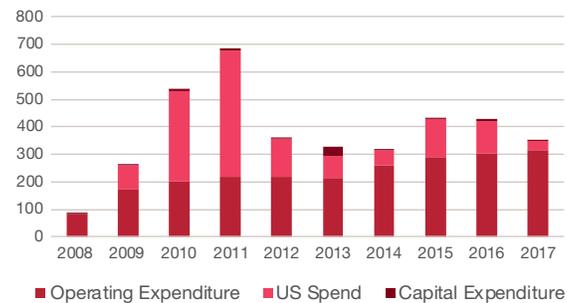
The chart below shows the total GDP or value-added impact of Lockheed Martin. Total contribution to GDP over ten years was \$3.8 billion.

Total GDP



The following breaks down the same GDP figures by source, i.e. operating expenses, capital expenditures, and spending by Lockheed Martin Corporation (US spend).

GDP by Source



The largest contributor to GDP in most years is operating expenses, which refers to the ongoing operations of the business. This has generally increased over the past ten years, increasing from \$84 million in 2008 to \$314 million in 2017.

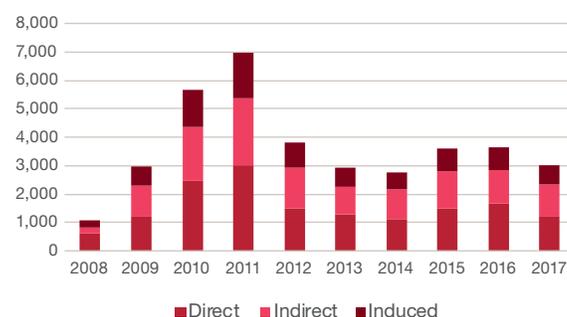
The second-largest contributor to overall GDP is US spending, that is spending by Lockheed Martin Corporation on Canadian suppliers. US spending was at its highest during 2010 and 2011. During this time, three major programs—F-35 Lightning II, Halifax class Modernization, and COMDEV satellite — were all purchasing parts from Canadian suppliers.

Economic impacts attributed to US spending are related to exports by Canadian suppliers.

Capital expenditures during the reviewed period had a relatively low economic footprint.

Employment is measured in full time equivalent (FTE) positions, and naturally follows a similar pattern as GDP. Total employment supported by Lockheed Martin was over 36,500 job years from 2007 to 2017, including 3,023 positions in 2017.

Employment



The cities in which Lockheed Martin has had the largest impact are Montreal, Ottawa, and Halifax. In 2017, the economic impact of Lockheed Martin was:

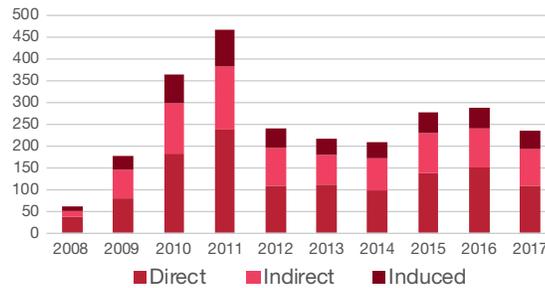
\$47 million in GDP and 463 jobs in Montreal

\$43 million in GDP and 459 jobs in Ottawa

\$28 million in GDP and 393 jobs in Halifax

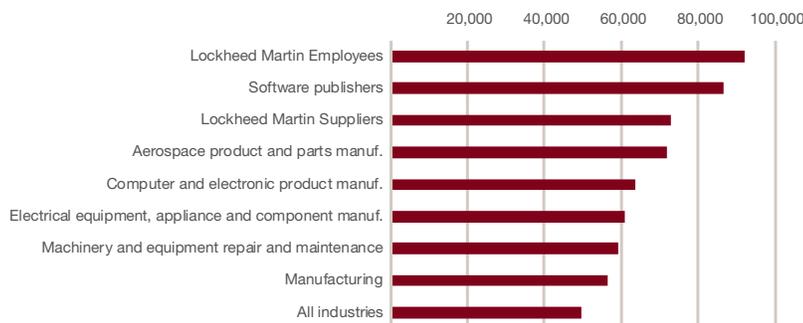
The following chart shows labour income earned by employees supported by Lockheed Martin. In 2017, average labour income per direct employee was \$90,527 and average labour income for all employees supported by Lockheed Martin (i.e. direct, indirect and induced) was \$77,500.

Labour Income



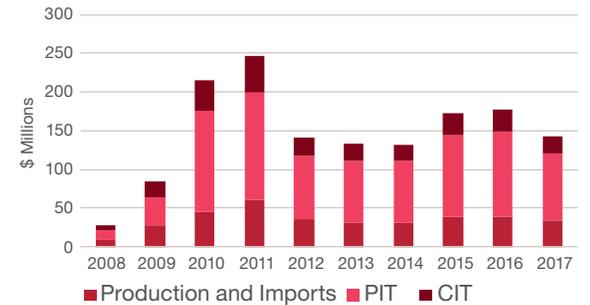
The annual salary earned by Lockheed Martin Canada employees and their suppliers is above that of employees in similar industries. As Lockheed Martin Canada's activities span a number of industry categories, several comparison industries have been included. In 2016, the most recent year for which comparable data was available, Lockheed Martin Canada's direct employees earned the highest income at \$92,090, followed by software publishers at \$86,618, and Lockheed Martin suppliers at \$73,033. The incomes of these groups exceed the average income in industries such as aerospace product and parts manufacturing, computer and electronic product manufacturing, and machinery and equipment repair and maintenance. Generally speaking, higher wages correspond to companies involved in higher value added activities.

Annual Income, 2016



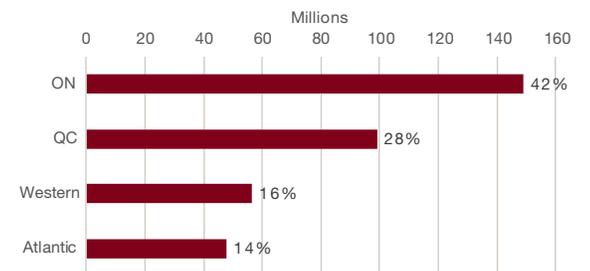
As noted above, tax contribution here includes taxes on production and imports at the municipal, provincial, and federal levels, as well as taxes on personal and corporate income at the provincial and federal levels. In 2017, total tax contribution was \$143 million.

Total Tax Impact



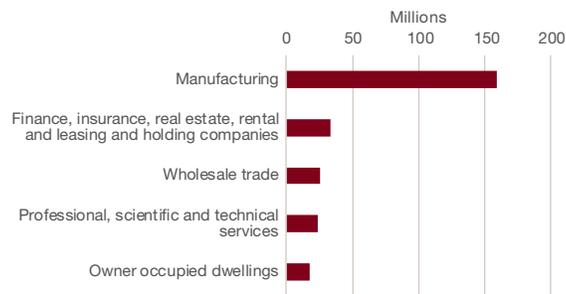
The province impacted the most by Lockheed Martin's operations is Ontario: in 2017, 42% of the overall GDP impact took place in Ontario. Quebec had the second-highest impact at 28%, followed by the Western provinces (Alberta, British Columbia, Manitoba, and Saskatchewan) at 16% and the Atlantic Provinces (Nova Scotia, New Brunswick, Newfoundland, and PEI) at 14%. The provincial breakdown of other metrics (employment, labour income, and tax) is very similar to the GDP breakdown shown below.

Total GDP Impact, 2017



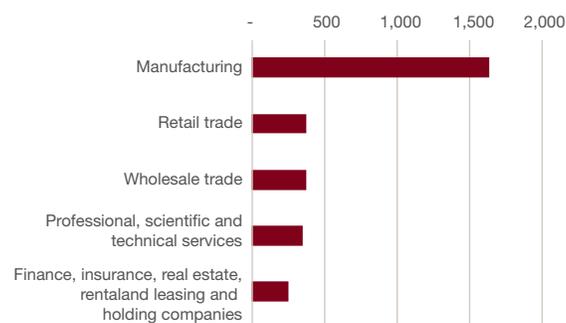
Almost half (46%) of Lockheed Martin's 2017 GDP footprint in Canada is in the manufacturing industry. Lockheed Martin's activities are mainly in aerospace and defence manufacturing, which is included in the broader manufacturing category. The remaining significant industry footprints include finance, insurance, real estate, rental and leasing and holding companies (10%), wholesale trade (10%) and professional, scientific, and technical services (10%).

GDP



In terms of employment, the industry impacted the most by Lockheed Martin is manufacturing, accounting for 41% of total employment impact, followed by retail trade with 9% of total employment and wholesale trade with 9%.

Employment Impact 2017



Exports

Because Lockheed Martin's systems are used globally, Canadian suppliers build on their experience maintaining, supporting, and upgrading Lockheed Martin systems in Canada to export these services to other defence departments worldwide. In particular, US purchases by Lockheed Martin Corporation represented \$1.9 billion in Canadian exports over the period 2008 to 2017.

Canadian exports facilitated by Lockheed Martin are not limited to the US as described below:

Following the success of the Halifax-class frigate modernization, Lockheed Martin Canada has won two contracts for similar modernizations in New Zealand and Chile. The work for the Chilean Navy started in 2017, and is projected to include \$69 million dollars in Canadian content value, including both Lockheed Martin and external suppliers. The contract with the New Zealand Navy began in 2014 and will provide \$46 million in Canadian content value over the life of the project.

In addition to these figures, Canadian suppliers and sustainment providers build on their experience working with Lockheed Martin aircraft and systems to further increase global exports. For example, Cascade Aerospace provides maintenance and upgrades on C-130 systems for the RCAF and was recently awarded a contract to modernize a C-130 Hercules for the Mexican Air Force. For more examples of Canadian companies exporting services for Lockheed Martin aircraft used abroad, see Section 5.

5. *Downstream impacts*

The economic footprint estimates shown in Section 4 include what is referred to as “upstream” impacts in the form of economic impact created by suppliers of Lockheed Martin and suppliers of these suppliers. In this section, we discuss the downstream impacts of Lockheed Martin, i.e. where Lockheed Martin systems drive demand for additional products and services. The downstream activities impacted by Lockheed Martin are significant and include maintenance, systems support, training for pilots and mechanics, and updates such as the CP-140 Aurora Structural Life Extension Project. Because Lockheed Martin’s systems are used globally, Canadian suppliers build on their experience maintaining, supporting, and upgrading Lockheed Martin systems in Canada to export these services to other defence departments worldwide.

In addition to generating demand for goods and services, Lockheed Martin’s aircraft and naval systems provide benefits to the Department of National Defence by increasing the efficiency of communication between Canada’s armed forces and their allies. Additionally, when different armed forces use Lockheed Martin technology, they effectively share the costs of developing upgrades, as has been the case with the CC-130. Finally, some Lockheed Martin systems are unique and thereby provide benefits to Canada’s economy not otherwise available.

This section describes the most significant additional economic impacts generated by Lockheed Martin after its systems are delivered for use in Canada.

Training and maintenance

CAE

Between 2010 and 2012, Lockheed Martin Aeronautics delivered 17 new CC-130J Super Hercules tactical aircraft to the RCAF. Once an aircraft is delivered, the RCAF requires many associated services including training for pilots and maintenance crew. CAE is the prime contractor to the DND for providing Operational Systems Training for Canada’s CC-130J aircraft, meaning

that it provides flight simulators and training for CC-130J pilots. Flight simulators are an important money-saving technology for the RCAF because training in simulators is substantially less expensive than using actual aircraft. CAE also provides comprehensive maintenance training for the CC-130J at their Air Mobility Training Centre in Trenton, Ontario.¹ ITB obligations for these two programs total \$593 million.

CAE was selected because of their previous experience, knowledge and skill in dealing with CC-130 aircraft maintenance training and simulation. CAE is a global company headquartered in Montreal and is a global leader in flight simulation and training systems integration. The relationship between CAE and Lockheed Martin goes back around 30 years and is one of the strongest among Canadian suppliers.

IMP Aerospace

IMP Aerospace and Defence (IMP), located in Halifax, NS, has provided several upgrades and modifications to Canada’s CP-140 Aurora fleet. IMP has provided support for the Aurora aircraft since it entered service for the RCAF in the early 1980s and has worked on both the Aurora Incremental Modernization Project (AIMP), which replaced mission systems and sensors, and the Aurora Structural Life Extension Program (ASLEP), which will extend the life of the fleet to 2030. On both projects, IMP performed installation work. As part of the ASLEP, IMP replaced wings, horizontal stabilizers, and centre wing box structures. It also updated the navigation and flight instruments, communications, and mission systems using kits provided by Lockheed Martin.² IMP has built on this expertise to perform a similar wing replacement on Norwegian P-3 Orions, a related Lockheed aircraft.³ IMP has a strong relationship with Lockheed Martin and also provides warehouse and supply chain management services for the CC-130J in Trenton, ON.

¹ (CAE, 2018)

² (Government of Canada, 2014)

³ (IMP Group, 2017)

Cascade Aerospace

Cascade Aerospace (“Cascade”), based in Abbotsford, BC, provides aircraft maintenance services on the CC-130 and CC-130J, and is the only Canadian provider of these services. As of 2012, Cascade Aerospace is a division of IMP. Services provided by Cascade for Canada’s 32 Hercules aircraft include component repair and overhaul, as well as maintenance and fleet management. For an upgrade performed by Cascade in 2016, Lockheed Martin introduced a new method of “block upgrading” where many changes are made at once and coordinated across Hercules fleets, as directed by Lockheed Martin. This replaces an incremental style of upgrading that was done by individual air forces on an ad-hoc basis. The new system is both more efficient and provides better quality. Additionally, different air forces can share the cost of developing enhancements for the aircraft.

Cascade Aerospace was selected by Lockheed Martin based on a competitive process that found them to be the most qualified and cost-competitive provider. In 2004, Cascade developed a partnership with several subcontractors including Marshall Aerospace, Derco Aerospace, and Standard Aero to provide services for the Hercules aircraft. These companies also have experience servicing Hercules fleets worldwide.⁴ Building on their experience with CC-130s in Canada, Cascade was recently awarded a contract by the Mexican Air Force to modernize a C-130 aircraft.⁵

Standard Aero

Standard Aero is one of the world’s largest providers of maintenance, repair, and overhaul (MRO) services, with Canadian operations in Winnipeg, MB. In Canada, it operates as a subcontractor to Rolls Royce, which manufactures the engine and outer casing of the CC-130J. Standard Aero is the only MRO provider for these engines other than Rolls Royce. In 2015, Lockheed Martin Aeronautics designated Standard Aero as an authorized Quick Engine Change Service Centre to provide maintenance for the CC-130J, meaning that it is officially licensed to perform maintenance on the aircraft, as well as all other CC-130 models. Currently, Standard Aero has contracts from the Department of Defence to perform interim and

long-term maintenance on both the CC-130 and CP-140 aircraft.

Standard Aero performs maintenance for several C-130 fleets worldwide, and in January 2018 it was awarded a \$600 million USD contract from the United States Air Force (USAF) for MRO work on the engines of their C-130H fleet, with work to be done at both the Winnipeg and San Antonio facilities.⁶

Other examples

Other examples of work done on Lockheed Martin systems by Canadian companies include:

- › General Dynamics Mission Systems Canada: Block IV, the final upgrade of the CP 140 AIMP, involving the development, installation and integration of new capabilities including computers, satellite communication systems and missile defence capabilities;⁷
- › L-3 Electronics: Optimized Weapon System Support for the CP-140 fleet; and
- › MacDonald Dettwiler: imaging and surveillance radar system and associated software upgrades for the CP-140 fleet.

Additional benefits

Canada benefits from the use of Lockheed Martin systems by armed forces around the world. As discussed above, the block upgrade method means that various fleets can share the costs of developing new capabilities for their systems, thereby saving money.

Additionally, some technology offered by Lockheed Martin offers unique capabilities and benefits to Canada. For example, the Hybrid Airship can deliver heavy cargo to areas of the world with limited transportation infrastructure such as roads. This technology has potentially significant implications for delivering humanitarian aid, which is a traditional priority for Canada’s foreign policy. This technology is also important in developing industries in remote areas of Canada, such as mining in Canada’s Arctic.

4 (Industry Canada, 2017)

5 (Cascade Aerospace, 2018)

6 (Standard Aero, 2018)

7 (General Dynamics, 2016)

6. Research and Development activities

There are three main channels through which Lockheed Martin generates research and development (R&D) spending in Canada: developing new capabilities within Lockheed Martin Canada, R&D investment through Canada's Industrial and Technological Benefits (ITB) program, and acquisition of innovative companies in Canada. The first two channels are described below, and examples of the third are discussed in Section 3, which highlights some of Lockheed Martin's successful acquisitions.

The Organization for Economic Cooperation and Development (OECD) defines R&D as "the money spent on creative work undertaken on a systematic basis to increase the stock of knowledge and the use of this knowledge to devise new applications."¹ This covers a range of activities including developing and commercializing new technology. Spending on R&D is an important driver of innovation and productivity, which has been slowing in many developed countries since the early 2000s or earlier. This is of concern because productivity is an important driver of growth and improvements in living standards.² Because of the links between R&D spending, productivity, and economic growth, many governments have made it a priority to increase R&D spending.

Additionally, R&D spending generates a "social return on investment," which refers to the full range of benefits created by a new technology including economic, environmental, and well-being benefits. Based on this potential range of benefits, commonly accepted economic multipliers for R&D spending are up to nine times the initial investment, meaning that every dollar invested in R&D is expected, on average, to yield up to \$9 in long-term economic benefits.

Overall, Canada lags behind most other developed countries in R&D investment. For example, in 2015 R&D intensity³ was 1.7% in Canada, compared to 2.8% in the US.⁴ The Canadian aerospace and defence industries have substantially higher R&D intensity than other industries in Canada:

- › In 2016, R&D intensity in Aerospace manufacturing was 18%, compared to 3% in all manufacturing.⁵
- › Between 2012 and 2014, 29% of aerospace manufacturing firms were involved in the development of new advanced technologies compared to 15% of all manufacturing firms.
- › Aerospace manufacturing firms are substantially more likely to collaborate with other companies, educational institutions, or government research institutions compared to all manufacturing firms.

In the defence industry, figures on R&D intensity are not available, but the fact that over 30% of jobs in this industry are related to innovation, suggest a relatively high level of intensity.⁶

Between 2008 and 2017, Lockheed Martin generated:

\$18 million
internal R&D

\$156.6 million
ITB investment in R&D

Acquisitions of innovative companies in Canada



1 (OECD, 2005)

2 (OECD, 2017)

3 R&D intensity is R&D spending divided by GDP.

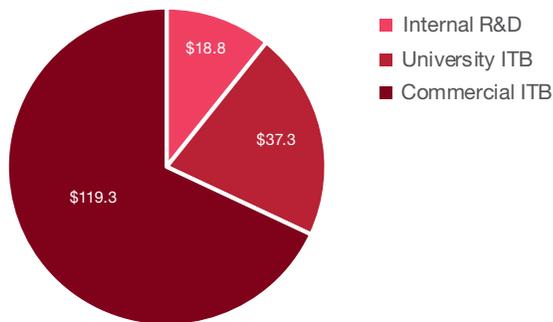
4 (OECD, 2017)

5 (ISED and AIAC, 2017)

6 (ISED and CADSI, 2016)

The chart below shows total R&D investment made by Lockheed Martin in Canada between 2008 and 2017. The largest portion comes from ITB investment, of which the majority is in commercial enterprises rather than university-based R&D. Between 2008 and 2017, R&D investment by Lockheed Martin represented 11.0% of direct GDP, compared to 1.7% for the Canadian economy overall.⁷

R&D Investment, \$ Millions 2008–2017



Development of new technologies by Lockheed Martin Canada

Lockheed Martin engages in R&D both directly through its own development of new technologies, and indirectly by supporting Canadian companies through the ITB program, as described in the following section. For example, Lockheed Martin Canada acquired its naval systems capabilities in Canada through the purchase of MEL Defence Systems and Loral Defence Systems. At the time of acquisition, MEL Defence Systems was an integrator, and since then Lockheed Martin Canada has substantially expanded this line of business. This part of Lockheed Martin Canada now performs management, design, and integration of naval systems, which is the largest portion of business in Canada. Expansion of this line of business involved development of new capabilities through R&D investment in developing technologies that are now exported around the world. Important recent projects have included the development of the CMS-330 naval combat management system (CMS) and the modernization of Canada’s Halifax-class frigates. Between 2008 and 2017, Lockheed Martin Canada spent \$2.1 million on internal R&D to develop the CMS. Another technology developed through internal R&D at Lockheed Martin Canada is the Solar Tilt Axis Roll Tracker, which moves

to follow the sun and is therefore more efficient than traditional fixed solar panels. Overall spending on internal R&D at Lockheed Martin Canada associated with the development of new technologies amounted to \$18.8 million from 2008 to 2017.

The Industrial and Technological Benefits program

When companies bid on Canadian defence contracts, they are evaluated on three criteria: technical specifications, cost, and a value proposition for contributing to Canada’s economy through ITB obligations. The impact of potential ITB contributions is evaluated by the Ministry of Innovation, Science, and Economic Development Canada (ISED). In 2014, this program underwent policy changes and changed its name from Industrial and Regional Benefits (IRB) to ITB. Lockheed Martin has both pre-2014 commitments through the IRB program and more recent commitments through the ITB program. Through the ITB program, contractors are required to invest in Canada an amount equal to the value of their contract.⁸

In a value proposition, defence contractors must demonstrate support for Canada’s Key Industrial Capabilities (KICs), as identified by the Canadian government and increase the global competitiveness of Canadian firms.⁹ The KICs provide areas of a focus for developing Canada’s defence industry. The defence industry is known to have high levels of technology and innovation, deliver high-value exports, and provide well-paying, high-skills jobs, and is therefore a promising way to promote long term economic growth. The KICs were chosen with three criteria in mind: operational requirements, potential for participation in global markets, and potential for innovation. The Key Industrial Capabilities, as identified in a 2013 report on the topic are:¹⁰

- > Arctic and Maritime Security;
- > Protecting the Soldier;
- > Command and Support;
- > Cyber-Security;
- > Training Systems; and
- > In-Service Support

⁷ (OECD, 2017)
⁸ (ISED, 2017)
⁹ (Industry Canada, 2014)
¹⁰ (Jenkins, 2013)

When Lockheed Martin puts together a value proposition for a DND contract, it considers the ways that its proposed ITB activities will contribute to the KICs identified by the DND, as well as other government priorities such as regional aspects, support for SMEs, and key technologies identified in the Request for Proposals (RFP). Since 1983, Lockheed Martin has completed activities valued at over \$6 billion through the ITB program. For example, over \$1.4 billion were recently completed as part of the CC-130J program one year ahead of schedule. Options to fulfil ITB commitments include procurement from Canadian companies, and R&D investments in Canadian companies. This section highlights the impacts of R&D spending, while Sections 4 and 7 look at the impacts of purchases from Canadian suppliers. Between 2008 and 2017, Lockheed Martin's total R&D investment in companies and through universities was \$91.8 million.

R&D investments by Lockheed Martin through ITB obligations include investment related to commercialization of technology, and R&D performed at universities. When deciding what types of R&D investments to make, Lockheed Martin identifies when companies or universities have developed or are developing a technology of interest, such as one that can be used across multiple business areas. In recent years, Lockheed Martin has invested in several emerging technologies some of which are described in detail in the next sub-section.

Examples of recent R&D investment

The following highlights some recent examples of R&D investments made by Lockheed Martin as part of its ITB commitments. As noted earlier, the amount spent on R&D does not necessarily provide the full economic impact of this spending, especially when the investment is made in the early stages of a particular technology that may take years to commercialize or provide returns.

Lockheed Martin has been an early investor in many technologies such as quantum computing, where applications are still being envisioned.

In addition to financial investments in R&D, Lockheed Martin also invests by lending its own staff to work on projects and making introductions between Canadian companies or labs and potential American buyers. In many of the following cases, Lockheed Martin's spending supports technology that has promising potential for advances in innovation and increases in productivity across companies and industries.



The Lockheed Martin IMPACT Centre located in Kanata, Ontario was created with a vision to promote growth of small Canadian businesses, advance research, support sustainability and enhance Canada's capability for exports in the defence and technology sector. The acronym "IMPACT" represents the centre's core purpose of fostering Innovation, Mentorship, Partnership, Collaboration and Technology and it also serves as an interactive venue for students and community partners to explore and advance STEM education.

University of Waterloo Second Heart Project

- ✓ *\$1.2 million invested by Lockheed Martin*
- ✓ *Innovative technology*
- ✓ *Cross-industry applications*
- ✓ *R&D commercialization*

The Second Heart project at the University of Waterloo is another example of technology motivated by Lockheed Martin that has a range of applications. In 2012, Lockheed Martin approached the University of Waterloo with the idea of working on technology that would improve cardiovascular circulation and endurance in high intensity scenarios. The technology developed is intelligent compression socks with air pumps that respond to information from sensors on the body. This technology can help people under sustained physical stress such as soldiers, athletes, and delivery people as it reduces the strain on the heart by helping to pump blood through the body. It can also provide benefits to individuals who are more sedentary such as truck drivers, as well as people with cardiovascular disease.

In 2016, Lockheed Martin invested \$1.2 million into this technology as part of its ITB commitments associated with the C-130J procurement. While Lockheed Martin wasn't intending to use this technology directly, it has potential to be highly beneficial to defence departments in Canada and elsewhere. The Second Heart research led to a spinoff company called Pression, which was formed in 2016 and is moving forward with commercializing the technology. Lockheed Martin's investment has led to the formation of a new company and the development of a technology that will improve the health and productivity of many.

Dalhousie University Project Descartes

- ✓ *\$4.7 million USD invested by Lockheed Martin*
- ✓ *13 R&D jobs in Halifax*
- ✓ *Innovative technology*
- ✓ *Cross-industry applications*
- ✓ *R&D commercialization*
- ✓ *Export activity*

In 2012, Lockheed Martin invested \$300,000 into "Project Descartes" as part of a quantum computing research consortium led by Dalhousie University. The project developed quantum algorithms for the verification and validation of complex software systems. The software integrates with existing programs to reduce errors and inconsistencies in system development, and has applications in developing new aerospace and defence technologies.

This project has led to a spinoff company called QRA, which is based in Halifax, and in which Lockheed Martin holds an equity position and has invested \$4.4 million USD. In addition to creating 13 jobs in research and development, QRA technology will enhance productivity through aerospace and defence applications. QRA plans to develop and market software for the D-Wave computers, which will increase the potential applications of quantum computing, lower the cost, and will make it easier for programmers with less technical expertise to use D-Wave systems. In 2016, the Government of Canada invested \$2.9 million in the company as part of the Atlantic Innovation Fund.¹¹

11 (ACOA, 2016)

Gastops

- ✓ *\$3.48 million USD invested by Lockheed Martin, in addition to procurement*
- ✓ *Export activity*
- ✓ *Innovative technology*
- ✓ *Cross-industry applications*

Gastops Inc., headquartered in Ottawa, is a leader in designing, manufacturing, and supporting machinery for sensing and analysing machinery fluid. By way of illustration, sensors can determine whether there are small amounts of metal in engine oil so the problem can be addressed before it affects the engine. The development of certain engine health monitoring sensors was sponsored by Lockheed Martin, and Gastops sensors are used on the F-35, as well as Lockheed Martin's F-22 Raptor, and many other aircraft produced by leading companies. This technology is versatile and can be used for any type of gas engine. In addition to aviation, Gastops technology is already used in energy, marine, rail, and mining applications. Gastops has partnered with GE Oil and Gas and PW Power Systems as suppliers.

Lockheed Martin made investments in Gastops through its ITB obligations for the CC-130J procurement, for design and development of new products and capabilities related to current Gastops technology. Overall, Lockheed Martin has invested \$3.48 million USD in Gastops. The investment framework between Lockheed Martin and Gastops provides future opportunities for innovation and developing new markets.

D-Wave

- ✓ *\$23.6 million USD invested by Lockheed Martin, in addition to procurement*
- ✓ *Innovative technology*
- ✓ *Cross-industry applications*
- ✓ *Export activity*

D-Wave, based in Burnaby, British Columbia, is the world's only commercial supplier of quantum computers and a world leader in the development of quantum hardware and software. Quantum computing is still a developing technology, but has the potential to drastically decrease the time it takes to solve computing problems, and may eventually be able to solve problems that traditional algorithms cannot. Potential applications of this technology include defence and mission planning, financial modeling, machine learning, and health care.¹²

Lockheed Martin holds an equity position in D-Wave, and purchased the world's first- and third- ever commercial quantum computers from them, as well as investing \$23.6 million USD in the company.¹³ Lockheed Martin has also invested in research on software and potential applications of quantum computing in order to facilitate its use in real-world problems (for example, see the next section on QRA). D-Wave is at the forefront of quantum computing and has sold systems to NASA and Google, among other customers.

¹² (D-Wave)

¹³ (Lockheed Martin, 2018)

Contextere

- ✓ 1.1 million USD invested by Lockheed Martin
- ✓ Innovative technology
- ✓ Cross-industry applications
- ✓ Export activity

Contextere is developing Artificial Intelligence (AI) software solutions that will help blue-collar workers, such as workers who perform aircraft maintenance, do their jobs more efficiently. It aims to use machine learning algorithms to present workers with the information they need at the right time in order to decrease downtime and errors and increase efficiency. This technology presents potential major gains in productivity in many blue-collar industries, and can also be used by Lockheed Martin as well as other suppliers such as Cascade Aerospace, which does maintenance for the CC-130J.

In 2017, Lockheed Martin invested \$1.1 million USD in Contextere as part of its ITB commitments associated with the CC-130J. The CEO of Contextere has described the relationship with Lockheed Martin as being transformational because of both the early financial investment and the credibility afforded to companies associated with Lockheed Martin.

Mannarino

- ✓ 13.4 million USD invested by Lockheed Martin
- ✓ 20 R&D jobs in Montreal
- ✓ Export activity

Mannarino designs and manufactures safety-critical systems, software, and hardware for aerospace, defence, space, simulation, and power generation applications. It was founded in 1999 and is located in the Montreal aerospace cluster. Lockheed Martin has invested in Mannarino systems as part of its ITB obligations, and has contributed \$13.4 million USD overall. This investment has resulted in more than 20 engineering R&D jobs in Montreal, and has allowed the company to continue to develop and commercialize its software products. While Mannarino is not a supplier of Lockheed Martin, they were selected because of their good prospects as an investment. Since Lockheed Martin's first investment, Mannarino has exceeded projections.¹⁵

Case Study: Solace Power

- ✓ 2.3 million USD invested by Lockheed Martin
- ✓ Innovative technology
- ✓ Cross-industry applications
- ✓ R&D commercialization

Solace Power is a small company located in Newfoundland that has developed a wireless power technology called Resonant Capacitive Coupling or RC2. This technology allows Unmanned Aerial Vehicles such as drones to recharge autonomously by using wireless power transfer. The technology has applications for Unmanned Aerial Vehicles such as those produced by Lockheed Martin, as well as a range of other potential uses in defence, transportation, and manufacturing. In 2017, Lockheed Martin invested \$2.3 million USD in the company, which will be used to accelerate commercialization of the RC2 technology.¹⁴ Both in Canada and internationally, Lockheed Martin has an interest in renewable energy technology, and intends to invest more in this field in the future.



Photo: Solace Power

¹⁴ (Solace Power, 2017)

¹⁵ (Mannarino, 2015)

7. *Industry perspective and clusters*

As discussed in the Introduction section of this report, industry clusters are known to spur innovation and create sustainable growth and well-paying jobs. As part of its plans to support innovation and growth, the Canadian government identified the creation of clusters as a priority. A good cluster requires active relationships between different companies, suppliers, and institutions. This section reviews the importance of clusters for innovation and productivity, Lockheed Martin's role in various industry clusters, and productivity-enhancing linkages outside of its core competencies. Lockheed Martin supports clusters by encouraging competition, generating business for its 1,400 Canadian suppliers, providing export opportunities, and creating spaces for collaboration.

Cluster theory

In his seminal work on the topic of industry clusters, Harvard economist Michael Porter defines clusters as “geographic concentrations of interconnected companies and institutions in a particular field.” They include producers of goods and services, as well as upstream suppliers, downstream industries, and institutions such as government agencies, universities, and think tanks.

Crucially, clusters can be said to be more than the sum of their parts: the interaction between cluster members encourages competition, spurs innovation, and increases productivity.

For this reason, many governments have taken measures to encourage clusters, seeing them as providers of sustainable growth and good jobs.

There are many reasons why clustering within an industry encourages productivity. Close proximity fosters coordination and trust between different companies, making it more effective to work together. Further, competition in a cluster is intense, and it is easy to compare companies operating within a similar environment. Clusters are often accompanied by a deep talent pool, making it easy for employers to recruit and train workers. Additionally, access to a deep and specialized supplier base reduces the cost of transactions, inventory, and imports and means that there are less likely to be delays and disruptions to the supply chain. Companies can also experiment with new technologies at a lower cost, and new companies find it less risky and costly to start, because suppliers, talent, and industry expertise are readily available. Finally, clusters can benefit from public goods such as infrastructure and information about technology, components, and processes. In order for clusters to succeed, members need to be part of a community and pursue their common interests, interacting through groups such as trade associations and research consortia.

Clusters located in Canada tend to consist of broader metropolitan areas, rather than a whole province. The sections below are organized by province, and describe which clusters are located there and how Lockheed Martin interacts with them. We note that Lockheed Martin also has connections with several of Canada's Superclusters.

Figure 10: Aerospace and defence clusters and Lockheed Martin's locations



The aerospace and defence industry in Canada

Canada is home to several major producers of aircraft for civil and defence markets. Bombardier Aerospace, an anchor of the Montreal aerospace cluster, is a leading manufacturer of commercial aircraft. Boeing also has a major presence in Canada, where facilities produce parts, components, and software for its commercial jets.

Bell Helicopter Textron invented the tiltrotor aircraft and produces commercial and defence helicopters including several for the RCAF. Pratt and Whitney is one of the world's largest suppliers of helicopter engines and is a prime contractor to Lockheed Martin on the F-35.

Suppliers, or “upstream” companies form another important part of Canada's aerospace and defence industry. General Dynamics produces hardware, software, and systems integration for land, air, and maritime forces. Raytheon's Canadian operations manufacture precision optics and radars, as well as providing systems integration, upgrades, and maintenance. L3 MAS specializes in communication, electronic, and sensor systems for military and commercial purposes.

“Downstream” activities include in-service support (ISS), maintenance, upgrades, and training for pilots and technicians. A number of large Canadian firms provide downstream services. IMP Aerospace and Defence provides engineering and maintenance for the DND including for Canada's search and rescue helicopters, as well as for international customers. CAE is one of the world's largest suppliers of civil flight simulation and provides modelling and training to clients including Lockheed Martin.

Naval companies are primarily located on Canada's east and west coasts. Irving Shipbuilding operates the Halifax Shipyard, and is contracted with the Government of Canada to build Canadian Surface Combatant (CSC) and Arctic Offshore Patrol Ships (AOPS) for the RCN under the National Shipbuilding Strategy. BAE Systems is an international aerospace and defence company that completed an upgrade Canada's Victoria-class submarines and provide ongoing technical support for them. Thales operates in naval systems, as well as aerospace, provides ISS for the AOPS, and provided surveillance radars for the Halifax-class modernization project. Thales is also present on the west coast and is the systems integrator for the RCN at the Vancouver Shipyards.

Overview of clusters supported by Lockheed Martin

The majority of Lockheed Martin Canada's activities fall under two overlapping major industries in Canada: aerospace and defence. Lockheed Martin is an active contributor to these clusters, with a network of over 1400 suppliers in Canada. Additionally, Lockheed Martin often competes with its own suppliers, contributing to a competitive and innovative environment.

In the aerospace sector, Canada has a strong reputation in civil, defence and space fields. There are over 400 aerospace firms in Canada, most of which are located in Quebec and Ontario. The Canadian aerospace sector is well-integrated with the United States, and Lockheed Martin has longstanding relationships with many of the major Canadian companies.

In the defence field, which includes air, land, and ocean technologies, there are over 800 companies in Canada that provide a range of technologies and services across the country. The defence field is export-focused, with exports accounting for 60% of sales in 2014.¹ Generally speaking, Western Canada is focused on ISS, Ontario and Quebec are focused on manufacturing and Atlantic Canada is focused on shipbuilding. The majority of sales and exports come from firms with a parent company outside of Canada such as Lockheed Martin.

The following section will review each region of Canada- what clusters are important in their economy and how Lockheed Martin participates in them, both through Lockheed Martin Canada's operations and through its suppliers and industry partners.

Quebec

In 2016, the Quebec aerospace industry accounted for more than half of Canada's Aerospace sector sales at \$14.4 billion, with 80% of production being exported.² It is home to 205 aerospace companies, as well as several research institutions such as the Canadian Space Agency, the Aerospace Manufacturing Technology Centre, and the Consortium for Research and Innovation in Aerospace in Quebec. A number of industry associations complement the cluster.

Within the province, Montreal is the hub of Canada's aerospace sector, with specialization in aircraft assembly, engine manufacturing, MRO, and avionics.

Lockheed Martin in Quebec

Lockheed Martin Commercial Engine Solutions (LMCES) is an MRO facility located in Montreal that has been operated by Lockheed Martin since 2013. MRO experience was one of the main drivers behind the acquisition of LMCES by Lockheed Martin. This experience was complementary to its San Antonio MRO facility and has created business synergy that benefited the Montreal facility. Since the acquisition, the LMCES has grown to 250 employees, and serves customers including commercial airlines such as Frontier Airlines, Air Wisconsin, European Aviation, Avion Express and International defence customers.

Lockheed Martin contributes to the success of the Quebec Aerospace cluster through LMCES, its large network of suppliers, as well as its participation in industry associations and linkages with educational institutions. Many of these relationships have a long history and contribute to sustainable growth.

Lockheed Martin Canada also has about 100 highly skilled employees working as part of the Rotary and Mission Systems organization in Montreal. This office was responsible for integrating a complex computer system for the upgrade of Canada's Halifax-class frigates.

¹ (Industry Canada, 2016)

² (Aero Montreal, 2017)

As discussed above, a successful cluster is predicated on companies seeking out interactions with other companies and institutions that can spur innovation and collaboration. As a matter of practice, LMCES considers Canadian companies first when looking for suppliers. Additionally, it has strong linkages with technical colleges in Montreal, employs 10-12 coop students at any given time, and sponsors research at Concordia University. Lockheed Martin has also sponsored an aerospace technician program curriculum for the Montreal school board.

Benefits of being in Montreal

Montreal is conveniently located as an aerospace hub, because it can serve customers from both North America and Europe. According to members of the industry, the quality of work completed in Montreal is world-class, and unique technologies and knowledge such as precision casting are available. Also, the high quality of postsecondary education in Montreal means that new employees of LMCES do not require as much training as they would otherwise.

Industry linkages in Quebec

Lockheed Martin has contact with many suppliers and partners throughout Quebec.

Infield Scientific

- › Located in Pointe-Claire, QC
- › Specializes in analysis and control of the electro-magnetic effects on board ships
- › They are working on four different programs for Lockheed Martin Canada and have worked with them for 15 years
- › Gets a substantial amount of their business from LM

Héroux-Devtek

- › Headquartered in Longueuil, QC with operations in QC, ON, and the US
- › Makes landing gear for the CC-130J, one of relatively few Canadian parts on this aircraft
- › Makes landing gear door uplocks for the F-35

Howmet Laval Casting (Laval) Vestshell (Montreal) Shellcast (Montreal)

- › These companies perform precision casting, which is a specialized function that is not commonly done in the US
- › The precision minimizes the amount of machine milling that needs to be done, so they preserve valuable aerospace metals
- › Lockheed Martin Aeronautics and Missiles and Fire Control have used these services for 15-20 years



CMC

- › Canadian operations in Montreal
- › Produces electronic components and some finished systems
- › Products are high-quality, unusual, and unique to military specifications

Aéro Montréal

- › An association that promotes and supports Quebec's aerospace cluster
- › A Lockheed Martin representative is on the board of directors

Ontario

Ontario is home to Canada's second largest aerospace cluster, with firms located in the Greater Toronto Area (GTA) and Southwestern Ontario. With \$6 billion in annual sales, Ontario represents roughly a quarter of Canada's aerospace industry.³ Like aerospace industries elsewhere, Ontario's aerospace sector is export-focused and R&D intensive. Ontario has strengths in aircraft parts manufacturing, systems development, and MRO. Ottawa, which is the location of Lockheed Martin Canada's headquarters, has strategic importance for the Canadian aerospace industry as Canada's Department of National Defence is headquartered there. Ontario is also home to 18 universities and colleges that offer aerospace-specific programs, with the University of Toronto, Ryerson University, and Carleton University offering graduate programs in aerospace engineering.

Lockheed Martin in Ontario

Lockheed Martin Canada officially opened its new head office in downtown Ottawa in 2013. The Rotary and Mission Systems facility (previously Mission Systems and Training) moved to its new 109,000 sq. foot facility in Katana over three years ago. The Ottawa based employees focus on Program management, engineering, business development, and government relations.

More than 20 Ottawa- and Trenton- based employees manage In Service Support for the RCAF's C-130J fleet. Notably this contract created 11 new high skilled engineering management positions.

Lockheed Martin's Impact Centre, opened in Ottawa in 2016, provides a space where partnerships and innovation can take place. It creates a platform for suppliers and researchers to meet and collaborate with Lockheed Martin, particularly focusing on naval technologies.

Lockheed Martin's Ontario investments include partnerships with institutions such as Ontario Centers of Excellence (OCE), the University of Waterloo, and associations such as the Aerospace Industries Association of Canada (AIAC) and the Canadian Association of Defence and Security Industries (CADSI). Lockheed Martin participates annually in CANSEC, the largest trade show in Canada, and the Canadian Aerospace Summit.

Lockheed Martin provides funding to the Canadian Global Affairs Institute, the Conference of Defence Institute, the MacDonald Laurier Institute, the Conference of Defence Associations Institute, the American Chamber Commerce in Canada and the American Business Council.

Benefits of being in Ottawa

A key benefit of its Ottawa location is proximity to the government of Canada's elected officials and public servants in the Department of National Defence, Innovation Science and Economic Development Canada and Public Services and Procurement Canada. Lockheed Martin is well positioned to understand the government's priorities, allowing it to better align its technology and solutions to meet Canada's needs.

³ (Ontario Aerospace Council, 2017)

Industry linkages in Ontario

MC Countermeasures

- › Headquartered in Kanata
- › Have developed an electronic jamming system to jam radio frequencies
- › Have worked with Lockheed Martin 4-5 years

Sonovision

- › Headquartered in Ottawa with locations in Montreal and Edmonton
- › Translates maintenance, operational, and technical manuals for Lockheed Martin

L3 Wescam

- › Located in Burlington
- › Provides a turret for the US Navy Cobra helicopter
- › Lockheed Martin worked with Wescam to modify the turret for a military purpose, resulting in a long-term contract with the US Navy
- › Lockheed Martin forms a substantial part of Wescam's business

COM DEV

- › International company headquartered in Cambridge
- › Acquired by Honeywell in 2016
- › Designs and produces unique space craft components primarily for use on satellites
- › Provides parts on sixteen Lockheed Martin satellites produced in the United States
- › Other customers include the DND, Canadian Space Agency, and European Space Agency

Centra

- › Located in Cambridge
- › Manufacturer of complex metallic aerostructures (airframe components)
- › Customers include several other leading aircraft manufacturers
- › Provides Keel Beam and Bulkhead Suppliers for the F-35



Magellan Aerospace

- › Located in Mississauga and Winnipeg
- › Provides Horizontal Tail, Machined Parts, and Centre Fuselage/ Wing composite parts for the F-35A
- › Also provides components for Boeing's Apache helicopter and Lockheed Martin's F 16 fighter

Ben Machine

- › Located in Woodbridge
- › Produces primary fabricated metal products
- › Electro-Hydraulic Actuation System components for the F-35

Gastops

- › Located in Ottawa
- › Worked with Lockheed Martin to develop engine sensors now used on the F-35
- › Customers include defence departments around the world as well as commercial airlines

Honeywell

- › Canadian Headquarters in Mississauga with locations in Ottawa and Cambridge
- › Provides avionics, engines, systems and service for military and commercial
- › Provides the power and thermal management system controller for the F-35
- › Ontario Centres of Excellence Member
- › Works with industry to assist in commercializing new technologies and encourage partnerships

Atlantic Canada

The aerospace and defence sector has a substantial presence in Atlantic Canada, with 167 firms participating in the Atlantic Canada Aerospace and Defence Association (ACADA). Atlantic Canada accounted for 12% of Canada's defence employment in 2016. This region specializes in MRO for military aircraft, ships, and combat vehicles, as well as naval mission systems, composite fabrication, and aircraft simulators.⁴ Annual revenues in aerospace and defence are over \$2 billion in Atlantic Canada, and over the past five years this region has had the fastest-growing MRO sector in Canada.⁵ Within Atlantic Canada's aerospace industry, Lockheed Martin is one of the major companies along with Pratt & Whitney, IMP Group, and Composites Atlantic. Atlantic Canada is also home to Irving Shipbuilding, builders of Canada's Arctic Offshore Patrol Ships. The Government of Canada has identified Atlantic Canada's aerospace and defence sector as an area for growth and recently invested in ACADA through the Atlantic Canada Opportunities Agency (ACOA).

Lockheed Martin in Atlantic Canada

Lockheed Martin has been in Atlantic Canada for decades and has built partnerships and long-term relationships with organizations, thus contributing to robust communities within regional clusters. In addition to working with local suppliers, Lockheed Martin has sponsored research at Cape Breton University, Dalhousie University, the Marine Institute at Memorial University in Newfoundland, and the University of New Brunswick. Recently, Lockheed Martin made a major investment in a 3-D metal printing centre in New Brunswick that will bring together industry, universities and colleges, to develop, commercialize, and train workers on new 3-D printing technology that can be used in marine and defence contexts.

Lockheed Martin Canada has offices in Halifax, NS and Dartmouth, NS, which focus on the development and delivery of combat systems for naval platforms. The main activities are the upgrade to Canada's Halifax-class frigates and the command and control system for the RCN's new fleet of Arctic Offshore Patrol Ships. Staff also support Direct Fire Targetry (i.e. target practice simulations) at the Gagetown, NB Canadian Army base. Lockheed Martin's main customer in Atlantic Canada is the Department of National Defence.

Benefits of being in Atlantic Canada

As so much work is done with the RCN, having a location in Atlantic Canada is important for both access to ships, and maintaining a strong relationship with this customer. In addition, the availability of a workforce with skills specializing in ocean technologies and many educational institutions supporting relevant research, provide a competitive advantage to industry players.

Industry linkages in Atlantic Canada

Stelia North America (formerly Composites Atlantic Limited)

- › Located in Lunenburg, NS
- › Provides composite weapons bay door inserts and Centre Fuselage/ Wing composite parts for the F-35
- › New composite part supplier to the C-130J fuselage
- › Other customers include Boeing, Honeywell, Northrop Grumman and other major aerospace companies



IMP

- › Located in Halifax, NS
- › Provides remanufacture, repair and overhaul
- › Has participated in multiple upgrades to Canada's CP-140 Auroras and other nations' P-3s
- › Other customers include US and Norwegian armed forces

Moog Components Group

- › Located in Dartmouth, NS
- › Produces rotary couplings for naval systems and unmanned vehicles

Halifax Partnership, Member

- › Promotes economic growth through business linkages

⁴ (Industry Canada, 2016)

⁵ (Government of Canada, 2017)

Western Canada

The aerospace and defence industry in Western Canada is diverse, and different regions have different specialties. In 2016, Western Canada accounted for 20% of Canada's defence employment and 15% of aerospace employment. Winnipeg is the largest aerospace cluster in Western Canada and is home to Magellan Aerospace, Standard Aero, and Boeing Canada. Standard Aero is one of the world's largest independent MRO providers for small turbine engines. Saskatchewan has a strength in satellite-based communications, and Alberta specializes in Unmanned Aerial Vehicles (UAVs), electronics, and MRO. British Columbia provides component manufacturing and assembly for commercial, defence, and space customers.

Industry linkages in Western Canada

Offshore Maritime Systems

- › Located in Vancouver, BC
- › Offshore Maritime Systems provides navigation systems for naval platforms

Standard Aero

- › Located in Winnipeg
- › One of the largest MRO providers in the world
- › Produces the outer casing of the CC-130J aircraft
- › Licensed to perform maintenance on all Hercules models

SED Systems

- › Located in Saskatoon
- › Provides satellite communication systems
- › Other customers include Boeing, the Canadian Space Agency and the European Space Agency

Qinetiq

- › Located in Medicine Hat, aAB
- › Produces target drones using technology from CDL systems in Calgary
- › Customers include Canada's DND and armed forces around the world

Cascade Aerospace

- › Located in Abbotsford BC
- › Provides fleet services including maintenance, modifications, and engineering
- › The only Canadian company licensed to provide second and third tier maintenance on the CC-130 and CC-130Js
- › Through an IP transfer from Lockheed Martin has won a contract to update a CC-130 Hercules for the Mexican Air Force
- › Works for commercial and military customers

Lockheed Martin in Western Canada

Lockheed Martin has a presence in Western Canada through its ownership of CDL Systems in Calgary, Alberta and its field offices in Victoria and Esquimalt, which provide in-field testing and maintenance for RCN submarines.

CDL Systems was founded in 1993 and acquired by Lockheed Martin in 2012. CDL's primary product is ground control software for UAVs, which functions like a cockpit that is on the ground and includes visual interfaces on computer screens. The company also provides hardware for these systems and designs software to help them interact with different types of UAVs. The main customers for these systems are defence-related, and the large majority is exported.

University of Calgary

- › CDL systems hires the majority of engineers from U of C and offers an internship program

Asco Aerospace

- › Located in Delta, BC
- › Produces the Wing Major Bulkhead for the F-35
- › Other customers include Boeing and Bombardier

Avcorp

- › Located in Delta, BC with a second location in Burlington, ON
- › Designs and builds airframe structures for Canadian and global companies
- › Provides CV Outboard Wing and Machining for the F-35

Toolcomm Technology

- › Located in North Vancouver, BC with staff on the Capilano First Nations Reserve
- › 100% Aboriginal owned
- › Designs and produces Voice over Internet Protocol and High Frequency Radios for the Artic Offshore Patrol Ships
- › Toolcom's contract with Lockheed Martin Canada has provided an opportunity to grow and develop an export business

Seaspan

- › Located in Vancouver and Victoria, BC
- › Partnered with Lockheed Martin Canada on the RCN's Halifax-class modernization project
- › Awarded a Supplier Excellence award by Lockheed Martin
- › Partnered with Lockheed Martin Canada on the CMS upgrade of New Zealand's ANZAC-class frigates



Canada's Superclusters

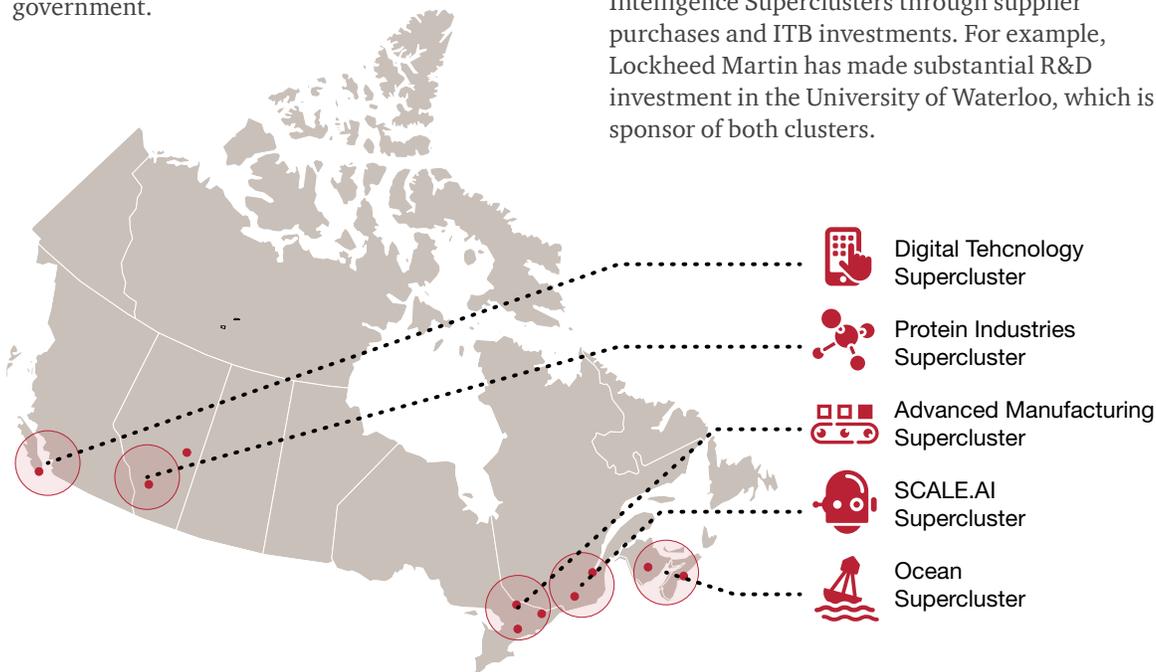
In addition to its linkages with Canada's regional clusters, Lockheed Martin is linked with several of Canada's "superclusters" for which the Government of Canada recently announced an investment of up to \$950 million, to be matched by industry.⁶

According to the Government of Canada, "A supercluster is an innovation hotbed that is home to a strong industrial cluster, or clusters, linked through their shared reliance on specialized inputs, including technologies, talent and infrastructure. Compared to clusters, superclusters have: stronger and more numerous linkages across sectors, and between firms, public and academic research assets; a strong brand and competitive advantage that translates into global recognition and impact, and the ability to attract talent and investment across highly innovative industries; and exceptional performance, including an outsize impact on job creation and GDP." The goals of supporting the superclusters are advancing Canada's technological abilities, helping industries build exports, and building Canada's global brand recognition. The map below shows the five superclusters that were selected to receive funding from the Canadian government.

In Atlantic Canada, Lockheed Martin's activities are part of the Ocean Supercluster, which includes companies involved in technology supporting oil and gas, defence, shipbuilding, ocean science and observation, ocean renewable energy, fisheries and aquaculture, coastal and ocean management, and seabed mining. Atlantic Canada specializes in high-tech engineering and manufacturing of ocean technologies for both civil and defence purposes.⁷ The Ocean Supercluster initiative plans to invest in developing digital technologies that support the associated industries.

D-Wave, which has received substantial investment from Lockheed Martin, is a founding member of British Columbia's Digital Technology Supercluster and is an important member within this cluster. With the funding from the Canadian government, the supercluster plans to use innovative solutions from data analytics, quantum computing, and virtual reality to accelerate projects in the areas of health, natural resources, and industry. Read more about Lockheed Martin's relationship with D-Wave in Section 6.

Additionally, Lockheed Martin supports members of the Advanced Manufacturing and Artificial Intelligence Superclusters through supplier purchases and ITB investments. For example, Lockheed Martin has made substantial R&D investment in the University of Waterloo, which is a sponsor of both clusters.



⁶ (Industry Canada, 2017)

⁷ (Industry Canada, 2017)

8. Lockheed Martin Canada's workforce

As the Canadian labour market faces changes such as an aging population and the entering of a new generation of employees with different expectations and needs, meeting these demands while remaining competitive is a key challenge for a company operating in Canada. Moreover, growing attention to diversity and equality issues in the workplace has encouraged Canadian companies to invest in addressing those issues. Lockheed Martin Canada handles these challenges by providing advanced training to its staff as well as instituting hiring processes that encourage the creation of a diverse and equalitarian workplace.

Lockheed Martin Canada's Investment in Training and Skills Development

A company's people and their core skills, in other words its human capital, is a key driver of economic and business growth. In a context where competitiveness is driven by productivity levels, Lockheed Martin Canada knows that investing in its people is critical to their success. In fact, Lockheed Martin Canada has developed training and skills development programs to build and grow the capability of its workforce. The programs aim to:

- › Develop the skills, capabilities and instil a positive mind-set to the management team;
- › Build and manage talent in accordance with the needs of the business;
- › Increase the effectiveness of the operations and the organization; and
- › Focus on culture and employee engagement.

More specifically, the different parts of the training program are detailed below.

Developing the skills, capabilities and instilling a positive mindset to the management team	Building and managing talent in accordance with the needs of the business	Increasing the effectiveness of the operations and the organization	Focusing on culture and employee engagement
<ul style="list-style-type: none"> › Teambuilding through leadership and teambuilding workshops › 360 Feedback development › Leadership training › Nomination process for the Center for Leadership Excellence (CLE) program 	<ul style="list-style-type: none"> › Talent Management › Identifying talent pipeline and career pathways › Executive coaching support for key roles › Identification of critical skills needed › Assist in building capacities in key areas 	<ul style="list-style-type: none"> › Integration support for M&A activity › Change Management support › New Leader engagement activities › Consulting on organizational design 	<ul style="list-style-type: none"> › Early career new graduate training programs; › Mentoring programs › Leadership engagement (roundtable discussions) › Facilitation of local inclusion councils › Corporate sponsored inclusion programs

Training need is driven from both the business needs and the employees' interests. Training content is typically delivered through classroom workshops, instructor-led, online or virtual courses, and on the job training. Lockheed Martin Canada has three different levels of training:

- › **Corporate Development Leadership Programming (Core):** Training offered to the leadership teams and to emerging leaders. The content is tailored to the level of the employee. There are functional training classes like finance, business development, program management, and capture management. All newly-appointed leaders take the first-line leadership program;
- › **Business needs:** Training offered following a business needs analysis. It aims at improving general skills development or technical skills;
- › **Employee needs:** Training based on needs identified by employees and soft skills development (through online training or on the job training).

Lockheed Martin Canada also implemented the Lockheed Martin Mentoring Program, which is supported by the Human Resources department. This program is available to all employees and is voluntary for both the mentor and mentee. In addition, online courses and electronic books are available in the Learning Management System. The content touches on business and leadership skills, digital skills, digital transformation, IT skills certification and compliance.

Lockheed Martin Canada assesses each of its training course based on feedback provided by employees and sometimes by their leaders. They also estimate, on an annual basis, the required metrics to the Quebec Government in compliance with the Declaration des activités de formation (Training activities declaration).

The investment Lockheed Martin Canada makes in its people also benefits society as a whole: further increases in skill levels of Canadian workers contribute to productivity growth and to increased standards of living for all Canadians.

Lockheed Martin Canada's Investment in Higher Education

It is of paramount importance to Lockheed Martin Canada to hire highly technical and / or highly educated employees to pursue its activities. Therefore, it aims at maintaining strong relationships with universities. It regularly participates in job fairs to connect with multi-disciplinary students and identify future talent. They hire 50-60 co-op interns annually for a four-month period. Following this, many newly graduates, especially from engineering programs, find quality jobs at the end of their study.

As shown in the table below, Lockheed Martin Canada hires people with a high level of education and, given the nature of its operations, employs many engineers.

Table 1: Overview of Education level of Lockheed Martin Canada employees (in percentage)

42%	Have more than one higher-education degree
34%	Have an engineering-related higher-education diploma

Case study – Education

Fostering innovation and enabling 3-D metal printing

In 2017, Lockheed Martin Canada's Aeronautics division contributed \$2.7 million to the Marine Additive Manufacturing Centre of Excellence at the University of New Brunswick, in Fredericton. This new centre of excellence combines research, manufacturing, training and workforce development in a unique project. The centre will work on developing a leading-edge and innovative technology to enable 3-D printing of metal parts. The centre and the technology it develops will foster innovation in the Fredericton area and will spur the formation of a cluster of expertise around that technology and its processes.



In 2018, The Career Directory recognized Lockheed Martin Canada as one of Canada's Best Employers for Recent Graduates.



Lockheed Martin Canada employs 1,000 employees in Canada in Ottawa, Montreal, Halifax, Calgary and Victoria. It aims at employing a highly qualified, innovative and diverse Canadian-based workforce. Lockheed Martin Canada has consistently been recognized as one of the National Capital Region's Top Employers over the past ten years.

Lockheed Martin Canada's investment in Diversity

When building relationships with universities and seeking future employees, Lockheed Martin Canada aims at integrating diversity as one of its selection lenses. It intentionally selects people from various backgrounds to represent the company at talent acquisitions events and recruitment fairs.

Canadian law by the Employment Equity Act, requires employers to engage in proactive employment practices to increase the representation of four designated groups.

Canada's four designated groups:

- › Women
- › People with disabilities
- › Aboriginal people
- › Visible minorities

Lockheed Martin Canada wants to ensure it will be an attractive employer to the entire workforce, including Canada's four designated groups. Lockheed Martin Canada considers that by having a diverse workforce, it is better able to attract and retain talent.

Gender diversity in defence is a challenge that Lockheed Martin Canada is willing to tackle. "Addressing gender inequality is first and foremost a question of fairness. (...) It is also a question of economic performance. There can be no robust growth economy without gender equality, a critical ingredient of any strategy for durable, resilient and more inclusive growth"

- Mari Kiviniemi, OECD Deputy Secretary-General

To pursue that objective, they have instituted the Diversity and Inclusion Council, comprised of representatives from all business units. The role of this council is to raise awareness on the importance of diversity, by delivering internal communications and supporting various events such as the international women's day. One of the initiative which was deployed in 2016 is a training program called "The illusion of inclusion" to give leaders insight about unconscious biases and how these biases limit innovation. This training should be delivered to all leaders in 2018.

Lockheed Martin Canada has developed its 2018-2020 Employment Equity Plan to achieve its employment equity goals and to support its Employer Brand and Workforce Strategy. The Employment Equity Plan was developed by systematically assessing all aspects of the human resources processes to ensure they are discrimination free. They developed relationships with partners and organizations that enable diversity of skilled job seekers.

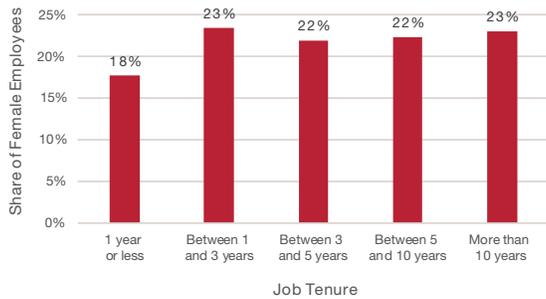
They also ensure that the training and talent development programs effectively supports the needs of employees from the four designated groups. The plan is shared with leaders from the business units who are responsible, together with the Human Resources department, for identifying and recruiting employees coming from a diverse background. All leaders are expected to demonstrate and promote workplace respect and inclusiveness.

Based on Lockheed Martin Canada's data, as of December 2017, the overall representation of the four designated groups in its workforce in Canada was the following:

Designated groups	%
Gender	
Men	78.4%
Women	21.6%
People with disabilities	1.2%
Aboriginal peoples	0.3%
Visible minorities	10.4%

The figure below shows the share of female employees at Lockheed Martin Canada by job tenure, displaying the the overarching challenge in increasing the share of female employees, particularly true in the last year.

Share of Female Employees by Job Tenure

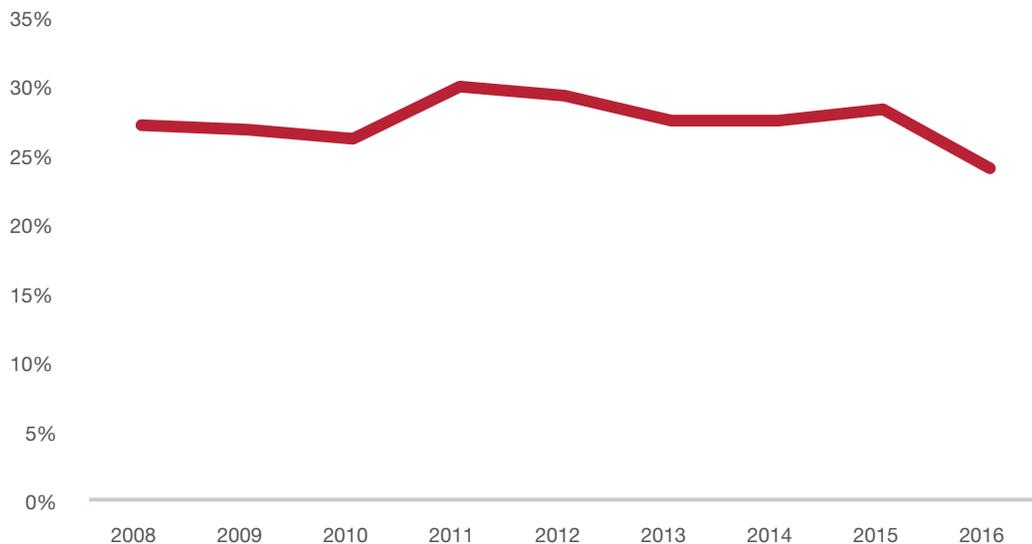


Challenges faced by Lockheed Martin are mirrored in the broader industries in which they operate: the chart below shows the share of female employees in three comparable industries.¹ For the past ten years, this ratio has been stagnant or decreasing. Lockheed Martin Canada’s female share is just beneath industry average.

Lockheed Martin Canada has been working to address gender representation through a range of activities including as female-oriented STEM initiatives, which are described in detail in Chapter 10. Moreover, Lockheed Martin Canada has set goals to bridge the gap between the actual representations of the designated groups in its workforce and with their representation in broader Canadian society. It believes that full representation may be possible for most of the designated groups in specific occupational groups by 2020. To this end, they have developed an action plan entailing several initiatives that will be regularly monitored and reviewed bi-annually. Progress will also be shared with the appropriate Federal ministry.

As a company that honours the Military personnel and veterans, Lockheed Martin Canada strives to help them transition to civilian life. Military veterans have work experience that is easily transferrable to Lockheed Martin Canada’s core business areas and accounted for one in nine employees in 2017. Lockheed Martin Canada is a certified Military Employment Transition (MET) partner. The commitment of Lockheed Martin Canada to veterans is further discussed in section 9.

Ratio of Female Employees in related industries



¹ The three industries taken for their proximity with Lockheed Martin activities are Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance and Component Manufacturing and Transportation Equipment Manufacturing.

9. Lockheed Martin Canada's Corporate Social Responsibility

Due to growing pressure and expectations from the public as well as from governments on businesses to function in a way that is socially acceptable, businesses have begun to create and endorse corporate social responsibilities standards. These include community involvement, protection of the environment, and employee satisfaction and wellbeing. Moreover, companies recognize that operating in an economically, socially and environmentally responsible manner, helps them succeed. Doing so in a transparent way encourages shared value¹ and may provide them with a social license to operate. Corporate Social Responsibility (CSR) at Lockheed Martin Canada is a program spearheaded at the corporate level and adopted by all business units. The corporate website details Lockheed Martin Canada's CSR strategy and vision as well as the key programs and initiatives it has put in place to ensure it acts as a good corporate citizen. Since 2016, the CSR program has focused on five core sustainability issues and objectives, as shown in the diagram below:

Diagram 1: CSR Program's Core Sustainability Issues and Objectives



Source: Lockheed Martin's 2016 Sustainability Report, p. 12

Lockheed Martin Canada's sustainability mission is to foster innovation, integrity and security to protect the environment, strengthen communities and propel responsible growth. Its CSR program is built on two main aspects: the management of Energy, Environment Safety and Health (EESH) and having a positive impact in the communities.

Energy, Environment, Safety and Health (EESH)

Lockheed Martin Canada is committed to providing safe and healthy working conditions, protecting the environment and conserving energy and natural resources. To achieve this goal, they commit to:

- › Meet and/or exceed all energy, environmental, safety and health legislative, regulatory, corporate and other requirements to which they subscribe;
- › Prevent pollution and workplace injuries/illnesses;
- › Continually improve their EESH management and performance;
- › Establish and achieve EESH objectives and targets; and
- › Communicate EESH issues with their employees, customers, suppliers, local communities and other interested parties.

Community involvement

Lockheed Martin Canada plays an active role in helping to strengthen the quality of life of the communities in which they live and work. Since 2008, it has provided approximately \$1 million to a variety of Canadian community organizations. Lockheed Martin Canada's commitment to the community concentrates on two key areas:

- › Science, Technology, Engineering and Mathematics (STEM) education;
- › Supporting military members, veterans, and their families.

Lockheed Martin Canada's involvement takes the form of financial support to not-for-profit organizations through donations and sponsorships, partnership with various associations and the engagement of its employees. Lockheed Martin Canada staff are encouraged to volunteer both time and expertise to support local community groups; for example, in the form of employee fundraising events and activities.

¹ As defined by Michael Porter, shared value is a management strategy in which companies find business opportunities in social problems.

Science, Technology, engineering and Mathematics (STEM) education

“For Canadian research to reach its true and full potential, it must be equitable, diverse and inclusive. A diversity of perspectives, voices and experiences is key in supporting innovation and excellence.”

– Danika Goosney, Executive Director,
Tri-agency Institutional Programs Secretariat

Lockheed Martin Canada plays an important role in advancing science, technology, engineering, and mathematics (STEM) education. It believes that it is critical to give young Canadians the skills they will need for the future, and recognizes the importance of educating young people in these areas. Lockheed Martin Canada is actively encouraging youth to pursue STEM education in their choice of studies, as these skills are essential to their industry and economic strength.

Lockheed Martin Canada has been supporting STEM programs in Canada for many years through funding, sponsorship, and education outreach activities for students from elementary school through university. Many of their employees are also passionate about STEM and dedicate a significant amount of time volunteering in classrooms and in support of local programs.

The Lockheed Martin STEM Council was initiated in 2015 to gather ideas and identify opportunities from all of their sites in Canada. Lockheed Martin Canada is supporting, amongst others, the following organizations:

- › **Actua:** national charity preparing youth to be innovators and leaders by engaging them in STEM experiences ;
- › **FIRST Robotics Competitions:** student teams are challenged in building and programming industrial-size robots in a six-week time limit;
- › **VEX Robotics Competitions:** student teams are tasked with designing and building a robot to compete in a game-based engineering challenge;
- › **Techsploration:** not-for-profit organization in Nova Scotia which focuses on reaching girls and young women and encouraging them to work in STEM fields;

- › **Science and Tech STEAM Horizon Awards Scholarships:** award led by the Science and Technology Museum to recognize young Canadians who promote positive changes throughout their community using science, technology, engineering, arts, and math (STEAM); and
- › **Cubes in Space:** this organization helps students embrace their curiosity, develop logical and methodological thought, engage in creative problem solving and experience the joy of learning something new.

Case Study – STEM

Partnering with Actua to build critical STEM skills



Lockheed Martin Canada has committed to give \$300,000 over a 3-year period to Actua and wants to keep fostering this relationship. Actua is a Canadian charitable organization that prepares young Canadians to be innovators and leaders by engaging them in exciting and accessible STEM experiences that build critical skills and confidence. Over the years, Actua has inspired over 225,000 youth, reaching every province and territory in Canada through the delivery of summer camps, classroom workshops, clubs and community outreach activities.

Actua has a National Girls Program specifically designed at inspiring young women to fulfill their role as leaders in STEM and encourage them in STEM fields like engineering and computer science, where they continue to be under-represented. The program includes science clubs, day and overnight camps, conferences, career fairs and special events with female mentors. Annually, 10,000 girls engage in this impactful all-girls program.²

² (Actua, 2018)

Military and Veterans Support

Lockheed Martin Canada recognizes and honours veterans and military members' selfless duty to Canada. In fact, one in nine Lockheed Martin Canada employees is a military veteran. They directly support the transition to civil life of military personnel and veterans through various ways. They also participate in the National Defence transition briefings at both the executive and employee level offering mentorship and guidance from a leadership perspective.

Lockheed Martin Canada partnering with Canada Company.

Lockheed Martin Canada has provided financial contribution to Canada Company³ is a charitable, non-partisan organization that helps veterans who are seeking jobs in the civilian workforce transition to a suitable job.

The following Canadian organizations are supported by Lockheed Martin Canada:

- › **Prince's Operation Entrepreneur:** a national program for transitioning Canadian Armed Forces members interested in starting their own business
- › **Soldier On:** Canadian Armed Forces program committed to supporting veterans and serving members to adapt and overcome permanent physical or mental health injuries through physical activity and sport;
- › **Canadian Army Run:** about Canadians and the Canadian Armed Forces – Air Force, Army, and Navy – joining together in the spirit of camaraderie and community;
- › **Habitat for Humanity Military Build:** The military build initiative began in 2017 and aims at helping make home ownership a reality for Canadian veterans in the Ottawa region. Habitat Greater Ottawa held its first-ever Veterans Build Day during Veterans Week 2017, which attracted more than 25 active duty military personnel and veterans, several from Lockheed Martin Canada, who helped build four homes; and
- › **Wounded Warriors:** a Canadian charity that supports veterans, first responders, and their families dealing with trauma and mental health issues.

Case study – Supporting Veterans and their Families

Invictus Games Toronto 2017



Lockheed Martin Canada sponsors Soldier On and Wounded Warriors Canada. Together, these two organizations played a critical role during 2017 Invictus Games held in Toronto. Lockheed Martin was also a key sponsor of the games, founded by Prince Harry, which saw more than 500 wounded, ill and injured servicemen and servicewomen from 17 allied nations compete in 12 adaptive sports. The unofficial motto of the Toronto games was “Transforming Empathy into Empowerment” and by bringing competitors and their families together on this international stage, during Canada’s 150th anniversary of Confederation is something that Lockheed Martin is very proud to support. Additionally, through internal feedback, Lockheed Martin Canada provided advice to enable its corporate sponsorship to continue on to the Invictus Down Under Games being held in Sydney, Australia in 2018.

³ (Canada Company, 2018)

10. Summary of major findings and conclusion

Lockheed Martin Canada's corporate vision aligns with the Government of Canada's focus on achieving sustainable growth for the Canadian economy through innovation and exports and is committed to deploying its resources in a manner that will increase new skills development. A basic step in achieving these goals is to establish a baseline against which current initiatives and future activities will be benchmarked. To this end, Lockheed Martin Canada has retained PwC to estimate its economic footprint in Canada over the last ten years (2008-2017) and to explore the extent to which this economic footprint supports the Canadian government's economic priorities.

Our Assessment has found that Lockheed Martin's operations and investments in Canada have generated a significant economic footprint across Canada over the past 10 years. Through both its Naval Franchise Line of Business and sustainment of military and commercial aircraft, Lockheed Martin Canada has grown its business and employee base in Canada and has demonstrated its ability to export its innovative made-in-Canada solutions to international markets. By employing 1,000 employees, facilitating a supply chain of 1,400 small-and- medium- sized companies, investing in key research projects and companies and meeting industrial and technological benefits, Lockheed Martin's strategic corporate vision for operations and investments in Canada is closely aligned with the government of Canada's objectives for the aerospace and defence sector.

Innovation

Innovation is a key lever of productivity and growth, particularly in high-tech industries such as aerospace and defence. Lockheed Martin contributes to innovative activities through three main channels in Canada: spending on developing new capabilities within Lockheed Martin Canada, R&D investment through Canada's Industrial and Technological Benefits (ITB) program, and acquisition of innovative companies in Canada. Between 2008 and 2017, the first two channels accounted for \$157 million in spending. In addition to these channels, Lockheed Martin's active participation in regional aerospace and defence clusters supports an environment that generates innovation and growth.

Exports

Exports are a priority for the Government of Canada because they are associated with stability, growth, and well-paying jobs. Within the export-focused aerospace and defence sectors, Lockheed Martin Canada supports a robust export sector in a number of ways. Firstly, Lockheed Martin Canada exports its own Canadian-developed systems such as the CMS-330 and VISTA electronic warfare software. Secondly, Lockheed Martin Corporation purchases parts and components from Canadian suppliers for aircraft assembled in the United States such as the F-35 Lightning II. Finally, because Lockheed Martin's systems are used globally, Canadian suppliers build on their experience maintaining, supporting, and upgrading Lockheed Martin systems in Canada to export these services to other defence departments worldwide.

Skills

Lockheed Martin Canada generates and supports employment in industries that have high value-added and therefore require skilled workers and pay well. On top of this, Lockheed Martin Canada invests in continuing education for its workforce, supports STEM programs for youth, and provides mentoring and coaching to future entrepreneurs from both military and indigenous communities.

Diversity

Lockheed Martin Canada recognizes the need for greater workplace diversity to encourage inclusive growth, particularly in aerospace and defence industries. When building relationships with universities and seeking future employees, Lockheed Martin Canada aims at integrating diversity as one of its selection lenses. It intentionally selects people from various backgrounds to represent the company at talent acquisitions events and recruitment fairs.

Environment

Environmental issues are a growing global concern, and one that the Government of Canada takes seriously as part of its plans for economic growth. Green technologies such as renewable energy sources will be an important part of reducing greenhouse gases. Lockheed Martin is expanding investment and operations in the area of sustainable energy. Currently, Lockheed Martin Canada manufactures the Solar Tilt Axis Roll Tracker, which is substantially more efficient than traditional fixed solar panels. This system also interacts with other energy sources to provide continuous service and has been implemented in remote and indigenous communities to provide renewable energy.



Participants in the Joint Economic Development Initiative (JEDI) business accelerator program competed for a \$5,000 grand prize at a competition hosted at the Lockheed Martin IMPACT Centre in Kanata, Ontario in March 2018. PLATO Testing won the competition with A1 3D Printing and Sacred Resorts Eco Tourism both receiving \$1,000 cash prizes as finalists.

Appendices

Appendix A

Glossary

AOPS: Arctic Offshore Patrol Ships

ASLEP: Aurora Structural Life Extension Project, undertaken by the RCAF

AIMP: Aurora Incremental Modernization Project, undertaken by the RCAF

CIT: Corporate income tax

CFHIS: Canadian Forces Health Information System

CMS: Combat management system

CSR: Corporate Social Responsibility

DND: Department of National Defence (Canada)

EESH: Energy, environment, safety and health

FTE: Full-time equivalent

EW: Electronic warfare

IRB: Industrial and regional benefits, a predecessor to ITB

ISED: Innovation, Science, and Economic Development, a federal ministry

ISS: In-service support

ITB: Industrial and technological benefits

KIC: Key industrial capability

Lockheed Martin: In this report, the term “Lockheed Martin” is used as a general term referring to all or part of its global operations.

Lockheed Martin Canada: The Canadian operations of Lockheed Martin.

LMCES: Lockheed Martin Commercial Engine Solutions, a Lockheed Martin Canada facility in Montreal

Lockheed Martin Corporation: The parent company of Lockheed Martin Canada. In this report, the term “Lockheed Martin” is used as a general term referring to all or part of its global operations.

MFC: Missiles and fire control, one of four core business areas of Lockheed Martin

MRO: Maintenance, repair, and overhaul.

OECD: The Organization for Economic Cooperation and Development, an international research group.

PIT: Personal income tax

R&D: Research and development

RCN: Royal Canadian Navy

RMS: Rotary and mission systems, one of four core business areas of Lockheed Martin

STEAM: Science, Technology, Engineering, Arts, and Math

STEM: Science, Technology, Engineering and Math

TRT: Tilt roller tracker, a solar panel technology developed by Lockheed Martin Canada

UAV: Unmanned aerial vehicle

USAF: United States Air Force

Appendix B

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Appendix C

Input output methodology

The economic footprint of a particular company is a series of measures that in combination provide a picture of the contribution that the subject company provides to an economy. A company's economic footprint extends well beyond its own operations; it also includes activities arising from its suppliers (i.e., indirect impact) and purchases made out of compensation received by its own and suppliers' employees (i.e., induced impact). Economic footprint measures commonly include: GDP, employment, labour income and government tax revenues.

The fundamental philosophy behind economic impact analysis is that spending on goods and services has attendant impacts throughout the economy. For instance, production of a naval system will generate demand for the inputs to this process (such as machinery and labour) that in turn generates additional demand that extends beyond the initial spending (such as spending by employees of Lockheed Martin and its suppliers). Our analysis permits the estimation of this cascading effect by using the multipliers calculated by Statistics Canada based on its input-output models of the provincial economies.

The input-output model¹ used for the purpose of this report estimates the relationship between a particular economic activity for a given good or service and the resulting impacts throughout the economy (including demand for other goods and services).

For the purpose of this report, economic impacts were estimated for the following measures of economic activity:

- › **Value added or GDP** – the value added to the economy, or the output valued at basic prices less intermediate consumption² valued at purchasers' prices. GDP includes only final goods to avoid double counting of products sold during a certain accounting period.
- › **Employment** – the number of jobs created or supported. It is expressed as the number of full-time equivalent ("FTE") jobs indicated in person years.
- › **Labour Income** – the amount earned by the employment generated.
- › **Tax Impacts**—the amount contributed to municipal, provincial and federal governments. Taxes measured in this analysis are taxes on production and imports, personal income tax, and corporate income tax.

As noted previously, economic impacts are typically estimated at the direct, indirect and induced levels:

- › **Direct impacts** result from Lockheed Martin's spending on suppliers and employees. This reflects direct operations.
- › **Indirect impacts** arise from the activities of the firms providing inputs to Lockheed Martin's suppliers (in other words, the suppliers of its suppliers). This would include, for example, producers of machinery and any inputs used by these producers.
- › **Induced impacts** are the result of consumer spending (such as food, clothing, and housing) by employees of the businesses stimulated by direct and indirect expenditures.

The **total economic impact** equals the sum of the direct, indirect, and induced economic impacts.

¹ The Statistics Canada Input-Output model was used for this analysis.

² Defined as the value of goods and services used or transformed as inputs by a process of production.

Appendix D

Limitations

Data limitations: PwC has relied on the information provided by Lockheed Martin regarding the provincial allocations of operating expenses and capital expenditures of Lockheed Martin's business operations in Canada. PwC has relied upon the completeness, accuracy, and fair presentation of all information and data obtained from Lockheed Martin and the various sources set out in our report, which were not audited or otherwise verified. The findings in this report are conditional upon such completeness, accuracy, and fair presentation, which have not been verified independently by PwC. Accordingly, we provide no opinion, attestation or other form of assurance with respect to the results of this study.

Where the information or data provided is not sufficient to conduct the analysis that has been requested, we have made assumptions, as noted throughout the report.

Receipt of new data or facts: PwC reserves the right at its discretion to withdraw or make revisions to this report should we receive additional data or be made aware of facts existing at the date of the report that were not known to us when we prepared this report. The findings are as of March, 2018 and PwC is under no obligation to advise any person of any change or matter brought to its attention after such date, which would affect our findings.

Input-output analysis: Input-output analysis (a model used to estimate Gross Domestic Product ("GDP") and employment impact) does not address whether the inputs have been used in the most productive manner or whether the use of these inputs in this industry promotes economic growth by more than their use in another industry or economic activity. Nor does input-output analysis evaluate whether these inputs might be employed elsewhere in the economy if they were not employed in this industry at the time of the analysis. Input-output analysis calculates the direct, indirect and induced economic impacts that can reasonably be expected to affect the economy based on historical relationships within the economy. This analysis does not take into account fundamental shifts in the relationships within the

economy that may have taken place since the last estimation of multipliers by Statistics Canada, nor shifts that may take place in the future.

Use limitations: This report has been prepared solely for the use and benefit of, and pursuant to a client relationship exclusively with Lockheed Martin. We understand that Lockheed Martin may share our report with third parties. Lockheed Martin can release this report to third parties only in its entirety and any commentary or interpretation in relation to this report that Lockheed Martin intends to release to the public either requires PwC's written consent or has to be clearly identified as Lockheed Martin's own interpretation of the report. PwC accepts no duty of care, obligation or liability, if any, suffered by Lockheed Martin or any third party as a result of an interpretation made by Lockheed Martin of this report.

Further, no other person or entity shall place any reliance upon the accuracy or completeness of the statements made herein. In no event shall PwC have any liability for damages, costs or losses suffered by reason of any reliance upon the contents of this report by any person other than Lockheed Martin.

This report and related analysis must be considered as a whole: Selecting only portions of the analysis or the factors considered by us, without considering all factors and analysis together, could create a misleading view of our findings. The preparation of our analysis is a complex process and is not necessarily susceptible to partial analysis or summary description. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.





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